

# Appendix C

## Additional Information

### GENERAL INFORMATION

An overview of water issues in the Sonoran Desert is found in Nancy Laney's *Desert Waters: From Ancient Aquifers to Modern Demands* published by the Arizona Sonora Desert Museum in 1998. A general introduction to water issues in Arizona can be found in *Ensuring Arizona's Water Quantity and Quality Into the 21st Century*, a background report prepared by the University of Arizona for the Seventy-first Arizona Town Hall, October 26-29, 1997. *A Water Issues Primer for the Tucson Active Management Area* published by the Southern Arizona Water Resources Association (SAWARA) in 1983 is a helpful, although somewhat outdated general introduction to the basics of water in the Tucson area. SAWARA has published a series of informative newsletters on a variety of Tucson area water topics, including recharge, CAP, constructed wetlands, water supplies and wastewater. These are available on a Web site. SAWARA also has a video presenting an overview of Tucson's water situation.

*Where to Get Free (or Almost Free) Information about Water in Arizona* (1998 edition) is a directory of sources of water information, including Web sites. *Where to Find Water Expertise at Arizona Universities* (1998 edition) is a directory of sources of water information at Arizona state universities. Both are by Barbara Tellman and are available free from the Water Resources Research Center (WRRC), The University of Arizona and are in searchable format at the WRRC Web site. This Web site also contains water information as well as links to water agencies.

### Chapter 2: LOOKING TO THE PAST TO UNDERSTAND THE PRESENT

Much of the information about the history of Tucson Water came from Lynn Baker, unofficial Tucson Water historian. Much of the information about the history of wastewater in Pima County came from John Schladweiler, unofficial Pima County Wastewater Management Department historian. A valuable source of information about the history of water development and technology in Pima County is a 1986 Master's thesis (University of Arizona) by Doug Kupel titled *Diversity Through Adversity: Tucson Basin Water Control Since 1854*. C.L. Sonnichsen's *Tucson: The Life and Times of an American City*, published by the University of Oklahoma Press in 1982, is a detailed history of Tucson. The history of the Santa Cruz River is discussed in *Arizona's Changing Rivers: How People Have Impacted the Rivers* by Barbara Tellman, Richard Yarde and Mary Wallace, published by the WRRC, The University of Arizona in 1997. More detailed information is available in *Arizona Stream Navigability Study for the Santa Cruz River*, a report by SFC Engineering and others for the Arizona State Land Department in 1996. The history of the Central Arizona Project was documented by Rich Johnson in *The Central Arizona Project*, published by the University of Arizona Press in 1977. The history of opposition to the CAP was documented by Frank Welsh in *How to Create a Water Crisis*, published by Johnson Books (Boulder) in 1985.

### Chapter 3: IN SEARCH OF ADEQUATE WATER SUPPLIES

General information about groundwater is available in a booklet from the American Institute of Professional Geologists titled *Ground Water Issues and Answers*, available from the Arizona Geological Survey office in Tucson. Edward Davidson's *Geohydrology and Water Resources of the Tucson Basin, Arizona* (USGS Water Supply Paper; 1939-E, 1973) has a description of the basics of local geohydrology.

Numerous government documents are available, some of which are listed below. Most of the local government documents and consultant reports done for local government are available in the Tucson Public Library's government reference section in the downtown library.

Tucson Water's Planning and Technical Services Division provides periodic reports on the aquifer and withdrawals, titled *Annual Groundwater Withdrawal and Use Report*. Tucson Water also provides an annual report, *Annual Static Water Level Basic Data Report: Tucson Basin and Avra Valley, Pima County, Arizona*. Tucson Water published a useful booklet in 1998, *Status of the Aquifer*, in conjunction with the U.S. Geological Survey and the Arizona Department of Water Resources. An example of a consultant's report with useful information is by Mark Cross, *Hydrogeologic Constraints on Continued Groundwater Withdrawals by the City of Tucson*. (Errol L. Montgomery and Associates, Inc. 1998). Tucson Water also produces long-term planning documents such as *Tucson Water Resources Plan: 1990 to 2100*.

