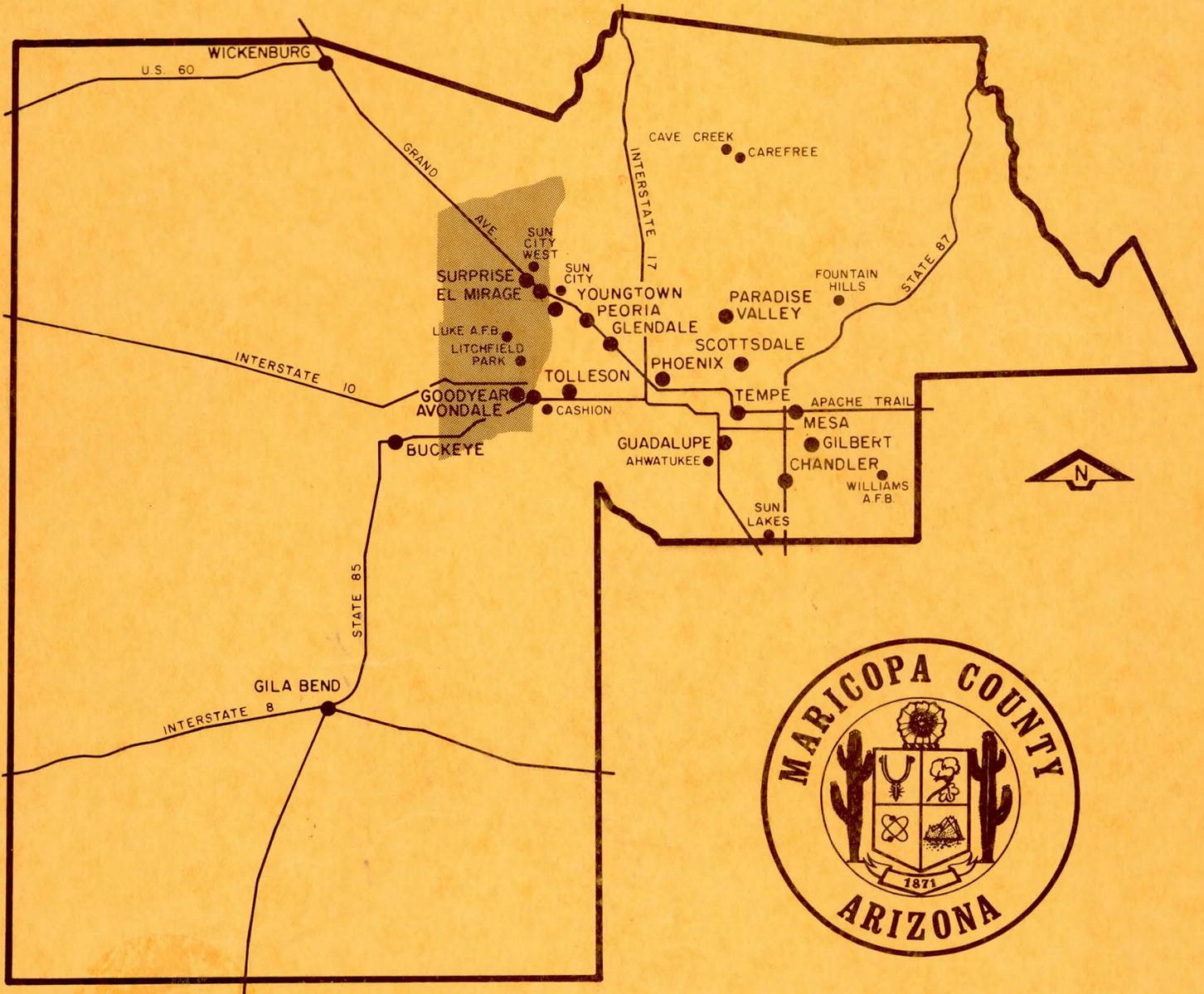


WHITE TANKS AGUA FRIA Technical Guide



M-142

BOARD OF SUPERVISORS

Tom Freestone		District 1
George Campbell	Chairman	District 2
Fred Koory, Jr.		District 3
Hawley Atkinson		District 4
Ed Pastor		District 5

PLANNING AND ZONING COMMISSION

William Mariner	Chairman	District 1
Charles Lemon		
Dolores Foyle		District 2
Idar Rimestad		
Cecil Apperson		District 3
Harold McCall		
*Robert L. Schulke		District 4
*Marvin T. Gibson	Resigned 3/82	
Harry T. Dykman		
Earl de Berge	Vice Chairman	District 5
Dale R. Smith		

*Liason with the White Tanks-Agua Fria Citizen Committee

WHITE TANKS-AGUA FRIA CITIZEN COMMITTEE

Jerry Roth, Chairman
H. Lynn Anderson, Vice Chairman

James Cain	Ron Rayner
Dick Crowell	Robert Weed
Bill Edwards	Ron Wheat
Art Lux	Dick Wilson
Mike Macchiaroli	Leyton Woolf
Inez McCullough	Luke Air Force Base

COUNTY MANAGER

Robert Mauney

DEPARTMENT OF PLANNING AND DEVELOPMENT

Don E. McDaniel, Jr., Director

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

THE WHITE TANKS - AGUA FRIA TECHNICAL GUIDE



January 1982

PUBLISHED BY

THE MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT
ROOM 300 111 SOUTH 3rd AVENUE
PHOENIX, ARIZONA 85003

MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT

STAFF PARTICIPANTS

Frank A. Schuma	Principal Planner (Resigned January, 1981)
Lester J. Ringenberg	Principal Planner (Resigned May, 1981)
Dudley Onderdonk	Principal Planner (From July, 1981)
Dean J. Svoboda	Planner II (Project Coordinator)
Ray B. Jacobs	Planner I, II
Steven B. Bauer	Planning Aide
Naomi Anderson	Secretary III

SUPPORTING STAFF

Floyd B. Burrier	Chief Cartographer
Gerard Berube	Planner II
Jon Rocos	Planning Aide
Bob Corley	Drafting Specialist III
Russell Heisinger	Drafting Specialist II
Ron Thomas	Drafting Specialist II
Dalen Buchanan	Drafting Specialist II
John Parsons	Drafting Specialist II
Craig Corcoran	Drafting Specialist II
Enalo Lockard	Drafting Specialist II
Frank Bostwick, III	Drafting Specialist I
Jean Lusk	Office Supervisor
Patti Jordan	Clerk III
Kathy Murphy	Typist II
Arleen Mudry	Typist II
Marilyn Coates	Typist I

ACKNOWLEDGEMENT

The White Tanks-Agua Fria Technical Guide was prepared by the Advance Planning Division of the Maricopa County Department of Planning and Development in close cooperation with a number of professionals, interested citizens, public officials, and government agencies. We would like to thank the many individuals who provided information or participated in the review of this report.

