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STATE OF ARIZONA

FLOOD HAZARD

MITIGATION PLAN



IN ACCORDANCE WITH
SECTION 409 OF PUBLIC LAW 93-288

ARIZONA DIVISION OF EMERGENCY MANAGEMENT

DECEMBER, 1992

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EXECUTIVE SUMMARY

Although Arizona is one of the most arid regions in the United States, it has a history of damaging floods. In fact, because of erosion and scouring in unstable stream channels, certain flood hazards exist in the arid Southwest that are not generally present in humid regions of the United States.

Since 1890, major floods have occurred twenty-nine times. Damages have extended from the mountainous regions of the northwest and the Grand Canyon, through the heavily populated areas of Phoenix and Tucson and onto desert, range and piedmont terrain. In addition to major floods, localized flooding occurs each year throughout the state. As Arizona's population continues to grow and as more and more people encroach into previously uninhabited areas, vulnerability to floods and all natural disasters increases.

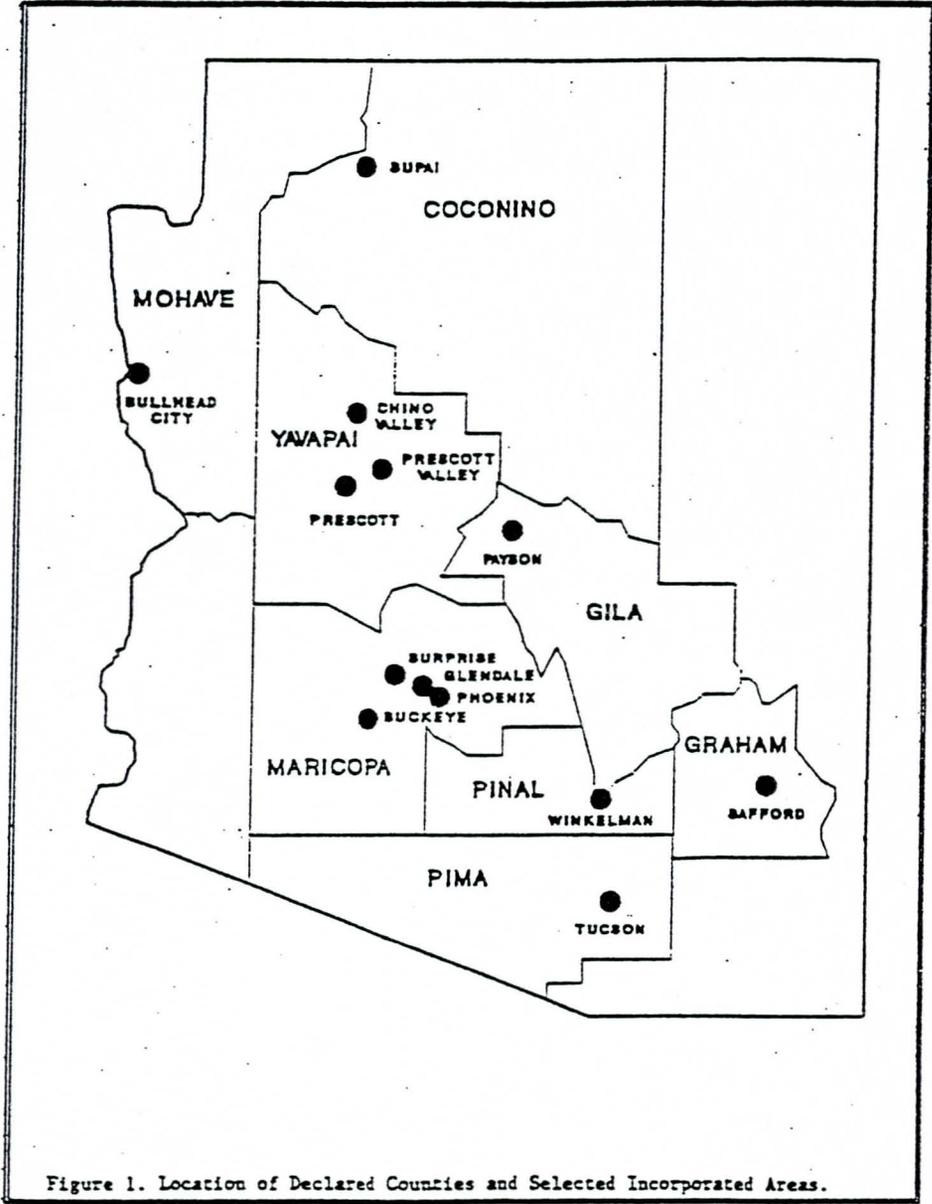
Flooding occurred again in 1990 as a result of a series of subtropical monsoon storms which took several lives and caused millions of dollars in public and private damages. Once again these floods alerted the people of the State to their susceptibility to floods and their devastating effects.

The *State of Arizona Flood Hazard Mitigation Plan* identifies hazard mitigation issues and action that can be taken to lessen the risk to life and property. This plan focuses on flood-related issues but many of the recommendations can be translated into an all-hazard approach. Each issue poses problems which can be solved by committing the necessary funds and/or personnel within identified local, State and Federal agencies. This plan was developed to present the State's mitigation perspective and priorities for action. Recommendations for hazard mitigation will be prioritized in order to enhance ongoing State and local mitigation efforts and ensure that the mitigation recommendations contained in this report are implemented.

STATE FLOOD MITIGATION GOALS

1. Save Lives and Reduce Public Exposure to Risk
2. Reduce or Prevent Damage to Public and Private Property
3. Reduce Adverse Environmental or Natural Resource Impacts
4. Reduce the Financial Impact on Public Agencies and Society

This plan identifies projects that could be funded under Section 404, the Federal Emergency Management Agency's Hazard Mitigation Grant Program.



I. INTRODUCTION

The Problem

Flooding is a natural process which has proven to be a serious, costly, and recurring problem in the State of Arizona. Every Presidential declaration of disaster Arizona has received has been flood-related. In addition, each year serious floods occur around the State that do not meet the Federal criteria for assistance. The cumulative human, economics, and environmental costs of these floods is not known. But it is clear that flooding is an on-going problem that will continue to affect the citizens of this State.

Purpose of Report

The purpose of this report is to offer post-flood hazard mitigation recommendations to State and local authorities. The goal of these recommendations is to provide a framework for flood-related mitigation opportunities which will result in saving lives, reducing injuries, and preventing damages during future floods. This report is designed to encourage the State and local governments to evaluate their vulnerability to natural hazards and to plan and carry out actions to mitigate their vulnerability, insofar as possible.

Although still studied as natural events, floods are now also the concern of policy makers and others who must deal with the destruction and social dislocation caused by flooding. The options available to policy makers can be summarized in two questions. To what extent can and should floods be controlled? And, to what extent can humans be guided and prevented from actions that expose them to the hazards of flooding?

Overview of Authority

When a state proclaims a State of Emergency and the President issues a major disaster declaration in response to that State's request for Federal disaster assistance, the various sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288, as amended) provide the framework for implementation of a variety of programs, including hazard mitigation. As a condition to receiving Federal disaster assistance, Section 409 of Public Law 93-288, as amended, requires that:

1. Repairs be done in accordance with applicable codes, specifications, and standards;
2. Natural hazards be evaluated by State and local governments and, if appropriate, actions taken to mitigate the hazards; and
3. A State Hazard Mitigation Plan be prepared which describes State and local actions that have been and will be taken to mitigate these hazards.

Under Section 409, FEMA encourages State and local governments to develop and maintain a program to implement measures for reducing vulnerability to floods. Disaster declarations become opportunities to review and update existing hazard mitigation plans.

This plan has been prepared by the Arizona Division of Emergency Management (ADEM), the Arizona Department of Water Resources (ADWR) and the State Hazard Mitigation Team in compliance with Section 409, Public Law 93-288, as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-707; the President's Executive Order 11988, Floodplain Management, and Executive Order 11900, Protection of Wetlands; and the Federal-State Disaster Assistance Agreement FEMA-884-DR-AZ.

This report focuses on the work elements in the Interagency Hazard Mitigation Survey Team Report, published in January, 1991 and is intended to be an update of the Flood Hazard Mitigation Program for the State of Arizona, prepared by the Arizona Division of Emergency Services, July, 1985.

Objectives

The primary goal of all mitigation is to minimize long-term and short-term damage, to protect human life and property, and ultimately to reduce the need for future disaster assistance.