(Produced by CH2M Hill for Tucson Water. July 3, 1989). and *Tucson Water 50-Year Operating Plan: Planning Assessment Report*. (Malcolm Pirnie, Inc. February 1994).

## CAP, General

An overview of the CAP is available in the Arizona Department of Water Resources' Governor's Central Arizona Project Advisory Committee's report (prepared with assistance of the Central Arizona Water Conservation District and the U.S. Bureau of Reclamation), *Description of the Central Arizona Project*. (April 1993). The Central Arizona Water Conservation District has several brochures, maps and informative materials about CAP. The fall-winter 1993 WRRC. *Arroyo*, "Long-Awaited CAP Water Delivers Troubled Water to State" also provides information. Analysis of the possibility of extending the CAP canal to the Green Valley area can be found in Malcolm Pirnie, Inc., in association with Errol Montgomery and Associates, Inc., *Sahuarita-Green Valley Area Central Arizona Project Water Use Feasibility Analysis and Delivery System Optimization Study*, prepared for Arizona Department of Water Resources, TAMA, September 1998.

## Recharge

A discussion of issues related to recharge in the Tucson area and an assessment of current and potential projects using CAP water can be found in the *Regional Recharge Plan*, written by the Institutional Policy and Advisory Group as part of the Regional Recharge Planning Process coordinated by the Tucson AMA of the Arizona Department of Water Resources (Institutional Policy and Advisory Group, 1998). This planning process began with the technical and background work completed by the Regional Recharge Committee, *Technical Report*, Arizona Department of Water Resources Tucson Active Management Area, September 1996.

A series of biennial symposia on recharge have been held over the years and contain much useful information. Copies of the proceedings for past years are available from WRRC. Another

## WEB SITES WITH WATER INFORMATION

Arizona Department of Environmental Quality – [www.adeq.state.az.us](http://www.adeq.state.az.us)  
Arizona Department of Water Resources – [www.adwr.state.az.us](http://www.adwr.state.az.us)  
Arizona Geological Survey – [www.azgs.state.az.us](http://www.azgs.state.az.us)  
Arizona Water Banking Authority – [www.awba.state.az.us](http://www.awba.state.az.us)  
Central Arizona Project and Central Arizona Groundwater Replenishment District – [www.cap.az.us](http://www.cap.az.us)  
Cooperative Extension, The University of Arizona – [ag.arizona.edu/extension](http://ag.arizona.edu/extension)  
Department of Hydrology and Water Resources, The University of Arizona – [www.hwr.arizona.edu](http://www.hwr.arizona.edu)  
Metropolitan Domestic Water Improvement District – [www.metrowater.com/](http://www.metrowater.com/)  
Oro Valley Water Utility – [www.ci.oro-valley.az.us/dpw/water\\_utility\\_.htm](http://www.ci.oro-valley.az.us/dpw/water_utility_.htm)  
Pima County Department of Environmental Quality – [www.deq.co.pima.az.us](http://www.deq.co.pima.az.us)  
Pima County Flood Control District – [sss.dot.co.pima.az.us/flood](http://sss.dot.co.pima.az.us/flood)  
Southern Arizona Water Resources Association – [www.scottnet.com/sawara/](http://www.scottnet.com/sawara/)  
Tucson Regional Water Council – [www.azstarnet.com/~trwc/](http://www.azstarnet.com/~trwc/)  
Tucson Water – [www.ci.tucson.az.us/water](http://www.ci.tucson.az.us/water)  
U.S. Bureau of Reclamation – [www.usbr.gov](http://www.usbr.gov)  
U.S. Environmental Protection Agency – [www.epa.gov](http://www.epa.gov)  
U.S. Geological Survey – [www.daztcn.wr.usgs.gov/](http://www.daztcn.wr.usgs.gov/)  
Water Resources Research Center, The University of Arizona – [ag.arizona.edu/AZWATER/](http://ag.arizona.edu/AZWATER/)  
WaterWiser - [www.waterwiser.org](http://www.waterwiser.org)

conference document is *Proceedings of the Symposium on Effluent Use Management*, edited by Kenneth D. Schmidt and Mary G. Wallace (AWRA 29th Annual Conference August 29 - September 2, 1993).