TABLE OF CONTENTS

	<u>Page</u>
LIST OF EXHIBITS	vi
INTRODUCTION	1
Part I. The Environment	
I. CLIMATE	3
Sunshine.	3
Temperature	3
Precipitation	3
Humidity.	6
Wind.	6
II. TOPOGRAPHY.	9
Elevation	9
Slope	9
III. GEOLOGY	11
Geologic History.	11
General Geology	11
Significant Mineral Resources	13
Mineral Construction Materials.	13
The Luke Salt Body.	13
Land Subsidence and Earth Fissures.	15
Earthquakes	16
IV. SOILS	19
Soils Within the Area	19
Soil Limitations.	21
V. DRAINAGE AND FLOOD CONTROL.	23
Natural Drainage Characteristics.	23
Stormwater Drainage Control	23
The Agua Fria and Gila Rivers	26
History of Flooding	26
Floodplain Characteristics.	29
Floodplain Development.	30

	<u>Page</u>
Regional Flood Control Projects	30
New River and Phoenix City Streams Project.	30
Interstate-10 Drainage Channel.	31
Gila River Channel Clearance.	32
Central Arizona Water Control Study	32
VI. GROUNDWATER	33
Subsurface Geology.	33
Distribution of Groundwater	34
Well Yields	34
Depth to Groundwater.	35
Groundwater Overdraft	35
Groundwater Quality	37
Fluoride.	38
Nitrate	38
Total Dissolved Solids.	39
Hardness.	41
VII. VEGETATION AND WILDLIFE	43
Vegetation.	43
Wildlife.	45
VIII. AIR QUALITY	47
IX. HISTORICAL RESOURCES.	49
X. SELECTED REFERENCES	51

PART II: SOCIO-ECONOMICS

I. POPULATION GROWTH IN MARICOPA COUNTY.	55
Past Population Growth.	55
Future Population Growth.	57
Distribution of Population Growth	58
II. POPULATION GROWTH WITHIN THE WHITE TANKS-AGUA FRIA AREA	63
Existing Population	63
Past Population Growth.	64
Future Population Growth.	65
III. POPULATION CHARACTERISTICS WITHIN THE WHITE TANKS-AGUA FRIA AREA	71
Ethnic Composition.	71
Age Composition	71
Income.	74
Education Levels.	76
Unemployment.	77

	<u>Page</u>
IV. THE ECONOMY OF MARICOPA COUNTY.	79
History of Economic Development	79
Existing Conditions	79
Employment by Sector.	79
Economic Base	79
Major Income Producers.	81
Distribution of Employment.	82
Future Conditions	83
V. THE ECONOMY WITHIN THE WHITE TANKS-AGUA FRIA AREA	87
Existing Conditions	87
Employment by Sector.	87
Major Employers	88
Economic Base	90
Future Conditions	90
VI. SELECTED REFERENCES	92
 PART III. LAND USE AND DEVELOPMENT 	
I. LAND OWNERSHIP.	93
Public Land Ownership	93
Private Land Ownership.	93
II. LAND USE.	94
III. ZONING.	97
Existing Zoning	97
History of Rezoning	99
IV. HOUSING	101
Existing Housing.	101
Housing Conditions.	103
Change in Housing Units 1970-1979	103
Housing Unit Projections.	106
Public Housing.	106
V. SUBDIVISIONS.	107
VI. LAND USE AROUND MAJOR AIRPORTS.	108
Luke Air Force Base	108
Accident Potential.	110
High Noise Levels	111
Luke Auxilliary Field #1.	117
Phoenix-Litchfield Municipal Airport.	117

	<u>Page</u>
VII. CITIES AND TOWNS.	119
Municipal Planning Areas.	119
Future Land Use Plans	119
VIII. APPROVED LARGE SCALE DEVELOPMENTS.	123
Litchfield Park.	125
Sun City West.	127
IX. SELECTED REFERENCES.	129

PART IV. TRANSPORTATION

I. STREETS AND HIGHWAYS	131
Existing Conditions.	131
The Major Road System.	131
Traffic Volumes.	132
Future Street and Highway Plans.	132
Section Line Roads	132
Existing and Committed Freeways.	133
Planned Transportation Corridors	134
Future Traffic Volumes	134
Transportation Improvement Programs.	135
II. BUS SERVICE.	137
Public Transit	137
Commercial Bus Lines	137
III. RAILROADS.	138
Regional Service Characteristics	138
Local Service Characteristics.	141
Future Rail Plans.	141
IV. PUBLIC AIRPORTS.	143
Existing Facilities.	143
Sky Harbor International Airport	143
Phoenix-Litchfield Municipal Airport	143
McNeley Aviation	143
Future Improvements.	145
Sky Harbor International Airport	145
Phoenix-Litchfield Municipal Airport	145
Glendale Municipal Airport	145
V. SELECTED REFERENCES.	146

PART V. PUBLIC SERVICES AND FACILITIES

I.	ELECTRIC POWER, GAS, AND TELEPHONE SERVICE	147
	Electric Power Service	147
	Natural Gas.	147
	Telephone Service.	148
II.	WATER SERVICE	149
	Domestic Water Service Areas.	149
	Irrigation Districts.	151
	The Central Arizona Project	151
III.	WASTEWATER TREATMENT.	153
	Existing Conditions	153
	Future Plans For Wastewater Treatment	155
IV.	SOLID WASTE DISPOSAL.	157
	Existing Landfills.	157
	Future Disposal Plans	159
	Hazardous Waste Disposal.	159
V.	EMERGENCY SERVICES.	160
	Police Protection	160
	Fire Protection	160
	Medical Facilities.	162
VI.	PUBLIC SCHOOLS.	163
	School Districts.	163
	Schools Within the Study Area	163
	Schools Outside of the Study Area	165
	Future Conditions	167
VII.	RECREATION.	169
	Municipal Parks	169
	Other Facilities Within the Study Area.	170
	County Parks.	170
	Proposed Hiking and Riding Trails	172
VIII.	SELECTED REFERENCES	173

APPENDICES

APPENDIX A	SUBSURFACE CROSS SECTIONS
APPENDIX B	DISTRIBUTION OF RECOVERABLE GROUNDWATER
APPENDIX C	HISTORY OF REZONING
APPENDIX D	EXISTING SUBDIVISIONS

LIST OF EXHIBITS

Maps

<u>Number</u>		<u>Page</u>
1	General Location.	2
2	Generalized Slope	10
3	General Geology	12
4	Luke Salt Body.	14
5	Land Subsidence and Earth Fissures.	16
6	Seismic Risk.	17
7	Soil Associations	20
8	(Not Included)	
9	Soil Limitations.	22
10	Generalized Drainage.	24
11	Gila River Basin.	27
12	Depth to Groundwater.	36
13	Change in Groundwater Levels 1923-1977.	36
14	Fluoride Content in Groundwater	38
15	Dissolved Solids in Groundwater	40
16	Generalized Natural Vegetation.	44
17	Archaeological Resource Potential	50
18	Subarea Percentage of Total County Population Growth 1970-1980.	59
19	Local and Municipal Planning Areas.	67
20	1970 Census Tracts.	75
21	Distribution of Employment Central Maricopa County, 1978.	82

