ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Janet Napolitano
Governor

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.adeq.state.az.us

Stephen A. Owens
Director

December 18, 2003

Dear Stakeholder:

The Arizona Department of Environmental Quality (ADEQ) has revised and updated the State's Five-Year Nonpoint Source Management Plan. The final plan is now available for reference at http://www.adeq.state.az.us/environ/water/non/index.html#5year. This State Management Plan will guide and direct ADEQ's activities for the next five years (2003 to 2008) and fulfills the requirements of Section 319 of the Clean Water Act. Arizona's Nonpoint Source State Management Plan comprehensively describes a framework for agency coordination and cooperation and serves to implement a strategy for employing effective management measures and programs to control nonpoint source pollution statewide.

A combination of tools, such as surface and ground water monitoring, watershed inventories, watershed characterizations, Total Maximum Daily Load (TMDL) studies, TMDL implementation plans, watershed-based plans, and water quality improvement projects, will be used to protect the state's water resources from nonpoint source pollution. With improved coordination, collaboration and combined agency and local stakeholders efforts working to implement measures outlined in this Plan, nonpoint source pollution can be better managed and controlled at both statewide and community levels.

If you have any questions, please contact Susan Ward-Craig, Watershed Management Unit Supervisor, at (602) 771-4509 or, toll free in Arizona, (800) 234-5677, Ext. 771-4509, or swl@ev.state.az.us.

Sincerely,

Karen Smith, Director
Water Quality Division

Cc: Linda Taunt, Hydrologic Support and Assessment Manager, ADEQ
Susan Ward-Craig, Watershed Management Unit Supervisor, ADEQ
Sandra Sutton, Grants and Outreach Unit Supervisor, ADEQ
Ephraim Leon-Guerrero, Arizona Project Officer, US EPA

Northern Regional Office
1515 East Cedar Avenue • Suite F • Flagstaff, AZ 86004
(928) 779-0313

Southern Regional Office
400 West Congress Street • Suite 433 • Tucson, AZ 85701
(520) 628-6733

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ADEQ
Arizona Department of Environmental Quality

Janet Napolitano, Governor
Stephen A. Owens, ADEQ Director

Arizona's Nonpoint Source State Management Plan

Five Year Plan
2003 - 2008

Prepared by the

Arizona Department of Environmental Quality

Hydrologic Support & Assessment Section

November 2003

Contents

Chapter 1 - Introduction 5
- Background 5
- Purpose 7
- Vision 8

Chapter 2 - Nonpoint Source Pollution 9
- Agriculture 9
- Forestry 11
- Urban Runoff 12
- Hydromodification 13
- Onsite/septic waste treatment systems 14
- Mining 15
- Recreation 15

Chapter 3 - Nine Key Element's 17

Chapter 4 - Dealing with Sediment in Arizona 22
- Change in Water Quality Standards 22
- Managing Sediment 23
  - Structural Controls 23
  - Non-structural Source Controls 23

Chapter 5 - ADEQ's NPS Management Program 25
- Surface Water Monitoring and Standards Program 25
  - Water Quality Standards Program 25
  - Surface Water Monitoring Program 27
    - Fixed Station Network (FSN) Monitoring 28
    - USGS Cooperative Fixed Station Network Monitoring 28
    - Basin Characterization Monitoring 28
    - Unique Waters Monitoring 29
  - Biocriteria Program 29
  - Clean Lakes Program 30
- Total Maximum Daily Load Program 30
  - Targeted Monitoring 31
- Watershed Management Program 31
  - Arizona's Integrated 305(b) Assessment and 303(d) Listing Report 32
  - TMDL Implementation Plans 32
  - NEMO 34
  - TMDL Public Involvement 36
  - Regional 208 Water Quality Management Planning 36
- Grants and Outreach Program 37
- Groundwater Monitoring Program 38

Ambient Groundwater Monitoring Program 38
Pesticide Contamination Prevention Program 39
Volunteer Monitoring Program 40
Other Programs Affecting NPS Management 41
Dredge and Fill Program (CWA 404 Program) 41
Stormwater Permit Program (NPDES) 42
Aquifer Protection Permit Program 42
Source Water Assessment Program 43
Compliance and Enforcement Programs 43
Data Management and Analysis Group 43

Chapter 6 - Partnerships & Program Integration 46
Cooperative Monitoring 46
Memorandums of Understanding 47
Water Quality Improvement Grant Program 47
Public Participation 47
303(d) Listing, TMDLs and Implementation 48

Chapter 7 - NPS Education and Outreach 49
Support for Arizona's NPS Program 49
General NPS education, materials, and opportunities 50
Adult Education 50
Youth Education 52
Public outreach events 52
Volunteer Monitoring 53
Watershed Partnerships 53

Chapter 8 - NPS Program Goals 54

Chapter 9 - Tracking Effectiveness 60
Water Quality Monitoring 60
Trend, Baseline, & Compliance Monitoring 60
Implementation Monitoring 61
Volunteer Monitoring 61
Project Monitoring 61
NPS Program Effectiveness 62
Water Quality Improvement 62
NPS Pollutant Load Reduction 62
Implementation of NPS Controls 63
Public Education, Awareness, and Action 63
References 64

Appendix A, Partners in the State (MOUs)

Appendix B, Water Quality Improvement Grant Recipients

Appendix C, Water Quality Improvement Grant Project Locations

Appendix D, Water Quality Division Organizational Chart

Appendix E, Hydrologic Support & Assessment Section Organization Chart

Appendix F, Arizona Watersheds

Appendix G, Counties, COGs & Major Watersheds

Arizona's Nonpoint Source Management Plan

(2003-2008)

Chapter 1 - Introduction

Background

Water is the vital link between ecosystems, connecting the mountains with the bays and estuaries along coastlines; providing habitat for fresh and salt water life; and helping to maintain climate and sustain life. People across the planet depend on water to grow food, generate power, cool the machines of industry, quench thirst, and revive spirits. Unfortunately, many of our nation's rivers and streams are in crisis and desperately need stewardship.

As a response to the threats to our natural waterways, the Clean Water Act (CWA) was created and has helped to provide cleaner and safer water. Early CWA programs concentrated on controlling point sources of pollution caused by discharges from large municipal and industrial sources. These programs achieved tremendous improvements in both groundwater and surface water quality. Despite these accomplishments, much remains to be done to achieve the goals of the CWA and ensure that the nation's waters are "fishable" and "swimmable." In addition to point sources of pollution, Arizona's water resources continue to be impacted by nonpoint sources (NPS) of pollution. NPS is now considered the single largest cause of water pollution throughout the nation.

Arizona's NPS Program, administered by ADEQ, has been operating under the guidance of a NPS State Management Plan approved by the U.S. Environmental Protection Agency (EPA) in 1998. The 1998 NPS State Management Plan led to many accomplishments within Arizona's NPS Program. ADEQ was successful in meeting the following goals identified in the 1998 plan and the accomplishments are highlighted below.

- The NPS Program was implemented using a watershed approach, encouraging local communities to target pollution reduction efforts in their watersheds.

- The Water Quality Improvement Grant Program replaced the Request for Proposal process to solicit and award contracts for water quality improvements through the 319(h) Program. The Water Quality Improvement Grant Program has a new customer-oriented format. A grant manual was further improved, providing a clear overview of the Program and information on how to prepare a successful grant application. Grant workshops were provided across the state for

each grant cycle.

< Technical oversight and excellent customer service was provided to grantees who received Water Quality Improvement Grants.

< Quality Assurance Project Plans were developed for specific grant projects that conducted water quality monitoring to measure water quality improvement. Guidance was developed to assist grantees in the development of individual monitoring plans so that the data collected was credible and scientifically defensible and could be used in *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report*.

< ADEQ worked with local watershed groups to identify and prioritize water quality issues in their watersheds and assisted these groups with finding better solutions. Watershed Restoration Action Strategies per the 1998 *Clean Water Action Plan* were important plans developed through this collaborative outreach effort.

< Environmental Assessment and Resource Management Plans were reviewed and comments were made to local, state and federal agencies about possible water quality and NPS impacts.

< Water quality monitoring data was compiled, assessed, and *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report* was completed.

< Best Management Practice (BMP) guidance documents were developed for a variety of NPS activities, including livestock grazing, urban runoff, and sand and gravel operations.

< ADEQ adopted the Surface Water Grazing Permit according to Arizona Revised Statute (A.R.S.) §49-202.01). This is a general permit that requires use of BMPs to reduce impacts from grazing activities. Compliance with the permit is through demonstration that effective BMPs are being used.

< NPS Watershed Inventories were completed for the entire state using Geographic Information Systems (GIS). The NPS inventories provide a baseline of information, highlighting the NPS issues unique to each watershed region, and can be used to educate the public, municipal officials, and government agencies.

As part of ongoing program review, the Arizona Department of Environmental Quality (ADEQ) determined that a new, integrated approach to NPS pollution was in order. With a new focus in mind, ADEQ created a NPS Program that is consistent with the goals of the CWA, and provides more opportunities for public involvement at the watershed or community level.

The new State Management Plan builds upon the foundation of the earlier work and will guide and direct activities for the next five years (2003 to 2008). ADEQ will continue to work with federal, state, tribes, local agencies, nonprofit organizations, the environmental community and local citizens to develop NPS watershed management strategies to reduce NPS pollution that degrades water quality. These management strategies will rely on the cooperation of all people, stakeholders that live within the watershed or have management responsibilities for the lands and the waterbodies within. Arizona's NPS Program will continue to rely on this type of cooperation, education and partnership as the primary method to reduce NPS pollution and improve the state's water quality.

Arizona's NPS Program gathers information, monitors and focuses on the following land use activities that can negatively impact surface and groundwater within the State:

- Agriculture
- Forestry
- Urban runoff
- Hydromodification
- Onsite/septic waste treatment systems
- Mining
- Recreation

Arizona's NPS State Management Plan integrates the state's CWA and Safe Drinking Water Act programs with voluntary incentives. ADEQ uses a combination of tools including: surface and ground water monitoring, watershed inventories, watershed characterizations, Total Maximum Daily Load (TMDL) studies, TMDL implementation and source water assessment plans, watershed-based plans, and water quality improvement projects to protect the state's water resources from NPS pollution. Staff work closely with stakeholders to develop community-led, watershed-based planning efforts. These local planning efforts assist the department in developing programs and outreach activities appropriate to the specific area and the issues. Since Arizona has a large amount of publicly owned lands, partnerships with federal, state and tribal land and resource management agencies are a key element in the Program's success.

Purpose

This NPS Management Plan Update (2003) fulfills the requirements of Section 319 of the CWA by comprehensively describing a framework for agency coordination and cooperation and serves to implement a strategy for employing effective management measures and programs to control NPS pollution statewide. Further, it incorporates nine key elements outlined in EPA's 1996 NPS guidance document. Through the use of a framework that addresses these key elements, Arizona will continue to have an effective but flexible NPS Program that is designed to achieve and maintain beneficial uses of water.

ADEQ strives to effectively lead and implement Arizona's NPS Program. By incorporating various components and elements into the NPS Management Plan to successfully address the nine key elements, EPA can continue to give ADEQ priority for multi-year grant work plans, streamlined review of grant applications, increased technical assistance, and reduced reporting requirements.

The Program strategy described herein amends the previous NPS Management Plan approved in 1998. The 2003 Plan covers:

- Chapter 1 - Introduction
- Chapter 2 - Nonpoint Source Pollution
- Chapter 3 - Nine Key Element's Discussion
- Chapter 4 - Dealing with Sediment in Arizona
- Chapter 5 - ADEQ's NPS Management Program
- Chapter 6 - Partnerships & Program Integration
- Chapter 7 - NPS Education & Outreach
- Chapter 8 - NPS Program Goals
- Chapter 9 - Tracking Effectiveness

Arizona's NPS State Management Plan is an important tool. ADEQ can better achieve restoration, maintenance and protection of the beneficial uses of both surface and ground water bodies through the NPS Management Plan. With improved coordination, collaboration and combined agency efforts working with local people on the implementation measures outlined in the Plan, NPS pollution can be better managed and controlled at both the statewide and watershed-scale level.

Vision

Water Quality Division Mission Statement

The mission of the Water Quality Division is to protect and enhance public health and the environment by ensuring safe drinking water and reducing the impact of pollutants discharged to surface and groundwater.

By working together with a diverse array of partners, ADEQ can identify and implement successful strategies to maintain and restore the chemical, physical and biological integrity of our waters. No doubt, many of these strategies will be tailored to specific problems in specific communities. Hence, the importance of the watershed as a social and hydrological reality. Here is where communities, neighbor to neighbor, can engage, educate and persuade one another in a mutual quest for shared goals.

The NPS Program aims to address water quality issues, educate the public to build a better understanding of the remaining water quality challenges and solutions, promote a public stewardship ethic and commitment, encourage public involvement and support for watershed protection programs.

A large portion of NPS pollution originates from "people pollution" because it can be caused by the collective impacts of individuals interacting with the land. Some examples of human-caused pollution include fertilizers, pesticides, and lawn chemicals that have been mis-applied; pet waste that has not been picked up; and even such seemingly benign acts as cars being washed in driveways. Stormwater runoff from these actions can pollute local water resources across the state. NPS pollution can also be created from the natural environment and rain events of sheet-flow across forest and desert landscapes. The following categories are helpful in understanding the different sources of NPS pollution.

A. **Agriculture**

Agricultural land produces an abundant supply of low-cost, nutritious food and other products. American agriculture is noted worldwide for its high productivity, quality, and efficiency in delivering goods to the consumer. However, improperly managed agricultural activities can negatively affect water quality. Based on the most recent *National Water Quality Inventory,* agricultural NPS pollution is the leading cause of water quality problems in the nation's rivers and lakes, the third largest source of impairments to estuaries, and is a major contributor to ground water contamination, including wetlands degradation. Based on the latest Geographic Information System (GIS) coverage (1993), approximately 2% of land in Arizona is cultivated agriculture.

Agricultural activities that cause NPS pollution include animal feeding operations, grazing, plowing, pesticide spraying, irrigation, fertilizer application, planting, and harvesting. The major agricultural NPS pollutants that result from these activities are increased sediment, pesticides, nitrate from fertilizers, animal wastes, bacteria and total dissolved solids. Agricultural activities also can damage habitat and stream channels. Surface disruption and reduction in natural vegetative cover associated with grazing is a well-known factor which can increase the erosion of lowland stream channels and upland range. Agricultural impacts on surface water and ground water can be minimized by properly managing these agricultural activities.

Sedimentation occurs when wind or water runoff carries soil particles from an area, such as a farm field, and transports them to a waterbody, such as a stream or lake. Excessive sedimentation clouds the water, which reduces the amount of sunlight reaching aquatic plants; covers fish spawning areas and food supplies; and clogs the gills of fish. In addition, other pollutants like phosphorus, pathogens, and heavy metals are often attached to the soil particles and wind up in the waterbodies with the sediment. Farmers and ranchers can reduce erosion and sedimentation by 20 to 90 percent by applying

management measures to control the volume and flow rate of runoff water, stabilizing the soil in place and reducing sediment transport.

Nutrients such as phosphorus, nitrogen, and potassium in the form of fertilizers, manure, sludge, irrigation water, legumes, and crop residues are applied to enhance production. When they are applied in excess of plant needs, nutrients can wash into aquatic ecosystems where they can cause excessive plant growth, which reduces swimming , fishing and boating opportunities, creating a foul taste and odor in drinking water, and potentially killing aquatic habitat. In drinking water, high concentrations of nitrate have been known to cause the potentially fatal "blue baby syndrome", or methemoglobinemia. Farmers can implement nutrient management plans which not only help maintain high yields, save money and optimize the use of fertilizers; they can also reduce NPS pollution.

By confining animals to areas or lots, farmers and ranchers can efficiently feed and maintain livestock. But these confined areas become major sources of animal waste. Runoff from poorly managed facilities can carry pathogens (bacteria and viruses), nutrients, and oxygen-demanding substances that contaminate fishing areas and other major water quality problems. Ground water can also be contaminated by seepage from animal feeding operations. These discharges can be controlled by storing and managing facility wastewater and runoff with an appropriate waste management system.

Irrigation water is applied to supplement natural precipitation or to protect crops against freezing or wilting. Inefficient irrigation can cause water quality problems. In arid areas, for example, where rainwater does not carry residues deep into the soil, excessive irrigation can concentrate pesticides, nutrients, disease-carrying microorganisms, and salts-all of which impact water quality-in the top layer of soil. Farmers can reduce NPS pollution from irrigation by improving water use efficiency. Actual crop needs can be measured with a variety of equipment.

Pesticides, herbicides, and fungicides are used to kill pests and control the growth of weeds and fungus. These chemicals can enter and contaminate water through direct application, runoff, wind transport, and atmospheric deposition. They can kill fish and wildlife, poison food sources, and destroy the habitat that animals use for protective cover. To reduce NPS contamination from pesticides, people can apply Integrated Pest Management (IPM) techniques based on the specific soils, climate, pest history, and crop for a particular field. IPM helps limit pesticide use and manages necessary applications to minimize pesticide movement from the field.

Overgrazing can expose soils, increase erosion, encourage invasion by non-native plants, destroy fish habitat, and reduce the filtration of sediment necessary for building streambanks, wet meadows, and floodplains. To reduce the impacts of grazing on water

quality, farmers and ranchers can adjust grazing intensity, keep livestock out of sensitive areas, provide alternative sources of water and shade, and revegetate rangeland and pastureland.

B. **Forestry**

Forestry activities can cause significant water quality problems if improperly managed. The latest *National Water Quality Inventory* reports that forestry activities contribute to approximately 9% of the water quality problems in surveyed rivers and streams nationwide.

Forests in Arizona are managed by various entities: Forest Service, Bureau of Land Management (BLM), private and other government organizations. Based on the latest GIS coverage (1993), the Forest Service manages approximately 15% of the land in Arizona and BLM manages 16%. Sources of NPS pollution associated with forestry activities include removal of stream side vegetation, road construction and use, timber harvesting, and mechanical preparation for the planting of trees. Road construction and road use are the primary sources of NPS pollution on forested lands, contributing up to 90 percent of the total sediment from forestry operations. Harvesting trees in the area beside a stream can affect water quality by reducing the streambanks shading that regulates water temperature and by removing vegetation that stabilizes the streambanks. These changes can harm aquatic life by limiting sources of food, shade, and shelter.

