Our Water, Our Future:
Policy Options to Safeguard Water Resources in Arizona

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Executive Summary

In Arizona, the most recent drought of the past decade has surpassed the worst drought in the last 110 years of recordkeeping. Arizona's finite, limited supply of water is being stretched between new, fast accumulating demands. Arizona's population is projected to double by 2030. Much of this growth is occurring in rural areas of the state where there are minimal protections or regulations on water and its use. According to the U.S. Bureau of Reclamation, Arizona could face a potential water supply crisis by 2025, meaning that existing water supplies may not be adequate to meet demands for people, farms, or the environment.

This path toward crisis is not inevitable. Rather, it is the product of unwise patterns and policies regarding water use in our state: 1) lack of conservation; 2) over-pumping and excessive river water withdrawal; 3) the threats of inter-basin and large volume intra-basin transfers of water to our environment and economy; 4) inefficient water use in industry, agriculture, and development; and 5) pollution.

By addressing these problems with the following policy solutions, Arizona can ensure that it will have enough water to prosper, now and in the future.

Conserving Our Water Resources
In order to conserve our water, we must not consume more water than our renewable supply. We can accomplish this by focusing growth where there is a sustainable, long-term amount of water and by monitoring and planning for our current and future use.

Preserving Our Rivers
We must keep enough water in our rivers and streams to support recreation and wildlife - integral parts of Arizona's natural heritage and quality of life. In order to preserve and protect our rivers for generations to come, we must control the amount of water removed from rivers and not draw water beyond what the river needs to remain healthy.

Maintaining a Local Supply of Water
We must use local groundwater supplies in a sustainable manner to protect the environment and local economies. When groundwater is transferred from one part of the state to another, that water is no longer available to the communities and ecosystems where it originated. For that reason, Arizona should maintain the bar on inter-basin transfers codified in the 1991 Groundwater Transportation Act. For local, intra-basin transfers, we need policies that encourage efficiency and temporary leasing, while preventing harm to ecosystems and communities.

Using Our Water Efficiently
We must ensure all sectors of our economy use water wisely, not wastefully, to obtain the most value from this precious resource. In order to accomplish this, statewide water efficiency standards should be set for urban, agriculture, and energy sources.

Maintaining Water Quality

Pollution is exacerbating our water quantity problems by rendering countless gallons unsafe for use. We must reduce and prevent water pollution as a key strategy for addressing the scarcity of this resource. Wastewater treatment plants should increase our usable water supply and salinity output should be minimized.

Current State of Arizona's Water Supply

Arizona has a limited, finite supply of water that is stretched thin between agricultural, municipal, and industrial interests. Arizona gets its water from five main sources: 41 percent from groundwater, 21 percent in-state rivers, 20 percent from the Colorado River, 15 percent from the Central Arizona Project (CAP), and 3 percent from reclaimed water.[1] Water use is split among agriculture (68 percent), municipal use (25 percent), and industry (7 percent).[2] The Phoenix region has not felt the effects of the drought mainly because of its diverse water supplies. The Phoenix region receives groundwater and river water from the Salt, Verde, Gila and Colorado Rivers. The reservoirs of the Colorado River and Lakes Mead and Powell have been crucial in keeping the Phoenix region supplied with ample water during the drought.

Even with these diverse supplies, demand from all sectors is rapidly increasing while our supply is not. The U.S. Census Bureau projects Arizona's population will double by 2030. Based on this population estimate, the research group ThinkAZ estimates that by 2025, 2.8 million acre feet (maf) of municipal water supplies will be required to support demand. Fifty percent of that amount, or approximately 1.4 maf, will be needed in the Phoenix region to support municipal and industrial demand.[3] In addition, the population of rural Arizona, which doubled to more than one million people in the past 25 years, is expected to grow by an additional 500,000 in the next 25 years.[4]

Lack of precipitation and meteorological drought combined with the decreasing river flows and groundwater levels - hydrological drought - have already affected the rest of the state, including the major cities of Tucson and Flagstaff, and could pose a threat to the Phoenix region, if the present drought continues.