<u>Number</u>		<u>Page</u>
22	Major Public Land Ownership	94
23	Major Private Land Ownership.	94
24	Index Map to Table 3-7.	105
25	Existing Zoning	98
26	Luke Air Force Base Flight Tracks	109
27	Crash Hazard and High Noise Areas	112
28	Municipal Planning Areas.	120
29	Surprise Development Guide.	122
30	Avondale Land Use Plan.	122
31	El Mirage Interim Land Use Plan	122
32	Goodyear Comprehensive Plan	122
33	Approved Large Scale Developments	124
34	Litchfield Park Master Plan	126
35	Sun City West Master Plan	128
36	Major Road System	132
37	Estimated Average Daily Traffic 1979.	132
38	The MAG Regional Street and Highway Plan.	134
39	Routes of High Capacity Public Utility Lines.	148
40	Estimated Year 2000 Average Daily Traffic	134
41	Programmed Transportation Improvements.	136
42	Phoenix Metropolitan Area Rail Facilities	140
43	Major Airports in Maricopa County	144
44	Water Services Areas.	150
45	Irrigation Districts.	152
46	Emergency Service Facilities.	162

<u>Number</u>		<u>Page</u>
47	School Districts.	164
A-1	Index Map to Subsurface Cross Sections	Appendix A
A-2	Distribution of Recoverable Groundwater	Appendix B
A-3	Zoning Changes 1970-1979	Appendix C
A-4	Existing Subdivisions	Appendix D
	Generalized Existing Land Use	Pocket

Figures

1-1	Summary of Climate.	4
1-2	Annual Precipitation.	5
1-3	Slope Comparisons	10
1-4	Geologic Time Scale	12
1-5	Hypothetical Model of the Luke Salt Body.	14
1-6	Native Plant Communities.	43
2-1	Population Increase by Components, Maricopa County, Arizona	56
2-2	Subarea Percentage of Total County Population 1970-2000	62
2-3	Distribution of Population White Tanks-Agua Fria Area 1979.	63
2-4	Distribution of Projected Population Growth White Tanks-Agua Fria Area 1980-2000.	68
2-5	Projected Changes in Employment by Sector Maricopa County, Arizona 1978-2000.	85
2-6	Comparison of Employment by Sector Maricopa County and White Tanks-Agua Fria Area 1978.	89
3-1	Suggested Land Use Guidelines for High Noise Areas	114
A-1	Subsurface Cross Sections	Appendix A

TABLES

<u>Number</u>		<u>Page</u>
1-1	Major Flows in the Salt River 1978-1980.	28
1-2	Major Flows in the Agua Fria River 1978-1980	29
1-3	Average Groundwater Level Declines in Selected Areas of the Salt River Valley	36
1-4	Characteristics of Natural Vegetation.	44
1-5	Source of Air Pollutants Within the Phoenix Metropolitan Area.	47
2-1	Population Growth Maricopa County, Arizona 1900-1980.	55
2-2	Projected Population Growth Maricopa County, Arizona 1980-2000.	57
2-3	Distribution of Population Growth Within Maricopa County, Arizona 1970-1980.	58
2-4	Distribution of Projected Population Growth Within Maricopa County 1980-2000.	61
2-5	Change in Population White Tanks-Agua Fria Area 1970-1979	64
2-6	Projected Population Growth Within the White Tanks-Agua Fria Area 1979-2000	65
2-7	Distribution of Projected Population Growth White Tanks-Agua Fria Area 1980-2000	66
2-8	Population Projections for Planning Areas Within the White Tanks-Agua Fria 1980-2000	69
2-9	Estimated Ethnic Composition of Major Communities White Tanks-Agua Fria Area July, 1978.	72
2-10	Estimated Age Structure of Major Communities White Tanks-Agua Fria Area July, 1978.	73
2-11	Income Levels White Tanks-Agua Fria Area 1970.	74
2-12	Education Levels White Tanks-Agua Fria Area 1970	76
2-13	Unemployment in Major Communities White Tanks- Agua Fria Area 1977-1980	77

<u>Number</u>		<u>Page</u>
2-14	Comparison of Employment by Sector State of Arizona and Maricopa County 1978	80
2-15	Comparison of Projected Employment by Sector State of Arizona and Maricopa County 2000.	84
2-16	Projected Change in Basic Employment by Sector Maricopa County, Arizona 1978-2000	86
2-17	Major Employment by Sector White Tanks-Agua Fria Area 1978	87
3-1	Major Public Land Ownership Within the White Tanks-Agua Fria Area	93
3-2	Existing Land Use White Tanks-Agua Fria Area	94
3-3	Summary of Existing Zoning White Tanks-Agua Fria Area	98
3-4	Summary of Rezoning 1971-1979.	100
3-5	Inventory of Housing Units White Tanks-Agua Fria Area.	102
3-6	Summary of Housing Conditions in Incorporated Communities White Tanks-Agua Fria Area	103
3-7	Distribution of Change in Total Housing Units 1970-1979.	104
3-8	Housing Unit Projections White Tanks-Agua Fria Area 1980-2000.	106
3-9	Suggested Sound Level Reductions for Structures in High Noise Areas.	116
3-10	Annexations Within the White Tanks-Agua Fria Area as of April, 1980	120
3-11	Approved Large Scale Developments in or Near the White Tanks-Agua Fria Area	123
4-1	Carloads Shipped and Received by Railroad Phoenix Metropolitan Area 1978	139
5-1	Water Service Areas Within the White Tanks-Agua Fria Area.	150

<u>Number</u>		<u>Page</u>
5-2	Inventory of Existing Sewage Treatment Facilities. . .	154
5-3	Public Landfills Within the White Tanks-Agua Fria Area	158
5-4	Generalized Fire Insurance Ratings for Selected Portions of the White Tanks-Agua Fria Area	161
5-5	Public Schools Serving the White Tanks-Agua Fria Area	164
5-6	Survey of Schools Serving the White Tanks- Agua Fria Area	166
5-7	Municipal Parks Within the White Tanks-Agua Fria Area	169
5-8	Visitors at Nearby Regional Parks 1976-1980.	171
A-1	Estimated Amount of Recoverable Groundwater Within the White Tanks-Agua Fria Area	Appendix B
A-2	History of Rezoning Within The White Tanks- Agua Fria Area 1970-1979	Appendix C
A-3	Existing Subdivisions White Tanks-Agua Fria Area	Appendix D

**I
N
T
R
O
D
U
C
T
I
O
N**

INTRODUCTION

THE AREA PLANNING PROGRAM

The Maricopa County Board of Supervisors is required by State Law to prepare and adopt a comprehensive plan for its area of jurisdiction (A.R.S. 11-821). The preparation and maintenance of the County's comprehensive plan is one of the responsibilities of the Maricopa County Planning and Zoning Commission.

Maricopa County contains over 9,200 square miles. The size and diversity of this area makes it difficult to fulfill the purpose of comprehensive planning. In response to this problem, the Planning and Zoning Commission divided the County into a number of smaller areas for general planning purposes. The White Tanks-Agua Fria area is one of these study areas.

The "area planning program" enables County officials to become familiar with local conditions and issues and balance these with County-wide concerns. It promotes cooperation between the County, local cities and towns, other government agencies, and private citizens. Citizen involvement is emphasized through a citizen committee which spearheads the planning effort.

The White Tanks-Agua Fria Citizen Committee was appointed by the Planning and Zoning Commission in January, 1979 to prepare an area plan for consideration by the Commission.