The specific objectives of this report are to encourage State agencies and local governments to:

1. Identify, recommend and implement appropriate cost effective mitigation actions that will reduce future disaster flood losses;
2. Coordinate mitigation needs with other jurisdictions and existing State and Federal efforts;
3. Reduce vulnerability to flood damage through comprehensive planning, improved design and standards, and programs that address current at-risk development;
4. Strengthen flood preparedness, response and recovery; and
5. Promote recognition of the value of hazard mitigation to the public safety and the welfare of the people of Arizona.

II. FLOOD HAZARD IN ARIZONA

The Flood Event

The Arizona monsoon occurs in the summer and early fall and is typified by increased humidity and high summer temperatures. According to the NWS, high pressure builds up in the Southwest, keeping Pacific storm systems to the North. Subtropical moisture is allowed to enter Arizona from the Gulf of California and the Gulf of Mexico. Solar heating at the earth's surface and/or weather impulses in the subtropical flow create instability and set off thunderstorms.

The 1990 monsoon began the first week of July and lasted through September. High intensity rainfall in short periods was typical. The number of storms was about normal, although the severity was above average. The unpredictability of the monsoon, and the movement of severe storms to new locations almost every day heightened the impact of the 1990 floods. According to the Maricopa County Flood Control District, the largest monthly rainfall in Maricopa County was 5.00 inches at Bloody Basin (25 miles north of the Phoenix metropolitan area) during September. The three largest storm events based on aerial distribution and intensity occurred on July 24, August 14-15, and September 3-4. Storm frequency for Maricopa County during the monsoon season ranged from less than a 1-year return period to more than 100-year frequency. During the monsoon many of the precipitation gauges exceeded the predetermined alarm rate of a 10-year one hour rainfall event. The average monsoon storm duration based on telemetry data was between one and three hours.

The 1990 monsoon produced greater than average rainfall amounts for most of Maricopa County. According to the National Weather Service, then located at Sky Harbor International Airport in Phoenix, as of October 1, 1990 Phoenix had a cumulative rainfall of 7.08 inches for the year, most of which was received during the monsoon. This total is almost 2 inches above normal for this time of year. Many of the Maricopa County Flood Control District gauges measured a considerably greater amount of rainfall than that reported at the airport.

Other examples of large amounts of rain in short periods are 3.03 inches of rain in a three-hour period in the Canada del Oro and Tanque Verde watersheds on July 7; 1.00 inches in 15 minutes in Pima County in the Avra Valley area on July 15; 4 inches in Pima County on July 24; and 1.9 inches of rain in Gila County in about an hour on July 22. Extensive wind damages occurred throughout the monsoon.

Climate and Geology

Climate and geology vary greatly in Arizona, especially north to south, affecting the occurrence and effects of floods within the State. The plateaus of northern Arizona concentrate drainage into incised channels or canyons. Communities are usually built on upland surfaces and therefore are generally unaffected by floods as water drains down entrenched river systems. Other northern communities, such as Flagstaff, are built on very permeable, mostly volcanic rock, surfaces that quickly drain water underground.

Flooding is more of a problem in southern Arizona where water runs off normally dry desert lands. This region is dominated by basin and range topography, with most communities located along stream channels in the center of basins or on piedmonts at the base of mountains. Along with being areas subject to various kinds of flood hazards, the lowlands of the basin and range province of the state are where more than 90 percent of Arizona's population resides.

Southern Arizona experiences precipitation mainly during two seasons: summer and winter. The precipitation is the result of three climatic patterns. Summer thunderstorms usually begin in late June or early July and initiate the monsoon season. The thunderstorms may occur in a limited area, possibly affecting only part of a watershed. They are generally of short duration, and the resulting runoff may quickly fill and overtop streams and washes causing local flooding.

Flash floods can result from summer thunderstorms. Described as too much rain falling in too small an area in too short a time, flash floods are a critical natural hazard in Arizona. Since 1970, 71 Arizona residents have lost their lives in flash floods, often when attempting to drive through swollen streams at dip crossings.

Another form of precipitation that affects Arizona comes from West Coast tropical storms. They usually move into the area during September and October. With intense precipitation and covering an entire region, tropical storms cause the most destructive flood events in southern Arizona. Climatic conditions interacting with such a storm were responsible for the rainfall of September 27 to October 3, 1983, subsequently referred to as the 1983 floods. Consequences included eight deaths and 975 reported injuries and an estimated \$226.5 million damages.

Between November and March, winter rainfall of less intensity but longer duration, covering large areas, tends to create runoff that combines with snowmelt to cause significant erosion.

Geologic and climatic variables also affect occurrence and frequency of floods. The dry climate of Arizona creates different flooding conditions from more humid areas. Generally, erosion and inundation create the hazards associated with flooding, in whatever region flooding occurs. With its usually dry riverbeds and arroyos and minimal vegetation, however, Arizona is especially prone to the effects of erosion. Floodwaters, usually of high velocity and with a high concentration of runoff, scour stream channels that then shift and change. Lateral bank erosion may move a river channel as far as 800 feet. Land collapses, with resulting serious property damages and loss of land. This happened in the 1983 floods.

The implication for floodplain management is that the assumption of a degree of stability in channel boundaries is not characteristic of the Southwest. Erosion can alter river channels significantly. Also, Federal floodplain regulations do not consider hazards that result from frequent channel-bank erosion. In alluvial, ephemeral-stream systems throughout the Southwest extensive erosion can occur without the action of unusual floodwaters and in areas not designated as 100-year floodplains. Federal regulations do not ensure that residents of such areas are adequately cautioned or protected.

Current and Future Exposures

Flooding in Southern Arizona appears to have become more frequent and intense. Gauges in the Santa Cruz River showed significant increase in flow in the 1960's and 1970's, as well as in the floods of 1983. The question is whether the causes are manmade or natural, or a combination of the two. Research concentrating on the Salt and Verde Rivers shows previous flooding events of the same size or a bit larger, but also asserts that flooding events are possibly occurring more frequently now than in previous periods.

Urbanization must be considered in determining intensity of floods. Urbanization involves creation of impervious surfaces covering natural land surface, which causes drainage problems. In an urbanized area, runoff is estimated to be four times that of a comparable undeveloped desert area. The drainage from the increased runoff that concentrates in rivers and washes accelerates the quantity and velocity of the flow on downstream reaches. Channels enlarge becoming deeper and wider, and damage from erosion becomes a greater threat.

It should be noted that the less populated areas of the State are also subject to severe storms and flooding. As these areas continue to grow, they represent a potential source of significant damage to life and property. Ensuring that these areas are developed consistent with good floodplain management practices will greatly reduce flood damage from occurring.

III. MITIGATION OPPORTUNITIES

Arizona has a history of strong bi-partisan commitment to reducing the danger of floods, wildland fires, dam failures, and other natural and technological disasters. Because flooding is Arizona's most frequently experienced disaster, a majority of mitigation efforts throughout the State, both structural and nonstructural, is directed towards Arizona's recurring flood damages. At city, county and State levels studies are being made and future plans written that identify and direct attention to present and future problems in this area. New building projects must include retention/detention basins for approval by planning commissions. Street improvement projects must strongly address drainage concerns and include the mitigation of existing drainage problems and chip sealing of vulnerable roads. Many local jurisdictions are seeking to procure easement rights to protect and maintain washes.

The primary responsibility for implementation of mitigation activities rests with local government. Local government reduces hazards through programs that directly regulate primary and secondary hazards, and through disaster planning activities. Often they have a direct impact on the hazards by implementing and enforcing fire and safety codes, and floodplain management administration that are more stringent than those at the State level. Through the Division of Emergency Management, the State's Hazard Mitigation Officer assists State agencies and local jurisdictions in lowering their vulnerability to recurring or threatened hazards by supporting pre- and post-disaster planning. Actions to mitigate the effects of disasters include encouraging the adoption and effective administration of building codes that contain features to protect structures during floods, fires, earthquakes, and other disasters and examining ways to improve safety through nonstructural means.

A big step forward in Arizona's mitigation goal is the combined effort of many cities and towns who, by working together with nearby cities and towns, irrigation districts, the county, and the State, are attempting to solve their common problems and avoid solving a problem in one area while increasing the problem in a nearby location.

IV. FLOODPLAIN MANAGEMENT

Floodplain management has two goals: the protection and maintenance of natural floodplain values and the reduction of existing and future flood loss potential. In recent years floodplain management has become less a defensive strategy against flood waters and more a response to human carelessness and lack of foresight in building and residing in floodplains.