Some other sources of information on recharge methods and recharge policy in the Tucson area include:

CH2M Hill. *Rillito Recharge Project: An Evaluation of Recharge Techniques*. Prepared for the Arizona Department of Water Resources in Cooperation With Tucson Water and Pima County Flood Control District, July 1992. Tucson water issued a series of reports on *City of Tucson Sweetwater Underground Storage and Recovery Facility* in 1991 and 1994. These are just a few of the many government documents on related topics.

Some theses and dissertations have provided useful information. A complete list of those from the University of Arizona's Hydrology and Water

Resources Department is available on the Web site. Keith, S.J., *Stream Channel Recharge in the Tucson Basin and Its Implications for Groundwater Management*. The University of Arizona, Department of Hydrology and Water Resources. M.S. Thesis, 1980.

An analysis of the impacts of the Water Consumer Protection Act can be found in a paper by L.G. Wilson, W.G. Matlock and K.L. Jacobs, *Hydrologic Uncertainties and Policy Implications: The Water Consumer Protection Act of Tucson, Arizona, USA*. Hydrogeology Journal. Vol. 6, pp. 3-14. 1998.

## Subsidence

A good general introduction to subsidence is in Steven Slaff's *Land Subsidence and Earth Fissures In Arizona* published by the Arizona Geological Survey, Down-to-Earth Series 3 in 1993. Another general

introduction can be found in the *Arroyo* published by the WRRC in Summer 1992 titled “Land Subsidence, Earth Fissures Are Changing Arizona’s Landscape.”

The following more technical studies were published by the U.S.G.S.:

Anderson, S.R. *Potential for Aquifer Compaction, Land Subsidence, and Earth Fissures in the Tucson Basin, Pima County, Arizona*. U.S. Geological Survey Hydrologic Investigations Atlas HA-713. 1988.

Hanson, R.T. *Aquifer-System Compaction, Tucson Basin and Avra Valley, Arizona*: U.S. Geological Survey Water Resources Investigations Report 88-4172. 1989.

Hanson, R.T., S.R. Anderson and D.R. Pool. *Simulation of Ground-Water Flow and Potential Land Subsidence, Avra Valley, Arizona*. U.S. Geological Survey. Water Resource Investigations Report. 1990.

Hanson, R.T. and J.F. Benedict. *Simulation of Ground-Water Flow and Potential Land Subsidence, Upper Santa Cruz Basin, Arizona*. U.S. Geological Survey. Water Resources Investigations Report 93-4196. 1994.

Frisch-Gleason, Robin, Steven Slaff and Richard A. Trapp. *Bibliography of Subsidence and Earth Fissures Within Arizona*. Arizona Geological Survey Open File Report 95-8. June 1995.

Hoffman, John P., Donald R. Pool, A.D. Konieczki and Michael C. Carpenter. *Investigation of the Causes of Sinks in the San Xavier District, Tohono O’odham Nation, Pima County, Arizona*. U.S. Geological Survey, Open File Report 97-19. 1997.

Schumann, Herbert H. and S.R. Anderson. *Land Subsidence Measurements and Aquifer-Compaction Monitoring in Tucson Basin and Avra Valley, Arizona*. U.S. Geological Survey. Water Resources Investigations Report 88-4167. December 1998.

## Effluent

The Winter 1997 issue of SAWARA’s Waterwords, *Wastewater, A Growing Resource?* and the Summer 1990 issue, *Special Issue on Effluent As A Water Supply* provide much valuable information.