The western U.S. has experienced moderate to severe drought conditions for the last decade, and evidence shows drought conditions could continue for as long as 20 to 30 years.[5] Five consecutive years of drought on the Colorado River system have left that storage system at 53 percent of capacity, down from 59 percent last year. According to U.S. Bureau of Reclamation officials, 2004 marks the first time since the reservoirs were initially filled that the combined average capacity of the two larger reservoirs, Lake Mead and Lake Powell, is only at 50 percent of normal. As of the end of April 2004, Lake Mead had dropped 80 feet and Lake Powell was down 120 feet compared to four years prior. Only the much larger size of these reservoirs has allowed downstream users to continue to draw water at normal levels. Some users have taken more than normal quantities to make up for lower in-state runoff.[6]

[1] Arizona Water Map Poster 2002, Water Resources Research Center, CALS, University of Arizona
[2] Arizona Water Map Poster 2002, Water Resources Research Center, CALS, University of Arizona
[3] "An Analysis of the Water Budgets of Buckeye, Payson, and Prescott Valley", ThinkAZ, 2005 http://www.thinkaz.org/documents/AnAnalysisoftheWaterBudgets.pdf
[4] "State's rural growth taxing water supplies." Arizona Republic 26 June 2005 http://www.azcentral.com/arizonarepublic/news/articles/0626rwater-main26.html
[5] City of Phoenix, "Drought in Perspective", Phoenix in Drought: http://phoenix.gov/WATER/drpers04.html (7 March 2006)
[6] Ibid.

In Arizona, the most recent drought of the last decade has surpassed the worst drought in the last 110 years of recordkeeping. A 1989 U.S. Geological Survey National Water Summary documented three severe droughts in Arizona during the 20th century.[7] According to Climate Assessment for the Southwest (CLIMAS) at the University of Arizona, 1999-2003 was one of the driest five-year periods of winter precipitation in the climate record. And most recently, a 2005 study conducted by the Rocky Mountain Climate Organization (RMCO) analyzed government temperature and snowpack records in the Colorado River basin and found that since 1990, 11 of the last 16 years have had below-average snowpack levels.[8]

Moreover, it is completely plausible that current dry conditions will remain in Arizona for the foreseeable future. Beyond the written record, tree ring research reveals that 20 to 30 year droughts were not uncommon over the past 1,000 years in the major watersheds serving the City of Phoenix and surrounding municipalities.[9] Finally, according to the U.S. Bureau of Reclamation, Arizona could face a potential water supply crisis by 2025 – meaning existing water supplies will no longer be adequate to meet demands for people, farms, and the environment.[10]

Any realistic view of Arizona's water future must encompass the twin strains of diminished supply and heightened demand.

The Root Causes of Arizona's Water Problems

The state of Arizona's water supply is precarious. The demands on our water supply are increasing while our supplies remain limited or are dwindling due to drought. The main problems associated with water quantity in Arizona are: 1) lack of conservation; 2) over-pumping and excessive river water withdrawal; 3) the threats of inter-basin and large volume intra-basin transfers of water to our environment and economy; 4) inefficient water use in industry, agriculture, and development; and 5) pollution.

By addressing these problems now with sound policy, Arizona can ensure that it will have enough water to prosper, now and in the future.

Lack of Conservation

Developing in Areas with Inadequate Supply

Currently, hundreds of thousands of homes are being planned across Arizona in areas with inadequate water supplies. According to Doug Dunham of the Arizona Department of Water Resources (ADWR) Assured and Adequate Water Supply Office, ADWR does not have the enforcement capability or legal framework to make sure that people do not buy homes with an

[7] United States Geological Survey, "Hydrologic Conditions in Arizona During 1999–2004: A Historical Perspective", U.S. Geological Survey Fact Sheet 2005-3081 http://pubs.usgs.gov/fs/2005/3081/

[8] Rocky Mountain Climate Organization, "Less Snow, Less Water: Climate Disruption in the West", 2005

[9] Ibid.

[10] United States Bureau of Reclamation. 2003. *Water 2025: Preventing crises and conflict in the West*. Washington, D.C.: U.S. Dept. of the Interior Bureau of Reclamation.

inadequate water supply.[11] Developments proposing homes that add up to thousands are being planned in rural Arizona, including areas just outside the Prescott city limits, near Chino Valley, Cottonwood and Benson.[12] In Mohave County, for example, ADWR in a letter to developers said they "…could not issue an adequate (water supply) finding…" for the entire Golden Valley Ranch master plan which includes 32,000 single family lots and more than 600 acres of commercial uses. ADWR has also advised that "…it is unlikely that adequate supplies of groundwater are physically available…" for other proposed master plans in this particular region. Under current laws, development can proceed even if with inadequate water supplies.