County Flood Control Districts

Floodplain management and flood control in Arizona is the responsibility of the counties. Counties were directed by statute (48-3602) in 1978 to form Flood Control Districts and regulate development within their areas of jurisdiction. The incorporated towns and cities are allowed to adopt a resolution stating they will do their own floodplain management within the incorporated areas of the City/Town. This statute assures that all communities in Arizona will manage their floodplains. If the incorporated community fails to enforce its floodplain management ordinance, the duties automatically fall to the County Flood Control District. This has never happened.

The County Flood Control Districts have taxing authority and provide technical structural and non-structural assistance to the incorporated areas.

Flood Warning and Flood Control

The most serious deficiencies in Arizona's floodplain management, flood warning and flood control are related to lack of funds. There are no recognized deficiencies in statutory authority or direction, and additional staff would be effective only if existing or desired programs were funded.

Flood warning would benefit from funding for flash flood warning systems. These systems would require funds for purchase, installation and maintenance of systems as well as additional staff for the flood warning office.

Floodplain Mapping

Floodplain management would benefit from funding for floodplain mapping. Some of the rapidly developing areas of the State are located in floodplains which have not been delineated. The Federal government has been cutting its mapping budget for several years. The State's budget does not allow for the required personnel to complete floodplain delineations. These budget cuts are leaving local jurisdictions without the maps necessary to regulate development in flood prone areas.

V. SUMMARY

Floods are and will remain Arizona's most frequently occurring hazard. Current and repetitive flood problems will not be solved overnight. Effective solutions for reducing the current flood hazard vulnerability will take a long-term commitment on the part of local, State, and Federal agencies and the public.

There is no single best solution for reducing flood losses. Effective flood damage reduction will require a variety of structural and non-structural measures in both existing and potential new growth areas to keep the problem from getting worse.

Choosing flood damage reduction options for existing development will lead to a variety of unavoidable public policy trade-offs. Life and property preservation, cost effectiveness, environmental and resource preservation and enhancement, development needs, and flood control will have to be balanced for entire river basins or watersheds.

Implementation, operation, and maintenance of flood control or flood damage reduction activities and programs are and will remain primarily a local responsibility.

The implementation phase of the following hazard mitigation recommendations is taken into consideration by FEMA when determining the extent and availability of future Federal assistance for other disasters.

VI. HAZARD MITIGATION RECOMMENDATIONS

Mitigation is most effective when a variety of strategies are implemented. Good decision making insures that scarce local, State and Federal resources are not wasted on mitigation projects that are not efficient or cost-effective.

The following recommendations are not only a result of the 1990 flood disaster but an active search for ways to prevent future ones. A number of issues identified were developed by state and local agencies based on recommendations contained in the *Interagency Hazard Mitigation Survey Team Report*.

Each hazard mitigation recommendation is structured in the following format:

- Work Element #:** (Each work element is designed to raise an issue with the intent of eventually solving a problem.)
- Background:** (Background information supporting the above recommendation. This information may be specific or generalized to the known risks of floods.)
- Recommendation:** (Description of hazard mitigation recommendation.)
- Lead Agency:** (Federal, State, and/or local agencies responsible for leading and coordinating this hazard mitigation action.)
- Support Agencies:** (Federal, State, and/or local agencies responsible for supporting the lead agency(ies) in accomplishing this hazard mitigation action.)
- Schedule:** (Timetable for implementation of the recommendation. Please note that the timetable is an estimate assuming that the necessary funding and personnel resources have been committed.)
- Funding:** (Description of how this action might be funded. Some of the recommendations have no identified source for funding.)

The recommendations are listed as work elements in the following broad categories:

- Storm Water Management and Flood Control Measures
- Maintenance of Flood Control Facilities
- Floodproofing/Acquisition/Relocation
- Forecasting/Warning/Gaging
- Public Awareness/Education/Information
- State Hazard Mitigation Officer/Team

STORMWATER MANAGEMENT AND FLOOD CONTROL MEASURES

Issue: Although stormwater management is a major concern for most communities in Arizona there is no comprehensive approach between jurisdictions. Often records of prior damages are inadequate and nonexistent. Decision makers need better information upon which to base their problem analysis, option identification and enforcement strategies.

Work Element #1: A Master Stormwater Management Plan should be prepared on each watershed.

Background:

Most stormwater management and land use planning in the State is based on political boundaries with responsibilities divided between political jurisdictions rather than on watersheds. There is a need for a more comprehensive approach to floodplain management. Regional Master Stormwater Management Plans should be developed between jurisdictions lying within the same watershed using the same technical information and based on a common criteria.

Recommendations:

Entire watersheds should be the focus of studies. Cooperative studies or joint projects should be explored by flood control districts and local jurisdictions within the same watershed.

1. Canvas various Federal and State Agencies to determine what watershed studies have been completed and what studies remain to be done.
2. Prioritize remaining areas for study by watershed.
3. Encourage interjurisdictional approach to flood protection, stormwater management, and land use planning. Meetings should be held to communicate technical information, proposed criteria, mitigation practices and future land use plans.
4. Compile current management practices and propose alternate management procedures that would minimize future flood losses and preserve and restore natural floodplain values to public/private land.

Lead Agency: USACE, SCS

Support Agencies: FEMA, ADWR, AFMA, County Flood Control Districts

Schedule: On-going

Funding: Existing program funds

Work Element #2: Stormwater drainage areas should be mapped and regulated by communities.

Background:

Most Arizona communities do not have the expertise to study stormwater drainage areas and include them on the land use maps. These areas are not included on flood insurance rate maps.

Recommendations:

1. The Corps of Engineers (USACE) or the Soil Conservation Services (SCS) should be requested to perform studies of selected watersheds to provide additional and improved hydrologic data to flood control districts and localities.
2. When hydraulic and hydrologic studies have been completed the information on stormwater drainage of selected watersheds should be included in communities floodplain management programs.
3. Stormwater drainage ordinances should be developed for each community and enforced. New subdivision plans should be reviewed to assure compliance with the new ordinances.

Lead Agency: SCS, USACE

Support Agencies: FEMA, Flood Control Districts, local jurisdictions

Schedule: On-going

Funding: SCS, USACE, Flood Control Districts

Work Element #3: Communities should change ordinances to require sediment transport analysis for new developments. Any master plan for development and drainage should include the location and design of roads since roads often block or convey water.

Background:

Soils in the arid southwest are highly erodible. Storms in this region cause erosion that significantly alter river channels, carrying large amounts of sediment downstream, plugging drainage systems and causing flooding and damage to homes and transportation systems. Rapidly developing downstream communities are often overwhelmed by the large amounts and high peaks of water and sediment flowing from upstream areas down normally dry stream beds and washes.

Stabilization of these areas and restrictions on their use is extremely important.

Recommendations:

1. Geologic studies of the large washes affecting communities throughout the declared area should be done to better understand sediment transport.
2. All future development should address erosion, runoff and other impacts. Communities should amend ordinances to require sediment transport analysis before allowing new development.
3. Sensitive areas must be identified and specific recommendations developed. Sensitive areas include unstable slopes, floodplains, wetlands, slide areas, alluvial fans, piedmonts, etc.

Lead Agency: FEMA

Support Agencies: ADWR, County Flood Control Districts

Schedule: 24 months

Funding: NFIP Mapping Funds

Work Element #4: Retention/detention basins and debris basins are either inadequate or unsafe and often contributed to the damage during the last flood. Adequate drainage facilities, necessary to control runoff and enable river channels to flow naturally, need to be upgraded or constructed.

Background:

Rapidly developing downstream areas are overwhelmed by the large amounts and high peaks of water flowing from upstream areas down normally dry stream beds and washes. Often this flow causes extreme erosion along the way and carries large amounts of sediments. New developments are not adequately planning for drainage. By temporarily storing water retention/detention basins extend the runoff period, reducing the volume and floodpeak and, at the same time, infiltration is increased.

Throughout the declared disaster area local drainage problems were prevalent and were a major contributor to flood problems. Many flood control structures and drainage facilities do not have the capacity to accommodate an intense rainfall over a short period of time.