Most problems from timber harvesting are related to vehicles and machinery, and the dragging and loading of logs. Problems include soil disturbance and compaction, and direct disturbance of stream channels. Poor harvesting and transport techniques can increase sediment and disturb as much as 40 percent of the soil surface. Careful selection of equipment and transport methods for logs can significantly reduce the amount of soil delivered to waterbodies. Stream channels should be protected from logging debris at all times during harvesting operations. Some typical BMPs that could be used to address silviculture needs are pre-harvest planning, stream side buffers, road management, revegetation of disturbed areas, structural practices and equipment, sediment control structures, timber harvesting equipment, and prescribed burns.

Another increasingly large source of NPS pollution that cannot be overlooked from forest lands is wildfire occurrence, especially during long drought periods. Arizona is currently experiencing it's worst drought in over 100-years and these extremely dry conditions are exacerbating the likelihood of wildfires. An infamous example of this is the Rodeo-Chediski wildfire that occurred in late June 2002. The economic and social impacts to the wildland-urban interface and the entire Mogollon Rim area will be enduring for many years. The aesthetic impacts of burnt trees and newly created moonscapes are not easily overlooked in these burned areas and will probably last for a very long time. However, less obvious to the public are the negative impacts that can devastate the

downstream water resources and natural ecosystems caused by wildfires. When wildfires occur in Arizona's pine forests, the after effects on soil conditions, hardening of the surface soils and removal of vegetation buffer areas can increase erosion rates exponentially. Sometimes 5-year flooding events can act like 100-year flooding events when wildfires consume most of the vegetative buffers that formerly slowed the rate of water naturally flowing. Some of the negative water quality impacts observed to the downstream Salt River and Roosevelt Lake after the wildfire will be documented and published in *Arizona's Integrated 305(b) Assessment and 303(d) Listing Report* in 2004.

C. Urban Runoff

Incorporated or urban areas make up approximately 3.5% (GIS 1993 Coverage)of the land area in Arizona. Urban areas are covered by sidewalks, parking lots, roads, buildings and driveways. Hardscapes prevent water from percolating down into the ground. Quickly flowing runoff can severely erode streambanks, damage streamside vegetation and actually widen streamchannels. Runoff from pavement is warmer, and increases the temperature of receiving waters. Native fish and other aquatic species cannot survive in these warmer waters. To protect surface and ground water quality, urban development plans need to limit runoff and reduce pollution.

Urban areas contain a great deal of impervious surface that accumulates pollutants and transports runoff rapidly to receiving waters

Grass and natural ground cover, are attractive and practical substitutes for asphalt driveways, walkways, and patios. Natural landscapes like forests, wetlands, and grasslands trap rainwater and snowmelt and allow it to filter slowly into the ground. Filtered runoff reaches receiving waters gradually and allows rainwater to slowly seep into the ground.

On November 27, 2002, Congress enacted the Great Lakes Legacy Act of 2002. This law includes a section that authorizes the use of Section 319 funds to carry out projects and activities that relate to the implementation of Phase II National Pollutant Discharge Elimination System programs. This enactment provided ADEQ an opportunity to develop the Stormwater Phase II Assistance Program. The Assistance Program is designed to aid local governments designated as Small Municipal Separate Storm Sewer Systems (Small MS4s) impacted by the new Stormwater Phase II regulations. Small MS4s that fell under this designation and will be eligible for this assistance include: Apache Junction, Avondale, Camp Verde, Chandler, Coconino County, Cottonwood, Douglas,

NPDES Storm Water Phase II Program Requirements

Regulated municipalities must develop and implement a Storm Water Management Program (SWMP) that will reduce pollutants in storm water to the Maximum Extent Practicable. The SWMP must include BMPs for each of the 6 Minimum Control Measures, which are:

1. Public Education and Outreach on Storm Water Impacts

2. Involvement/Participation Public

3. Illicit Discharge Detection and Elimination

4. Construction Site Runoff Control

5. Post-Construction Storm Water Management in New Development and Redevelopment

6. Prevention/Good Pollution Housekeeping for Municipal Operations

In addition to BMPs, regulated municipalities will also have to develop Measurable Goals that will allow both the municipality and the permitting authority to gauge whether each BMP was successful. Municipalities also need to develop a timeline for implementation of each element of the program and identify the party or parties

El Mirage, Flagstaff, Fountain Hills, Gilbert, Goodyear, Guadalupe, Lake Havasu, Litchfield Park, Marana, Maricopa County, Nogales, Oro Valley, Paradise Valley, Peoria, Pinal County, Prescott, Prescott Valley, Sedona, Sierra Vista, South Tucson, Surprise, Tolleson, Yavapai County, Youngtown, Yuma, Yuma County.

Most Small MS4s were required to obtain permit coverage by March 10, 2003. To obtain permit coverage, designated Small MS4s were required to: submit a Notice of Intent (NOI) to ADEQ, provide a plan to develop, implement and enforce a Stormwater Management Program that would reduce pollutants in stormwater discharge to the maximum extent practicable, and to fully implement the plan no later than December 19, 2007. However, no funds were provided to help local governments implement their plans. Funding provided under the ADEQ Stormwater Phase II Assistance Program is designed to assist these municipalities with implementing their plans.

D. **Hydromodification**

Hydromodification is the alteration of the hydrologic characteristics of coastal and non-coastal waters, which in turn can cause degradation of water resources. This category covers all NPS pollution associated with channelization and channel modification, dams, and streambanks and shoreline erosion. Much of these modifications in Arizona were done to improve the state's water supply reserves or to extract precious metals through the mining industry.

In drier states like Arizona, over pumping of groundwater near stream beds can change the water level and may actually cause the stream to dry up. This form of hydromodification changes the physical nature of streams. Numerous communities rely solely on their groundwater supplies. Water rights and other water supply issues are major concerns for rural communities throughout Arizona.

Some typical BMPs that could be used to address hydromodification needs are conservation easements, swales or filter strips, shore erosion control, wetland development and restoration, bank and channel (grade) stabilization. Any work involved with wetland or riparian area protection or restoration is included under this category.

Several organizations, such as The Nature Conservancy (TNC) purchase agricultural land to protect and restore the land. Two new riparian areas are undergoing restoration by TNC along the San Pedro and marked improvements are already evident. The San Pedro River is the only major river in Arizona that has not been modified by human-made dams. The Lower San Pedro, however, has suffered from over pumping and has been dry for many years along major reaches that were once free flowing year round. Limiting groundwater pumping near an arid riverbed or streambed helps restore the natural subflow regime. Some stretches of perennial flow along the Lower San Pedro have been restored by these combined management measures.

E. **Onsite/septic waste treatment systems**

Household wastewater disposal systems are used to treat and dispose of wastewater from the home. Improperly designed or installed system can become direct conduits between pollutants (e.g., bacteria, nutrients) and the receiving water. A system that is properly constructed and maintained will function for years and can minimize the potential for ground and surface water contamination.

The control of nutrient and pathogen loadings to surface waters can begin with the proper design, installation, operation of on-site disposal systems. These septic systems should be situated away from open water, ground water and other sensitive resources like wetlands and flood plains to reduce the potential for contamination. An absorption field should never be sited within 50 feet of a stream or other waterbody a sewage disposal system should not be installed in a flood plain that is subject to frequent

flooding.

On-site systems should be inspected, pumped out, and repaired regularly. Dumping grease and oil down the home drain can clog the pipes or build up in the septic tank. Household chemicals that are poured down the drain can damage septic systems. Bacteria present in the system decompose the sewage. When household chemicals are added, they may destroy the beneficial bacteria, impairing the effectiveness of the sewage treatment process. Maintaining home septic systems also prevents excessive discharges to water.

In addition to conforming with all local regulations and implementing various management measures, certain precautions for protection and convenience should be taken in selecting the absorption site. Keep in mind the following:

< Soil permeability should be moderate to rapid, and the soil percolation rate should be at least one inch per hour.
< Groundwater level, during the wettest season, should be a least four feet below the bottom of the trenches in a subsurface-tile absorption field and four feet below the pit floor in a field using seepage pits.
< Rock formations or other impervious layers should be more than four feet below the bottom of trenches, seepage-bed floor, or pit floor.
< Trenches and seepage beds are difficult to lay out and construct on slopes steeper than 15 percent. If steep, shallow soils that are underlain by rock or other impervious material are used as absorption fields, the septic tank effluent is likely to seep to the surface.

E. **Mining**

This category covers all NPS pollution caused by mining and quarrying activities. There are 10,431 abandoned mines sites and 103 active mining operations in Arizona (GIS 1993 Coverage). These larger active mines extract copper and other heavy metals. Many of these active mines have also engaged in large-scale hydromodifcation of stream channels, digging large pits, using explosives underground and changing the natural flow of the stream courses near mine workings. The legacy pollutants that remain from these active and former mines are some of the major pollution sources for Arizona's waterbodies.

Typically, many mining operations are located near sources of water to aid in the extraction and delivery of mined ores and extracted byproducts. Unfortunately the placement of these mines and subsequent waste products have become a direct source to the watersheds where many abandoned mine workings, tailings piles and overburdened stockpiles erode directly into the stream channels during rain events. Some typical BMPs that could be used to address resource extraction needs are

detention berms, seeding, revegetation, passive wetland treatment cells, geotextile encapsulation and numerous erosion control practices.

F. **Recreation**

Arizona's beautiful landscapes attract many tourists to the rural areas of the state. A lot of watershed recreation activities in Arizona involves motor vehicles. Scouring of the desert due to off-road vehicles has created many pollution problems and has contributed to the degradation of wildlife and plants. Road scars cover both dry desert areas and forested areas throughout Arizona. Reducing off-highway vehicle traffic in already damaged areas helps control erosion.

Boating is also an extremely popular outdoor activity in Arizona. Numerous lakes and streams attract boaters to cool off in Arizona's hot desert climate. Motorized boats can also degrade water quality due to oil and gasoline spills into lakes. Limits on gas-powered motors, requiring the use of electric motors or requiring the use of four-cycle instead of two-cycle gas engines on watercraft can help improve water quality.

Many other recreational activities can contribute NPS pollution to the watershed and these include: horseback riding, fishing, swimming, hunting, hiking, exploring and mountain biking. Human waste from boaters, rafters and campers can cause coliform bacteria problems in waterways. Solar-powered composting toilets, posting signs and other public education campaigns can lessen the problem. Other BMPs used to control pollution sources from recreationists are: composting toilet facilities along popular river areas, access to garbage bags and garbage containers along trail heads, improved parking facilities near trail heads, and improved education and outreach.

Chapter 3 - Nine Key Elements

Late in1996, the EPA issued national guidance which contained specific requirements and instructions for updating State NPS Management Plans. This guidance described nine key elements for effective management of NPS pollution. State Programs must incorporate these elements into management program updates, and then be approved by EPA, in order to remain eligible for continuing Section 319 funding. Below are each of the 9 elements and a synopsis of how the Arizona NPS Management Plan addresses each element.

1. **Explicit short- and long-term goals, objectives and strategies to protect surface and ground water.**

   Arizona's long-term goals are consistent with the national program vision that all States implement dynamic and effective NPS programs designed to achieve and maintain beneficial uses of water. Arizona will continue to expand its voluntary, community-led watershed approach to control NPS pollution. ADEQ's NPS Program focuses on restoring impaired waters and this begins with implementation of CWA and Safe Drinking Water Act protection programs such as the Total Maximum Daily Load (TMDL) Program, the Watershed Management Program, the Water Quality Improvement Grant Program (Section 319), and the Source Water Protection Program. (For more information on ADEQ's programs, see Chapter 5.) Watershed partnerships, along with various involved and concerned citizens, state and federal agencies, tribes, and local business, help guide the Program's growth. A key goal for ADEQ is to develop ways to assess NPS improvements through Arizona's NPS State Management Plan, the 319(h) Program and through other voluntary applications of NPS BMPs to improve water quality. Short and long term goals are listed in Chapter 8.

2. **Strong working partnerships and collaboration with appropriate State, interstate, tribal, regional, and local entities (including conservation districts), private sector groups, citizen groups, and Federal agencies**.

   Arizona achieves this key element through partnerships and stakeholder efforts implemented through a variety of formal and informal agreements, cooperative projects, sharing and combining of funds, and meetings to share information and ideas. See Appendix A for a list of current partnerships and agreements ADEQ maintains to further the goals of these programs. Through these partnerships, Arizona is able to work with federal, state, tribes and local agencies to incorporate other appropriate water quality controls through the use of other

agencies' regulatory framework. In addition to partnerships with other agencies, ADEQ works with community-led watershed groups to identify, assess, and help implement voluntary efforts to control NPS pollution. ADEQ also works collaboratively with sister agencies in the state to implement the Water Quality Improvement Grant Program (see Appendix B for a list of grant recipients).

3. **A balanced approach that emphasizes both statewide NPS Programs and on-the-ground management of individual watersheds where waters are impaired or threatened.**

On the ground implementation of practices and programs is the best means of reducing and preventing pollution from NPS pollution and Arizona achieves this on the ground implementation by combining our watershed approach and other statewide programs. Other ADEQ programs that can have an impact on NPS pollution include Surface Water Monitoring and Standards, TMDLs, Watershed Management, Grants and Outreach, Volunteer Monitoring, Groundwater Monitoring; permitting programs such as the National Pollutant Discharge Elimination System (NPDES), Aquifer Protection (APP), the Army Corps of Engineers' Dredge and Fill Program (CWA 404); and Drinking Water Programs such as the Source Water Assessment Program. Partners within the state include, federal, state, local, private, nonprofit entities and other environmental organizations.

Arizona encourages voluntary implementation of NPS BMPs. ADEQ administers a statewide grant program, the Water Quality Improvement Grant Program, to fund water quality improvement projects to address 303(d) listed waters impaired by NPS of polluted runoff by focusing funds toward implementing goals (or measures) outlined in a TMDL and/or watershed-based plan. Local, state, federal, nonprofit, private, and tribal entities are eligible to apply. Results from these projects are used to plan and implement BMPs statewide. Arizona also sets aside additional Section 319 funds for pollution prevention and education and outreach. Educational programs such as Nonpoint Source Education for Municipal Officials (NEMO) and Envirothon provide education to both adults and children across the state (see Education and Outreach, Chapter 7 for more information).

4. **The state program (a) abates known water quality impairments resulting from NPS pollution and (b) prevents significant threats to waters quality from present and future activities.**

Arizona uses an integrated approach of voluntary incentives and regulatory tools in the CWA and the Safe Drinking Water Act to implement community-led planning efforts on a watershed basis. Arizona's NPS State Management Plan is directed at abatement of known water quality problems. Arizona's NPS program addresses significant threats from existing NPS activities and sources through

TMDL studies and TMDL implementation plans, watershed-based plans, and the Water Quality Improvement Grant Program. In addition, ADEQ focuses on actions that prevent pollution.

Although it may take years to remedy waters that are already impaired, ADEQ is also taking appropriate steps to protect clean waters from reasonably foreseeable degradation. One of the program's priorities is to protect waters from future NPS pollution through education and outreach. While the number one goal must be to achieve and maintain beneficial uses of water, Arizona hopes to focus its efforts more proactively in the years to come. Continuing educational programs help lay the foundation for future water quality protection.

5. **An identification of waters and watersheds impaired or threatened by NPS pollution and a process to progressively address these waters.**

Upon developing its impaired waters list, ADEQ ranks the waterbodies according to a variety of factors established in both statute and rule. Generally speaking, this ranking coincides with scheduling a given impaired water for TMDL development. Arizona identifies impaired and threatened waters through monitoring, water quality assessments, and watershed characterizations. Arizona updates the identification of waters and their watersheds impaired or threatened by NPS pollution in a single integrated water quality assessment and impaired water's list every other year (see *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report 2002*). TMDLs must identify the pollutant loads and sources of the loads. These identified and quantified water quality problems are then addressed by developing TMDL implementation plans or watershed-based plans and getting water quality improvement projects on the ground.

Factors used by Arizona to progressively address its waters include a variety of relevant environmental and administrative considerations, including, human health, the beneficial uses of the water, likelihood of collecting data (i.e. drought conditions preclude collection of data), presence of threatened and endangered species, implementability, extent of alliances with other federal agencies and states to coordinate resources and actions, and readiness to proceed. ADEQ links its prioritization and implementation strategy to other programs and efforts as appropriate.

6. **The State reviews, upgrades and implements all program components required by Section 319 of the CWA and establishes flexible, targeted, iterative approaches to achieve and maintain beneficial uses of water as expeditiously as practicable.**

Arizona follows a strategic planning and budgeting cycle, and all plans and program components are reviewed for currency as part of this process. This

includes the need to list or delist impaired waters, identification of additional partnership agreements required to move forward, resource requirements to implement water quality improvement plans, and changes to the overall NPS Management Plan as necessary. In addition to Arizona's own strategic water quality planning, ADEQ and EPA Region IX meet throughout the year to review work plans, define common goals and strategies, and measure progress. Frequently ADEQ meets with EPA to discuss the Impaired Waters List, TMDLs, watershed plans, and monitoring activities. These meetings, and the mutual commitment to communicate frequently, allows Arizona to maintain a flexible approach to plan elements, and make adjustments as needed.

7. **An identification of Federal lands and objectives, which are not managed consistently with State, program objectives.**

Arizona achieves this key element and avoids inconsistencies through implementation of federal consistency provisions of the CWA, the Clean Water Action Plan, and formal intergovernmental agreements or Memorandums of Understanding and annual meetings with federal partners and some tribes. In these agreements, the federal entity agrees to function as the designated agency for a variety of programs including implementation of NPS management measures on lands under its control. Each year ADEQ meets with the Forest Service, the Bureau of Land Management, and the Bureau of Reclamation (other annual meetings are considered as well) for an annual update on activities of both agencies. ADEQ has developed working partnerships to assure that federal programs and/or activities in the state are consistent with the goals of the NPS Management Plan. Coordination issues with federal agencies are an established part of the agenda for discussion with EPA Region IX.