Finally, the known estimates of development outstripping supply are merely the tip of the iceberg. This is because the state has not had the resources to confirm likely scarcities in many rural areas outside the active management areas (AMAs).

Wildcat Subdivisions

Subdivisions that are created by splitting a property six or more times are governed by zoning and subdivision law; those that are created by five or fewer splits outside AMAs are not. "Wildcat" subdivisions are split five or fewer times, resold, split again, and so on, creating a dense area of homes that are completely unregulated, exploiting a loophole in the already minimal regulations that apply to lands outside the AMAs. This practice is technically illegal if it can be proven that all the buyers and sellers are in collusion, but according to water managers at ADWR, this has almost never been proven.

The seller is not required to provide a water source to the homes. Moreover, since the lots are split five or fewer times, the lots are not governed by subdivision law; developers do not even need to apply for a certificate of adequacy or inadequacy from ADWR. For these properties, it is likely that no information exists on the water supply. Many of these buyers then drill their own wells and begin pumping unmonitored quantities of water, next to others doing the same, in a populated subdivision. Another scenario that occurs is that there is no groundwater beneath the property to pump. In these cases, water must be trucked in. Nearly one-half of the Navajo Reservation residents truck in water, as do hundreds of people in vicinity of Flagstaff, Williams, and Kingman.[13]

These "wildcat" subdivisions are flourishing in Pima and Cochise Counties in the south and Yavapai and Mohave Counties in the north, but they are affecting the entire state's water supply. The commonly known underlying philosophy of these developments, as well as legal subdivisions building with Certificates of Inadequacy, is that if they build, they will be bailed out if they run out of water. These developments threaten the immediate environment that depends on the water and also threaten other areas' supplies.

[11] Developers cashing in on weak water laws" Arizona Republic 27 June 2005 http://www.azcentral.com/specials/special26/articles/0627rwater-main27.html
[12] Ibid.
[13] "Hauling water is way of rural life" Arizona Republic, 27 June 2005 http://www.azcentral.com/specials/special26/articles/0627rwater-haulers27.html

Over-pumping and Excessive Groundwater and River Water Withdrawal

Many rivers in Arizona are suffering because of low flows due to overuse and over-pumping of groundwater. Rivers in Arizona, particularly the Salt, Verde, Gila, and San Pedro Rivers, are left unprotected from development pumping along their banks. According to Arizona water law, there is no connection between groundwater and surface water, although hydrologically there is a strong connection. Also, for most wells, the law requires monitoring for how much water they are pumping.

All wells in Arizona that pump under 35 gallons/minute and are used for domestic purposes are exempt from monitoring. This is true both inside and outside of an AMA. A notice of intention to drill must be filed with ADWR before a well is drilled, but no monitoring is conducted. There are also no regulations on how close a well can be to a river, leading to wells that pump the river's subsurface flow, which affects the river more immediately than groundwater pumping. Arizona's rivers are even more sensitive than its groundwater reserves since they rely on ever-scarcer precipitation.

The strong connections between groundwater and surface water have become more apparent as users have pumped more of Arizona's groundwater. Researchers at the University of Arizona have stated that there is no difference between the legally-defined deep groundwater, shallower groundwater, or "subflow", and surface water and that they are constantly interchanging.[14] Wells sited near rivers pump water that contributes to river flow, no matter which legally-defined layer of groundwater is tapped. Flows in rivers such as the San Pedro and the Verde have decreased significantly due to pumping of groundwater that is connected to the rivers.[15] According to the United States Geological Survey, groundwater pumping will affect the Verde's headwaters and could reduce river flows.[16] Rampant growth in this area is removing water from the Verde River by pumping groundwater that is connected to the river.

One river that has been significantly affected by over-pumping is the San Pedro River. The San Pedro River has a unique ecology and provides a critical stopover for up to four million migrating birds each year. Unfortunately, over-pumping from development in the San Pedro watershed is causing the river level to fall. This development is mostly occurring near the town of Sierra Vista. Agriculture near the border also affects the San Pedro. University of Arizona scientists warned over a decade ago that over-pumping from encroaching development could dry up the San Pedro River in 10 to 15 years, and stretches of it have already been running dry.