Information on the supply-related aspects of effluent can be found in:

Galyean, Kenneth C. *Infiltration of Wastewater Effluent in the Santa Cruz River Channel, Pima County, Arizona*. Water Resources Investigations Reports; 96-4021, 1996.

Pima County Wastewater Management Department’s *Tucson Water. Regional Effluent Utilization Plan. Phase A: Preliminary Regional Effluent Utilization Study*. Malcolm Pirnie, Inc. February 1991 and a final report in 1995.

Grey Wilson and others studied the water quality impacts of effluent recharge in *Water Quality Changes During Soil Aquifer Treatment of Tertiary Effluent*. Water Resources Research, Vol. 67, No. 3, pp. 371-376. 1995.

## Alternative Supplies

Information about alternative water supply and conservation strategies can be found in several issues of *Arroyo*, a periodical series published by the WRRC, The University of Arizona. The spring 1992 issue, “Weather Modification, a Water Resource Strategy to be Researched, Tested Before Tried,” the August, 1998 issue, “Managing Watersheds to Improve Land and Water”.

## Chapter 4: COPING WITH FLOODWATER

An historical, if somewhat dated summary of flooding issues and information in Pima County can be found in *Flooding and Erosion Hazards in Tucson*, published by Southwest Environmental Service in 1980. This is out of print, but available in libraries. Two issues of WRRC’s *Arroyo* dealt with general urban wash and flooding issues. “Often Neglected, Urban Washes Now Seen as Attractive Resource” (June 1991) and “Flood Hazards, a Concern in Desert Areas of Arizona” (June 1990).

Numerous reports from the Pima County Flood Control District and the City of Tucson deal with specific flood-related issues. There are reports for each major watercourse in connection with proposed projects. *Flood Control Concept Report for the Lower Santa Cruz River*, for example, by the Pima

County Department of Transportation and Flood Control District (July 1987) looks at alternative flood control measures in the Marana area. There are also reports for the non-structural flood control projects, such as the Cienega Creek Preserve. Reports dealing with streambed recharge projects are also available from the same sources. FEMA floodplain maps may be viewed at the flood control districts.

## Floodwater and Recharge

Guzman, A.G., L.G. Wilson, S.P. Neuman and M.D. Osborn. *Simulating Effect of Channel Changes on Stream Infiltration*. Journal of Hydraulic Engineering. American Society of Civil Engineers, Vol. 115, No. 12, pp. 1631-1645. 1989.

The Regional Recharge Committee issued an informative Technical Report printed by the Arizona Department of Water Resources Tucson Active Management Area in September 1996.

## Chapter 5: THE MANY USES OF WATER

### Water Use

Much of the information on water use comes from the Arizona Department of Water Resources’ Tucson Active Management Area Draft Third Management Plan 2000-2010 (1998) and from the first and second management plans. Also see the Arizona Department of Water Resources’ Tucson Active Management Area 1996 report, *State of the AMA*.

### Water Conservation

Every major water provider in the area has information for its customers on water conservation techniques. Water CASA and SAWARA also provide such information.

General studies of water conservation include B. Dziegielewski’s *Evaluating Urban Water Conservation Programs: A Procedures Manual*, prepared

for California Urban Water Agencies by Planning and Management Consultants, Ltd. February 1992.

A study of the impact of water rates on conservation is in Ari Michelsen and others' *Effectiveness of Residential Water Conservation Price and Nonprice Programs* published by the Research Foundation of the American Water Works Association, Denver, 1998.

Residential lawns in Tucson were studied by David Mouat and Michael Parton, *Assessing the Impact of Tucson Peak Water Demand Reduction Effort on Residential Lawn Use, 1976-79*. Office of Arid Lands, University of Arizona, December 1979.