8. **Efficient and effective management and implementation of the State's NPS Program, including necessary financial management.**

Arizona achieves this key element through integration of NPS Program activities within the Water Quality Division. The majority of program activities is administered within ADEQ's Hydrologic Support and Assessment Section. However, as part of the state's new NPS Management Plan, additional effort will be given to incorporating Safe Drinking Water Act programs such as Wellhead Protection and Source Water Assessment. The Hydrologic Support and Assessment Section is comprised of both a Surface and Groundwater Monitoring Unit, a Watershed Management Unit, a TMDL Unit, and a Grants and Outreach Unit. This organization maximizes the effectiveness of the employees engaged in these activities and ensures singular management oversight of all critical activities related to identifying and quantifying water quality impairments and in developing and implementing water quality improvement strategies for Arizona's

streams and lakes. ADEQ's Water Quality Improvement Grant Program administered by the Grants and Outreach Unit, ensures that federal funds entrusted to Arizona are spent appropriately and produce on the ground water quality improvements. Arizona tracks financial management through EPA's Grants Reporting Tracking System (GRTS) , and reports quarterly on use of funding and workplan objectives. ADEQ is required to report annually to EPA on progress made toward the implementation goals of Arizona's NPS State Management Plan. This report is provided to EPA in September each year.

9. **A feedback loop whereby the State reviews, evaluates, and revises its NPS assessment and its management program at least every five years.**

ADEQ practices a continuous cycle of program improvement. This consists of annual meetings with federal and state partners to discuss program objectives and results, quarterly discussions and quarterly exception reporting to EPA Region IX on program objectives. When changes to Arizona's NPS Program are required, ADEQ communicates with EPA to institute the changes immediately and in an integrated manner.

Based on the *National Water Quality Inventory Report to Congress (305b Report)*, sedimentation impairs 84,503 river and stream miles (12% of the assessed river and stream miles and 31% of the impaired river and stream miles). This national finding is consistent with recent findings of water quality impairment in Arizona rivers and streams published in *Arizona's Integrated §305(b) Assessment and §303(d) Listing Report - 2002*. ADEQ reports that turbidity is the second leading cause of impairment in Arizona rivers and streams. ADEQ reported that 125.4 stream miles (<1% of the assessed stream miles and 36% of the impaired stream miles) in Arizona were identified as impaired because of violations of water quality standards for turbidity.

Excessive sedimentation and siltation is a problem in rivers and streams for many reasons. Excessive sediment adversely affects aquatic life by suffocating fish eggs and smothering the aquatic habitats of bottom-dwelling organisms. The loss of aquatic insects in a stream because of siltation and excessive sediment can have a domino effect that ripples through the entire stream ecosystem. Habitat degradation and the subsequent loss of aquatic insects can affect the prey base of fish and other aquatic organisms at higher trophic levels that feed on the aquatic insects. High concentrations of suspended solids in the water can reduce the size of the light zone in surface waters and reduce photosynthetic activity of primary producers in aquatic ecosystems. High concentrations of sediment can cause direct physical harm to aquatic organisms by clogging and abrading gills. Excessive sediment can adversely affect other designated uses of surface water. Sediment can cause taste and odor problems in drinking water, foul filtration systems, and reduce the capacity of drinking water reservoirs. High levels of sediment can impair recreational uses by reducing water clarity and adversely affecting the aesthetic qualities of a surface water.

Change in Water Quality Standards

In March 2003, ADEQ repealed the numeric criteria for turbidity that was established to maintain and protect water quality for aquatic life designated uses. ADEQ has adopted a new numeric criterion for suspended sediment concentration or SSC to replace the turbidity standard. The suspended sediment criteria is expressed as a geometric mean value that must be achieved in a stream at or near base flow conditions (that is, when a stream is not receiving flow from precipitation or runoff and is primarily made up of groundwater inflow and not during storm events. Instead of using the turbidity standard, ADEQ will rely on 1) a numeric criterion for suspended sediment concentration to protect fish, and 2) a narrative standard for bottom deposits to maintain and protect water quality for aquatic life.

Turbidity is a qualitative measure of water clarity or opacity. Turbidity in water is caused by fine suspended particles such as clay, silt, organic and inorganic matter, plankton, and other microscopic organisms. ADEQ determined that turbidity criteria expressed as single sample

maximum concentrations are inappropriate for use in Arizona ecosystems. The watershed processes that cause adverse sediment impacts are rarely simple and they cannot be reduced to instantaneous measurements of a single indicator such as turbidity. Therefore, ADEQ is pursuing a narrative approach to address excessive sedimentation and bottom deposits. In the meantime, ADEQ adopted the suspended sediment concentration standard which it believes represents a more accurate and reliable measure of the concentration of suspended sediment.

While ADEQ no longer supports turbidity criteria to protect aquatic life, ADEQ recognizes that the concentration of suspended solids in a surface water is an important water quality parameter because of the effect of suspended solids on light penetration, temperature, and on aquatic life. EPA's *National Water Quality Inventory, 2000 Report* identifies sedimentation and siltation as the second most widespread cause of impairment of the nation's rivers and streams, lakes, reservoirs, ponds, and estuaries.

Managing Sediment

ADEQ's focuses on educating and working with stakeholders to encourage BMP implementation aimed at reducing sediment for each of the NPS categories. Agriculture, forestry, mining, construction, stormwater and urban runoff all contribute to the sediment problem in Arizona's surface waters. One of the most effective erosion and sediment control strategies is a natural approach. By simply increasing vegetation and practicing forest, range and vegetative conservation, sediment can be controlled. Conservation of vegetation on headwaters, supplemented by bank controls downstream, is most feasible when considering cost, time and the most far-reaching results. However, there are numerous other ways to manage and control sediment.

Structural Source Controls

This is a collective term that describes a management approach aimed at the prevention or mitigation of excessive sedimentation at or close to the source. Locating potential NPS contributions and keeping them away from critical areas such as steep slopes, highly erodible soils, and areas that drain directly into geologically sensitive features, is the first step to controlling sediment by structural means. Preventative sediment controls include seeding and mulching and revegetating critical areas. Protect existing or newly planted vegetation in flood plains, upstream and within riparian areas, by using fencing, buffer strips or buffer zones, tree armoring, retaining walls, or tree wells, re-routing roads and traffic. Wind erosion can be controlled with barrier walls and sprinkling. Benches, terraces, or ditches are management measures which break up slopes and decrease runoff rates and flow volumes.

Non-structural Controls

Non-structural controls are techniques that aim to change human behavior, such as community education and outreach that enhance knowledge and understanding of sediment management, governmental permits, and compliance actions. Education and outreach efforts increase awareness and understanding of issues and challenges, generate

more data, help determine priorities, increase support for remediation programs, and generally enhance the likelihood of implementing successful management measures.

Where construction and development activities are being planned, good stormwater management planning and implementation through the use of site specific prevention, mitigation and site stabilization techniques, aid in the management of sediment. Storm events with large flows have been correlated with high sediment so implementing BMPs aimed at controlling stormwater runoff will yield sediment reduction.

Other types of sediment source controls that can be effective both as preventive and mitigating would be installation of perimeter controls like temporary diversion dikes, intercepting swales, earthen dikes, temporary pipe slope drains, sediment basins or traps, sediment chambers or filters, and wind, sand, snow fences, and brush barriers. Use check dams to prevent erosion at an outlet of a channel or conduit. Proper planning and implementation of erosion and sediment controls will result in sediment reductions in Arizona's surface waters. By applying the appropriate preventive and mitigation measures and combining many techniques which supplement one another, Arizona is managing sediment and improving water quality.

Chapter 5 - ADEQ's NPS Management Program

As mentioned previously, ADEQ adopted an integrated approach to NPS pollution and the NPS Program was initiated and implemented in 1999. Structure within the Hydrologic Support and Assessment Section of ADEQ's Water Quality's Division (see Appendix D for organizational chart) was established to administer the majority of ADEQ's NPS Program. Among many other functions, the Hydrologic Support and Assessment Section is responsible for surface and groundwater monitoring, TMDLs and implementation plans, a statewide water quality assessment, education and outreach, water quality regional planning (section 208 of the CWA), developing watershed-based plans and awarding Water Quality Improvement Grants to improve water quality by controlling NPS pollution. The Hydrologic Support and Assessment Section is divided into Units (see Appendix E for the organizational chart). Each Unit or team within the Section is responsible for managing a piece of the NPS Program.

Through state-wide watershed characterizations and monitoring, Arizona identifies threatened and impaired waters. Based on statewide monitoring, all waters are identified in a single comprehensive state water quality assessment, *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report*. The report is developed and updated on a continuous cycle. If a waterbody is deemed impaired, TMDLs are developed to help identify potential problems and pollutant loads. In short, the TMDL provides the diagnosis, TMDL implementation plans and watershed-based plans (developed as a community effort) are developed to help plan for restoration and protection, and the grant program provides funds for water quality improvement projects to protect and restore water quality. By working with partners within the state, community-led watershed partnerships, and other interested stakeholders, ADEQ is implementing voluntary efforts to control NPS pollution.

Pieces of the puzzle...

A. Surface Water Monitoring & Standards Program

Water Quality Standards Program

In 1972, Congress enacted landmark legislation to protect the nation's waters from pollution. The primary goal of the CWA is to "…restore and maintain the chemical, physical, and biological integrity of the nation's waters."

Congress also established interim goals to achieve, where attainable, a level of water quality that "…provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." These latter or interim goals of the Act are commonly called the "fishable and swimmable" goals of the CWA. Congress envisioned that all waters of the United States would have water clean enough for fishing and swimming and that provides for the protection and propagation of balanced populations of fish, shellfish, and wildlife.

To achieve these goals, the CWA requires states to adopt water quality standards for its surface waters. Arizona's surface water quality standards are codified in Title 18, Chapter 11, Article 1 of the Arizona Administrative Code. The water quality standards program is a cornerstone water quality management program that provides the benchmarks and restoration goals for a number of CWA regulatory and non-regulatory programs. For example, water quality standards provide the benchmarks that are used to assess the health of the Arizona's streams and lakes. The standards are used as the basis for listing impaired waters. Water quality standards also provide the basis for development of load and wasteload allocations in TMDL analyses designed to restore water quality in impaired surface waters. ADEQ uses water quality standards to derive water quality-based discharge limitations in Arizona Pollutant Discharge Elimination System (AZPDES) permits that regulate and limit the point source discharge of pollutants to surface waters. Water quality standards have three basic elements: 1) designated uses, 2) criteria to protect water quality for the designated uses, and 3) an antidegradation policy.

Designated uses are the beneficial uses that water quality should support. Arizona streams and lakes have many beneficial uses. Water is used for domestic water supply, recreation, and agricultural uses, including irrigation and livestock watering. Also, Arizona's surface waters are vitally important to aquatic life and wildlife. Arizona recognizes all of these designated uses in its surface water quality standards regulations. Arizona's designated uses include domestic water source (DWS), fish consumption (FC), full body contact recreation (FBC), partial body contact recreation (PBC), agricultural irrigation (AgI), and agricultural livestock watering (AgL). In addition, Arizona has established four subcategories of designated uses intended to maintain and protect water quality for aquatic life and wildlife. The four aquatic life designated uses are aquatic and wildlife cold water, aquatic and wildlife warm water, aquatic and wildlife effluent dependent water and aquatic and wildlife ephemeral water.

Each of the designated uses has a set of water quality criteria that must be met to maintain and protect water quality for that use. There are two general types of water quality criteria: 1) numeric criteria, and 2) narrative criteria. Numeric water quality criteria establish numeric thresholds for physical conditions or chemical parameters that must be achieved to support a designated use. Most of the numeric criteria in Arizona's

surface water quality standards regulations prescribe limits on the concentrations of chemicals that are allowed in a surface water. Narrative criteria describe water quality conditions that must be maintained in Arizona surface waters. Arizona's surface water quality standards regulations include a narrative standards rule with several "free from" narrative criteria. For example, "a surface water shall be free from pollutants in amounts or combinations that …are toxic to humans, animals, plants, or other organisms." Other narrative criteria require that surface waters be free from pollutants that settle to form bottom deposits that adversely affect aquatic life, that cause taste or odor problems in drinking water.

Of particular importance to the NPS Program is the evolution of narrative and numeric surface water quality standards intended to control and prevent excessive sedimentation in surface waters. ADEQ adopted a narrative standard which requires that a "surface water shall be free from pollutants in amounts or combinations that…settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life." ADEQ also adopted a numeric water quality criterion for suspended sediment concentration to protect the aquatic and wildlife cold water and aquatic and wildlife warm water designated uses. ADEQ's primary purpose in adopting the narrative "bottom deposits" standard and the numeric suspended sediment concentration standard is to maintain and protect water quality for aquatic life.

The third major element of water quality standards is an antidegradation policy. The state's antidegradation policies are narrative statements that are intended to protect existing uses and prevent surface water quality from degrading, even if the water quality is better than that required by water quality standards. The antidegradation rule establishes three tiers of antidegradation protection. Tier 1 sets the floor for water quality and requires that impaired waters not be allowed to further degrade. Tier 2 requires that existing water quality in high quality surface waters be maintained and protected, but it allows limited degradation if certain conditions are met. Tier 3 prohibits water quality degradation in unique waters.

Surface Water Monitoring Program

The Surface Water Monitoring and Standards Unit is responsible for implementing ADEQ's ambient surface water quality monitoring program. Field personnel obtain water quality data that is used to assess the biological, chemical, and physical integrity of Arizona's rivers, streams, lakes, and reservoirs. In general, this group collects data to characterize baseline water quality conditions, determine compliance with applicable surface water quality standards, provide data to determine water quality trends, provide data to support water quality assessments, and to support the development of new water quality standards for physical and biological integrity. Collected water quality data is used for *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report*. The primary objectives of ADEQ's Surface Water Quality Monitoring and Standards Unit are:

Conduct ongoing monitoring of the waters of the state as required by state law,
Provide credible data to determine water quality trends from long-term Fixed Station Network sites,
Provide credible data to characterize baseline water quality of surface waters located in selected basins according to the 5-year basin monitoring schedule,
Provide credible data for surface water quality assessments
Provide credible data to identify impaired surface waters and the specific causes of impairment
Provide credible data to determine compliance with applicable surface water quality standards,
Provide bioassessment and habitat data on the regional biocriteria reference site network to determine trends in reference conditions over time and to test indexes of biological integrity, and
Provide credible data to characterize baseline water quality in the state's unique waters and to determine whether water quality is being maintained and protected or is being degraded.

Fixed Station Network (FSN) Monitoring

One core ambient water quality monitoring program is the Fixed Station Network (FSN) monitoring program. The ADEQ FSN monitoring program is a statewide data collection program whose primary purpose is to characterize baseline water quality of perennial, wadeable streams and to provide data to determine long-term water quality trends. ADEQ FSN sampling sites are sampled quarterly each year. The ADEQ FSN monitoring program incorporates longer monitoring time frames (20+ years) and lower site densities per watershed than the basin monitoring program. Long-term FSN sites have been established on wadeable, perennial streams in 9 of the10 major surface water basins or watersheds in the state. (There are no ADEQ FSN sites in the Colorado River / Grand Canyon basin.) Currently there are 28 ADEQ FSN sites.

USGS Cooperative Fixed Station Network Monitoring

For a number of years, ADEQ has entered a joint funding agreement with the U.S. Geological Survey to operate the Cooperative Fixed Station Network monitoring program (USGS co-op program). The USGS conducts water quality monitoring at 16 USGS co-op program sites located on Arizona's larger rivers. USGS maintains gage stations on these rivers which are of a size and annual flow that precludes ADEQ staff from the ability to monitor. The USGS collects water quality data quarterly at sites located on the Colorado River, Salt River, Gila River, Bill Williams River, and the Verde River.

Basin Characterization Monitoring

ADEQ has identified 10 major surface water basins or watersheds in Arizona (see watershed map, Appendix F). In 1998, ADEQ adopted a rotational watershed framework where by staff conducts water quality monitoring in wadeable, perennial

streams located in 2 watersheds each year. All 10 watersheds are monitored over a 5-year cycle. The following table provides the basin monitoring schedule for the next 5 years.

Basin Monitoring Schedule**	
Watershed	**Year**
Verde River, Colorado River-Grand Canyon*	July 1, 2003 to June 30, 2004
San Pedro River, Upper Gila River, Wilcox Playa	July 1, 2004 to June 30, 2005
Little Colorado River, Santa Cruz River, Rios de Mexico	July 1, 2005 to June 30, 2006
Salt River Middle Gila	July 1, 2006 to June 30, 2007
Colorado River - Grand Canyon, Bill Williams River	July 1, 2007 to June 30, 2008

* Due to budget constraints, monitoring in the Colorado River-Grand Canyon watershed has been deferred from FY04 to FY05.

** Staff conduct basin monitoring on the state fiscal year (FY) calendar which starts July 1st and ends June 30th of the following calendar year.

This group obtains basic water quality data on streams and lakes through it's basin monitoring program. Field personnel make field measurements of pH, total dissolved solids, dissolved oxygen, dissolved oxygen saturation, water temperature, specific conductivity, turbidity, flow, and bacteria at sampling sites. Water samples are collected and analyzed for general water chemistry, major cations and anions, nutrients, and dissolved and total recoverable metals. Annual bioassessments and habitat assessments are made each spring to assess the health of the aquatic communities in wadeable, perennial streams.

Unique Waters

As resources allow, surface water quality data is collected to characterize existing water quality and to determine whether water quality is being maintained and protected in Arizona's outstanding state resource waters or "unique waters." Currently, there are 18 unique waters in Arizona. A long-term goal of this program is to acquire enough water quality data over time to determine water quality trends in Arizona's unique waters and to determine whether state antidegradation requirements are being met (i.e., is water quality improving, being maintained, or degrading). Staff conducts water quality monitoring in the 10 watersheds over a 5-year cycle, sampling sites are selected on unique waters located within the each watershed. Field personnel conduct quarterly monitoring at sites located on the unique waters.