[14] Water Resources Research Center, "Is That My Groundwater or Your Surface Water?" *Arizona Water Resource:* Vol.10, No. 3: 2002 University of Arizona: http://www.ag.arizona.edu/AZWATER/awr/janfeb02/feature1.html
[15]Water Resources Research Center, "Managing the Interconnecting Waters: The Groundwater-Surface Water Dilemma" http://ag.arizona.edu/AZWATER/arroyo/081con.html (8 March 06)
[16] "Preliminary Geophysical Framework of the Upper and Middle Verde River Watershed, Yavapai County, Arizona" by Langenheim, DeWitt and Wirt, 2005

Water Transfers

Human and environmental needs are best met when water is kept where nature put it – in its local area of origin. Although some transfers of water will be necessary to sustain a growing population and economy, these transfers should be restricted to ensure that the environment, public welfare and economic potential in the area of origin are protected.

Inter-basin Transfers

Under the 1991 Groundwater Transportation Act, Arizona disallowed inter-basin transfers of groundwater, meaning the transfer of groundwater from one hydrologic basin to another. Unfortunately, growing towns and cities are looking to fuel development through new inter-basin transfers. Inter-basin transfers, however, are damaging to the economy and environment of the area in which the water is taken. Economies suffer as the businesses and sources of revenue that relied on the water - directly like farmers or indirectly like business that rely on farmers – erode.[17] The environment suffers because river flows may diminish wildlife and vegetation, increasing salinity concentrations in the water, and may increase costs of treating sewage because there may be less water to dissolve the discharged pollutants in order to meet water quality standards.[18]

Intra-basin Transfers – A Mixed Blessing

Intra-basin transfers are a mixed blessing in that they can harm if they interrupt ecosystems and communities who currently use the water, but also can alleviate water scarcity if a water transfer is the least damaging way to increase water supplies.

"Water ranching" transfers—when a landowner sells the right to pump groundwater beneath their lands permanently—harm the environment and deplete local groundwater reserves. The right to pump groundwater comes with purchase of the land. Flagstaff has recently purchased 8,500 acres of ranchland that will give it access to thousands of acre-feet of water. The water from this ranch alone would yield 10,000 to 20,000 acre-feet per year,[19] Another major water ranching transfer is the Big Chino Ranch purchase, which plans to transport approximately 12,400 acre-feet/year through pipeline to Prescott and Prescott Valley.[20] Given the strong hydrologic connections from this aquifer to Verde River,[21] the Big Chino Ranch transfer could harm endangered species, recreation, smaller communities downstream, and possibly the City of

[17] Water Conservation, Reuse, and Recycling: Proceedings of an Iranian-American Workshop (2005): National Research Council of the National Academies
[18] Ibid.
[19] "Flagstaff secures potential water supply", Arizona Republic, 6 January 06: http://www.azcentral.com/arizonarepublic/local/articles/0106water0106.html
[20] Protecting the Verde Prescott/Prescott Valley's Big Chino Ranch Groundwater Pumping & Pipeline; Centers for Biological Diversity, 2005 http://www.endangeredearth.org/slideshows/Protecting_the_Verde_River-VRCA.pdf
[21] United States Geological Survey, "Hydrogeologic Review of the Drake Cement Project, Yavapai County, Arizona" USGS Open-File Report 2004-1439

Phoenix.[22] The Salt River Project provides water to Phoenix and other Valley cities from the Verde, and those water rights would be reduced if the river's long-term flow dropped.[23]

New development does need water to grow and should come from intra-basin transfers that do not permanently retire water rights and are least damaging to the environment and communities.

Inefficiencies

Urban Water Inefficiency
While Arizona cities have made some strides in reducing water waste inside the home, we are still squandering gallon after gallon with inefficient landscaping and lawn-watering practices. According to the Environmental Protection Agency (EPA), about 37 percent of home water use is used outside. According to a report from the American Water Works Association, highlighted in the *Arizona Republic*, this number can be up to 70 percent in Phoenix.[24] Unfortunately, there is little regulation – or even effective pricing or incentives – aimed at reducing this outdoor water use. The problem is especially acute in Phoenix, where residents use a significantly larger amount of water than other cities driven by the need to supply water to lawns and trees from wetter climates.[25] Phoenix uses 220 gallons of water/day (GCD), per capita, while Tucson, a city that receives more rain and is home to individuals who prefer desert landscaping, has reduced its per capita water use to 176 GCD.[26] One of the main suggested reasons for this discrepancy is that the price of water in Phoenix is $400/acre-foot, one of the lowest rates in the United States.[27]

Agricultural Inefficiency
Agriculture uses approximately 68 percent of water consumed each year in Arizona and has irrigated crops on 1,280,000 acres of Arizona's total 72,730,000 acres. Crops most often are flood irrigated, which leads to high evaporation rates and the waste of water.