Recommendations:

1. As funds become available Flood Control Districts and local jurisdictions should build retention/detention basins.
2. Cities and local jurisdictions should amend their ordinances and require retention/detention and/or debris basins as part of approving plans for any new development.
3. Local jurisdictions should require all new development include adequate drainage.
4. When funds becomes available all inadequate drainage facilities should be improved or upgraded to include:
 - 4.a Improved manholes to withstand pressure from excess flows
 - 4.b Installation of storm drain relief lines
 - 4.c Drainage System Inventory Program
 - 4.d Channelization

Lead Agencies: Local Jurisdictions, Flood Control Districts

Support Agencies: ADEM, ADWR

Schedule: On-going

Funding: Local Jurisdictions, FEMA/Section 404

Work Element #5: The State should establish and maintain a system to collect information on what type of flood damage occurred, where it occurred and the cost to repair. Flooding caused by inadequate flood control facilities should be included.

Background:

Although many areas of the State have suffered repetitive damage from floods, the State and most local governments have no comprehensive records on the cumulative and recurrent cost of flood damage to specific areas. Historical data and future flood damage information should be compiled for more effective mitigation decision making.

Recommendations:

1. Establish a system to input historical data (when available) and future flood damage information:
 - 1.a Determine the types of information to collect, both historical and for future floods, and identify existing sources
 - 1.b Design a data base for storage and procedures for updating
2. Initiate data collection and input as new information becomes available. Establish procedures for other public agencies to access data.
3. Data concerning the identification, analysis, and mapping of secondary flood impacts, such as interactive hazards, also may need to be developed and considered in future policies and regulations.

Lead Agency: ADEM

Support Agencies: ADWR, County Flood Control Districts, USGS, USACE

Schedule: On-going

Funding: FEMA/DPIG Program

MAINTENANCE OF FLOOD CONTROL FACILITIES

Issue: Lack of maintenance of flood control facilities was a major contributor to flood damage.

Work Element #6: Structural flood control maintenance

Background:

Flood control structures can provide protection only if they are in good working order and are maintained properly. Some jurisdictions, because of lack of funds or commitment, do not perform proper maintenance on existing flood control facilities which contributed to their flooding problems.

Recommendations:

1. An Inspection/Maintenance program should be initiated by each jurisdiction to determine the condition of all levees, dams, culverts and other flood control structures. A program of maintenance and repair should be developed to ensure that flood control structures perform as designed.
2. Adequate funding for the maintenance of drainage channels should be provided by local jurisdictions to accomplish routine inspections and clearing.
3. Stream beds, culverts and channels should be inspected to determine if flow obstructions exist and drainage channel capacity is not being impaired by debris or sediment. Flood obstructions such as vegetation and debris should be removed at least once a year.
4. A system of replacing inadequate culverts with larger culverts to better accommodate intense volumes of water should be included in maintenance schedules. Funds for replacing these culverts should be included in yearly budget requests.
6. Existing facilities that provide flood control benefits should be accepted by a public entity for maintenance.

Lead Agency: Local Jurisdictions, County Flood Control Districts, SCS

Support Agencies: ADEM, ADWR

Schedule: 24 months

Funding: Local Jurisdictions, County Flood Control Districts, FEMA 404
Recommendations 15

FLOODPROOFING / ACQUISITION / RELOCATION

Issue: Floodproofing of damaged structures could reduce damages in future floods.

Work Element #7: Encourage floodproofing of damage structures

Background:

Damage to homes and public buildings is a common occurrence in some areas during and after every heavy rainfall. Although there was only a small amount of damage to non-residential structures during the last flood many residences in the flooded areas were flooded several times over a period of weeks. Floodproofing of both homes and public facilities could reduce damage in future floods but few owners know how to solve this persistent problem. Likewise, local governments are often unaware of the many ways structures can be floodproofed to reduce flood damage.

Recommendations:

1. Develop and conduct classes in proper floodproofing techniques for homeowners, renters and local government officials in those areas that have a history of flooding of residential and/or public facilities. Target audiences should also include local building inspectors, engineers and architects.
2. Working with local officials compile a list of flood damaged property that could be floodproofed to prevent or alleviate future flood damage.
3. When funds become available, local governments should floodproof those public facilities which were damaged during the last flood.
4. Copies of FEMA's Retrofitting Manual (FEMA 114/September 1986) should be put in local libraries and be available through County Emergency Services' Offices.
5. All homeowners/renters and local governments who have structures located in the floodplain should be notified and encouraged to purchase flood insurance.

Lead Agency: ASFPM, FEMA, ADEM

Support Agencies: County Emergency Services, CRS

Schedule: Within 12 months

Funding: FEMA, ASFPM, NFIP, DPI

Issue: Public acquisition of land and relocation of residents and essential public services located in the floodway is often the only solution.

Work Element #8: Relocate residents and essential government facilities out of the floodplain.

Background:

Although Arizona has a long-standing commitment to relocation and has successfully relocated entire communities or sections of communities out of the floodplain, the lack of funding for such projects has brought these program to a halt. Entire communities, many of the people elderly and on fixed incomes, and essential governmental services and emergency facilities still remain in the floodplain and experience repetitive flood damage during each heavy rain. Public acquisition of properties that are vulnerable to damages is one way to permanently break this cycle.

Recommendations:

1. When funds are available, relocate those homes that still remain in the floodway and have experienced repetitive damage. Priority should be given to the following communities:
 - 1.a Winkleman Flats (Gila county)
 - 1.b Riverside (Pinal County)
 - 1.c Other areas as identified

2. Conduct a survey to determine which essential government facilities lie within the floodplain.
 - 2.a Using FEMA Floodplain maps, determine which facilities lie within the floodplain.
 - 2.b Meet with local officials and ensure they are aware of these facilities and of FEMA requirement for Flood Insurance.
 - 2.c Encourage local officials to do minimal floodproofing by relocating critical services, documents, etc.
 - 2.d Relocate facility out of the floodplain when funds are available.

Lead Agency: Local jurisdiction, Flood Control Districts, NFIP, CDBG

Support Agencies: ADWR, USACE, ADEM, NFIP

Schedule: On-going

Funding: CDBG, FEMA 404, County Flood Control Districts

Work Element #9: Public acquisition of land

Background:

Future damages could be avoided by acquiring land within the floodway. Acquisition programs can set aside flood-prone land in two ways. the outright purchase of land or the purchase of development rights to preclude future development uses incompatible with floodplain management. Acquired land can then serve other community goals by using it for public recreation and open spaces.

Recommendations:

1. When funds are available, purchase land located within the floodway. Some of the areas to be considered for acquisition are:
 - 1.a Clipper Wash (Yavapai County)
 - 1.b Valencia Wash (Pima County)
 - 1.c Black Wash (Pima County)
 - 1.d Other areas as identified
2. When funds are available, purchase development rights of land within the floodway.
3. Acquired land should be returned to counties or local jurisdictions to be used for public recreation and open spaces.

Lead Agency: Local Jurisdictions, Flood Control Districts

Support Agencies: ADEM, ADWR, NFIP

Schedule: On-going

Funding: Local Jurisdictions, Flood Control Districts, FEMA/Section 404, NFIP

FORECASTING / WARNING / GAGING

Issue: Rain and stream gages are inadequate or non-existent in many areas of the State. Current procedures for relaying information on flooding from the National Weather Service to counties and local jurisdictions are also inadequate. Many gaging systems are incompatible with other systems in adjacent counties.

Work Element #10: Continue development and completion of the Statewide ALERT flood-warning system.

Background:

Flood forecasting, early warning and emergency preparedness measures are an integral part of a well-balanced flood management system yet are inadequate or incompatible.

Recommendations:

1. Complete installation of systems in Gila County, the town of Clifton (Greenlee County) and Pinal County.
2. Complete planning and begin installation of systems in Mohave County and Santa Cruz County.
3. As funds are available, complete installation and implementation of the ALERT system in all Arizona counties.
3. Statewide Tabletop Exercises should be held on a yearly basis to test warning and evacuation systems currently in place.

Lead Agency: NWS, ADWR, USACE, local Jurisdictions

Support Agency: ADEM

Schedule: Five years

Funding: ADWR, Local Jurisdictions

Work Element #11: Support the State Climatologist's Office in collection of stream gage and precipitation gage data throughout the State.

Background:

Computer models developed for the purpose of delineating floodplains are statistical. In the arid west, the statistics for 100 years does not exist. In some areas we may have 35-40 years of data; in others there is no data. With the installation of flood warning systems, there should be a 24-hour data collection center established. This center should have the capability to store the gage information and make it available for study to contractors, flood control districts, etc. and others who do flood insurance studies. The more information they have the more accurate the flood insurance studies will be.