Biocriteria Program

Staff also conduct bioassessments to provide data to support the development of Arizona's biocriteria program. ADEQ began research to develop a state biocriteria program in 1992. Bioassessments and habitat assessments are conducted at biocriteria reference sites, ADEQ FSN sites, basin sites, and unique water sites to develop Arizona's regional reference site network statewide and to monitor trends in reference conditions over time. Another purpose of the biocriteria program monitoring effort is to test existing indexes of biological integrity for warm and cold water streams over a range of impaired conditions and sources of stressors. The goal is to conduct bioassessments at a minimum of 10 biocriteria reference sites in each watershed each water year. Benthic macroinvertebrate samples in wadeable, perennial streams with suitable riffle habitats are collected during the spring index period (April, May, or June of the water year).

Clean Lakes Program

The Clean Lakes Program staff collect data and information on lake and reservoir water quality and watersheds to identify water quality problems, and determine potential sources of pollution. The overall monitoring objectives of the Clean Lakes Program are to evaluate the water quality status of lakes and reservoirs by identifying natural and human-induced conditions affecting lake water quality and to develop feasible ways to maintain, protect, and restore lake water quality. Clean Lakes Program staff collect biological, chemical, and physical limnology data to characterize baseline water quality conditions. The Clean Lakes Program also follows the 5-year basin monitoring schedule to organize it's monitoring activities. Clean Lakes Program staff focus their monitoring resources on lakes and reservoirs located within the two major watersheds that are identified for study each water year. The Clean Lakes Program monitoring activities incorporate three basic approaches, baseline water quality monitoring and assessment, TMDL analyses to diagnose and recommend the most feasible ways to improve lake water quality, and most recently have embarked on a comprehensive criteria development project to better classify lakes by factors such as origin which in turn will help to establish class-specific criteria to protect the resource.

B. Total Maximum Daily Load Program

In fulfillment of Section 303(d) of the CWA, states must develop total maximum daily loads (TMDLs) for each navigable waterbody identified as impaired. TMDL development begins the process that leads to identification of a waterbody's load capacity for each pollutant. The final TMDL includes: point source allocations, NPS allocations, and load reductions necessary for attainment of water quality standards based on the critical condition(s) for loading. Records review, stakeholder interviews, field reconnaissance, field measurements, and modeling are performed to better understand the location, magnitude, and conditions causing the impairment. This process ultimately leads to understanding what needs to be done to reduce and prevent the impairment and how long it might take a waterbody to attain water quality standards.

The TMDL analysis starts with identification of the pollutant(s) of concern and the water quality standard(s) that must be attained to protect the designated use(s). Pollutant specific numeric targets are set based on the most stringent water quality standard applicable to the waterbody. Source analysis identifies the location and magnitude of point source and NPS source loadings. Point source loads are from discrete conveyances of discharge directly to a waterbody (i.e. wastewater treatment plant outfall) and NPS loads are from non-discrete discharges, including runoff generated by activities such as grazing, agriculture, mining and forestry. The TMDL also establishes the naturally occurring "background conditions" of the watershed which is included in the NPS load category. A pollutant specific load capacity, which includes a margin of safety, is calculated based on flow characteristics and the numeric target (generally the applicable surface water quality standard). When the load capacity and sum of the sources contributions during the critical condition are compared, load allocations and necessary load reductions can be discerned.

Waste load reductions from point sources can be managed through permitting programs such as Arizona's Pollutant Discharge Elimination System (AZPDES). However, there are no regulatory programs for NPS pollution so load reductions from NPS are strictly voluntary. In Arizona, most waterbody impairment is a result of NPS pollution. NPS pollution may include excessive sediment caused by the denudation of grasslands, the location of roads, construction, bacteria from wildlife and/or recreation, metals from historic mining practices and road cuts through ore bodies, and pesticides from historic agricultural practices. Stakeholders are encouraged to participate throughout the TMDL process. For most impaired waterbodies, achievement of water quality standards will be borne through voluntary efforts such as participation in watershed management groups, volunteer monitoring, pursuit of funding for cleanup measures, and education.

Targeted Monitoring

Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report reflects EPA's guidance for placing all waters in the state on one of 5 categories ranging from water that meets all water quality standards and designated uses, "attaining all uses" (Category 1) to waters that are impaired, "impaired" (Category 5).

The TMDL Unit also monitors waterbodies on the "Planning List" (Categories 2 & 3), focusing it's efforts on those that have had numerous exceedances of water quality standards or those where the existing data suggest potential impairments. Surface waters with some monitoring data but insufficient data to determine whether a surface water is attaining it's designated uses or is impaired are included in *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report,* Category 2 List. Category 3 waters are waters that have insufficient data to determine whether any uses are met. Also, the data sets for some sample sites are incomplete and do not include all core parameters needed for assessment purposes. These surface waters also are included on the Planning

List. The majority of the sampling sites that are selected for monitoring as part of the basin monitoring program are Planning List sites. These are focused, intensive monitoring efforts that are designed to ensure monitoring captures seasonality, spatial and temporal variations and suspected critical loading conditions .

C. Watershed Management Program

ADEQ's Watershed Management Unit is responsible for five main functions within the Hydrologic Support and Assessment Section all of which are key pieces of the NPS Program. The Unit's five main tasks include completing the *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report,* writing TMDL implementation plans, assisting the TMDL Unit with stakeholder involvement, coordinating regional 208 water quality management planning (CWA section 208) activities, and co-managing the NEMO (Nonpoint Source Education for Municipal Officials) project. Each of these components are discussed in more detail below.

Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report

The Watershed Management Unit coordinates the preparation of the Integrated Report which is due every even year (2004, 2006, and 2008). This comprehensive report provides an assessment of surface and ground water resources in Arizona in relation to meeting Arizona's water quality standards. The Report provides individual surface water assessments along with a description of the assessment and impaired waters identification methods. This report fulfills the requirements of the CWA to assess surface waters, report on the quality of ground water, and list any impaired surface waters.

The waters are placed in one of five assessment categories. In broad terms, these categories are :

Category 1: All designated uses are met;
Category 2: Some of the uses are met but either is insufficient data to determine if remaining uses are met;
Category 3: Insufficient data to determine whether any uses are met;
Category 4: Water is impaired but a TMDL is not needed (either a TMDL has been adopted and is awaiting implementation, a remediation strategy is underway so development of a TMDL is not needed, or the impairment is not due to a pollutant);
Category 5: Water is impaired and a TMDL is needed (303(d) List)

Category 5 of the integrated report is Arizona's 303(d) List of waters (impaired waters list). Arizona's 303(d) List submission is subject to review and approved by EPA. EPA can approve, disapprove or partially disapprove the States List. Notice of EPA's action, including any additional listings, must be published in the Federal Register. The report

also describes ADEQ's programs involved in monitoring, assessments, and mitigation of water quality problems. Volume II documents the assessment data, providing a summary of the current monitoring data available for each surface water. It provides a watershed context for the assessments including a description of the water quality research and implementation projects being conducted in each watershed. The assessment helps ADEQ plan and determine appropriate and specific monitoring sites. With effective planning and monitoring, ADEQ can work to prevent new water quality problems from present and reasonably foreseeable NPS activities.

TMDL Implementation Plans

The Watershed Management Unit has recently switched gears to become much more focused in developing TMDL Implementation Plans for impaired waters which will allow the TMDL program to focus on preparing TMDLs for water quality improvement. During the next five years, the Watershed Management Unit will be responsible for developing TMDL implementation plans for several completed and/or ongoing TMDL studies within Arizona. According to Arizona state statue, "For each TMDL, the department shall establish a TMDL implementation plan that explains how the allocations and any reductions in existing pollutant loadings will be achieved." The first priority for the Watershed Management Unit will be to focus and write TMDL implementation plans for impaired waters where a TMDL has been completed and approved. At the same time, the Watershed Management Unit will also strive to prepare TMDL implementation plans for TMDLs being initiated or in progress. While supporting the TMDL effort and gaining the interest of stakeholders, the Watershed Management Unit will write implementation plans with the people involved. By the time the TMDL is completed, a plan will be written and be ready for implementation by local stakeholders. Water Quality Improvement (Section 319) grant proposals in support of a TMDL or with a implementation plan rank higher in the review process.

Each member of the Watershed Management Unit will take on a least 2 projects a year, one completed and approved TMDL and one new/current TMDL. For determining load reductions, the Watershed Management Unit will continue to research efforts to establish load reduction estimates for BMPs. TMDL implementation plans will provide a strategy that explains how the allocations in the TMDL and any reductions in existing pollutant loadings will be achieved and the time frame in which compliance with applicable surface water quality standards is expected to be achieved. The plan may include a phased process with interim targets for load reductions. Based on EPA guidance, each implementation plan will include the following components:

1. A description of the management measures or BMPs and associated costs that will need to be implemented to achieve the load reductions estimated in the plan and an identification (using a map or a description) of the critical areas where those measures are needed.

2. An estimate of the overall load reductions which the plan expects to achieve. An estimate of the load reductions expected for each of the management measures or BMP (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Costs should also be included.
3. An action plan for implementing the management measures identified in the plan that is reasonably expeditious.
4. A schedule of interim, measurable milestones for determining whether the management measures or other control actions are being implemented.
5. A description used to evaluate the progress and effectiveness in achieving the plan goals.
6. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing BMPs.
7. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement the plan.

These implementation plans will use the information contained in the TMDL to develop a plan that encompasses the entire area causing known or potential pollution and contributing to the impairment. Scale will vary depending on the causes and sources of contamination. These plans will be community-led, when possible, and focus on getting volunteer groups to lead the way in implementing water quality improvement projects through the use of ADEQ's Water Quality Improvement Grant Program or other funding sources. The goal is to make sure that all of Arizona's waterbodies are clean and safe for uses such as swimming or fishing.

NEMO

The Watershed Management Unit also co-manages, along with the Grants and Outreach Unit, the University of Arizona's (UofA) NEMO project (funded by Section 319 funds). UofA has been tasked to help improve water quality by developing watershed characterizations and watershed-based plans for at least three watersheds over the next three years. Originally this project was designed to solely produce watershed characterizations for three of Arizona's watersheds, the Bill Williams watershed, the Verde watershed and the Upper Gila watershed. After experimenting with different ideas, UofA and ADEQ agreed that this project would benefit Arizona most if this comprehensive characterization document evolved into a watershed-based plan. This project will greatly increase the agency's knowledge of the watershed and help to more effectively fund grant projects and get more money on the ground for water quality improvement in Arizona.

By characterizing and better understanding the dynamics of each watershed, these watershed-based plans will help ADEQ with their TMDL and monitoring efforts. Watershed characterizations will help the monitoring programs improve site selection and identify priority-planning sites. These watershed-based plans will include many of the same elements of a TMDL implementation plan but are written for a much larger area. UofA will also include implementation recommendations that will assist ADEQ to focus on potential problems and problem areas. The goals of this project are:

1. Characterize the watershed (soils, slope, population, geology, etc.)
2. Identify areas that are susceptible to water quality problems and pollution (point and nonpoint sources). The plans will not only identify 303(d) listed or non-attaining waters, but also identify those waters/areas that are vulnerable to degradation.
3. Identify the sources that need to be controlled to protect or improve water quality.
4. Identify the problem areas ADEQ and/or stakeholders should address through monitoring or project implementation. Identify pristine areas (i.e. unique waters or special areas of concern) that need to be protected.
5. Identify management measures to be implemented to protect or improve/restore water quality. Where and why? Estimate costs of the potential management measures.
6. Estimate the load reductions expected from the different management measures. Rank the management measures to demonstrate which measures are the most effective means for protecting or restoring water quality.

Based on EPA's *Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003*, watershed-based plans must include nine key elements. Where the watershed-based plan is designed to implement a TMDL, these elements will help provide reasonable assurance that the NPS load allocations identified in the TMDL will be achieved. However, even if a TMDL has not yet been completed, EPA believes that these nine elements are critical to assure that public funds to address impaired waters are used effectively. In broad terms, the elements that EPA requires for a watershed based plan are:

Element 1: Causes and sources
Element 2: Expected load reductions
Element 3: Management measures
Element 4: Technical and financial assistance
Element 5: Information/education component
Element 6: Schedule
Element 7: Measurable milestones

Element 8: Evaluation of progress
Element 9: Effectiveness monitoring

Once the University of Arizona completes the project, ADEQ will add additional components to fully address watershed health and complete portions of Elements 6 through 9 for a complete, EPA accepted, watershed-based plan. Having watershed-based plans written for three of Arizona's large watersheds will alow the Water Quality Improvement Grant Program to fund a wide variety of projects to control NPS pollution.

From the documents that are created about each watershed, the University of Arizona will work with the Cooperative Extension Service to develop educational materials targeted for land-use decision makers and other stakeholder groups. The UofA NEMO project is discussed in more detail in Chapter 7, NPS Education and Outreach.

TMDL Public Involvement

ADEQ's Watershed Management Unit is also taking a new role in proactively involving and educating the stakeholders affected by the TMDL while the TMDL is being written so citizens are aware of the problems up-front and realize their role in helping remedy the identified problems. As stated above, the Watershed Management Unit will assist the TMDL program's effort by gaining the interest of stakeholders and simultaneously writing plans with the people involved. By the time the TMDL is completed, a plan will be written. ADEQ will provide for public notice and comment on each TMDL implementation plan, similar to the public process required of the estimate and draft allocation of the TMDL. The same stakeholders can review and comment on the TMDL and the implementation plan for a more efficient and effective approval process. Note that EPA approval is not required for TMDL implementation plans.

Regional 208 Water Quality Management Planning

Areawide Waste Treatment Management Planning was authorized by the CWA, Section 208 in 1972. It requires regional planning agencies to develop comprehensive water quality management plans. These plans identify existing and proposed wastewater treatment facilities to meet the anticipated municipal and industrial waste treatment needs of an area over a 20-year period, as well as provide general planning guidance for NPS, sludge, stormwater and other activities. The plans assure maintaining consistency with the state's water quality standards. The 208 plans also provide the foundation for activity to be conducted pursuant to BMPs, which can be terminated or modified.

In the 1970's , the six Council of Governments (COGs), as Designated Planning Agencies (DPAs) under Section 208, were given the responsibility to develop Water Quality Management Plans, a composite planning document for a region that addresses municipal and industrial wastewater treatment facilities, point and nonpoint source management, waste management, planning area description, water quality issues,

drinking water, and implementation measures for the regional continuing planning process. Each Water Quality Management Plan is reinforced by the Continuing Planning Process manual which contains procedures for planning and implementing water quality management programs in Arizona.

The original areawide 208 plans were prepared and adopted in 1979. In the intervening years, various changes and growth have required numerous amendments to those original plans. Five of the six original COGs updated their plans in 1993 and 1994. The sixth COG, Western Arizona Council of Governments (WACOG), determined that it no longer wanted to be involved in regional water quality planning. Per Section 208, the responsibility fell back to the state to act as the DPA for the counties of Yuma, La Paz, and Mohave. More recently, each of these 3 counties has been designated as the DPA for their planning area. Currently, the DPAs are Maricopa Association of Governments (MAG), Pima Association of Governments (PAG), Northern Arizona Council of Governments (NACOG), Central Arizona Association of Governments (CAAG), Southeastern Arizona Governments Organization (SEAGO), La Paz, Mohave and Yuma Counties. View the map of the COGs/DPAs in Appendix G.

The Watershed Management Unit's 208 Program is responsible for three main tasks: 1) *208 Consistency Reviews* to assure that the proposed facility or usage will be consistent with the existing Certified Regional Water Quality Management Plan, 2) coordinating water quality management plan amendment approvals, and 3) providing technical support and outreach to regional planning agencies in developing comprehensive Water Quality Management Plans. This includes participation in the Water Quality Management Working Group bi-monthly meetings and updating ADEQ's *Continuing Planning Process* as necessary. The working group consists of the 8 DPAs and various state, federal or local entities involved in regulatory water quality planning and meets bi-monthly to review plan amendments and make recommendations to ADEQ on regulated water quality management issues. ADEQ continues to work with the DPAs on incorporating a watershed-based approach to the 208 process. This is a slow process because the DPAs were established on political jurisdictional lines and pollution knows no boundaries. These watershed-based discussions also encourage the DPAS to begin focusing more efforts on the NPS side of the program.

D. Grants and Outreach Program

The Grants and Outreach Unit provides program oversight for the Water Quality Improvement Grant Program. This includes assuring compliance with state and federal law, guidance and policy. Staff is responsible for holding workshops for the public which describe the grant program and how to apply. Once the applications are received, staff is responsible for processing of the grant applications including receipt, evaluation, and

award. After the grants are awarded, staff must negotiate and execute grant agreements and maintain contractual and programmatic files.

The Grants and Outreach Unit has project managers who are assigned to manage each project that is awarded funding. They are responsible for making sure that every aspect of the project follows the terms and conditions of the contract, processing and approving payments to grantees, and review and approval of quarterly and final financial and project oriented reports.

In addition, the Grants and Outreach Unit is responsible for tracking all financial and project information of each project funded by Section 319 money, providing mid-year and annual reports to EPA. Staff is responsible for keeping EPA's Grant Record Tracking System (GRTS), a federal database, up to date. GRTS tracks all Section 319(h) expenditures and includes a new mandated field to report on pollution reduction for projects addressing sediments and nutrients.

The Grants and Outreach Unit is the primary group responsible for education and outreach regarding NPS pollution (see addition information in Chapter 7, Education and Outreach) and takes the lead in marketing for the Water Quality Improvement Grant Program. Other programs within the Hydrologic Support and Assessment Section also provide education and outreach such as coordinating volunteer monitoring. These other programs work closely with the Grants and Outreach Unit. Along with the Watershed Management Unit and others, the Grants and Outreach Unit provides technical assistance regarding the grant program, NPS pollution and effective methods of NPS pollution control.

E. Groundwater Monitoring Program

Ambient Groundwater Monitoring Program

The Ambient Groundwater Monitoring Program is based on the legislative mandate which requires ADEQ to "conduct ongoing monitoring of the waters of the state, including... aquifers to detect the presence of new and existing pollutants, determine compliance with applicable water quality standards, determine the effectiveness of BMPs, evaluate the effects of pollutants on public health or the environment, and determine water quality trends." The Program collects data for use in evaluating groundwater quality changes over time.