Power Plant Inefficiency
Power plants also use significant volumes of water. For example, the Navajo Generating Station, a power plant near Paige, Arizona, consumes 34,000 acre-feet of water per year (11.1 billion gallons). This waste continues even though plants can use dry cooling technology, which require significantly less water than a typical plant.[28]

[22] The Verde River supplies water to the Salt River Project (SRP), which is a key water source for Phoenix. See Protecting the Verde Prescott/Prescott Valley's Big Chino Ranch Groundwater Pumping & Pipeline; Centers for Biological Diversity, 2005
[23] "Pumping endangers state rivers and wildlife", Arizona Republic, 26 June 05: http://www.azcentral.com/specials/special26/articles/0626rwater-enviro26.html
[24] "Cities push water conservation: Use less without sacrifice", Arizona Republic, 6 January 05: http://www.azcentral.com/specials/special26/articles/0105conserve-main06.html
[25] Phoenix in Perspective: Reflections on Developing the Desert, Grady Gammage Jr, ASU 1999
[26] Arizona Department of Water Resources 1991
[27] Phoenix in Perspective: Reflections on Developing the Desert, Grady Gammage Jr, ASU 1999
[28] Western Resource Advocates, "The Last Straw: Water Use by Power Plants in the West", 2003: http://www.westernresourceadvocates.org/media/pdf/WaterBklet-Final.pdf

Pollution

Polluted water affects quantity because it removes needed water from an already stressed supply. The main pollutants that reduce the amount of potable, irrigable water in Arizona are salinity and arsenic. Nitrates, which enter the water system through runoff, and perchlorate, a pollutant from spilled rocket fuel, are also of concern.[29]

High salinity is a major problem in Maricopa County. The main sources of the salinity are: 1) agricultural runoff; 2) industrial practices that require "ultra pure water", such as semiconductor manufacturing, and release large volumes of saline water; 3) waste water treatment, in which one cycle of municipal use increases the salt content of water by 200 to 400 milligrams per liter; 4) household water softeners; and 5) natural sources from rock and soil.[30] This pollution problem becomes a genuine water scarcity issue when salinity is above 500 parts per million (ppm) – the point at which water is neither potable nor usable for irrigating crops or landscaping. Salinity measurements have exceeded this 500 ppm threshold in western Maricopa County and in Tucson.[31]

A second widespread contaminant in Arizona is arsenic. Arsenic is a naturally occurring element in the soil and rocks of Arizona and presents itself in nearly all groundwater in Arizona.[32] According to the World Health Organization (WHO), long-term exposure to arsenic in drinking-water causes cancer of the skin, lungs, urinary bladder, and kidney. Increased risks of lung and bladder cancer have been observed at drinking-water arsenic concentrations of less than 0.05 mg/L.[33] According to the EPA, some people who drink water containing arsenic in excess of EPA's standard over many years could experience skin damage or problems with their circulatory system and may have an increased risk of getting cancer.[34] In relation to quantity, the main problem with arsenic is that it removes water from the useable supply.

Other pollutants affect Arizona's water supply, the main ones being perchlorate and nitrates. Perchlorate is a component of rocket fuel that can harm the thyroid and especially threatens infants and pregnant women. Perchlorate was found at levels above the EPA draft safe level in Arizona, as reported by the National Resources Defense Council (NRDC).[35] According to a NRDC report, nitrate levels approached the national standard in 2003. Nitrate pollution concentrations are continuing to increase in areas with septic tank systems and agricultural