THE WHITE TANKS-AGUA FRIA AREA PLAN

The White Tanks-Agua Fria Area Plan is a two volume report. The White Tanks-Agua Fria Technical Guide summarizes information on the history, existing conditions, and trends within the study area. It provides essential background for the planning process. The White Tanks-Agua Fria Policy and Development Guide presents proposed goals, objectives, policies, and recommendations. When adopted, it will guide County decision-making to the year 1990.

STUDY AREA BOUNDARIES

The White Tanks-Agua Fria planning area covers approximately 314 square miles in West Central Maricopa County. It includes the incorporated communities of Avondale, El Mirage, Goodyear, and Surprise; the major unincorporated communities of Litchfield Park and Sun City West; Luke Air Force Base; and a substantial rural area. The boundaries of the study area are shown on Map 1. They are:

- North: the Central Arizona Project Granite Reef Aqueduct;
- South: the floodplain of the Gila River and the Estrella Mountains;
- East: the floodplain of the Agua Fria River; and
- West: the White Tanks Mountains.

PURPOSE OF THIS REPORT

The White Tanks-Agua Fria Technical Guide presents basic information on the natural and man-made characteristics of the study area and those of the surrounding region. It documents the extensive research and analysis which accompanied the White Tanks-Agua Fria planning effort.

The Technical Guide was designed to be both comprehensive and general in nature. It resulted from working papers prepared for the White Tanks-Agua Fria Citizen Committee. Generally, it reflects information collected during 1979 and 1980.

The Technical Guide is designed to fulfill a number of functions. They are:

- *to acquaint elected officials and local citizens with the general characteristics of the planning area and to provide a sound background for decision-making during the planning process.
- *to serve as a supplement to the Policy and Development Guide which provides additional information on key issues of concern.
- *to provide a single reference which consolidates information on the area and will be useful to public and private decision-makers in the future.

Much of the information contained in this report will need to be updated as new studies become available. In addition, more detailed studies should accompany site specific planning.

REPORT ORGANIZATION

The Technical Guide is divided into five main parts. They are: The Environment, Socio-Economics, Land Use and Development, Transportation, and Public Services.

Part I: Environment contains information on climate, topography, geology and soils, groundwater, vegetation and wildlife, archaeological resources, drainage and flood control, and air quality.

Part II: Socio-Economics addresses population growth within the area and the surrounding region, characteristics of the population, and the economy within the study area and Maricopa County as a whole.

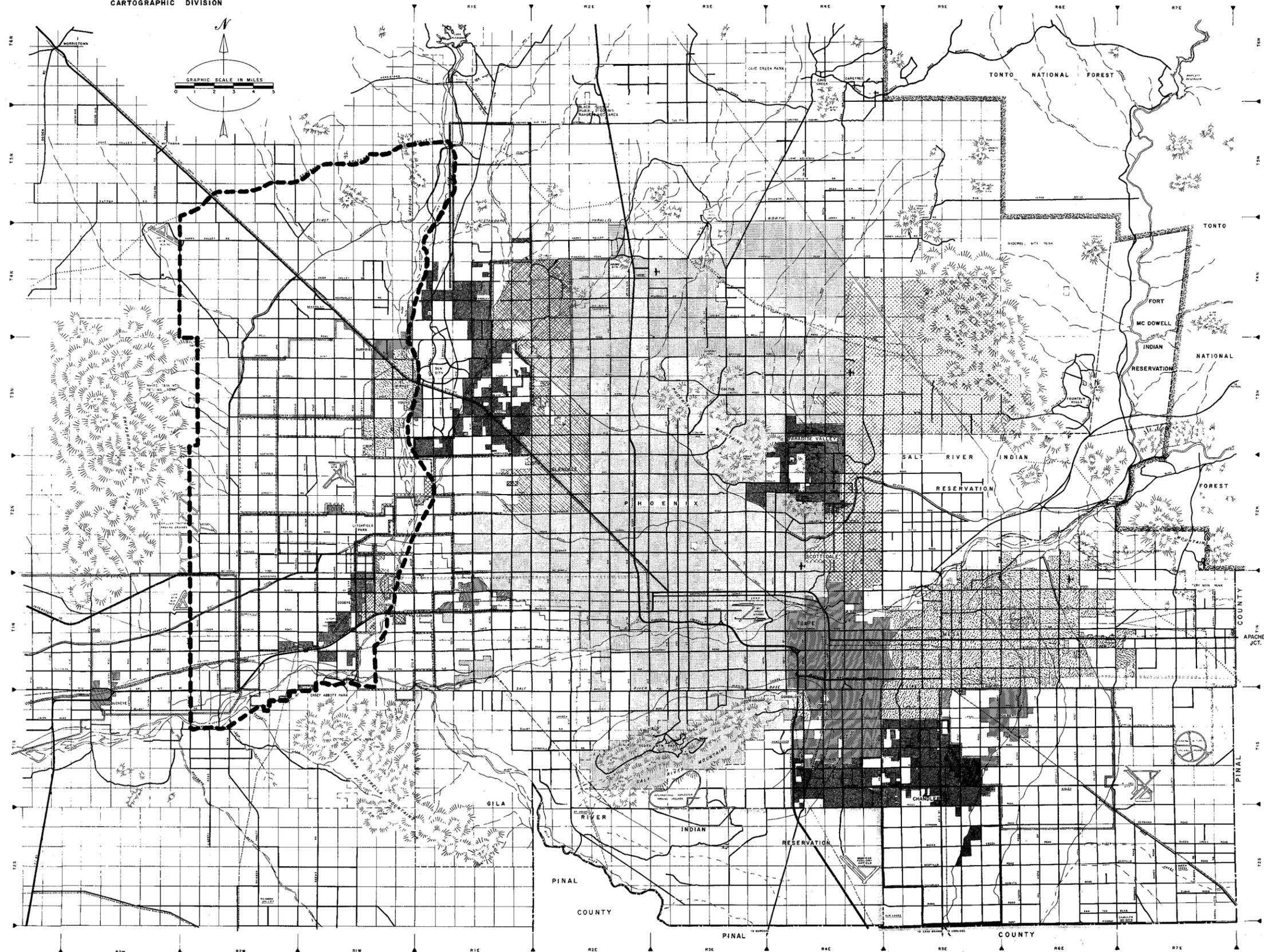
Part III: Land Use and Development provides data on land ownership, existing land use, zoning, housing, subdivisions, the plans of cities and towns, and approved large scale developments.

Part IV: Transportation addresses all aspects of the transportation system including streets and highways, bus service, rail service, and public airports.

Part V: Public Services and Facilities, contains information on local utilities, water service, wastewater treatment, solid waste disposal, emergency services, public schools, and outdoor recreation.

CENTRAL MARICOPA COUNTY

PREPARED BY THE
MARICOPA COUNTY PLANNING DEPARTMENT
CARTOGRAPHIC DIVISION



----- WHITE TANKS-AGUA FRIA STUDY AREA

GENERAL LOCATION MAP

MAP I

**E
N
V
I
R
O
N
M
E
N
T**

I. CLIMATE

The semi-arid climate of Maricopa County is characterized by low annual rainfall and low relative humidity. Daytime temperatures are extreme throughout the summer months. The winters are mild and sunny, although nighttime temperatures may drop below freezing during the coldest months. Gentle winds prevail, however, summer thunderstorm activity may be intense.