Martin Karpisak and others discussed conservation in *Residential Water Conservation: Casa del Agua*. Water Resources Bulletin. Vol. 26. No. 6, December 1990. pp. 939-948.

*Residential Water Demand: A Micro Analysis Using Survey Data*. by Gary Woodard and Todd Rasmussen, (Hydrology and Water Resources in Arizona and the Southwest, 14, 1984) examines factors that influence conservation.

Other surveys of municipal water use include: and in Tucson Water's *Results from the Fall 1992 Residential Household Survey*. (Draft.1995) and Craft, Marti, "Draft Summary of Landscape Survey Results, for ADWR, TAMA, unpublished.

## **Water Harvesting, Xeriscape and Reuse**

*Harvesting Rainwater for Landscape Use*, by Patricia Waterfall (University of Arizona Cooperative Extension and the Tucson Active Management Area. Sept. 1998) provides practical, how-to information for homeowners. Pima County Cooperative Extension has a variety of pamphlets dealing with xeriscaping and low water use plants. See their Web site. The Summer 1993 issue of WRRC's *Arroyo* "Home Use of Graywater, Rainwater Conserves Water and May Save Money" provides a good overview. The water quality aspects are discussed in Charles Gerba and others' *Water Quality Study of Graywater Treatment Systems* (Water Resources Bulletin. Vol. 31, No. 1, pp.109-116). An examination of large scale reuse can be found in numerous reports prepared for Tucson Water. One

example is *Tucson Metropolitan Wastewater Reuse Assessment Update*. (Malcolm Pirnie, Inc. August 1994).

## **Riparian Water Use**

Information about water use for local riparian and wetlands came from the City of Tucson Multiple Benefit Project and Pima County Flood Control District. Both agencies have brochures for the public describing various planned and completed projects. Riparian preservation and restoration issues were described in two issues of the *Arroyo*. The City of Tucson also has information on the Sweetwater Wetland. The December 1988 issue of *Arroyo* "Flow of Rivers and Streams Provides Rich Benefits, Raises Varied Concerns" and the Spring, 1993 issue "Managing the Flow to Better Use, Preserve Arizona's Rivers" discuss water for riparian areas. Information about the legal aspects of effluent use in riparian areas came from Barbara Tellman's *Arizona's Effluent Dominated Riparian Areas: Issues and Opportunities*. (WRRC, Issue Paper No. 12, 1992).

## **Agriculture**

Studies concerning agriculture include Paul Wilson's *An Economic Assessment of Central Arizona Project Agriculture*, Department of Agricultural and Resource Economics, University of Arizona, A Report Submitted to the Office of the Governor and the Arizona Department of Water Resources, 1992; Arizona Academy, Tenth Arizona Town Hall, Do Agricultural Problems Threaten Arizona's Total Economy? April, 1967. Some statistical information on agriculture can be found in Arizona Agricultural Statistics Service. Arizona Agricultural Statistics. USDA, Phoenix.

Some theses and dissertations on Arizona agriculture include Esher, Joseph C., *The Economic Sustainability of Central Arizona Project Agriculture*. M.S. Thesis, Department of Agricultural and Resource Economics, 1994. Peacock, Bruce, *Complying With the Arizona Groundwater Management Act: Policy Implications*, PhD Dissertation, Department of Agricultural and Resource

Economics, University of Arizona. 1994; and Mark Evans, *An Assessment of the Impact of the Arizona Groundwater Management Act in the Phoenix Active Management Area*. M.S. Thesis. Department of Agricultural and Resource Economics.

## **Metal Mining**

Some useful information on metal mining in the Tucson area can be found in Southwest Groundwater Consultants, Inc., *Conservation and CAP Use Potential of Tucson AMA Mines*, Prepared for Arizona Department of Water Resources, TAMA, 1997. Pima Association of Governments, *Groundwater Monitoring in the Tucson Copper Mining District - Detailed Upper Santa Cruz Basin Mines Task Force Area Recommendations*, July 1983. Arizona Department of Mines and Mineral Resources, *Arizona's Mining Update*, 1998.