Groundwater sampling is conducted by the Ambient Groundwater Monitoring Program on a groundwater basin basis to examine regional groundwater quality. There are eight-four groundwater basins in the state. Selection of basins for investigation are based on a number of factors including watershed rotation schedule and development pressures

in the basin. Systematic, grid-based random sampling is conducted to investigate potential NPS pollution impacts on groundwater quality. Higher density sampling occurs around targeted land uses to determine their affect on groundwater quality. Samples for Safe Drinking Water Act inorganic analysis are collected at each groundwater sampling site while samples for Volatile Organic Compounds (VOCs), Groundwater Protection List (GWPL) pesticides, banned pesticides, radionuclides, bacteria, perchlorate and others are also collected in areas where these parameters are likely to be encountered. Samples for oxygen, hydrogen and nitrogen isotope analysis are collected at certain sites, to assess aquifer recharge characteristics. Based on the groundwater sampling results and statistical analysis, index wells are selected which will be re-sampled in the future to determine groundwater quality change over time.

Monitoring objectives

< To fulfill state water quality monitoring requirements.
< To collect data to determine long-term groundwater quality trends.
< To collect data to determine regional groundwater quality levels.
< To collect data to determine groundwater quality impacts from specific anthropogenic sources.

Program-specific data quality objectives

< Regional groundwater quality sampling sites will be chosen according to a systematic, grid-based random selection process.
< Studies targeting anthropogenic sources potentially affecting groundwater quality will include upgradient, control samples to contrast with results of on-site samples.

Collaboration

Basin groundwater studies are sometimes conducted in collaboration with other internal and external monitoring programs. The internal programs which sampling is conducted in collaboration with include the Pesticide Contamination Prevention Program, the Border Program, and the Aquifer Protection Program, while external entities include the U.S. Geological Survey.

Reporting

Data collected by this program are incorporated into ADEQ's Groundwater Database as well as provided to the well owner from which the groundwater sample was collected. A comprehensive report and a summary fact sheet is published for each basin studied. Brief abstracts of the studies are also presented in *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report*.

The Ambient Groundwater Monitoring Program provides important information to the public, including an overview of the groundwater quality within a basin, areas where specific groundwater quality problems can be expected to occur, and whether there has been any change over time in the groundwater quality of the basin. This program is particularly important in evaluating effectiveness of NPS pollution control by its broad, regional approach.

Pesticide Contamination Prevention Program

Under the Environmental Quality Act, ADEQ is required to implement and enforce the Pesticide Contamination Prevention Program. This Program is intended to prevent contamination of groundwater, soil, and the vadose zone from use of agricultural pesticides. A statewide monitoring program designed to monitor the presence or absence of those pesticides listed on the Groundwater Protection List (GWPL) was implemented in July 1987. This GWPL includes pesticide active ingredients or their metabolites that have the potential to pollute groundwater of the state. All these pesticide active ingredients or their respective metabolites are the main targets of the monitoring program. The Pesticide Contamination Prevention Program collects data for use in evaluating the wells exceeding aquifer water quality standards and wells testing positive for any agricultural pesticide. The Program's goal is chiefly to determine if there is NPS pollution from general usage of pesticides rather than examining for point source pollution from mixing and loading sites. Monitoring provides an early detection of GWPL pesticide active ingredients in groundwater and soil and provides subsequent remedy to prevent further contamination. Any detection of pesticides will result in a follow up investigation. During this investigation, strict quality control samples consisting of splits, duplicated and field spikes will be collected and tested.

Monitoring Strategy and Program Design

The Pesticide Contamination Prevention Program is a statewide program. After 10 years of data collection, efforts were scaled back to focus on two areas where contamination was primarily confined, Maricopa and Yuma counties. These areas with intense agricultural activities are sampled every other year with funding provided by EPA through the Department of Agriculture. If the contamination is verified and is due to agricultural uses, appropriate compliance or enforcement actions will be taken. While the focus of the Pesticide Contamination Prevention Program has shifted to known areas of impact, through the ambient groundwater program, pesticide monitoring is still conducted in basin studies where land uses exist to suggest possible impacts.

Data Analysis

Monitoring results are compared to water quality standards, Arizona Department of Health Services' Human Health Based Guidance Levels for the Ingestion of Contaminants in Drinking Water and Soil and other standards.

Reporting
All data collected by this program are included in the 305(b) Report and the Annual Groundwater Quality Report to the Legislature. In addition, quarterly monitoring results are sent to the Arizona Department of Agriculture.

F. Volunteer Monitoring Program

Across the nation, volunteer groups monitor the condition of streams, rivers, lakes, reservoirs, estuaries, coastal waters, wetlands, and wells. They do this because they want to help protect a stream, lake, bay or wetland near where they live, work, or play. Their efforts are of particular value in providing quality data and building stewardship of local waters.

Volunteers can make visual observations of habitat, land uses, and the impacts of storms, measure the physical and chemical characteristics of waters and assess the abundance and diversity of living creatures; aquatic insects, plants, fish, birds, and other wildlife. Volunteers can also clean up garbage-strewn waters and become involved in restoring degraded habitats. The number, variety, and complexity of these projects are continually on the rise.

During the next year, ADEQ will be devoting efforts in developing a Volunteer Monitoring Program. Volunteer groups across Arizona will collect data to supplement the water quality information collected by ADEQ. The volunteer data can be used by ADEQ to: screen water for potential problems, further research or restoration efforts, establish baseline conditions or trends for waters that would otherwise go unmonitored, and help evaluate the success of BMPs designed to mitigate problems. Helping volunteer groups to collect credible and scientifically defensible water quality data is important since ADEQ, like many other organizations, is continuing to do more with less resources in both personnel and funding. In 2003, the Hydrologic Support and Assessment Section created a Water Quality Liaison position that will have 2 primary responsibilities: 1) work with state, federal and local entities to bring credible data in house in a timely and efficient format for use in Hydrologic Support and Assessment programs; and 2) develop the Volunteer Monitoring Program. ADEQ is working closely with GateWay Community College to develop a modular water quality curriculum to train volunteers and others in proper sampling techniques, developing Sample and Analysis Plans, Quality Assurance Plans, and care and maintenance of equipment. The goal is to have a curriculum that can be tailored to the specific needs of the group while hopefully providing ADEQ with valuable, useable water quality information.

ADEQ will work with volunteer monitoring groups to develop the Volunteer Monitoring Program. In the upcoming years, ADEQ looks forward to working with the various volunteer monitoring groups to ensure that the monitoring groups develop strong Quality

Assurance Plans and Sample and Analysis Plans. These documents cover how samples are collected and analyzed and how information is stored and disseminated, and will used as reference for training volunteers. This coordination will also ensure, to the extent practical, that the volunteer groups collect data that meets Arizona's credible data requirements in the *Impaired Waters Identification Rule* (Arizona Administrative Code R18-11-6). ADEQ recognizes that the Volunteer Monitoring Program effort will take time to mature and that not all volunteer monitoring groups will strive to meet the credible data requirements. It is the agency's belief that this data has value to the department even if it is solely for informational purposes. There is tremendous goodwill developed through volunteer efforts that will aid the department in achieving cooperation in its restoration work.

G. Other Programs Affecting NPS Management

Although the majority of NPS management falls under the direction of the Hydrologic Support and Assessment Section, other Water Quality Division programs aid in the advancement of Arizona's NPS Program.

Dredge and Fill Program (CWA 404 Program)

CWA 404 Program at ADEQ is responsible for permitting the discharge of dredged or fill material into waters of the U.S. A 404 permit will not be issued if a practical alternative exists. The program is jointly administered between the Army Corps of Engineers and the EPA. The U.S. Fish & Wildlife, the National Marine Fisheries Service and State Resources Agencies (e.g., ADEQ, Arizona Game and Fish Department, Arizona Department of Water Resources) have important advisory roles. Issuance of a 404 permit is a federal action which requires water quality certification by ADEQ under CWA Section 401 before it can be issued. ADEQ reviews the application to determine if surface water quality standards will be maintained. If it is determined by ADEQ that a waterbody would be significantly degraded by the discharge of dredged or fill material, a 401 certification could not be issued and the 404 permit will not be issued by the Army Corps of Engineers. In applying for a 404 permit, the applicant must show that they have:

- Taken steps to avoid wetland impacts where practicable
- Minimize potential impacts to wetlands
- Provided compensation for any remaining, unavoidable impacts through activities to restore or create wetlands.

Stormwater Permit Program (NPDES)

EPA issued regulations in 1990 creating a National Pollutant Discharge Elimination System (NPDES) permitting system for stormwater discharges from select municipalities,

construction projects and certain industrial activities. ADEQ was recently given delegation of the NPDES program. This program is called AZPDES, which stands for Arizona Pollutant Discharge Elimination System. An AZPDES permit is required for any point source discharge of pollutants to a water of the U.S. Because stormwater runoff can transport pollutants from a municipal separate storm sewer system or industrial or construction site to a water of the U.S., permits are required for those discharges.

Many stormwater discharges are permitted under various general permits. However, an individual permit may be required when the general permit requirements do not accurately represent the activity at a facility or the facility is discharging to an impaired waterbody. In these cases, a permit is customized for the site and circumstances.

Aquifer Protection Permit Program

Any owned or operated facility that discharges is required to obtain an Aquifer Protection Permit (APP). According to state statue, "discharge means the addition of a pollutant from a facility either directly to an aquifer or to the land surface or the vadose zone in such a manner that there is a reasonable probability that the pollutant will reach an aquifer". The following facilities are considered to be "discharging" and require permits, unless exempted, or the Program determines that the facility will be designed, constructed and operated so there will be no migration of pollutants directly to the aquifer or to the vadose zone.

< Surface impoundments, pits, ponds, and lagoons
< Solid waste disposal facilities
< Injection wells
< Land treatment facilities
< Facilities adding pollutants to a salt dome, salt beds, or salt formations, drywells, underground caves, or mines
< Mine tailings piles and ponds
< Mine leaching operations
< Septic tank systems with a capacity greater than 2000 gallons/day
< Underground water storage facilities (if wastewater - effluent is used)
< Point source discharges to navigable waters
< Sewage or wastewater treatment facilities

Source Water Assessment Program

The Source Water Assessment Program or SWAP evaluates the source water that provides drinking water to each public water system in Arizona. This evaluation determines the degree to which a public water system is protected, or at risk of contamination. Once completed, SWAP reports will be used to assist local communities in implementing protection measures such as Wellhead Protection. In addition, specific

monitoring requirements can be tailored for each system. For example, if a public water system has no history of a particular chemical, as well as no potential for future contamination (based on land use practices and the risk they might pose to water sources), then monitoring relief or reduced monitoring for that chemicals(s), would be granted for that public water system. If a different public water system has a history of problems with that same chemical(s), then monitoring would still be required.

ADEQ is confident that the SWAP and the related source water protection activities will prove instrumental in preserving drinking water quality. By knowing the adjacent land uses around water sources and current contamination problems throughout the state, local solutions to local problems can be undertaken.

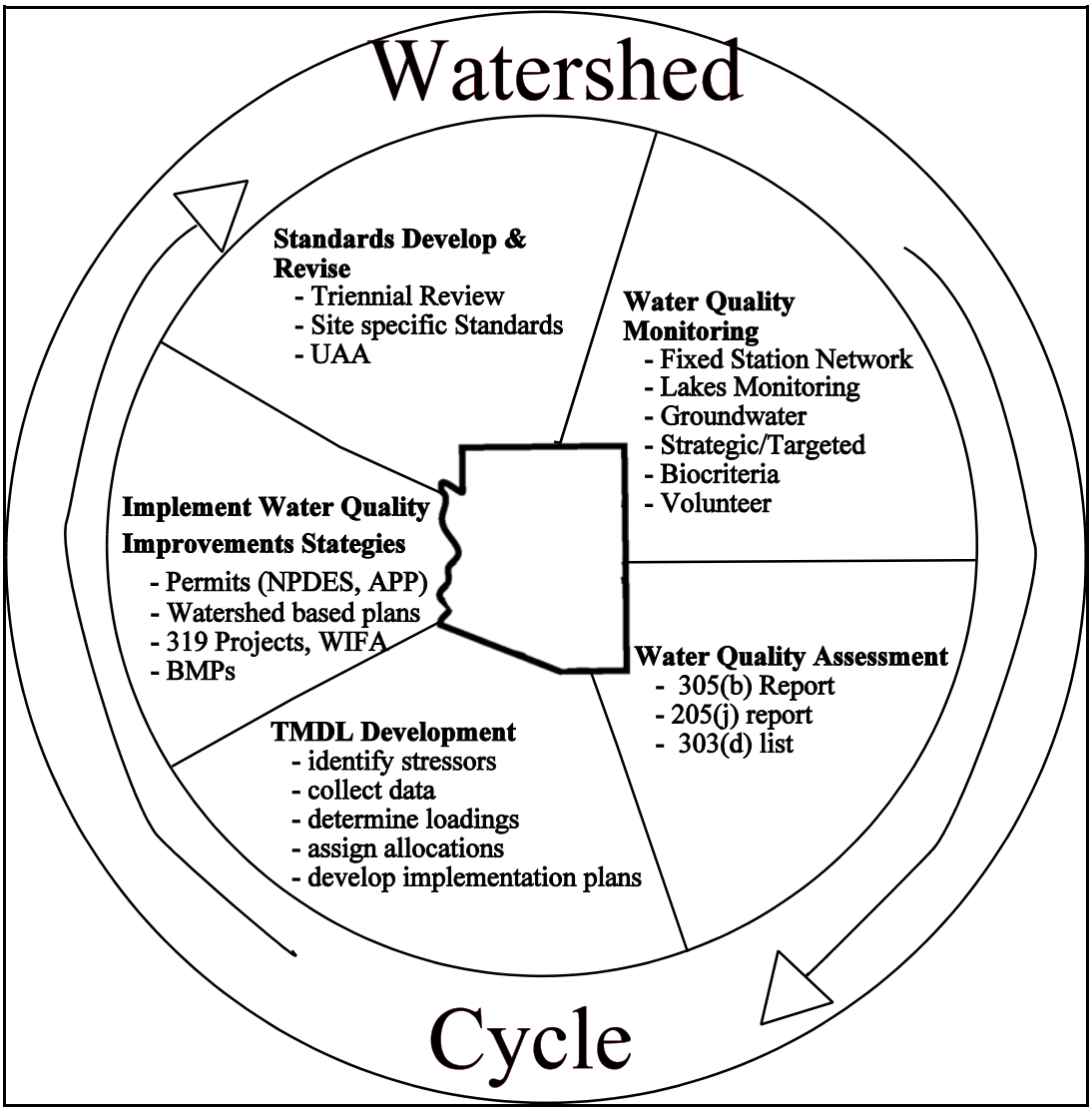
Compliance and Enforcement Programs

Nationwide and in Arizona, surface water pollution and the potential for surface water pollution exists through the discharge of runoff or wastewater to waterways from livestock facilities. ADEQ has established a Concentrated Animal Feeding Operations (CAFO) Inspection Program for the purpose of curtailing existing off-site discharges of runoff or wastewater and to evaluate individual livestock facilities for potential to discharge water contaminated by animal wastes. Recommendations and violations are written to facilities to correct deficiencies in waste management practices, waste handling devices, and waste handling structures.

Data Management and Analysis Group

This group is tasked to advance and support data management and analysis functions through design and implementation of high quality, user friendly, integrated, relational data management systems and practical analytical applications. ADEQ seeks to improve the availability and quality of data to make sound environmental decisions.

The Data Management and Analysis Group also provides GIS (geographic information system) support. GIS support is very valuable as it allows ADEQ to estimate and inventory potential sources of NPS pollution in a watershed area. GIS is a very effective, cost efficient, and timely tool to use. ADEQ continues to make tremendous progress in managing water information, including sharing data with the public, states, tribes, the EPA and other interested parties.


Watershed
Standards Develop & Revise
- Triennial Review
- Site specific Standards
- UAA
Water Quality Monitoring
- Fixed Station Network
- Lakes Monitoring
- Groundwater
- Strategic/Targeted
- Biocriteria
- Volunteer
Implement Water Quality Improvements Stategies
- Permits (NPDES, APP)
- Watershed based plans
- 319 Projects, WIFA
- BMPs
Water Quality Assessment
- 305(b) Report
- 205(j) report
- 303(d) list
TMDL Development
- identify stressors
- collect data
- determine loadings
- assign allocations
- develop implementation plans
Cycle

Example Watershed

Step#1 Surface Water Monitoring and Standards Program
Establish water quality standards for John Doe Creek.

Step #2 Field personnel obtain water quality data that is used to assess the biological, chemical, and physical integrity of John Doe Creek.

Step #3 **Volunteer Monitoring Program**
Works with volunteer groups across Arizona to collect data. These data supplement water quality data and information collected by ADEQ and other agencies on John Doe Creek.

Step #4 **Watershed Management Unit**
Completes state water quality assessment (305b Report) and John Doe Creek is identified as impaired and placed on the 303(d) List of impaired waters for copper and zinc.

Step #5 **TMDL Unit**
A TMDL study is completed for copper and zinc on John Doe Creek. After the load capacity and contributions from the pollution sources (point and NPS) during the critical conditions are compared, load allocations and necessary load reductions are discerned.

Step #6 **Watershed Management Unit**
A TMDL implementation plan to improve water quality in the creek is developed. A TMDL implementation plan must identify management measures, estimate load reductions, and contain an action plan with milestones to be implemented by the stakeholders.

Step #7 **Grants and Outreach Unit**
The stakeholders within the John Doe Creek watershed apply for a Water Quality Improvement Grant and receive priority because there is a TMDL implementation plan in place.

Step #8 The project(s) is approved and the Grants and Outreach Unit is responsible for managing the project.

Step #9 **Volunteer Monitoring Program**
Works with project managers or other volunteer groups to collect data. These data help to determine the effectiveness of the management measures that are implemented, as identified in the TMDL implementation plan.

Step #10 **Grants and Outreach Unit**
The water quality improvement project is completed and the project is closed out.