Sunshine

The State of Arizona receives more sunshine than any other part of the United States (ASU, 1978, p. 34). The Phoenix area is seldom affected by persistent cloud cover. On the average, it receives over 80% of the possible annual sunshine. The minimum monthly average is 77% in December and the maximum is 94% in June (U.S.D.A., Soil Conservation Service, 1977a).

Temperature

Average monthly temperature extremes recorded at the Litchfield Park weather station are shown in Figure 1-1. Daily maximum and minimum temperatures within the study area can differ as much as 40° Fahrenheit (F).

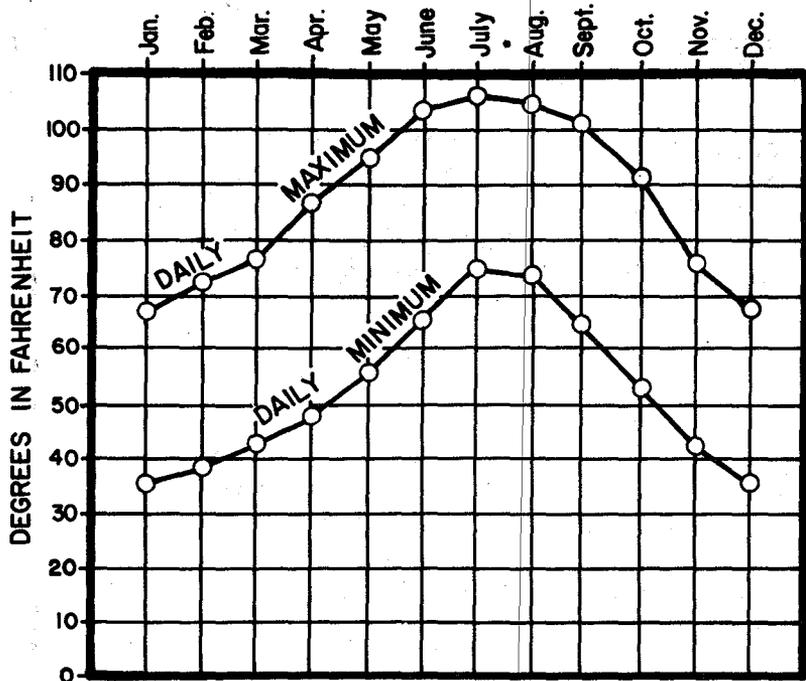
Daytime temperatures reach or exceed 90° F about 180 days each year. From early June until mid-September the average daily maximum temperature exceeds 100° F and temperatures above 110° F are not uncommon. Average nighttime lows during the summer range from the mid 60's to the mid 70's, but temperatures frequently remain above 80° F. The warmest month is typically July.

From November through March the average daily maximum temperatures range from the high 70's to the high 60's, although temperatures above 80° F do occur. During the winter months the average nighttime lows range from the mid 30's to the mid 40's. Minimum temperatures of 32° F or below occur an average of 28 days each year. Temperatures below zero have never been recorded. The coldest months are usually December and January.

Precipitation

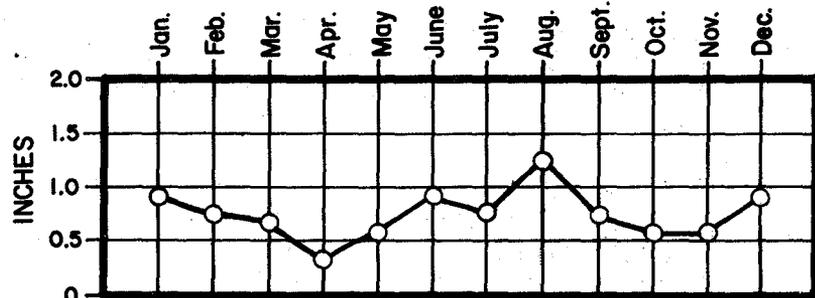
Precipitation within the study area averages 7 to 8 inches annually, although as in all desert climates this amount is highly variable. Since 1919, annual precipitation at the Litchfield Park Weather Station has ranged from less than 3 inches to over 18 inches (See Figure 1-2).

FIGURE I-1
SUMMARY OF CLIMATE



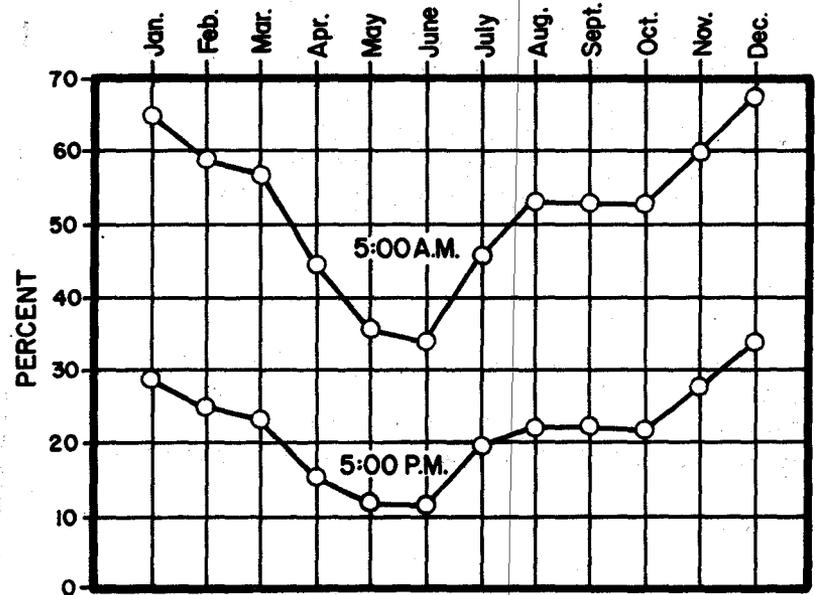
TEMPERATURE

LITCHFIELD PARK WEATHER STATION MEANS, 1951-1973.



PRECIPITATION

LITCHFIELD PARK WEATHER STATION MEANS, 1951-1973.