[29] National Resources Defense Council, "What's On Tap?: Grading Drinking Water in U.S. Cities", 2003: http://www.nrdc.org/water/drinking/uscities/pdf/phoenix.pdf
[30] Water Resources Research Center, "Desalination, an Emerging Water Resource Issue?" *Arizona Water Resource:* Vol.11, No. 4: 2003 http://www.ag.arizona.edu/AZWATER/awr/mayjune03/feature1.html
[31] Ibid.
[32] Arizona Geological Survey, "Arsenic in Groundwater", *Arizona Geology* Vol. 30, No. 3: 2000 http://www.azgs.state.az.us/Fall2000.htm
[33] World Health Organization, "Arsenic in Drinking Water" 2001 http://www.who.int/mediacentre/factsheets/fs210/en/ (8 March 2006)
[34]U.S. Environmental Protection Agency, "Drinking Water Contaminants", EPA Ground Water and Drinking Water: http://www.epa.gov/safewater/hfacts.html (8 March 06)
[35] National Resources Defense Council, *op. cit.*

irrigation, especially Quartzsite, Bullhead City and Lake Havasu City.[36] Nitrates are the product of fertilizers and human or animal waste and can cause shortness of breath, nausea, vomiting, diarrhea, lethargy, loss of consciousness, and even death in infants (called "blue baby syndrome").[37]

Policy Recommendations

Conserve Our Water Resources

In order to conserve our water we must not consume more water than our renewable supply. We can accomplish this by focusing growth where there is a sustainable, long-term amount of water and by monitoring and planning for our current and future use. We recommend the following policies:

1. Require developers to show that there is a 100-year renewable supply of local, clean water as a condition of permitting new industrial, commercial or residential development anywhere in the state. This solution would keep homes from being built with inadequate supplies of water and close the loopholes that allow "wildcat" subdivisions. This one solution would solve the main weakness in Arizona's water policy that leaves water unprotected from development in 80 percent of the state. We can conserve our water supplies by ensuring that growth only occurs where there is sufficient water. With this overarching policy, Arizona can ensure that its continued growth occurs in balance with its finite water supplies.

2. Prohibit new wells or withdrawals where groundwater levels are dropping or there is inadequate supply. In order to conserve our groundwater supplies, we must not remove more water from depleted areas or areas with minimal resources.

3. Provide ADWR with sufficient funding to acquire, catalogue, and analyze data on water supply across the state, especially in rural areas. ADWR should initiate a statewide, automated groundwater monitoring system that monitors the hydrologic behavior of groundwater basins and assesses changing groundwater levels over time. This will require $755,000 annually and could be appropriated from the general fund. This is a badly needed tool that requires sufficient funding so that ADWR can determine how much water is available and draft water budgets and water conservation plans. The Phoenix AMA, for example, has felt little effect during the past major drought due in part to its cataloguing of water resources and long-term water budgets and conservation plans. Arizona as a state can benefit from the AMA model by having accurate data on all water supplies and developing sound budgets and conservation plans that ensure we do not consume more water than our renewable supply.

[36] Arizona Dept. of Environmental Quality, "Groundwater protection in Arizona: An assessment of groundwater quality and the effectiveness of groundwater programs", 2002 http://www.azdeq.gov/function/forms/download/2002/five.pdf
[37] National Resources Defense Council, *op. cit.*

4. Require a finding of adequacy or inadequacy of water supply before the sale of any existing home in Arizona. All homes and land outside AMAs should be sold with an obvious, clearly stated notice if the subdivision or area has an inadequate water supply. This notice should extend to subsequent as well as primary buyers. All Arizonans have a right-to-know about the status of their water supply. This also could provide prospective with an incentive to buy homes where there is an adequate water supply. This policy would promote and encourage growth only where there is enough water to support it for the future.

5. Measure and meter all water usage to have a better handle on balancing supply and demand of our water resources. In order for Arizona to conserve water for its future, all water sources and demands must be known, and they must be monitored for use in order to project future needs.

Preserve Our Rivers

We must keep enough water in our rivers and streams to support recreation and wildlife - integral parts of Arizona's natural heritage and quality of life. In order to preserve and protect our rivers for generations to come, we must control the amount of water removed from rivers and not draw water beyond what the river needs to remain healthy. We recommend the following policies:

1. "Sustainable yields" criteria, the amount of water that can be drawn from a river or aquifer while leaving enough to sustain the river's environment, should be established for the state's rivers and groundwater basins. The Yakima River in Washington State provides an example of how this type of criteria can be used successfully to determine how much water can be removed while keeping the river healthy. The Yakima River Basin Water Enhancement Project legislation, developed by the Secretary of Interior's Yakima River Basin Conservation Advisory Group, ensured that minimum in-stream flows allowed for healthy river channel maintenance and river ecology.[38]

2. Prohibit any groundwater pumping that would, singularly or cumulatively, reduce a river's in-stream flow. This will require a change in Arizona water law – to acknowledge the connection between all groundwater and surface water. Other Western states have made their water policies consistent with this hydrologic reality. Both Nevada and Utah manage all their water use together, without distinguishing between surface and groundwater. While Idaho and Wyoming do technically manage groundwater and surface water separately, permits for usage are reviewed to determine effects on both groundwater and surface water users.