## **Chapter 6: ENSURING SAFE DRINKING WATER**

Information about water quality in Arizona is available from the EPA Web site. ADEQ also has a Web site with Arizona information. ADEQ's biennial reports (published in even-numbered years) on water quality in Arizona contain valuable information about surface and groundwater quality, including contamination sites of special concern. See Arizona Department of Environmental Quality. *Arizona Water Quality Assessment 1996*. The USGS is collecting a large amount of water quality information under its NAWQA Project (National Water Quality Assessment) some of which is available from the Tucson office. Pima County, City of Tucson, Dames and Moore. A summary of the TCE cleanup project is in *TARP In-Channel Recharge Pilot Proposal, Abbreviated Report* (Pima County, City of Tucson and Dames and Moore. January 1997).

## **Water Quality**

Some general introductions to water quality issues can be found in several issues of the WRRC

*Arroyo* by Joe Gelt. These include "Water Quality, a Complex Issue" (Summer 1987), "Nonpoint Source Pollution: Unfinished Business on the Water Quality Agenda" (April 1990), "Constructed Wetlands: Using Human Ingenuity, Natural Processes to Treat Water, Build Habitat," (March, 1997) and "Microbes Increasingly Viewed as Water Quality Threat" (March, 1998).

The Pima Association of Governments has published a series of reports on regional water quality matters. Topics include *A Regional Plan for Water, Sewerage and Solid Waste Management; An Assessment of Groundwater Quality Near the Sahuarita Landfills, Sahuarita, Arizona; Phase I Report. Final, Avra Valley Recharge Project Stable Isotope Study Year-End Progress Report Fiscal Year 1996-1997; CAP Water Salinity Impacts on Water Resources of the Tucson Basin; Central Avra Valley Storage and Recovery Project Pilot Phase and Expanded Pilot Phase Stable Isotope Study; Fiscal Year 1997-1998 Progress Report; Groundwater Monitoring in the Tucson Copper Mining District - Detailed Upper Santa Cruz Basin Mines Task Force Area Recommendations; Landfills Along the Santa Cruz River in Tucson and Avra Valley; Arizona and the Water Quality State of the Region Report.*

Public attitudes toward CAP water were surveyed by Gary Woodard and other in *Impacts of Changes in Water Quality and Consumer Responses in Tucson, Arizona.* (WRRRC 1993). Malcolm Pirnie Environmental Engineers looked at another similar community's experience with a change in water source in *Investigation of Potable Water Complaints in Dickinson, Texas* (Malcolm Pirnie, Inc., Special Study Report, May, 1986).

## Water Treatment

Dames and Moore produced a series of papers for Tucson Water on CAP Use Study for Quality Water in 1994 and 1995.

## Corrosivity

A study was done for Tucson Water by M. McGuire and others, *Review of Corrosion-Related Water Quality Problems in the City of Tucson* (McGuire Environmental Consultants 30 September, 1993).

More general discussions of corrosivity are by R. Lane, *Control of Scale and Corrosion in Building Water Systems* (McGraw Hill, New York, 1993) and I. Wagner, *Internal Corrosion in Domestic Drinking-Water Installations.* Aqua, 41(4), 219-223, 1992. The effects of corrosion on steel were studied by R.J. Pisigan and J. Singley, *Effects of Water Quality Parameters on the Corrosion of Galvanized Steel* (Journal American Water Works Association, 76-82, November, 1985).

## Disinfection and Disinfection Byproducts

These are just a few of many studies of disinfection treatment methods and disinfection byproducts. White, G., *The Handbook of Chlorination*, Van Nostrand Reinhold Company, New York; McGuire, M., S. Reiber, R. Sierka, J. Singley, and C. Steelink, *Disinfectants for Drinking Water Treatment— A White Paper* (Prepared for Tucson Water by Central Arizona Project Water Quality Expert Panel), 25 April, 1995.