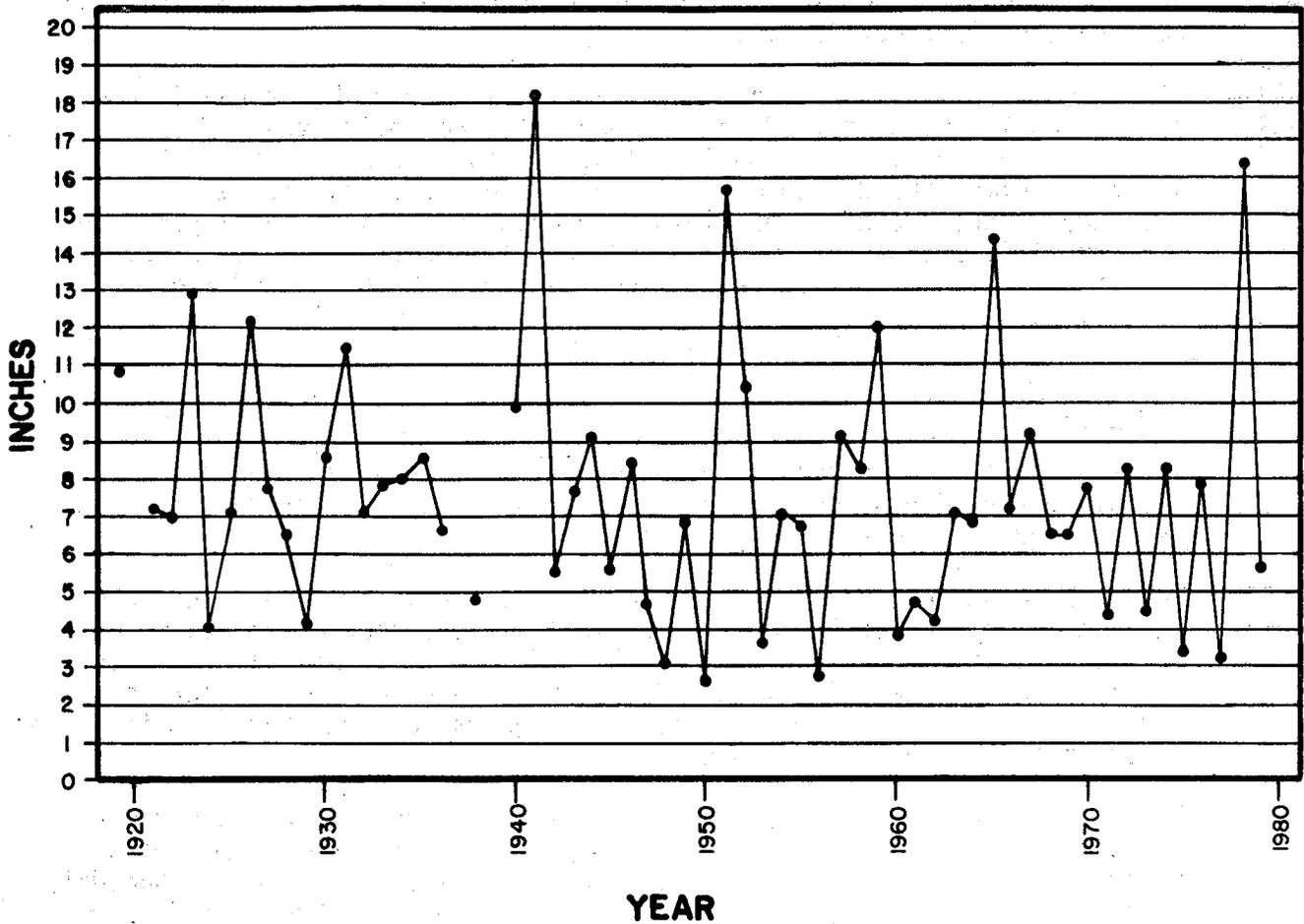


HUMIDITY

SKY HARBOR INTERNATIONAL AIRPORT MEANS, 1954-1970.

SOURCE: Maricopa County Planning Department, 1978.

FIGURE 1-2
ANNUAL PRECIPITATION — LITCHFIELD PARK, ARIZONA
1919-1979



SOURCE: National Oceanic and Atmospheric Administration, December 1979.

As shown by Figure 1-1, the majority of precipitation occurs within two definable seasons. The first occurs from November to March when the area is subjected to winter storms from the Pacific Ocean. During the winter months, meteorological conditions may cause cloudy skies and intermittent showers to prevail for several days. At other times, the area may have little precipitation until spring. Snowfall is rare, but light falls do occasionally occur in the mountains above 2,500 feet (U.S.D.A., Soil Conservation Service, 1977a).

The second precipitation period occurs in July, August, and September when the area experiences thunderstorms associated with moist air moving into Arizona from the Gulf of Mexico or the Gulf of California. Storms usually occur between 8 p.m. and midnight and are extremely variable in their intensity and location. These storms often produce substantial amounts of rainfall in short periods of time. On the average, August has more precipitation than any other month of the year (U.S.D.A; Soil Conservation Service, 1977a).

Winter storms exert their maximum influence in the higher elevations of the regional watersheds. When combined with snow melt, they often create the potential for flooding along the Agua Fria and Salt-Gila Rivers. Summer thunderstorms often result in localized drainage problems due to the amount of precipitation which falls in a short period of time. The impact of any storm depends on its duration, location, and the condition of the watershed (See Chapter V. Drainage and Flood Control).

Humidity

Relative humidity fluctuates throughout the day in a cyclical manner. The highest readings occur around sunrise while the lowest readings are recorded during the early evening hours.

Maricopa County enjoys a low average relative humidity. Readings taken at Phoenix Sky Harbor Airport, which is located approximately 20 miles east of the study area, are presented in Figure 1-1. At this location the maximum average relative humidity ranges from 58% in December to about 35% in May and June. Minimum readings range from about 34% in December to 12% in May and June.

Relative humidity is highest during the winter months when lower temperatures prevail. It drops considerably during the warm dry months of March, April, May, and June. Summer rains increase the relative humidity during July and August, but it is still lower than the December-January period. The relative humidity remains somewhat constant from August to October then increases as the cooler and wetter winter season begins.

Wind

Local windflows in Central Maricopa County are controlled by the daily heating and cooling of the earth's surface. As the sun rises, east facing mountain slopes are heated causing the air to rise. In turn, south facing and west-facing slopes become heated and change the direction of air flow throughout the day. The slopes cool after sunset causing the air in contact with them to become more dense and flow downhill.

Within the study area the daily "mountain-valley wind shift" is controlled by the orientation of local slopes. Usually, wind direction alternates between north and south along the Agua Fria River Valley. The wind blows toward the west and south at night and in the early morning hours, and up the valley toward the north and east during the daylight hours. Regional alterations in wind flows result from the low pressure systems which cross the state in the winter and spring months, and from thunderstorms during the summer season (Arizona State University, Office of State Climatologist, 1978).

Light winds prevail throughout the central Maricopa County region averaging $6\frac{1}{2}$ miles per hour annually at Sky Harbor Airport in Phoenix. The highest daytime velocities are normally reported in the spring while the strongest nighttime winds occur in midsummer. Peak gusts seldom exceed 50 miles per hour. The strong gusting winds which frequently precede summer thunderstorms are often accompanied by blowing dust (National Oceanic and Atmospheric Administration, 1979).

"Dust devils" or "thermals" are common throughout the area especially during the late spring and summer months when they form readily over the hot desert floor. These "miniature tornadoes" are the result of localized differential heating. Although normally harmless spires of dust, some do become developed enough to cause minor damage.

Wind damage in central Maricopa County is slight compared to that found in the tornado and hurricane belts in the midwest, east, and southeastern portions of the United States. Although tornadoes and damaging windstorms have occurred, this is not considered a high risk area.