Recommendations:

1. County Flood Control Districts should support efforts on behalf of the State Climatologist to fund positions necessary to collect rain and stream gage data and store if in usable, easily accessible format.
2. Flood Control Districts, ADWR and the State Climatologist should prepare Inter-Governmental Agreements to assure that funding will be ongoing for the continuation of data collection.

Lead Agency: ADWR

Support Agencies: County Flood Control Districts, State Climatologist

Schedule: On-going

Funding: ADWR, Flood Control Districts, State Climatologist

Work Element #12: Every County (and Indian Reservation) in Arizona should subscribe to the Weather Wire.

Background:

Currently none of the counties in Arizona subscribe to the Weather Wire. Several jurisdictions that were severely affected by the flood could have greatly benefited by prior warning.

Recommendations:

1. Counties/Indian Tribes should install Weather Wires in their EOCs.
2. Monthly fees would be paid out of local funds.

Lead Agency: NWS, County Emergency Services, FEMA's DC&W

Support Agency: ADEM

Schedule: 12 months

Funding: FEMA/Section 404 Hazard Mitigation Grant Program for installation. Counties, Flood Control Districts (Indian Reservations) would pay monthly subscription fees.

Work Element #13: Coordination of disaster warning and response should be undertaken by the three County Flood Control Districts in the Santa Cruz River Basin.

Background:

The Santa Cruz River Basin is located in Santa Cruz, Pima and Pinal Counties in southern Arizona, and the State of Sonora, Republic of Mexico. The Santa Cruz River flows north from Mexico entering the United States at Nogales. It has a drainage area that is about 170 miles long and 50 miles wide. The river area is vulnerable to flooding primarily because the river and its tributaries do not have stable channels.

During the 1990 flood, the river fanned out and began sheet flooding near Marana. High velocity and large flows caused the channels to meander over the entire floodplain, cutting and filling especially in Pinal County. The river also impacted berms at the Central Arizona Project in Pinal, altering course and creating new floodplain areas in rapidly growing communities of the County.

Recommendations:

1. A coordinated disaster warning and response should be undertaken by the three County Flood Control Districts in the Santa Cruz River Basin.

Lead Agency: Santa Cruz, Pima and Pinal County Flood Control Districts

Support Agencies: County Emergency Services, ADEM, NWS, USGS

Schedule: 10 months

Funding: Current budgets

Work Element #14: Support the AZ Department of Transportation, NWS, FHWA, and other State and local agencies on their project to refine the rainfall atlas for the southwest US.

Background:

Historically, gathering and studying rainfall information in the desert southwest has not been considered a high priority. Flood events occurring during the last 20 years have highlighted the need to reprioritize many of those lists.

Currently hydrologists, climatologists, engineers and others must use information that is considered weak. Updated rainfall information is needed for purposes ranging from simple design of culvert crossing sites to the complex design of nuclear waste storage sites.

Recommendation:

1. Support continued study of precipitation frequency in the southwest to include Arizona, New Mexico, Utah, Nevada and parts of California and northern Mexico. Study will include:
 - 1.a Gathering rainfall data for the region.
 - 1.b Examination of geographical distribution of rain gages.
 - 1.c Depth duration relations for 1 hour or less for areas of 100 square miles and less.
2. Final product will be a refined and updated precipitation-frequency atlas.

Lead Agency: FHWA (ATRC), NWS, ADOT

Support Agencies: Flood Control Districts in Arizona and adjacent states

Schedule: Five years

Funding: FHWA, NWS, ADOT

PUBLIC AWARENESS / EDUCATION / INFORMATION

Issue: Local officials and the general public need to ^{be} better informed on the nature of flooding in Arizona, their vulnerability and protective actions that can be taken.

Work Element #15: Expand the statewide effort to advance public awareness/education on the flood hazards in Arizona and the importance of floodplain management and preparedness. Arizona.

Background:

Each year a great number of people endanger themselves and others during storms by driving through flooded dips and across usually dry riverbeds. Lives are lost during each storm when cars are swept downstream. It is critical that policy makers, the public and individuals have better access to flood information and how to mitigate against such occurrences.

Recommendations:

1. Identify the audiences, methods and components of a public education program for all aspects of flood awareness and preparedness for public officials, citizens, businesses, industry and emergency workers.
1. Flash Flood Awareness Week should be proclaimed and information should be distributed throughout the State by using press releases, brochures, floodproofing workshops and emergency response and planning.
2. All residents in special hazard areas should be aware of flood warning information and evacuation procedures. These procedures should be published and distributed in those areas.
3. Develop public information bulletins on flood cleanup to be sent to the press following floods. Provide for a rapid dissemination of information.
4. Support AFMA, a non-profit organization, in the development of public awareness videos to be shown to local officials, organizations, private groups and the public.

5. Continue to educate the public on flood insurance, good building practices, flash flood hazards, the risks of locating in a floodplain, residential floodproofing and other available mitigation strategies.
6. Support AFMA proposed legislation making it illegal to sell or lease property without disclosing whether it is in the 100-year floodplain.

Lead Agency: ADEM, ADWR, AFMA, Flood Control Districts

Support Agencies: FEMA, NWS

Schedule: On-going

Funding: FEMA, CAP, AFMA, DPI Program, ADEM

STATE HAZARD MITIGATION OFFICER/TEAM

Issue: Creation of a full-time State Hazard Mitigation Officer and an official State Hazard Mitigation Team, with the support of the Governor, has been found to be the most successful and effective method of preparing and implementing hazard mitigation planning and initiatives within the State.

Work Element #16: Develop and fund a full-time State Hazard Mitigation Officer and State Hazard Mitigation Team.

Background: Successful hazard mitigation requires the involvement of all agencies and local officials who have flood hazard responsibilities. It is essential the State Hazard Mitigation Officer (SMHO) and members of the State Hazard Mitigation Team (SHMT) have knowledge of their agencies programs, activities and jurisdictions and have the ability to speak for their agency. The SMHO and the SHMT should have an all-hazard approach to mitigation.

Recommendations:

1. Develop and fund a full-time State Hazard Mitigation Officer.
2. Permanently establish a State Hazard Mitigation Team, headed by the State Hazard Mitigation Officer, whose responsibilities include the following:
 - 2.a Identify vulnerability to various natural hazards and evaluate the options available to mitigate such risks.
 - 2.b Develop a unified management strategy with recommendations concerning State, Federal or local mitigation responsibilities.
 - 2.c Prioritize hazards statewide.
 - 2.d Provide technical mitigation assistance to local jurisdictions.
 - 2.e Serve on the committee to prioritize and select those projects for Hazard Mitigation Grant Program Funding.
 - 2.f Meet at the call of the State Hazard Mitigation Officer, but no less frequently than once a year.
 - 2.g Prepare annual work programs and status reports and provide periodic updates to local governments on progress achieved, activities and recommendations of the team.

Lead Agency: AZ Division of Emergency Management

Support Agencies: State Agencies and local jurisdictions, FEMA - Region IX

Schedule: 12 months

Funding: Not required

VII. PLAN MAINTENANCE

This plan will be evaluated on at least an annual basis to ensure that implementation occurs as planned, and the plan remains current. The State Hazard Mitigation Officer will be responsible for the evaluation with input from the State Hazard Mitigation Team.

A. Maintenance

Plan maintenance involves:

1. Coordination of the implementation of hazard mitigation work elements;
2. Monitoring implementation progress and any changes, positive or negative, in the vulnerability analysis;
3. Evaluation of the success or failure of each effort; and
4. Updating the Arizona Hazard Mitigation Plan to reflect the above factors.

B. Implementation

Implementation will be coordinated by the State Hazard Mitigation Officer with the support and advice of the State Hazard Mitigation Team. Coordination will be in conjunction with those local government officials who are responsible for implementing specific projects. The *State Hazard Mitigation Administrative Plan* outline the management procedures to be followed in administering the Hazard Mitigation Grant Program.

C. Monitoring

The State Hazard Mitigation Officer is responsible for maintaining a tracking and reporting system to monitor and report on the progress of mitigation projects. As specified in the *State Hazard Mitigation Administrative Plan*, quarterly progress reports will be submitted by the responsible local official(s) to the State Hazard Mitigation Officer beginning the first full quarter after receipt of the funding. The State Hazard Mitigation Officer will submit reports to FEMA as required. The final report on each project will consist of a complete assessment of project accomplishments.