Disinfection byproducts are discussed in R.J. Bull's *Toxicology of Drinking Water Disinfection*, (Washington State University, Pullman, WA); G. Cline and J. Russell's *An Evaluation of Treatment Strategies for the Control of Disinfection By-Products: Water Quality vs. Cost* and W.H. Glaze's *Reaction Products of Ozone: A Review.* Environmental Health Perspectives, 69, 151-157, 1986. A great deal of information on this subject is available from the EPA Web site.

## Salinity

Studies of salinity in the Colorado River include the Colorado River Basin Salinity Control Forum's *Water Quality Standards for Salinity, Colorado River System, 1993*; the U.S. Department of the Interior's *Quality of Water - Colorado River Basin* (Progress Report No. 18, 1997); and T.G. Miller and others *The Salty Colorado*, The Conservation Foundation, Washington D.C., 1986.

The impacts of salinity are examined in Garrett, Charles K. *Long Range Salinity Impacts in the Tucson Basin* (Prepared for Tucson Water. December 1992); Kleinman, A. and F. Brown, *Colorado River Salinity: Economic Impacts on Agricultural, Municipal and*

*Industrial Users* (U.S. Department of Interior, Denver, 1980); Lohman, L., et al., *Estimating the Economic Impacts of Salinity of the Colorado River* (prepared for the U.S. Bureau of Reclamation. Final Report, 1988); R. d'Arge and L. Eubanks, *Municipal and Industrial Consequences of Salinity in the Colorado River Service Area of California, Salinity Management Options for the Colorado River*, 1978; G.C. Ragan and others, *Improved Estimates of Economic Damages from Residential Use of Mineralized Water* (Completion Report No. 183 Colorado Water Resources Research Institute, Colorado State University, August, 1993); Black and Veatch Consulting Engineers, *Economic Effects of Mineral Content in Municipal Water Supplies* (Research and Development Progress Report No. 260, U.S. Department of Interior, Office of Saline Water, 1967); the California Department of Water Resources, *Consumer Costs of Water Quality in Domestic Water Use - Lompoc Area*, Los Angeles, 1978; and Farnham, D., *Water Quality: Its Effects on Ornamental Plants* (Leaflet 2995), University of California Cooperative Extension, 1985.

Treating water to reduce salinity is discussed in Thompson, M., M.R. Wiesner, G. P. Westerhoff and M. P. Robinson, *Manual on Membrane Processes for Drinking Water Treatment*, Malcolm Pirnie Technical Publication, November, 1991 and in M.S. McGuire and others *Membrane Processing of Surface and Ground Waters for Human Consumption* (by Central Arizona Project Water Quality Expert Panel), 16 January, 1995.

## Taste

The following are just a few of many studies of taste in water. Bruvold, W., H. Ongerth and R. Dillehay, *Consumer Assessment of Mineral Taste in Domestic Water.* Journal American Water Works Association, 575-580, November, 1969 and Bruvold, W., and J. Daniels, *Standards for Mineral Content in Drinking Water.* Journal AWWA, February, 1990.

Home water treatment alternatives are discussed in WRRRC *Arroyo*, "Consumers Increasingly Use Bottled Water, Home Water Treatment Systems to Avoid Direct Tap Water" (March 1996) and a pamphlet by SAWARA and the League of Women Voters, *Home Water Treatment*. Information on this

subject is also available from the Arizona Water Quality Association (602) 947-9850.