Maintain a Local Supply of Water

We must use local groundwater supplies in a sustainable manner to protect the environment and local economies. When groundwater is transferred from one part of the state to another, that water is no longer available to the communities and ecosystems where it originated. The 1991

[38]American Rivers, "Water Scarcity – Instream Flow Toolkit", American Rivers: http://www.americanrivers.org/site/PageServer?pagename=AMR_content_fa87 (8 March 06)

Groundwater Transportation Act should be defended against rollbacks and local, intra-basin transfers of groundwater must not harm ecosystems and communities. We recommend the following policies:

1. Restrict harmful intra-basin transfers that remove large volumes of groundwater from local ecosystems and aquifers and encourage beneficial transfers that are minimally harmful to the environment and communities. There should be a comprehensive impact statement performed before approving the transfer that takes into account not only the water needs of the environment, but also the economic and social interests of the area that would be losing water. When water is transferred to a new use in a different area, a percentage of the water should be dedicated to meeting environmental needs in the area from which the water is being transferred. We must ensure that local communities have the right of first refusal over water transfers. Local governments or water trusts should have the option of purchasing or exercising options on water transfers before any water leaves their community.

2. Defend the 1991 Groundwater Transportation Act, that does not allow inter-basin transfers of water, against rollbacks. This Act protects groundwater basins and keeps their water resources intact.

Use Our Water Efficiently

We must ensure all sectors of our economy use water wisely, not wastefully, to obtain the most value from this precious resource. In order to accomplish this, statewide water efficiency standards should be set for urban, agriculture, and energy sources, across the state. We recommend the following policies:

1. Establish mandatory minimum efficiency standards for all water uses. These standards will ensure that water is not wasted in any sector and that agricultural and industrial users of water will be held accountable for the amount of water they use. In addition, effective efficiency incentive programs should be created. There are already examples of this solution working at the local level in Arizona. Within the AMAs, management plans have been implemented to ensure increasing efficiency standards for municipal, industrial, and agricultural sectors. The management plans are revaluated every 10 years to make sure that efficiency is increasing. The City of Tempe has substantially decreased consumption of water and reduced wastewater discharges through its incentive program.[39] Water efficiency programs in the City of Phoenix have been estimated to save 40 million gallons/day (mgd).[40] Management plans should be implemented across the state to establish strong state-wide efficiency standards.

2. Create statewide efficiency standards for new housing. An effective solution, advocated by many experts, including ADWR, is to require new developments to capture rainwater

[39]City of Tempe, "Water Conservation", Water Conservation Information, City of Tempe, AZ: http://www.tempe.gov/water/conserve.htm (8 March 2006)
[40] Environmental Protection Agency: Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs 2003 http://www.epa.gov/owm/water-efficiency/utilityconservation.pdf

and graywater through gutters and piping from drains and washing machines for use in the home's irrigation. Many technologies are currently available to increase efficiency, including low-flow toilets, faucets, and showerheads.

3. Water pricing should take use into account and reward efficiency in all use sectors and should be scaled by use within each sector. In all sectors, pricing water at appropriate levels encourages efficiency. There are many examples of cities that have implemented water pricing structures to save water. One of the most effective has been the Irvine Ranch Water District's plan in California. Here, a tiered rate structure was implemented to reward water efficiency and identify areas where water is being wasted. In this structure, users' rates are adjusted to reflect estimated needs. When users waste water, they are given progressively expensive penalties, and they are rewarded for saving water.[41] In the first year this program was implemented, water use declined by 19 percent.

4. Increase efficiency in agricultural and landscape irrigation by substantially converting to drip irrigation, instead of flood irrigation. According to the University of Arizona, subsurface drip irrigation provides the ultimate in water use efficiency for open-field agriculture, often resulting in water savings of 25-50 percent compared to flood irrigation. [42] Drip irrigation also leads to less salinity and pollutant runoff.