Step #11 **TMDL Unit**
The targeted monitoring staff of the TMDL Unit collects water quality monitoring data. The data indicates that John Doe Creek is meeting water quality standards and the creek is removed from the 303(d) List of impaired waters and added to the list of "attaining" waters.

Water quality in John Doe Creek is restored!

Key element #2 requires that States build "Strong working partnerships and collaboration with appropriate State, interstate, tribal, regional, and local entities (including conservation districts), private sector groups, citizen groups, and Federal agencies." Arizona achieves this key element through partnerships and stakeholder efforts implemented through a variety of formal and informal efforts Through partnerships, Arizona is able to work with federal, state, and local agencies to incorporate other appropriate water quality controls. In addition to partnerships with other agencies, ADEQ works with community-led watershed groups to identify, assess, and help implement voluntary efforts to control NPS pollution.

For example, ADEQ is working towards better collaborative solutions with the U.S. Forest Service, BLM and other agencies to address forest management activities that can prevent wildfire devastation. The U.S. Forest Service has had to adjust some of their forest management priorities to dedicate time to wildfire prevention and management. To address the devastation of the Rodeo-Chediski Wildfire, ADEQ helped fund it's largest Water Quality Improvement Grant project in history. ADEQ awarded the "Trees for the Rim" Project with Section 319 Water Quality Improvement Grant Program Funds to help the people of this area. This project will aid in replanting live trees in the burned areas which will help stabilize soil sediments and hasten the slow process of forest restoration in the most severely burned areas.

ADEQ acknowledges the importance of working at a watershed level to clearly understand the issues impacting water quality as well as the need to involve and work with local jurisdictions and citizens. It is important to understand that watersheds are a geographic area and the natural boundaries of watersheds do not correspond with political boundaries. City, county, state, and federal jurisdictions provide a maze of legal and political perspectives, as well as different and diverse management goals to work through. For any comprehensive watershed approach to have long term success, it will need to involve private and public landowners, numerous political jurisdictions and coalitions of special interest groups. Through federal, state and local partnership, we are achieving our goal of providing a cleaner, safer environment and ensuring its integrity for future generations.

Cooperative Monitoring

Both the Surface Water Monitoring and Standards and Groundwater Monitoring Units work with the U.S. Geological Survey to conduct water quality monitoring. The USGS collects water quality data quarterly at sites located on Arizona's larger rivers and groundwater basin studies are occasionally conducted in collaboration with ADEQ.

ADEQ has recently partnered with GateWay Community College of Phoenix to develop a curriculum that can provide specific training to Arizona volunteer groups on water quality sampling techniques, and designing and implementing sampling plans. A modular curriculum has been developed and tailored to train volunteers on streamflow measurements and basic surface water as well as groundwater quality sampling techniques. Special emphasis is given to Quality Assurance Project Plan and Sampling and Analysis Plan development, data quality objectives, and indicator principles. ADEQ and GateWay have also developed an agreement whereby GateWay will store ADEQ's volunteer field equipment and has agreed to perform essential maintenance and calibration of the equipment. In return, when the equipment is not being used by volunteer groups, GateWay will use the field equipment in their Water Resources Technology Program and other courses on Hydrologic Studies.

Memorandums of Understanding

ADEQ has entered into several Memorandums of Understanding (MOUs) with partners in the State to respond to mutual water quality objectives. MOUs help identify responsibilities and activities to be performed by each agency and foster a collaborative effort in meeting natural resource and public health goals to sustain healthy conditions in Arizona's watersheds. A list of the agencies that ADEQ shares MOUs with is in Appendix A.

Water Quality Improvement Grant Program

The Water Quality Improvement Grant Program opens the door for working partnerships. ADEQ encourages grantees to work with other state agencies' grant programs so that the state funded grants can be used to meet the 40% non-federal match requirement of Section 319 grants. The match ensures local ownership of the projects. ADEQ works with the Arizona Department of Water Resource's Water Protection Fund and the Rural Watershed Initiative Program, the Water Infrastructure Finance Authority and Arizona's Game and Fish Department's Heritage Fund to assure that these grant programs are being promoted for the benefit of the state. ADEQ wants to ensure that Section 319 funds complement and leverage funds available for technical and financial assistance from other federal, state, and local sources. By distributing grant funds to all entities in Arizona, including stakeholder groups and watershed partnerships, ADEQ is not only building partnerships but also controlling NPS pollution.

Public Participation

Public participation in decision-making and policy development processes is key to ensuring equitable, sustainable development. Including public concerns in policies and programs ensures that they are all-inclusive and meet the needs of everyone. Many of the activities that take place in the NPS Program require public participation. All new and revised rules and permits require public notice which sets forth a specified public

comment period during which time citizens may present written questions, comments or suggestions. Generally a public hearing is held if a request is submitted and ADEQ finds sufficient grounds to address the issue. ADEQ representatives record the public's questions, comments and suggestions and develop a written record of responses and changes, as appropriate. EPA and ADEQ work together to ensure that there is adequate public participation in the development of *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report* and water quality standards development and adoption. ADEQ must also provide public notice and allow for comment on each draft estimate and draft allocation designated in a TMDL report.

303(d) Listing, TMDLs and Implementation

Guidance from EPA notes that "adequate public participation should be a part of the impaired waters listing process to make sure that all water quality limited waters are identified." Once listed, development of a TMDL, or cleanup plan for waters not meeting minimum criteria, must involve stakeholders. Stakeholder involvement is extremely valuable in reviewing the relevant water quality criteria and waterbody use designation for appropriateness, identifying likely sources of problem pollutants, developing strategies for reducing pollutant loads, and implementing the selected strategies. When TMDLs address NPS of pollution, stakeholder participation is even more helpful. Watershed residents and land managers usually have a much richer knowledge of potential pollutant loading activities and a local perspective of what's likely to work in terms of remediation. By involving the local communities in decision-making, ADEQ expects a higher probability of successful TMDL implementation will result.

Chapter 7 - NPS Education and Outreach

NPS education and outreach efforts must reach a broad and diverse audience, portraying to the public the importance of a holistic watershed approach for the protection and restoration of ecological systems. Since most NPS pollution is generated by individuals, rather than by factories, it can be resolved by the corrective actions of individuals, rather than through huge end-of-pipe spending campaigns. The first step in finishing the job of cleaning up Arizona's waters is to raise awareness that people are all part of the remaining problem, and must all therefore be part of the solution. The solution is to translate this new-found awareness into action. Action must be taken by policy makers, planning and zoning officials, natural resource personnel, educators, government officials, developers, landowners, watershed groups, students, and everyone.

The goal is to provide information in a variety of formats including printed material, targeted seminars and workshops, brochures, videos, multimedia computer programs, classroom and community involvement projects. ADEQ is committed to providing information in clear understandable language, at an audience appropriate technical level, free of jargon and use of acronyms. ADEQ must foster a sense of community and local stewardship for watersheds and water quality as well as provide support for Arizona's NPS Program. In addition, each funded water quality improvement project has an education and outreach component which helps to strengthen ADEQ's efforts.

Severe shortages of resources, both in personnel and funding, will make it critical that NPS education and outreach efforts continue to focus on the following long term goals: 1) emphasize good coordination and cooperation with various federal, state and tribal agencies, public and private organizations and educational institutions within the State, 2) review and utilize existing NPS/water quality educational activities and materials as appropriate and 3) encourage all staff members to be knowledgeable about ADEQ's NPS programs and identify opportunities for staff to act as ambassadors for the program.

To set in motion NPS education and outreach, ADEQ developed three areas of focus, each of which will be explored below: 1) provide education and outreach support for Arizona's NPS Program, 2) provide general NPS educational materials and opportunities (this category is further broken into a focus on adults and a focus on children, and 3) develop education and outreach opportunities at public outreach events.

<u>Support for Arizona's NPS Program</u>

The three units within the Section that have primary responsibility for this focus are the Grants and Outreach Unit, the TMDL Unit and the Watershed Management Unit.

While the Grants and Outreach Unit has the lead responsibility for NPS education and outreach, the scarcity of resources makes it critical that staff from each unit be able to speak knowledgeably at every opportunity about the Water Quality Improvement Grant Program, the TMDL Program and Watershed Management in Arizona. Additionally, team members can provide information about NPS pollution in general and how it can be controlled.

As an example, the Grants and Outreach Unit conducts many workshops around the state for the Water Quality Improvement Grant Program. At each of those workshops, approximately half of the workshop focuses on the grant program and application process, while the other half is spent educating the audience on the causes of NPS pollution and promoting the TMDL and Watershed Management Units' mission. This education and outreach support effort is a creative and efficient approach especially necessary given the small number of staff designated specifically for NPS education and outreach in a state as big and diverse as Arizona. It requires staff to be technically versed in their own work responsibilities as well as general NPS issues and requires close coordination between the Units to be successful.

General NPS education, materials, and opportunities

Adult Education

The adult education and outreach portion currently consists primarily of the Compliance Assistance Project, the Arizona Nonpoint Source Education for Municipal Officials (NEMO) project, and the Master Watershed Stewardship Program. The Regulated Agriculture Activities Assistance Program is a compliance assistance partnership between the Arizona Department of Agriculture and ADEQ. It addresses water quality issues related to Animal Feeding Operations (AFOs). The project provides site specific education of voluntary BMPs and other measures operators can do to assure their facility is in compliance with water quality regulations.

ADEQ has contracted with the University of Arizona (UofA) to characterize, assess, and create watershed-based plans for three of Arizona's ten watersheds. From the documents that are created about each watershed, UofA will develop educational materials targeted for land use decision makers and other stakeholder groups. UofA and ADEQ are working together to increase awareness among county and city officials, stakeholders, etc. about how personal decisions impact water quality. Education will also be provided to these groups to help them learn how to control NPS pollution and make better planning decisions. A variety of management approaches will be used, ranging from comprehensive planning to the use of BMPs to address current and future problems.

The goal for the educational piece of the Nonpoint Source Education of Municipal officials (NEMO) project is to educate land use decision makers to make choices and take actions that will mitigate NPS pollution and protect our natural resources. This will be accomplished by non-regulatory, research-based education using geospatial information and other advanced technologies for education, analysis and research.

The NEMO project is an education approach for addressing the issues of natural resource protection and watershed management. The goal of NEMO is not to replace other approaches, such as regulations, technical assistance, or incentive programs, but to support these with complimentary endeavors. However, in this "new era" of natural resource protection, defined largely by land and water use generated problems such as NPS pollution, habitat fragmentation and inefficient use of water resources, education is one of the most effective tools for addressing the problems.

The Master Watershed Stewardship Program is currently being developed in partnership with the Uof A's Cooperative Extension Service. This program will be modeled after the highly successful Master Gardner Program and will provide watershed, water quality, and NPS pollution education to concerned and interested citizens. In addition, the program will provide information on developing and facilitating watershed groups/partnerships. ADEQ expects this program to help in capacity building for many of the current Watershed Groups and hopefully create incentive for the creation of new watershed groups.

Preliminary Master Watershed Stewardship courses have been taught in Yavapai and Cochise counties and these same counties will be the pilot locations for program development the first year. The goal is for the program to be statewide and self sustaining by the end of three years. A course typically consists of 40 hours of course work and two full day field trips. Topics covered in the course include: hydrology, meteorology, geology, soils, climate, riparian and aquatic ecology, water law, BMPs, group organization and funding sources. Upon successful completion of the course, including a comprehensive final examination, participants are given Associate Master Watershed Steward status. After contributing 40 hours of volunteer service to their community, delivering pre-approved watershed-related education, they become Certified Master Watershed Stewards.

It is anticipated that each region will have direct outreach to 400-500 stakeholders, with a multiplying effect on Arizona residents through the efforts of

volunteers. Stakeholder ages will range from middle school to senior citizens. Several community workshops will be held initially to gather stakeholder input and prioritize critical local and state issues. A conference will be held in each of the watersheds over the course of the three-year project. Master Watershed Steward volunteers will be utilized to organize and deliver county-wide educational programs.

Youth Education

The programs that primarily support NPS education for children include: 1) Arizona Envirothon, 2) Project WET (Water Education for Teachers), and 3) ADEQ's NPS Education School Days.

Envirothon is a natural resources competition for high school students. Teams of five students work to answer natural resource questions and develop solutions to environmental problems. Envirothon integrates five areas of study: forestry, aquatics, wildlife, soils, and an environmental issue that changes each year. With Section 319 funding, ADEQ has been able to support the Arizona Envirothon since its establishment in 1998. Arizona's high school students are the hope for the future and Envirothon provides a great learning experience that can strengthen the foundation for environmental stewardship.

Another partnership project with UofA, Project Water Education for Teachers (Project WET), was developed to provide educational materials for teachers to use in their classrooms. The UofA has put together water quality and NPS pollution curricula for grades kindergarten through twelfth. ADEQ provided initial funding for the development of the program and UofA is now implementing this education statewide. ADEQ is also able to use this curriculum for their education and outreach activities.

ADEQ's NPS School Days is a program where ADEQ staff members work directly with teachers in the community and provide a day of education focusing on water issues. The goal is to provide assistance and/or materials anytime teachers or other interested parties request assistance. A variety of tools including the NPS *Enviroscape* model, are used to demonstrate the many ways people contribute to NPS pollution and things they can do to control it.

A new partnership program established in 2003, is the National Science Olympiad, another competition that involves both junior high and high school youth. Science Olympiad focuses on science topics including water issues.

Public outreach events

A good method of providing NPS information to large groups with a minimum investment of resources is to attend events, particularly events with a water or natural resource emphasis. ADEQ currently supports or sponsors the following events each year: Verde River Days, the Sedona EcoFest, the Arizona Children's Water Festival, and various Earth Day events.

Volunteer Monitoring

With the Volunteer Monitoring Program (See Chapter 5), ADEQ works with and trains watershed partnerships and other interested groups on proper water quality sampling methods. This type of training provides the perfect opportunity for education about water quality and NPS pollution. Through volunteering monitoring, ADEQ is building the foundation for active, educated, articulate, and effective groups of environmental stewards. This foundation is an essential component in NPS management and preservation of Arizona's water resources.

As interest in monitoring streams grows, so too does the desire of groups to apply an integrated approach to the design and implementation of volunteer programs. More and more, volunteer monitors are interested in taking a combination of physical, chemical and biological measurements and are beginning to understand how land uses in a watershed influence the health of its waterways. Through a heightened effort to increase volunteer monitoring partnerships, ADEQ and other volunteer programs gain improved credibility and access to professional expertise and data.

Watershed Partnerships

In the mid 1990's, ADEQ embraced the watershed approach to protect and preserve the quality of surface water and groundwater. This watershed approach has developed rapidly over the past decade at the federal, state, and local levels. Arizona manages its water resources on a watershed basis, considering all impacts within a drainage area rather than discrete programs to address point and nonpoint sources of pollution.

Engaging and involving stakeholders benefits both regulatory and non-regulatory actions to restore and protect Arizona's waters. Synthesizing people, policies, priorities, and resources through watershed partnerships blends science, technology, and statutory responsibilities with social, economic, and cultural considerations. ADEQ utilizes the organization and venue of several watershed partnerships throughout the state to strengthen its outreach efforts.

Chapter 8 - NPS Program Goals

The NPS Program is a dynamic and adaptive program intended to facilitate and promote statewide efforts to manage NPS pollution. Milestones have been placed on both the long-term goals and short-term objectives which outline the State's implementation strategy for the restoration and protection of beneficial uses impaired due to NPS. The long-term goals listed below are desired end points of the various action strategies described throughout this document. While the long-term goals are based on a ten to fifteen year time frame, the short-term objectives listed below will be implemented and revised as necessary over the next five years such that beneficial uses of the state's waters (to the extent practicable) are fully restored or maintained. Many of the short-term objectives are taken from ADEQ's EPA approved workplan. ADEQ is required to report the status of these tasks or short-term objectives to EPA quarterly. The tasks and deliverables scheduled as part of the workplan are designed to attain our long-term goal of implementing a dynamic and effective NPS Program designed to achieve and maintain beneficial uses of water. These priority program elements are as follows:

<u>Protect, Improve Water Quality</u>

1. Support ground and surface water quality monitoring that provides data for assessments, identification of impaired waters, TMDLs, and effectiveness of remediation and protection strategies.
2. Identify and quantify water quality problems in Arizona.
3. Develop TMDLs for 303(d) listed waterbodies.
4. Develop and Implement Water Quality Improvement Plans.
5. Focus Section 319 incremental grant funds and non-federal matching resources on priority watersheds with impaired waters.
6. Effectively and efficiently use financial resources and leverage funds with other programs to target NPS priority issues and areas.

<u>Foster NPS Program</u>

7. Work with and provide technical support to Arizona watershed partnerships.
8. Provide statewide NPS education and outreach.
9. Develop, implement, and evaluate NPS management measures and other pollution prevention strategies to minimize degradation and protect surface water and groundwater quality.
10. Maintain and expand partnerships and cooperative opportunities with NPS stakeholders, other agencies, organizations, and citizens.
11. Complete NPS Annual Report.
12. Review and assess the goals and objectives of the NPS Management Plan and revise the Plan as appropriate.

Goals and Milestones

GOAL: Support ground and surface water quality monitoring that provides data for assessments, identification of impaired waters, TMDLs, and effectiveness of remediation and protection strategies.

MILESTONE	2003 - 2004	2005	2006	2007	2008
1. Perform surface and ground water quality monitoring throughout the state.					
2. Determine water quality improvements and BMP effectiveness through project monitoring and oversight.					
3 Develop narrative implementation procedures and utilize narrative standards, as well as numeric water quality standards, to assess Arizona's waters.					
4. Develop, initiate, and support a Volunteer Monitoring Program.					

GOAL: Identify and quantify water quality problems in Arizona.

MILESTONE	2003 - 2004	2005	2006	2007	2008
1. Support watershed rotation based monitoring program to provide water quality data on long-term stations and watershed characterization sites within the 10 surface watersheds.					
2. Complete *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report* due April 1, 2004 and 2006.					
3. Complete 205(j) Report in 2005 and 2007.					
4. Complete watershed characterizations for at least three watersheds in Arizona (Bill Williams, Upper Gila, and Verde) by January 2004.					

GOAL: Develop TMDLs for 303(d) listed waterbodies.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Develop TMDLs.					
2. Hold public meetings to involve local and affected stakeholders.					
3. Receive and evaluate comments.					