II. TOPOGRAPHY

Elevation

The majority of the White Tanks-Agua Fria area is located on a wide, essentially flat desert valley plain that is partially bordered on three sides by mountain ranges. These rise somewhat abruptly from the adjacent landscape to form a distinct horizon. To the north, the southern extremities of the Hieroglyphic Mountains rise to an elevation of over 2,000 feet above sea level. The White Tank Mountains peak at approximately 4,000 feet on the west. The Sierra Estrella Mountains extend to over 4,500 feet to the southeast.

Elevations within the study area range from approximately 900 feet near the Gila River to over 1,500 feet near the Central Arizona Project aqueduct. This gentle rise in elevation generally occurs in a north, northwest direction (See Map 2).

Major variations from the characteristics of a flat desert plain occur at the following general locations:

- 1) south of the Gila River where the Sierra Estrella Mountains extend into the study area;
- 2) west of the Beardsley Canal where the alluvial fan of the White Tank Mountains begins;
- 3) south and east of Luke Air Force Base where alluvial hills are present; and
- 4) in the northern part of the study area where Bunker Peak and other extremities of the Hieroglyphic Mountains extend into the study area.

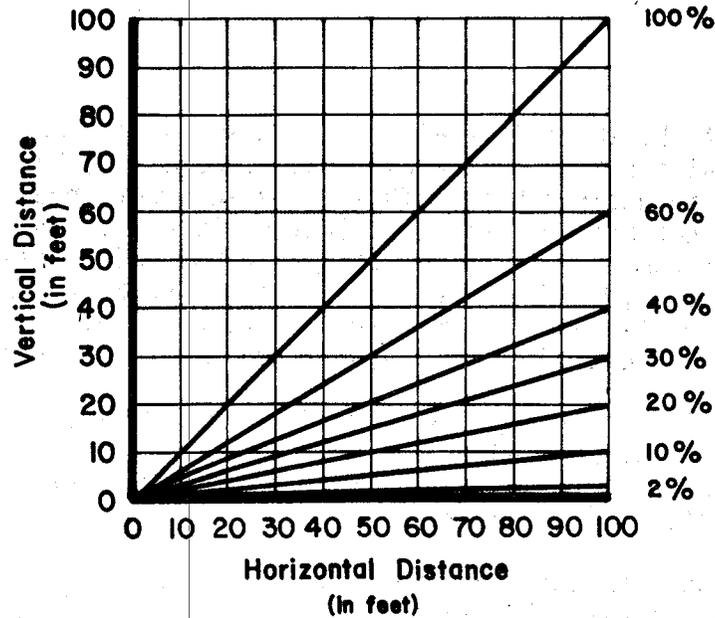
Slope

Slope is a percentage measurement which defines the relative significance of changes in elevation. The formula for determining slope is as follows:

$$\text{Average Slope} = \frac{\text{Change In Elevation (feet)}}{\text{Horizontal Distance (feet)}} \times 100$$

A slope of one percent is the equivalent of one foot change in elevation within a horizontal distance of one hundred feet. A slope of ten percent indicates a ten foot change in elevation within one hundred feet. Figure 1-3 shows a graphic comparison of various slopes.

FIGURE 1-3
SLOPE COMPARISONS



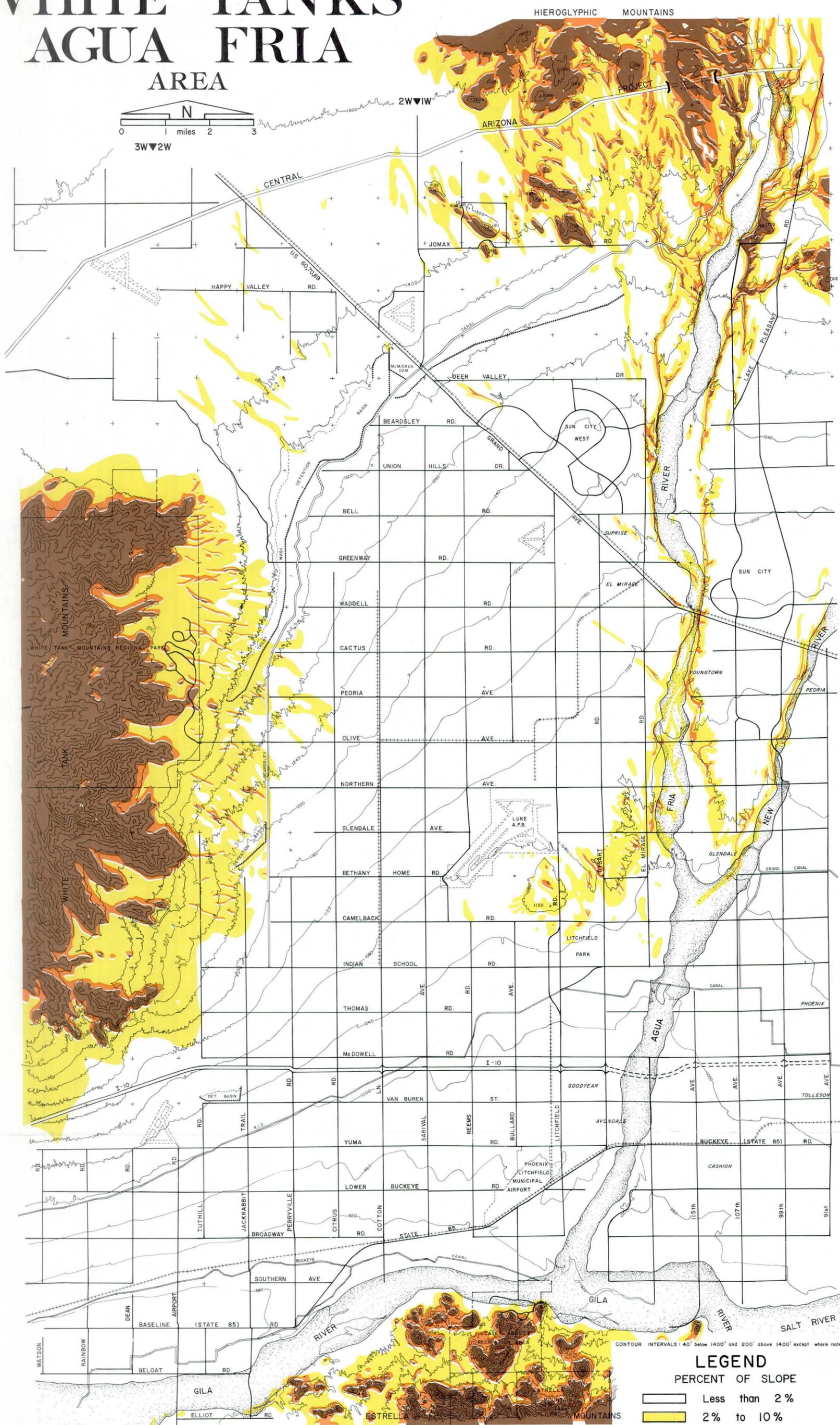
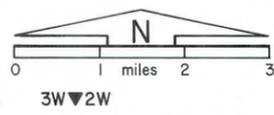
As shown by Map 2, the majority of the White Tanks-Agua Fria area has a slope of less than two percent (2%). This nearly level landscape poses few limitations to urban or agricultural development when appropriate soil and drainage conditions exist and the land is not located in a floodplain.