5. Set standards for dry cooling of current power plants. There are many examples of plants that are efficiently using water through dry cooling. The Pacific Power and Light Company's Wyodak Generating Station in Wyoming was converted to dry cooling, and this technology reduced the station's water requirement to 300 gallons/minute from 4,000 gallons/minute.[43]

6. Ensure that a significant portion of future energy needs will come from renewable energy, which will conserve the most water. Renewable technologies use less water and produce less pollution than fossil fuel generating plants. Adopting a renewable energy standard to increase electricity generation from clean and renewable sources by at least one percent per year, to 20 percent by 2020, in Arizona would conserve a total of 23 billion gallons of water over the next 15 years.[44]

Maintain Water Quality

Pollution is exacerbating our water quantity problems by rendering countless gallons beyond use. We must reduce and prevent water pollution as a key strategy for addressing the scarcity of this resource. Wastewater treatment plants should be effective in increasing our usable water supply and minimizing salinity output. We recommend the following policies:

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[41] Ibid.
[42] University of Arizona, Dept of Soil, Water, and Environmental Science, "Subsurface Drip Irrigation Demonstration and Research Project" http://ag.arizona.edu/crops/irrigation/azdrip/SDI.htm (8 March 06)
[43] U.S. Environmental Protection Agency, "How to Conserve Water and Use It Effectively", http://www.epa.gov/OW/you/chap3.html (8 March 06)
[44] Renewing Arizona's Economy: The Clean Energy Path to Jobs and Economic Growth; April 2005 Arizona PIRG Education Fund

1. Require all dischargers, including wastewater treatment plants and semiconductor manufacturers, to utilize the best available technology to minimize salinity output. These methods have been used in the Los Angeles area effectively, most notably at the Chino Desalter Plant which produces more than eight million gallons per day of high-quality drinking water, serving 20,000 homes.[45]

2. Establish a permitting and monitoring process for the discharge of salinity into groundwater. Permitting has been used effectively in Arizona to control the discharge of pollutants from industries, such as wastewater treatment plants, under the Clean Water Act. To protect surface water discharges, industrial dischargers of salinity, such as semiconductor manufacturers, should be required to reduce salinity as a condition of their National Pollutant Discharge Elimination System (NPDES) permits.

3. Provide adequate funds and support to build and maintain environmentally-sound wastewater treatment plants to produce useable water and remove pollutants like arsenic, nitrate, and perchlorate from water supplies. The funding for this policy should come from a polluter pay provision requiring polluting industries to pay into a centralized fund for remediation of the environmental degradation that they collectively have created.

4. Curb agricultural runoff of pollutants by mandating usage of Best Management Practices (BMPs) for application of fertilizer and insecticide, including nutrient management and reduced use of pesticides, and by requiring vegetative buffers between agricultural land and waterways. An example where usage of BMPs is working is in California's Imperial Valley, where monitoring at several key drainage points shows reduced pollutant levels, and pollution into the Salton Sea is going down as well.[46]

[45]National Water Research Institute, *et al.*, "Salinity Reduction Study": Presentation at the Salinity Management Workshop, Santa Clara Valley Water District, 8 July 05
[46] U.S. Environmental Protection Agency, "TMDLs and Agriculture in the West", EPA 909-F-03-003

Appendix- Arizona Groundwater Management Act (GMA)

Under the Arizona Groundwater Management Act (GMA), only developments within an AMA (Active Management Area) must assure a 100 year supply of water to build. The meaning of a "100 year supply" is that the draw on groundwater estimated for the subdivision in combination with competing water demands must not draw the groundwater table down below 1200 ft. The Arizona Department of Water Resources (ADWR) oversees the GMA. Major urban areas with the exception of Flagstaff and Yuma and some rural communities operate under Assured Water Supply rules. The Assured Water Supply rules state that all developments must meet five criteria to obtain a certificate to allow them to build:

1. The water supply must be physically, legally, and continuously available for the next 100 years.

2. The water must meet water quality standards or be of sufficient quality.

3. The proposed water use must be consistent with the management goal of the AMA.

4. The proposed water use must be consistent with the current management plan of the AMA.

5. The developer must demonstrate the financial capability to construct any necessary water storage, treatment, and delivery systems.

Outside the AMAs, an area encompassing approximately 80% of the state's area, a 100 year supply does not have to be shown and no criteria met in order to build. Developers must ask ADWR to give an adequate or inadequate determination but can build even if the supply is inadequate, meaning less than a 100 year water supply as defined by the GMA. These rules are governed under the Adequate Water Supply program at ADWR.