1. All reports will indicate the status of each FEMA approved mitigation project, with an evaluation of any problems and/or issues which have developed and with recommendations for additional, modified, or no action.
2. Information received by the State Hazard Mitigation Officer will be furnished to the members of the State Hazard Mitigation Team.

D. Evaluation

Upon a Presidential disaster declaration, Arizona will be required to update the State Hazard Mitigation Plan. Evaluation and updating may include:

1. Developing new hazard mitigation needs and/or issues;
2. Reprioritizing existing mitigation actions;
3. Expanding the plan to address additional hazard; and
4. Determine if there are policies, programs, and capabilities to address the hazard and reduce future vulnerability.

APPENDIX A - SUMMARY OF FEDERAL MITIGATION PROGRAMS

This section contains brief description of Federal agencies having mitigation responsibilities.

BUREAU OF RECLAMATION

This agency of the Department of Interior is responsible for programs which may include hazard mitigation in individual projects. Federal Reclamation Projects are projects that provide for Federal development of multi-purpose water and related land resources projects, including such functions as irrigation, municipal and industrial water supplies, flood control and river regulation, water quality control, outdoor recreation, and fish and wildlife enhancement in the 17 contiguous states. In Small Reclamation Projects, the Federal government assists in the rehabilitation and betterment of construction of water resource development.

The Bureau has an ongoing Safety and Dams Program which includes inundation studies, inspections and corrective measures.

Coolidge Dam is located 90 miles southeast of Phoenix, AZ on the Gila River Indian Reservation. Recent studies have indicated that water could overtop the Dam by up to 21 feet, jeopardizing the integrity of the Dam. Additional safety problems include general deterioration and inadequate spillways capacity. The Bureau of Reclamation has begun modification that will mitigate against a possible dam failure. Completion of the modifications to the Dam is expected to take three years.

FEDERAL EMERGENCY MANAGEMENT AGENCY

The FEMA Hazard Mitigation Grant Program was created by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 100-707). When a major disaster is declared, the Federal Emergency Management Agency (FEMA) may contribute up to 50% of the cost of hazard mitigation measures which the President has determined are cost effective and which substantially reduce the risk of future damage, hardship, loss or suffering in any area affected by a major disaster.

The Hazard Mitigation Grant program is an independent grant program, which is closely tied to the post-disaster hazard mitigation plans defined under Section 409 of Public Law 93-288. Applicants eligible for hazard mitigation grants include State and local governments, private non-profit organizations, and Indian tribes.

The Federal assistance will not exceed 10 percent of the total estimated assistance provided under specified categories of Section 406 (Section 406 authorizes permanent restoration projects under FEMA's Public Assistance Program) based on Damage Survey Reports. The non-Federal share may exceed the Federal share and be a combination of other State, local, and private funding sources.

The *Individual and Family Grant Program*, authorized under Section 411, can be used by individuals to fund limited hazard mitigation activities. The IFG Program provides grants to states for the purpose of making subgrants to individuals or families for the purpose for serious and unmet disaster-related needs. These awards may be used to take minimum protective measures required to protect homes against the immediate threat of damage from events such as additional rain, flooding, erosion, or wind.

The *Hazard Mitigation Assistance Program* provides funding assistance to States and local governments to reduce vulnerability from recurring or potentially severe hazards by supporting hazard mitigation planning activities. The focus of the program is on hazard mitigation plans, including updating plans, implementing measures identified in hazard mitigation plans, developing local hazard mitigation plans, and developing state legislation or adopting local ordinances.

The *National Flood Insurance Program* is administered by FEMA's Federal Insurance Administration. The program makes flood insurance available to local communities. In exchange, the local community agrees to adopt and enforce a floodplain management ordinance and to regulate flood-prone areas to help reduce future flood losses. *Section 1362 of the National Flood Insurance Act of 1968* supports mitigation through floodplain management and the flooded property acquisition program.

The *Dam Safety Program* objectives include establishing effective dam safety programs in every state, developing public awareness programs, and producing needed technical assistance materials.

Other key FEMA Mitigation Programs include the Disaster Preparedness Improvement Grant Program, Emergency Management Assistance, and the Earthquake and Hurricane Vulnerability Analysis and Preparedness Grants.

U.S. STATES ARMY CORPS OF ENGINEERS

The U. S. Army Corps of Engineers (USACE) is extensively involved in several hazard mitigation activities throughout the State. The long-range purpose of these programs is flood control.

Emergency Operations (Code 910-200): There are two types of activities under this code: 1) field investigation of potential hazards and 2) flood emergency operations.

Field Investigations involve a reconnaissance review of potential areas which may be impacted by flooding and emergency inspection of structurally threatened dams.

Flood Emergency Operations by the Corps may consist of contracting for emergency construction to raise or reinforce existing levees, channels, etc; construct temporary structures; channel clearing and snagging operations; furnishing of flood fighting materials for use by local governments; assisting in search and rescue; and providing advice and technical assistance.

The flood emergency operations are supplemental assistance to State and local efforts in flood fighting operations. Their role is temporary in nature and geared to the impending threat. The Corps' response cannot replace local responsibility and authority to initiate flood fighting operations.

The following are U.S. Army Corps of Engineers' project currently being planned for Arizona.

Little Colorado River at Holbrook, AZ

This project is located in Holbrook, Navajo County, AZ, about 150 miles northeast of Phoenix. The population of Holbrook is about 6,000. The Little Colorado River drains an area of about 27,800 square miles in northeastern Arizona and northwestern Nevada.

The existing project, built by the Corps of Engineers in 1948, was a levee on the north side of the river designed to protect the main part of the City of Holbrook from a 100-year flood. Extensive damages and near disasters have occurred on three separate occasions since 1970. Existing property in the floodplain is valued at \$45 million.

The proposed project, as amended by the City of Holbrook in 1988, is a single levee along the north bank of the Little Colorado River providing 100-year level of protection and relocation of the southside community.

It is estimated that preconstruction, engineering, and design will be completed in October 1992.

Rillito River in the vicinity of Tucson, AZ

This proposed project, authorized by the Water Resources Development Act of 1986, is located in the Tucson metropolitan area, Pima County, Arizona. Tucson has a population of more than 535,000. The Rillito River drains an area of about 1,000 square miles and empties into the Santa Cruz River at Tucson.

Urban development within the project area is subject to serious flood damage because of major bank erosion and channel instability along the Rillito. Seven significant floods occurred from 1962 to 1983 causing serious damage to businesses, residential property, crops, and transportation

arteries. The October 1983 flood of record caused damages estimated at \$10 million (\$12 million at 1988 prices).

The plan of improvement provides for bank erosion control along 13.2 miles of the Rillito River within the metropolitan area. The project would also provide recreational opportunities for residents of the area. The total estimated (1088) cost of the project is \$17.8 million of which \$13.3 million would be Federal and \$4.5 million non-Federal.

San Francisco River, Clifton, AZ

The town of Clifton is located in southeastern Arizona, approximately 170 miles northeast of Tucson, and is the county seat of Greenlee County. Part of the urbanized area of Clifton lies in the San Francisco River floodplain with a drainage area of about 2,750 miles.

Following the most severe flood of record, October, 1983, approximately 41 homes and 40 businesses were destroyed and 231 homes and 57 businesses suffered major damage in Clifton. Damages and emergency costs totaled nearly \$20 million (\$22 million in 1988 costs).

Under the Water Resources Development Act of 1986, a project was authorized for flood control on the San Francisco River at Clifton, Arizona, for the purpose of protecting residential and commercial properties on the east side of the river downstream from the State Highway 666 Bridge at a total cost of \$8 million. The flood control plan consists of both structural and non-structural elements including a 2,500-foot trapezoidal compacted earthfill levee, with flood gates, bridge modifications, evacuation and relocation of floodplain residents, and floodproofing of businesses. The project will eliminate residential damage in the Clifton area from a 125-foot and greatly reduce commercial damages. Also proposed for development is a 2 1/2-acre tent-camping-only site with restroom facilities. A larger more intensive area across the river will be developed for trail/tent use, complete with at-site water and electricity, shower facilities, picnic ramadas and parking areas.

The State of Arizona and Town of Clifton support this comprehensive flood control project.

Santa Cruz River, Nogales, AZ

The project area is in southern Arizona in the central and border portions of the City of Nogales in Santa Cruz County. As the major drainage system for the City of Nogales, Nogales Wash originates in Mexico and enters Nogales, AZ, as a covered floodway constructed by the International Boundary and Water Commission (IBWC) during the 1930s.