GOAL: Develop and Implement Water Quality Improvement Plans					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Write TMDL implementation plans.					
2. Write and develop watershed-based plans for all ten Arizona watersheds.					
3. Hold public meetings with stakeholders.					
4. Receive and evaluate comments.					

GOAL: Focus Section 319 incremental grant funds and non-federal matching resources on priority watersheds with impaired waters.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Coordinate and conduct annual meetings to set internal goals for priority funding.					
2. Conduct statewide grant workshops annually.					
3. Award Section 319(h) grant money each year to implement water quality improvement projects on impaired waterbodies.					

GOAL: Effectively and efficiently use financial resources and leverage funds with other programs to target NPS priority issues and areas.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Use the Grants Reporting Tracking System (GRTS) to track grant funding and effectiveness.					
2. Coordinate with other funding programs (i.e. Arizona Water Protection Fund, Water Infrastructure Finance Authority, Environmental Quality Incentives Program) to leverage money to target NPS management in priority areas.					

GOAL: Work with and provide technical support to Arizona watershed partnerships.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Actively involve the community, including watershed partnerships, with the development of watershed-based plans and TMDL implementation plans.					
2. Provide support to community watershed partnerships.					
3. Assist with the development and implementation of the Master Watershed Stewardship Program.					

GOAL: Provide statewide NPS education and outreach.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Plan, develop and implement a strategy to conduct education/outreach efforts to increase public awareness of NPS impacts to surface and groundwater resources.					

GOAL: Provide statewide NPS education and outreach.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
2. Update web site information to reflect current activities.					

GOAL: Develop, implement, and evaluate NPS management measures and other pollution prevention strategies to minimize degradation and protect surface water and groundwater quality.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Develop BMP guidance documents for NPS categories, including sediment, mining, and nutrients.					
2. Research and identify ways to quantify load reductions as required in *EPA's 2003 NPS guidance*.					
3 Document BMP effectiveness from water quality improvement projects in GRTS and guidance documents.					

GOAL: Maintain and expand partnerships and cooperative opportunities with NPS stakeholders, other agencies, organizations, and citizens.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Coordinate with federal land management agencies on water quality and watershed improvements as needed.					
2. Oversee, and update as needed, a ll Memorandum of Understandings (MOUs) so that state, federal, tribes, and local resource management agencies have identified responsibilities in carrying out portions of Arizona's NPS State Management Plan.					

GOAL: Maintain and expand partnerships and cooperative opportunities with NPS stakeholders, other agencies, organizations, and citizens.					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
3. Coordinate meetings and updates with other state, federal, tribal, and local partners in the state (i.e. Arizona Department of Water Resources, Arizona Game and Fish Department, Bureau of Reclamation).					
4. Provide leadership, technical assistance, expertise and support to outside planning and governmental entities to support watershed planning and 208 regional water quality management planning.					

GOAL: Complete NPS Annual Report					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Write and develop a NPS Annual Report summarizing the goals and accomplishments yearly.					
2. Use annual reports to gauge progress on five year Plan					

GOAL: Review and assess the goals and objectives of the NPS Management Plan and revise the Plan as appropriate					
MILESTONE	**2003 - 2004**	**2005**	**2006**	**2007**	**2008**
1. Amend NPS Management Plan as necessary.					

Chapter 9 - Tracking Effectiveness

As Arizona continues to focus efforts on restoring waters that have been listed as impaired as well as to protect waters that are currently not impaired, it is critical that ADEQ monitor both: 1) the progress being made towards achieving and maintaining water quality standards; and 2) the implementation of programs and projects to assure that they are successful. ADEQ uses several sets of measures to fully determine the success in implementing the NPS Program. These include measures that indicate progress towards achieving and maintaining beneficial uses of water; towards other long-term goals of the Program (i.e. achieving load reductions, or implementing particular watershed projects); and towards shorter-term goals and objectives that are designed to lead to the achievement of longer-term goals.

ADEQ uses several approaches such as ambient water quality monitoring, biological and physical assessment, implementation monitoring, model projections, and photographic evidence to measure effectiveness. Environmental indicators such as these are used to the greatest extent feasible so that the public may best recognize the State's progress in addressing water quality problems in terms that are most relevant to the public's concerns.

Water Quality Monitoring

Monitoring is an essential tool to enable ADEQ to identify NPS pollution problems, develop effective watershed-based plans, evaluate the effectiveness of actions taken, and meet Section 319 reporting requirements. Monitoring strategies are designed to focus on whether loading reductions are being achieved over time and substantial process is being made towards attaining or maintaining water quality standards. Arizona's surface water quality standards establish the benchmarks for ambient water quality to be achieved for Arizona's streams and lakes. In some Arizona surface waters, these benchmarks are not achieved and often, the sources of pollutants causing violations of water quality standards are NPS. Water quality standards may be used in watershed plans that are developed and implemented to prevent or reduce NPS discharges of pollutants to surface waters. They can be used as the benchmarks for determining the effectiveness of management measures implemented to control NPS pollution.

Trend, Baseline, & Compliance Monitoring

In an effort to determine effectiveness, the Surface Water Monitoring and Standards Unit conducts both trends and baseline monitoring to determine whether surface waterbodies are meeting water quality standards and supporting designated uses. Trend monitoring means that water quality measurements are made at fixed locations at regular, well-spaced intervals over a long period of time to determine long-term trends in targeted water quality parameters. ADEQ's Fixed Station Network Monitoring Program is an

example of trend monitoring. Baseline monitoring is used to characterize existing water quality conditions and to establish a database for planning or future comparisons. ADEQ's 5-year rotating basin monitoring program is an example of baseline monitoring. Data from both programs are used to compare existing water quality to applicable surface water quality standards to determine whether the water quality standards are being met and whether the waterbodies' designated uses are bing supported.

Implementation Monitoring

ADEQ's NPS Program has matured to the point where sufficient projects have been implemented and now need to be evaluated for effectiveness. Implementation monitoring is used to determine whether activities are carried out as planned and how effective the activities have been. One of the most common uses is to determine whether BMPs are implemented as specified in a watershed plan, environmental assessment, or contract. Implementation monitoring provides feedback to project managers as to whether BMPs are being carried out as intended and how successful they were for a given set of project factors.

Volunteer Monitoring

The goal of the ADEQ Volunteer Monitoring Program is to have the volunteer groups collecting water quality data that is credible and defensible and can be used by ADEQ for research, screening or assessment purposes. Data collected by these volunteer groups should comply with the Credible Data Requirements in Arizona's *Impaired Waters Identification Rule* (Arizona Administrative Code R18-11-6). Therefore, the effectiveness of the ADEQ Volunteer Monitoring Program will be measured in two different ways:

< Number of volunteer groups that have a Quality Assurance Project Plan and Sampling and Analysis Plan in place that meets the "credible and scientifically defensible data requirements". The Plans must be kept current by the volunteer group to reflect any changes in the group's monitoring objectives.

< Number of volunteer groups that are trained on water quality sampling concepts and techniques according to the curriculum developed by ADEQ and GateWay Community College or other similar training course. This training must be kept current by the volunteer group to reflect any changes on group monitoring objectives or group volunteers.

Project Monitoring

Each project funded by the Water Quality Improvement Grant Program to implement a watershed-based plan, must describe how the monitoring component will be used to evaluate the effectiveness of the implementation efforts over time. Monitoring can include photographic points and/or actual water quality monitoring.

Information on reductions in NPS pollutant loads will be tracked and reported in the

Section 319 Grants Reporting and Tracking System (GRTS). Beginning in 2004, ADEQ is required to enter all in-stream water quality monitoring data collected as part of the Section 319(h) Program into STORET (EPA's "storage and retrieval" data system). For this reason, the Volunteer Monitoring Program's training courses on credible data collection and sampling plan development is a critical element.

NPS Program Effectiveness

To measure the progress and success the NPS Program, ADEQ uses three sets of measures: 1) Arizona's overall water quality assessment in achieving and maintaining beneficial uses of water; the long-term goals; and 3) the short-term objectives outlined in this NPS Management Plan. Section 319 requires States to report annually on their progress in meeting the long-term and short-term goals contained in their NPS Management Plan (implementation milestones) and to report available information on reductions of NPS pollutant loadings and on improvements to quality resulting from implementation of the NPS Program. In general, the report enables EPA and the public to ascertain whether outputs and milestones are being achieved on schedule, to identify any problems that may be developing carrying out task in the grant work plan, to identify corrective actions to address such problems expeditiously, and to adequately account for all federal Section 319 funds expended. Water quality and implementation measures and indicators, enhanced public education, awareness and action will be used to track the effectiveness of the NPS Program.

Water Quality Improvement

For overall program status and trends, ADEQ uses *Arizona's Integrated 305(b) Water Quality Assessment and 303(d) Listing Report* to compare the quality of Arizona's surface waters to water quality standards. As stated in Chapter 5, the report provides an assessment of surface and ground water resources in Arizona in relation to Arizona's water quality standards. This report assesses all surface waters, reports on the quality of ground water, and lists any impaired surface waters. This water quality assessment report is another means by which ADEQ can determine the effectiveness of management measures implemented to control NPS pollution.

< Number of river/stream miles and lake acres that fully support all designated beneficial uses.
< Demonstrable improvements in relevant surface and ground water quality parameters.
< Fish consumption advisories lifted or removed.
< Prevention of new impairments (i.e. number of river/stream miles removed from the "Planning List" and found to be fully attaining).

NPS Pollutant Load Reduction

a. Reductions in pollutant loadings from NPS in impaired waters.

b. Reductions in pollutant loadings from NPS in priority watersheds.

Note that ADEQ is working to incorporate this measure. NPS load reductions are difficult to quantify, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time.

Implementation of NPS Controls

a. Number of on-the-ground practices implemented in watersheds across the state.
b. Number of TMDLs, TMDL implementation plans, and watershed-based plans to address NPS pollution.
c. Percent of watersheds with completed plans.

Public Education, Awareness, and Action

a. Participation rates in various public awareness and educational efforts.
b. Participation rates in NPS activities such as volunteer monitoring, watershed partnerships, and stakeholder involvement through TMDL and watershed-based plan implementation.
c. Number of groups/individuals completing volunteer monitoring training through Gateway Community College.
d. Participation rates in Grant Workshops across the state.

ADEQ will continue to work with federal, state, tribal and local partners to improve the efficiency and effectiveness of existing programs, provide technical and financial assistance and conduct outreach activities. In the short-term, ADEQ will coordinate with their partners in the state to focus technical and financial assistance on high priority waterbodies and watersheds. The implementation of management measures will be tracked and ADEQ will attempt to evaluate the effectiveness through water quality monitoring and the other techniques mentioned above.

In 2008 (the end of the five year planning period), ADEQ will conduct an evaluation of how well performance measures and implementation goals identified in this NPS Management Plan have been met, and assess possible mechanisms, including rulemaking, to improve program implementation. For those areas in which progress is being made, it is anticipated that EPA and ADEQ can begin to examine ways to better target monitoring and streamline reporting. For those areas in which sufficient progress is not being made, ADEQ and EPA will identify what, if any, changes need to be made. ADEQ will move forward in their efforts to advance a results-based approach to NPS pollution control and other environmental protection concerns.

References

Tetra Tech, Inc., 2003*, Getting in Step: Engaging and Involving Stakeholders in Your Watershed*.

U.S. Environmental Protection Agency, 2002, *National Water Quality Inventory Report to Congress (305(b) Report)*.

U.S. Environmental Protection Agency, June 2003, *Nonpoint Source Program and Grants Guidelines for States and Territories*, Preliminary Staff Draft.

U.S. Environmental Protection Agency, Winter 2002-2003, *Congress on Control of Nonpoint Source Water Pollution: Options and Opportunities,* Renewable Resources Journal Special Report, Volume 20, Number 4.

U.S. Environmental Protection Agency, January 1998, *The Watershed Protection Approach*, URL: www.epa.gov/OWOW/watershed/wacademy/its/statwid/chapter1.htm.

U.S. Environmental Protection Agency, November 1997, *Volunteer Stream Monitoring: A Methods Manual*, EPA Report No. 841-B-97-003.

U.S. Environmental Protection Agency, *Watershed Protection: A Statewide Approach*, URL: www.epa.gov/OWOW/watershed/statewide/chaptr1.htm.

Partners in the State

Partners	Memorandums of Understanding
Resource Conservation and Development Districts	Natural Resource Conservation Service
Arizona State Parks	U.S. Department of Agriculture, Forest Service, Southwest Region
Water Infrastructure Finance Authority	Bureau of Land Management
Southwest Strategy	Arizona Game and Fish Commission
Farm Bureau	Arizona Game and Fish Department
The Nature Conservancy	Arizona State Land Department
The Audubon Society	Hualapai Tribe
Watershed Partnerships	Coordinated Resource Management
Various Stakeholders	Navajo Nation Environmental Protection Agency
Central Arizona Project	Verde Natural Resource Conservation District
Salt River Project	Arizona Department of Water Resources
Arizona Public Service	
Natural Resource Conservation Districts	
U.S. Geological Survey	
U.S. Fish and Wildlife Service	
University of Arizona Cooperative Extension	
Northern Arizona University	
U.S. Forest Service	
Arizona Department of Agriculture	
U.S. Bureau of Reclamation	

Water Quality Improvement Grant Recipients

Cycle 1, July 2000

1. James W. Crosswhite, EC Bar Ranch
2. Merlyn Rogers, Private Rancher
3. Town of Eagar
4. Blue Ridge and Long Valley Ranger Districts
5. USDA, Tonto National Forest Service
6. Anita Waite, Private Rancher
7. Coronado Resource Conservation and
8. Development Area, Inc.
9. Yavapai County Flood Control

Cycle 2, January 2001

1. Apache County
2. USDA, Apache-Sitgreaves National Forest Service
3. James W. Crosswhite, EC Bar Ranch
4. Coronado Resource Conservation and Development Area, Inc.
5. Overgaard Townsite Domestic Wastewater Improvement District
6. Raymond C. Keeler, Private

Cycle 1, July 2001

1. James W. Crosswhite, EC Bar Ranch
2. USDA, Apache-Sitgreaves National Forest Service
3. Coronado Resource Conservation and Development Area, Inc.
4. Molly Meyer, Private
5. Tolchii' Kooh, Inc.
6. Bil Taylor Design Associates
7. Pima Natural Resource Conservation District
8. The Nature Conservancy

Cycle 2, January 2002

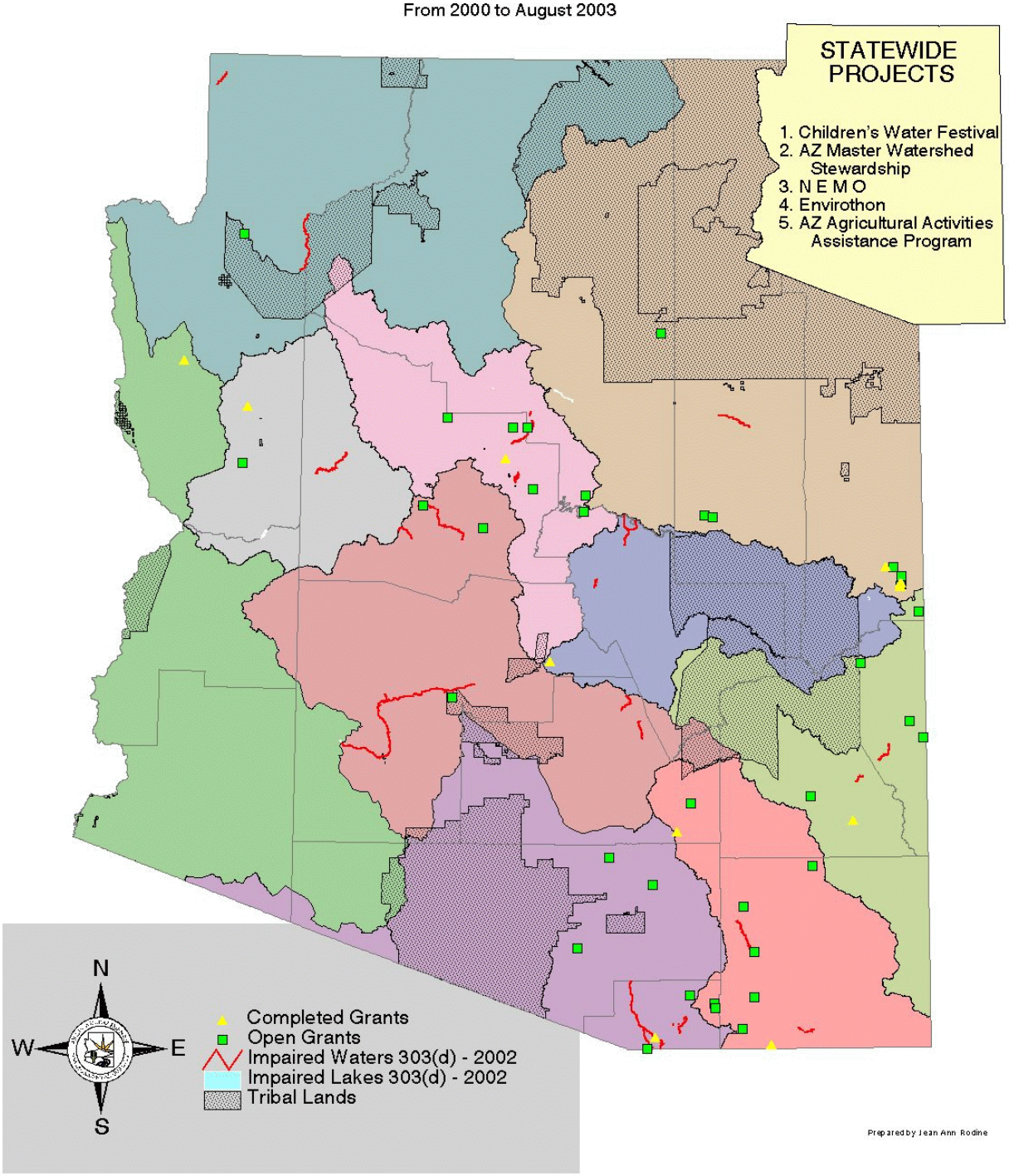
1. James W. Crosswhite, EC Bar Ranch
2. USDA, Coconino National Forest Service
3. Engineering and Environmental Consultants, Inc. (EEC)
4. The Nature Conservancy
5. Boy Scouts of America, Grand Canyon Council, Inc.
6. USDA, Apache-Sitgreaves National Forest Service
7. Darcy and Gary Ely, Owner, 4 Drag Ranch
8. Cathy Cosgrove, HERO Consulting
9. Hualapai Department of Natural Resources
10. Coronado Resource Conservation and Development Area, Inc.
11. National Audubon Society Appleton-Whittell Research Ranch
12. Richard C. Collins, C6 Ranch
13. Upper Agua Fria Watershed Partnership
14. EcoResults! Inc.