## **Chapter 7: ROLES OF CITIZENS AND GOVERNMENT IN WATER POLICY**

William E. Martin, Helen Ingram and others described the development of Tucson's water policies and problems in *Saving Water In A Desert City*, published in Washington, D.C. by Resources for the Future in 1984. A more recent analysis can be found in an article by Wilson, L.G., W.G. Matlock and K.L. Jacobs, *Hydrologic Uncertainties and Policy Implications: The Water Consumer Protection Act of Tucson, Arizona, USA*. (Hydrogeology Journal. Vol. 6, pp. 3-14. 1998). A summary of the City of Tucson's current water policies can be found in the City of Tucson's Mayor and Council Water Policies. Resolution No. 17929. Adopted January 26, 1998. For information about views of the Citizens Alliance for Water Security, email them at caws@techstar-online.com. Philip C. Metzger analyzed Tucson's water management in *To Master A Thirsty Future: An Analysis of Water Management Efforts in Tucson, Arizona*. (A Case Study Report from the Water Resources Program, The Conservation Foundation, May 1984.)

*Ensuring Arizona's Water Quantity and Quality into the 21st Century* contains a summary of laws pertaining to water quantity and water quality. This background report prepared by The University of Arizona for the 1997 Arizona Town Hall is available from the Arizona Town Hall office in Phoenix.

Discussions of the Groundwater Management Act and its implementation are discussed in

"ADWR Developing Second Management Plan" (WRRC Arroyo Spring, 1987) and "The Groundwater Management Act: Saving Water and Developing Water Policy" (WRRC Arroyo Spring 1988). "Debate, Discussion Mark Ten-Year Anniversary of Arizona's Groundwater Management Act" (WRRC Arroyo October 1990); Robert J. Glennon's *Because That's Where the Water Is: Retiring Current Water Uses to Achieve the Safe-Yield Objective of the Arizona Groundwater Management Act*. Arizona Law Review 33:89 1991; State of Arizona Office of the Auditor General, Performance Audit of Arizona Department of Water Resources, Report No. 99-8, April 1999.

General information about the Colorado River Compact is in WRRC's August 1997 *Arroyo*, "Sharing Colorado River Water: History, Public Policy and the Colorado River Compact."

Some problems confronting small water systems are discussed in "Arizona's Small Water Systems Confront Questions, Uncertainties" (WRRC. *Arroyo*. October, 1991).

Regional water management is examined in "Regional Water Supply Agency, A New Arizona Water Policy Concept" (WRRC Arroyo, April, 1991).

Information about the Arizona Water Banking Authority is available from the AWBA Web site. The Central Arizona Water Conservation District (Central Arizona Project) and Central Arizona Groundwater Replenishment District also have a Web site with current information.

A thorough discussion of Indian water rights issues can be found in *Indian Water Rights: Negotiating the Future* published in 1983 by Elizabeth Checchio and Bonnie Colby, available from the Department of Agricultural Economics, The University of Arizona. A shorter explanation can be

found in "Settlement of Indian Water Rights, a Priority Issue" (December 1989 WRRC *Arroyo*).

## **STATUTES DEALING WITH WATER**

### **Water Quantity**

ARS (Arizona Revised Statutes) Title 45: Chapter 1 deals with surface water laws; Chapter 2 contains the Groundwater Code, including laws dealing with water rights, transportation of groundwater, wells and artificial recharge; Chapter 3 contains provisions for underground water storage; Chapter 8 contains flood control statutes and the remaining chapters deal with dams, irrigation districts and other matters.

### **Water Quality**

The federal Clean Water Act is contained in 33 USC (United States Code) Chapter 26. This includes laws controlling NPDES permits, wastewater treatment discharges, and related activities.

43 USC contains the Safe Drinking Water Act. The National Environmental Policy Act of 1969 is in 42 U.S.C.4321-4347. CERCLA (or Superfund) is contained in 42 USC - 9601 et seq.

Information about EPA regulations and water quality standards is available from the EPA Web site [www.epa.gov](http://www.epa.gov). This site also has a list of water providers in Pima County.

ARS Title 49 deals with environmental management, including water quality matters, with emphasis on groundwater protection. The Arizona Administrative Code, Title 18 Chapters 9 and 11 contains specific regulations under the statutes.