Much of Nogales, AZ, and Nogales, Mexico, has been built in the floodplain of Nogales Wash/Potrero Creek. Flooding in both cities has historically been a problem, and seems to be worsening with increased urban development in Nogales, Sonora, Mexico. In October 1977, a flood caused more than \$700,000 in damages and displaced 29 families in Nogales, AZ. Again in October, 1983, flooding along Nogales Wash caused about \$450,000 in damages, resulting

in Santa Cruz County being included in a disaster declaration by the President. In July 1984, flooding caused an additional \$200,000 in damages. Today, the present flood-control system designed by the IBWC in the 1930s to protect both communities is no longer effective due to the increase in urbanization and runoff.

In 1984, since the Mexican Government indicated to the U.S. Commissioner of the IBWC that it could not participate either in the study or the implementation of solutions in Mexico because of financial constraints, study efforts were directed towards developing solutions that could be implemented only within the United States. The Nogales Wash flood control study, authorized under the Flood Control Act of June 28, 1938 (Gila River and Tributaries) and the Energy and Water Development Appropriation Bill of 1984, have been investigating the area along Nogales Wash and a segment of Potrero Creek.

The current plan includes a lateral collector channel to capture overland street flow and divert it into existing covered channels and a new diversion channel system to be constructed at Chula Vista, and, in addition, will also include an early flood warning system and recreational facilities. The average annual flood control benefits are estimated to amount to \$1.3 million. Recreational amenities identified include three picnic sites and a bicycling/hiking road. Total project cost is estimated at \$7 million. The project is not yet authorized for construction.

Bisbee, AZ (Tombstone Canyon)

Bisbee, located in Cochise County in Southeastern Arizona, has an economy based on tourism, trade, and service, along with a downtown area that contains more than 30 nationally registered historical buildings. On July 14, 1986, 3/4 inch of hail and 3 inches of rain caused severe local flooding and a threat that a covered channel built in 1908 might collapse and cause a flood in the downtown area. Historical structures would also be flooded in a 100-year event. Under Section 205 a reconnaissance study was completed in September 1991. The completed project will increase the strength of the channel with a project cost of \$3.58 million. Construction was scheduled to begin the spring of 1992 but the local jurisdiction was having difficulty finding the matching funds for project completion.

Other key Federal Agency Programs:

Department of Agriculture

- U.S. Soil Conservation Service (SCS)
- Watershed protection and flood prevention
 - Floodplain Management Studies
 - Resource Conservation and development
 - Emergency watershed protection
 - Soil and snow surveys

Small Business Administration

- Disaster loans

Department of Housing and Urban Development

- Community Development Block Grants

Department of Commerce

National Weather Service

- River forecasts
- Forecasts and warnings
- Meteorological, hydrometeorological, and hydrological data and analyses
- Disaster preparedness and hazard analysis program

U.S. Department of the Interior

U.S. Geological Survey

- Earthquake Hazard Reduction Program
- Geologic-Related Hazards Warning Programs
- Flood hazards studies

APPENDIX B - STATE, COUNTY AND LOCAL PROGRAMS

ARIZONA DIVISION OF EMERGENCY MANAGEMENT

: *The Arizona Division of Emergency Management (ADEM)* is charged with the overall responsibility for comprehensive and coordinated emergency management capability throughout the State and the administration of emergency preparedness, disaster response and recovery, and hazard mitigation for Arizona. As mandated by Arizona Revised Statute (ARS) 26-305 ADES coordinates the mobilization and response of State and local agencies, including requests from local governments for Federal assistance. Their mission is to minimize loss of life and property, restore essential services and expedite recovery from a natural or technological disaster.

The Arizona Division of Emergency Management is an agency within the Arizona Department of Emergency and Military Affairs.

The Governor's Emergency Council: The Governor, as Chief Executive Officer of the State, has emergency authority over all agencies of State government during a declared state of emergency and exercises overall direction and control of State response. To assist the Governor in setting procedures and monitoring each emergency, Arizona Revised Statute (ARS) 26-304 established a State Emergency Council, composed of the Governor, Secretary of State, Attorney General, Adjutant General, Directors of Emergency Management, Transportation, Health Services, Department of Environmental Quality and the Department of Public Safety. The President of the Senate and the Speaker of the House of Representative serve as advisory members.

The Governor has the authority to declare a state of emergency and allocate up to \$100,000 for response to any emergency situation. If more than \$100,000 is required for the response, the Governor must call the Emergency Council into session. The Emergency Council has the authority to allocate up to \$2.5 million per fiscal year.

THE ARIZONA DEPARTMENT OF WATER RESOURCES

The Arizona Department of Water Resources (ADWR) has been appointed Coordinator for the National Flood Insurance Program (NFIP), making that agency responsible for all of the program aspects of floodplain management within the State. In addition to the duties mandated by the NFIP Rules and Regulations, the State statutes direct ADWR to assist communities in delineating their floodplains and installing flood warning systems. A Handbook for Arizona Communities on Floodplain Management and the National Flood Insurance Program was prepared by ADWR to assist local government officials to understand the concepts of floodplain management and their roles in the NFIP.

The "Omnibus Flood Control and Relief Act" of 1979 directed ADWR to establish a flood warning office in cooperation with the National Weather Service (NWS). This office is currently staffed by 1.5 persons from ADWR and one person from the NWS. It is activated to 24-hour operation whenever weather and watershed conditions indicate an unusually high flood potential. ADWR paid for the installation of a satellite telemetry network and continues to pay the U.S. Geological Survey (USGS) to maintain that network. The flood warning system can forecast floods on the major rivers in the State, but flash floods, which pose the greatest threat to individual safety, and which caused the damage for which this plan is written, cannot be predicted.

Recent budget cuts at both Federal and State levels threaten the effectiveness of the present system. If money is not available, the present system will not be maintained. The USGS budget will not allow that agency to participate in the installation of additional gages, flood warning systems or the maintenance of the present network. ADWR may not have the funds to pay the USGS for maintenance of the present systems.

The State Hazard Mitigation Officer (SHMO) and the State Floodplain Insurance Administrator (Department of Water Resources) serve on the Federal Interagency Hazard Mitigation Team in preparing the report that is required within 15 days of a Presidential declaration. In addition, the SHMO coordinates the preparation of the State Mitigation Plan, due to FEMA 180 days after the declaration.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Arizona Department of Environmental Quality (ADEQ) has the responsibility to protect public health and to preserve, protect and enhance the environment of Arizona. This mission involves water pollution control through implementation of the Nonpoint Source (NPS) Water Quality Management Program. The statutory authorities for the Arizona NPS programs are derived from two laws: The Arizona Environmental Quality Act (EQA) of 1986, and the Federal Clean Water Act as amended in 1987.

The Watercourse Alteration Technical Advisory Group's (WATAG) goal is to establish Best Management Practices (BMPs) that protect and enhance environmental quality due to watercourse alterations. One of the first year objectives of the committee is to provide clear guidance to implement regulation of watercourses.

Best management practices are defined in ARS 49-201.2 of the EQA as "those methods, measures or practices to prevent or reduce discharges and include structural and nonstructural controls and operation and maintenance procedures. Best management practices may be applied before, during and after discharges to reduce to eliminate the introduction of pollutants into receiving waters. Economic, institutional and technical factors shall be considered in developing best management practices."

COUNTY FLOOD CONTROL DISTRICTS

Floodplain management in Arizona is the responsibility of the counties. Counties were directed by statute (48-3602) to form *Flood Control Districts* and regulate development within their areas of jurisdiction. The incorporated towns and cities are allowed to adopt a resolution stating they will do their own floodplain management within the incorporated areas of the City/Town. This statute assures that all communities in Arizona will manage their floodplains. If the incorporated community fails to enforce its floodplain management ordinance, the duties automatically fall to the county flood control district. This has never happened.

The Flood Control Districts have taxing authority and provide technical structural and non-structural assistance to the incorporated areas.

The primary responsibility for implementation of mitigation activities rests with local government. Local government reduces hazards through programs that directly regulate primary and secondary hazards, and through disaster planning activities. Often they have a direct impact on the hazards by implementing and enforcing fire and safety codes, and floodplain management administration that are more stringent than those at the State level. Through the Division of Emergency Services, the State's Hazard Mitigation Officer assists State agencies and local jurisdictions in lowering their vulnerability to recurring or threatened hazards by supporting pre- and post-disaster planning. Actions to mitigate the effects of disasters include encouraging the adoption and effective administration of building codes that contain features to protect structures during floods, fires, earthquakes, and other disasters and examining ways to improve safety through nonstructural means.