Cycle 1, January 2003

1. James W. Crosswhite
2. San Pedro National Resource Conservation District
3. Coronado Resource Conservation and Development Area, Inc.
4. Universal Entech, LLC
5. Arizona Community Tree Council
6. Montessori De Santa Cruz Charter School
7. Maughan Ranches
8. M Diamond Management, LLC
9. 3 Links Farm

Water Quality Improvement Grant Recipients

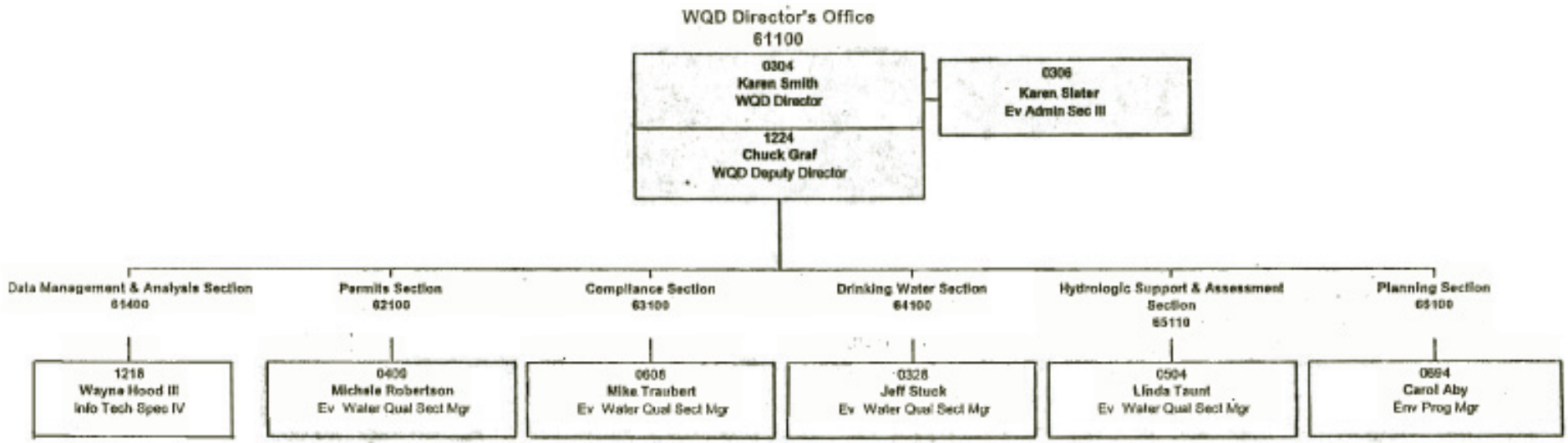
From 2000 to August 2003



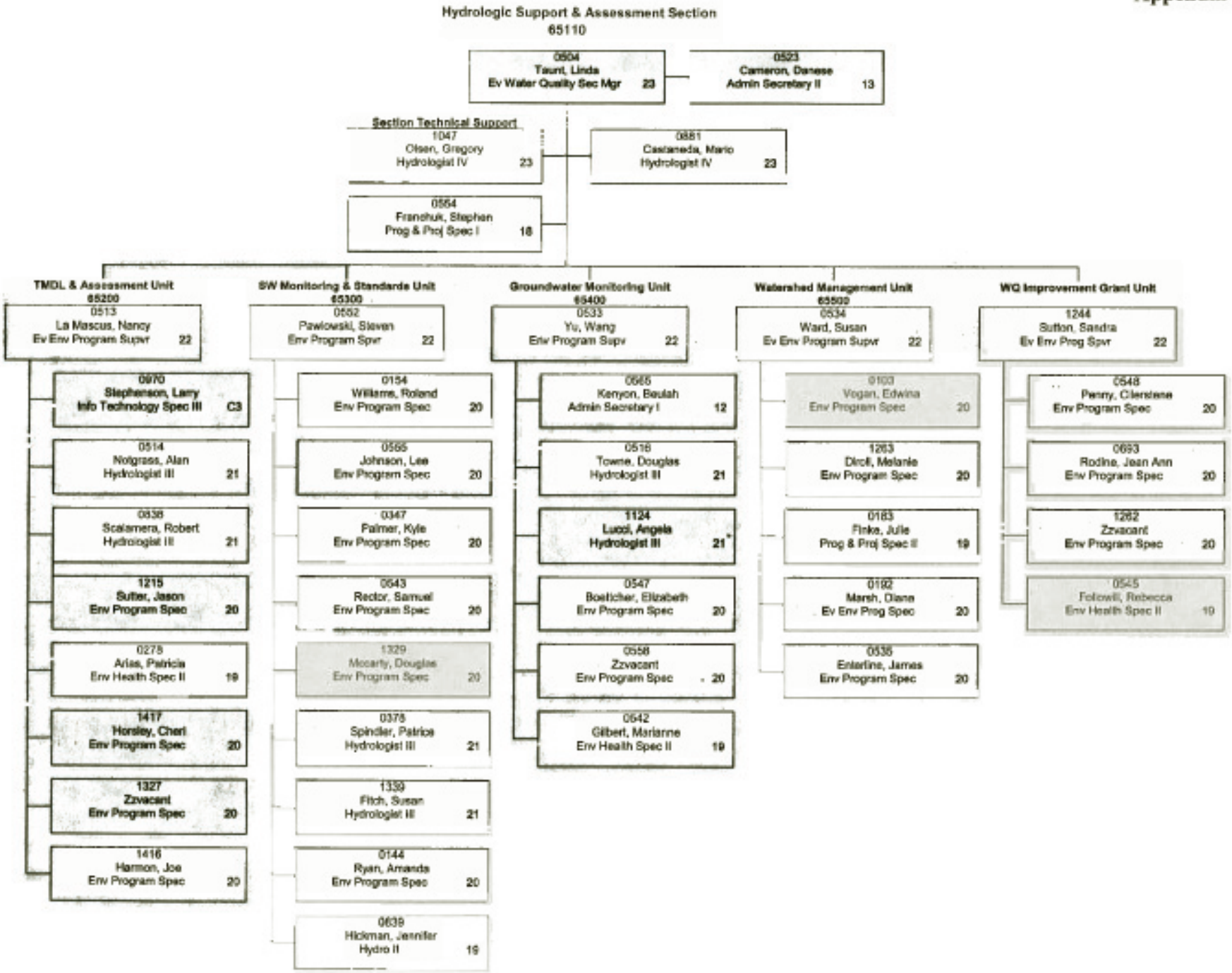
Prepared by Jean Ann Rodine

Arizona Department of Environmental Quality
Water Quality Division

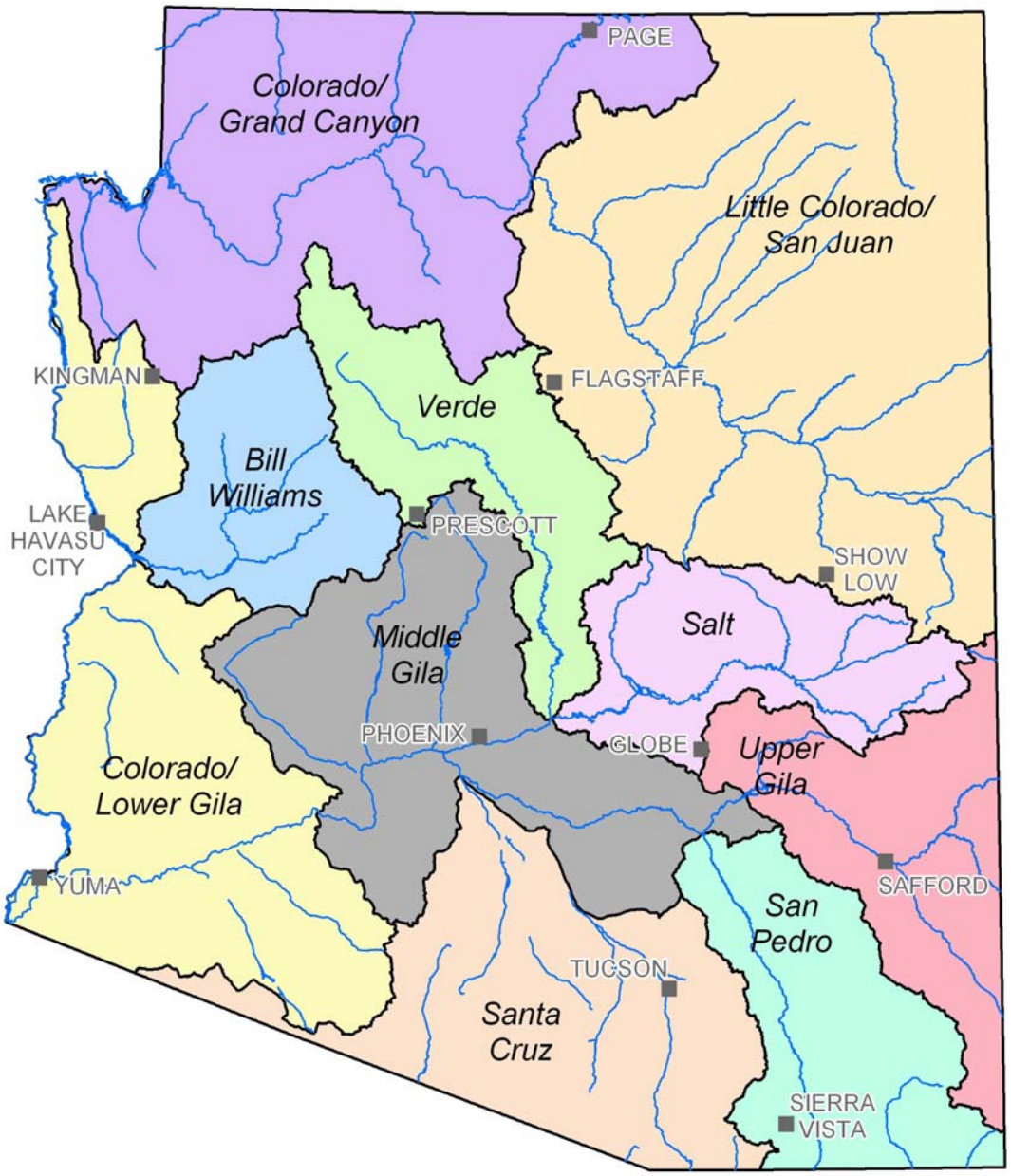
Appendix D

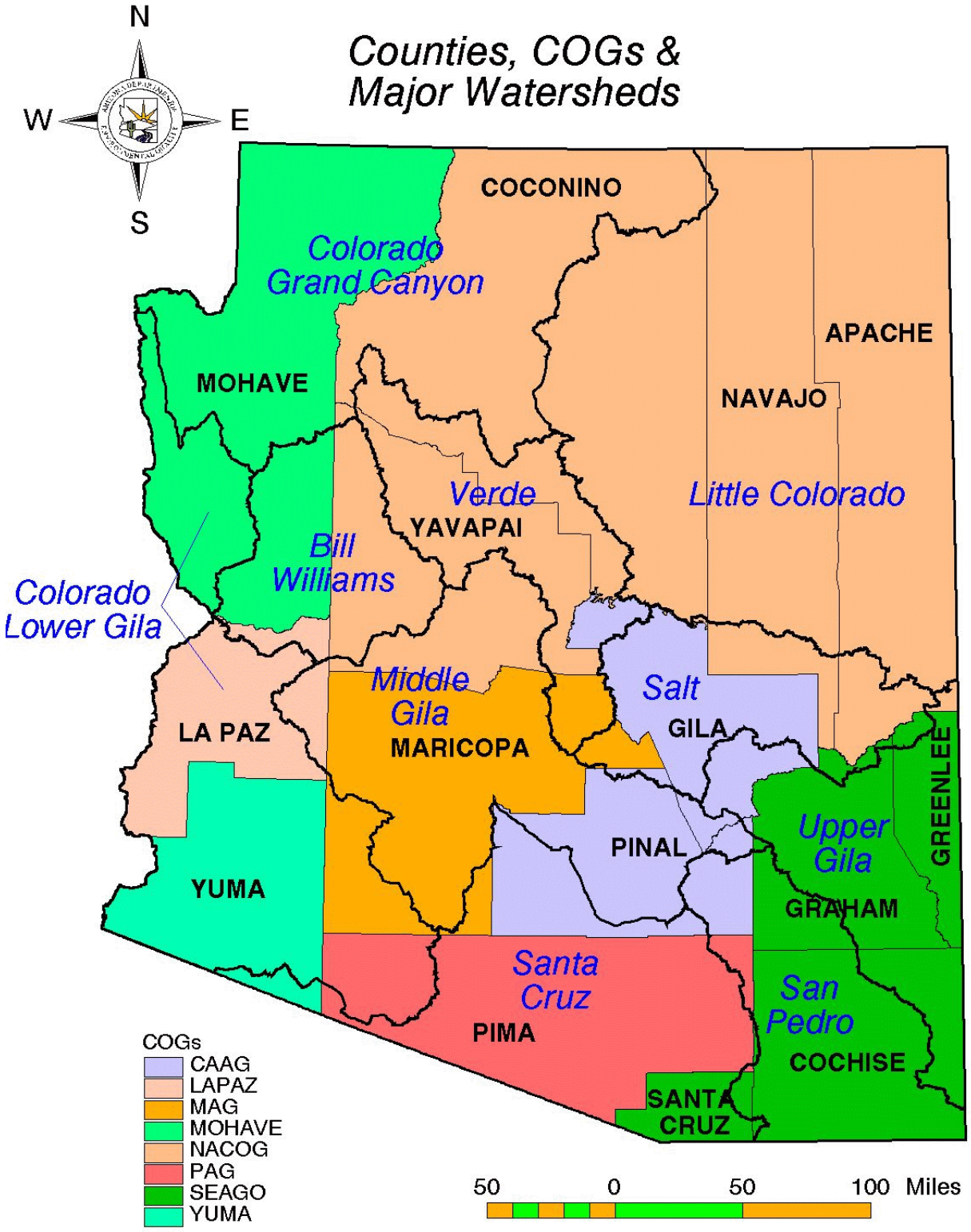


Appendix E


Hydrologic Support & Assessment Section
65110
0504 Taunt, Linda Ev Water Quality Sec Mgr 23
0523 Cameron, Danese Admin Secretary II 13
Section Technical Support
1047 Olsen, Gregory Hydrologist IV 23
0881 Castaneda, Mario Hydrologist IV 23
0564 Franchuk, Stephen Prog & Proj Spec I 18
TMDL & Assessment Unit 65200
0513 La Mascus, Nancy Ev Env Program Supvr 22
0970 Stephenson, Larry Info Technology Spec III C3
0514 Nolgrass, Alan Hydrologist III 21
0838 Scalamera, Robert Hydrologist III 21
1215 Sutter, Jason Env Program Spec 20
0278 Arias, Patricia Env Health Spec II 19
1417 Horsley, Cheri Env Program Spec 20
1327 Zzvacant Env Program Spec 20
1416 Harmon, Joe Env Program Spec 20
SW Monitoring & Standards Unit 65300
0552 Pawlowski, Steven Env Program Spvr 22
0154 Williams, Roland Env Program Spec 20
0565 Johnson, Lee Env Program Spec 20
0347 Palmer, Kyle Env Program Spec 20
0643 Rector, Samuel Env Program Spec 20
1329 Mccarty, Douglas Env Program Spec 20
0378 Spindler, Patrice Hydrologist III 21
1339 Fitch, Susan Hydrologist III 21
0144 Ryan, Amanda Env Program Spec 20
0639 Hickman, Jennifer Hydro II 19
Groundwater Monitoring Unit 65400
0533 Yu, Wang Env Program Supv 22
0565 Kenyon, Beulah Admin Secretary I 12
0518 Towne, Douglas Hydrologist III 21
1124 Lucci, Angela Hydrologist III 21
0547 Boelicher, Elizabeth Env Program Spec 20
0558 Zzvacant Env Program Spec 20
0542 Gilbert, Marianne Env Health Spec II 19
Watershed Management Unit 65500
0534 Ward, Susan Ev Env Program Supvr 22
0103 Vogan, Edwina Env Program Spec 20
1263 Dirolf, Melanie Env Program Spec 20
0183 Finke, Julie Prog & Proj Spec II 19
0192 Marsh, Diane Ev Env Prog Spec 20
0535 Enterline, James Env Program Spec 20
WQ Improvement Grant Unit
1244 Sutton, Sandra Ev Env Prog Spvr 22
0548 Penny, Clerstene Env Program Spec 20
0693 Rodine, Jean Ann Env Program Spec 20
1262 Zzvacant Env Program Spec 20
0545 Folowill, Rebecca Env Health Spec II 19

Arizona Watersheds




Counties, COGs &
Major Watersheds
N
W
E
S
COCONINO
Colorado
Grand Canyon
APACHE
MOHAVE
NAVAJO
Verde
Little Colorado
YAVAPAI
Bill
Williams
Colorado
Lower Gila
Middle
Gila
Salt
LA PAZ
MARICOPA
GILA
GREENLEE
Upper
Gila
PINAL
YUMA
GRAHAM
Santa
Cruz
San
Pedro
PIMA
COCHISE
SANTA
CRUZ
COGs
CAAG
LAPAZ
MAG
MOHAVE
NACOG
PAG
SEAGO
YUMA
50
0
50
100
Miles