PRIVATE NON-PROFIT

The Arizona Floodplain Manager's Association (AFMA), an association of local officials charged with floodplain management responsibility for their jurisdictions, was formed in 1982. This provided a forum for the local jurisdictions to share information and assist each other in solving their floodplain management problems. AFMA was instrumental in writing legislation requiring additional freeboard for floodplain development and strengthening floodplain management throughout the state. The Association, the first of its kind in the country, continues to be active in both statewide and nationwide floodplain management activities. Workshops are held three times a year to keep local floodplain administrators informed of the latest issues and techniques for protecting development from flood hazards.

APPENDIX C - DEFINITIONS

Computerized Hazard Identification Program: part of FEMA's Integrated Emergency Management System, this evaluation program identifies the hazards posing the greatest threat to state and local governments and the capabilities of existing programs to respond. (Formerly referred to as Hazard Identification and Capability Assessment.)

Disaster Preparedness Improvement Grant Program: authorized under Section 201 of the Stafford Act. Annual matching awards not to exceed \$50,000 are provided to states to improve or update their disaster assistance plans and capabilities.

Emergency: any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States which requires Federal emergency assistance to supplement state and local efforts to save lives and protect property, public health and safety or to avert or lessen the threat of a disaster.

Emergency Response Plan: sets forth actions to be taken by state or local governments for response to emergencies or major disasters.

Executive Orders 11988 and 11990: The requirement to avoid direct or indirect support of floodplain development and to minimize harm to floodplains and wetlands. Federal decision-makers are obligated to comply with these orders, accomplished through an eight-step decision-making process.

Executive Order 12699: required that new construction of Federal buildings must comply with appropriate seismic design and construction standards.

Federal Hazard Mitigation Officer: the FEMA employee responsible for representing the agency for each declaration in carrying out the overall responsibilities for hazard mitigation and for Subpart M, including coordinating post-disaster hazard mitigation actions with other agencies of government at all levels.

FEMA-State Agreement: States the understandings, commitments, and conditions for assistance under which FEMA disaster assistance shall be provided. This agreement imposes binding obligations on FEMA, states, and their local governments in the form of conditions for assistance which are legally enforceable.

Hazard Mitigation: any action taken to reduce or permanently eliminate the long-term risk to human life and property from natural hazards.

Hazard Mitigation Assistance Program: provides a limited amount of funding to states and local jurisdictions to cover or to assist in covering the cost of preparing a pre-disaster hazard mitigation plan, one or more components of such a plan, or a related activity which will contribute to reducing vulnerability to hazards either throughout the State or for a selected area within the State.

Hazard Mitigation Grant Program: authorized under Section 404 of the Stafford Act. Provides funding for hazard mitigation projects that are cost effective and complement existing post-disaster mitigation programs and activities by providing funding for beneficial mitigation measures that are not funded through other programs.

Hazard Mitigation Plan: the plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in society that includes the actions needed to minimize future vulnerability to hazards.

Hazard Mitigation Plan Update: an update to an existing hazard mitigation plan, which may be accomplished either by updating the status of mitigation actions within the existing plan or by expanding the existing plan to address additional hazards or mitigation issues.

Hazard Mitigation State Administrative Plan: the plan developed by the state to describe the procedures for administration of the Hazard Mitigation Grant Program.

Hazard Mitigation Survey Team: the FEMA/State/Local survey team that is activated following disasters to identify immediate mitigation opportunities and issues to be addressed in the Section 409 Hazard Mitigation Plan. The Hazard Mitigation Survey Team may include representatives of other Federal Agencies, as appropriate.

Hazard Mitigation Survey Team Report: developed by the Hazard Mitigation Survey Team, and similar in format to the Interagency Hazard Mitigation Team Report. This report identifies mitigation measures for implementation and recommends issues to be addressed in the State Hazard Mitigation Plan, including those measures recommended for funding under the Hazard Mitigation Grant Program.

Individual Assistance: supplementary Federal assistance provided un the Stafford Act to individuals and families adversely affected by a major disaster or emergency.

Interagency Agreement for Post-Flood Hazard Mitigation: agreement signed by 12 Federal agencies as a result of a July 10, 1980 directive issued by the Office of Management and Budget to these agencies to coordinate their post-disaster recovery assistance following Presidentially declared flood disasters and to use this assistance to promote non-structural approaches to reducing future flood damages.

Interagency Hazard Mitigation Team: the mitigation team that is activated following flood related disasters pursuant to the Office of Management and Budget directive on Nonstructural Flood Protection Measures and Flood Disaster Recovery, and the subsequent December 15, 1980 Interagency Agreement for nonstructural Damage Reduction.

Interagency Hazard Mitigation Team Report: developed within 15 days following any Presidentially declared flood disaster by an interagency, intergovernmental, and interdisciplinary team representing each of the signatory agencies of the Interagency Agreement for Post-Flood Hazard Mitigation. The report identifies post-flood mitigation opportunities and common post-flood recovery policies.

Local Hazard Mitigation Officer: the representative of local government who serves on the Hazard Mitigation Survey Team or the Interagency Hazard Mitigation Team, and who is the primary point of contact with FEMA, other Federal agencies, and the state in the planning and implementation of post-disaster hazard mitigation activities.

Public Assistance: Federal financial assistance provided to state and local governments or to eligible private nonprofit organizations for disaster-related requirements.

Section 404: of the Stafford Act, authorizes the Hazard Mitigation Grant Program which provides funding for cost-effective hazard mitigation measures.

Section 409: of the Stafford Act, enacted to encourage identification and mitigation of hazards at all levels of government, Section 409 requires the identification and evaluation of mitigation opportunities as a condition for receiving Federal disaster assistance.

Section 409 Hazard Mitigation Plan: the hazard mitigation plan required under Section 409 as a condition of receiving Federal disaster assistance.

Stafford Act: Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288.

State Hazard Mitigation Officer: the representative of state government who serves on the Hazard Mitigation Survey Team and Interagency Hazard Mitigation Team and who is the primary point of contact with FEMA, other Federal agencies, and local units of government in the planning and implementation of post-disaster mitigation activities.

State Hazard Mitigation Team: composed of key state agency representatives, local units of government, and other public or private sector bodies or agencies. The purpose of the State Hazard Mitigation Team is to evaluate hazards, identify strategies, coordinate resources, and implement measures that will reduce the vulnerability of people and property to damage from hazards.

Subpart M, Hazard Mitigation Planning: 44 CFR Part 206 Subpart M prescribes the actions and procedures for implementing Section 409 of the Stafford Act.

Subpart N, Hazard Mitigation Grant Program: 44 CFR Part 206 Subpart N provides guidance on the administration of hazard mitigation grants made under provisions of Section 404 of the Stafford Act.

APPENDIX D - SOURCES OF INFORMATION

- The Arizona Division of Emergency Management
- The Interagency Hazard Mitigation Team Report
- National Weather Service memorandum to Arizona Division of Emergency Services, September 12, 1990
- The Flood Hazard Mitigation Program for the State of Arizona, Disaster Declaration FEMA-730-DR, prepared by the Arizona Division of Emergency Services July, 1985
- The Interagency Flood Hazard Mitigation Report in Response to the October 5, 1983 Disaster Declaration (FEMA-691-DR-AZ)
- The Arizona Floodplain Management Association Newsletter, Volume 10, No. 1, January 1991
- The Flood Control Districts of Maricopa and Pima County
- The Arizona Department of Water Resources
- "Arroyo", Vol. 4 No. 2, June 1990, a newsletter of the Water Resources Research Center, University of Arizona
- Arizona Statistical Review, 45th Annual Edition, December, 1989, published by Valley National Bank of Arizona
- Water Resources Development in Arizona 1989, US Army Corps of Engineers, South Pacific Division
- Handbook for Arizona Communities on Floodplain Management and The National Flood Insurance Program, Arizona Department of Water Resources, December, 1989
- Commonwealth of Kentucky Hazard Mitigation Plan, Division of Disaster and Emergency Services, October, 1991
- Washington State Flood Damage Reduction Plan (Interim), Washington State Department of Community Development, Emergency Management Division, September, 1991
- Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments, DAP-12, Federal Emergency Management Agency, September, 1990