Gentle Slopes: Areas with a slope of two percent (2%) to ten percent (10%) can usually be developed for residential use and some types of commercial and industrial use. Land in the upper range of this slope category may require careful site planning to be effectively used.

Moderate Slopes: Sites within the ten percent (10%) to twenty percent (20%) slope category are often suited to low density residential development if ample consideration is given to site planning and the installation of necessary utilities and facilities. While limited-area commercial and multi-family residential uses may be feasible in the lower range of this category, increasing problems in the upper range generally preclude their development.

Steep Slopes: Severe economic, environmental, and engineering constraints occur when slopes exceed 20%. They become more significant as the slope increases. Important factors which require special site planning, design, and construction include the lack of suitable building sites, relative steepness of the sites, access limitations, thin soils, drainage and erosion problems, potential rock falls, proximity of bedrock to the surface, and in some cases the possibility of soil creep. While areas in the lower range of this slope category may be suitable for low density single family residential development, site limitations often preclude all but open spaces uses on the steeper slopes.

WHITE TANKS AGUA FRIA AREA



LEGEND
PERCENT OF SLOPE

[White box]	Less than 2%
[Yellow box]	2% to 10%
[Orange box]	10% to 20%
[Brown box]	Greater than 20%

CONTOUR INTERVALS: 40' below 1400' and 200' above 1400' except where noted.

SOURCE: Maricopa County Planning Department, 1975

GENERALIZED SLOPE

III. GEOLOGY

Geologic History

The White Tanks-Agua Fria area lies within the Sonoran Desert region of the Basin and Range physiographic province. This region is characterized by wide, essentially flat, alluvium filled valleys surrounded by rugged low relief mountain ranges.

These characteristics are the result of a complex geologic history. The most recent event of significance was the "Laramide Revolution" which began over 63 million years ago and continued until approximately one million years ago. During this period, stresses within the earth resulted in the widespread warping, folding, and faulting of the land surface as well as uplifting, subsidence, and intrusive and extrusive igneous activity. Deep basins surrounded by block faulted mountains were the result.

Since the end of Laramide activity, the geologic development of the region has been dominated by erosion and sedimentation as the basins have filled with alluvial deposits. The thickness, vertical sequence, and lateral variation of these deposits has been determined by the intermittent uplift, subsidence, and volcanic activity which has occurred within the last million years, and by changing drainage patterns. Today, the Basin and Range Province is relatively stable in terms of overt geologic activity although the process of erosion and sedimentation continues (USDI, Bureau of Reclamation, 1977).

General Geology

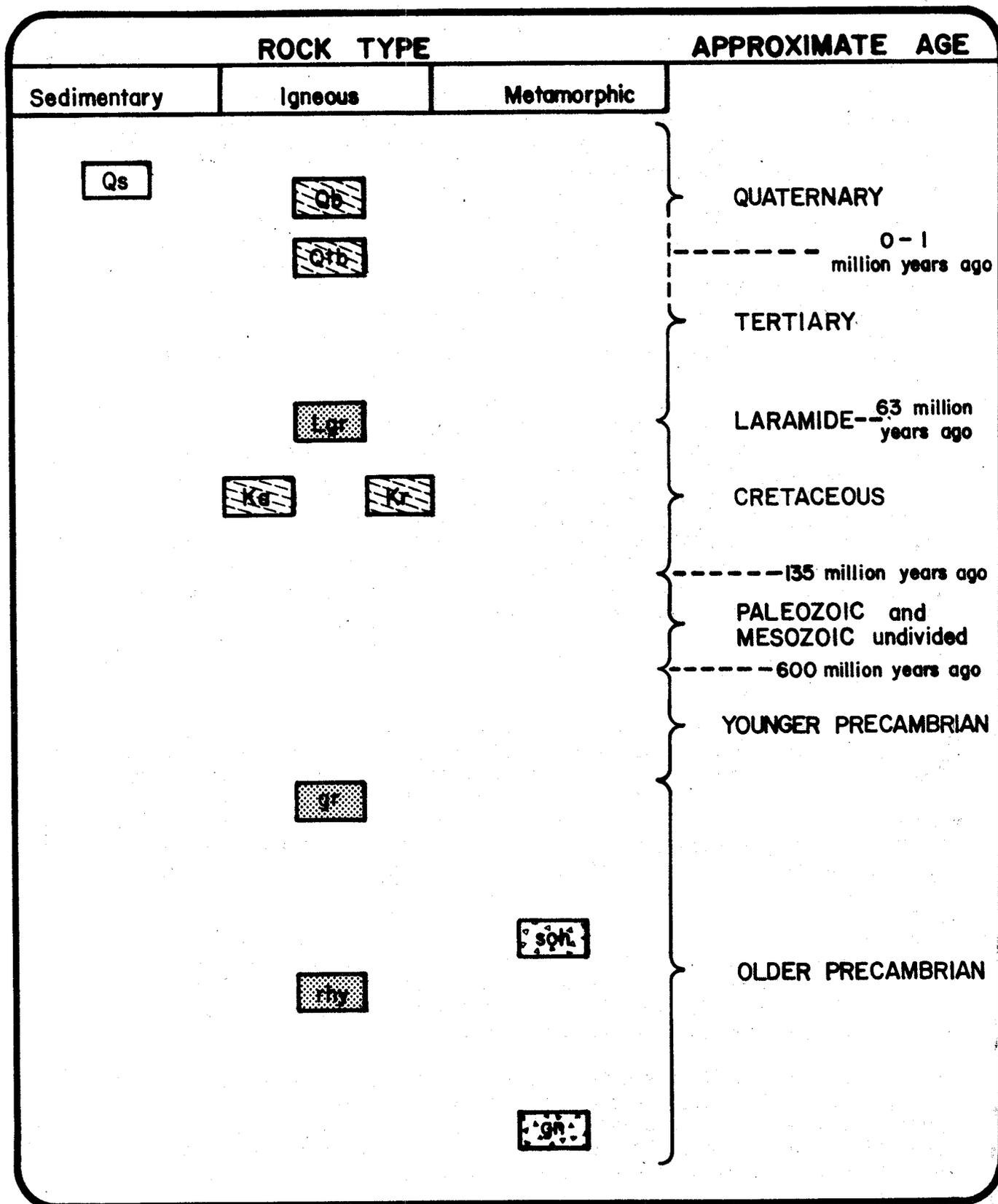
The White Tanks-Agua Fria area is situated on a broad alluvium filled valley that is partially surrounded on three sides by highland bedrock. (See Map 3). The basin continues to the east as part of the Salt River Valley. The alluvial deposits range in depth from a few feet near the mountains to over 1,200 feet in the majority of the basin. Their maximum depth is unknown, but in the deeper part of the basin in Township 2N, Range 1W these deposits are estimated to be 10,000 to 15,000 feet thick (USDI, Bureau of Reclamation, 1977).

The mountain ranges surrounding the area are primarily composed of consolidated igneous and metamorphic rocks. These include gneiss, granite, schist, rhyolite, basalt, and andesite (see Map 3). The basement complex that underlies the basin is probably composed of rocks similar to those which form the mountains.

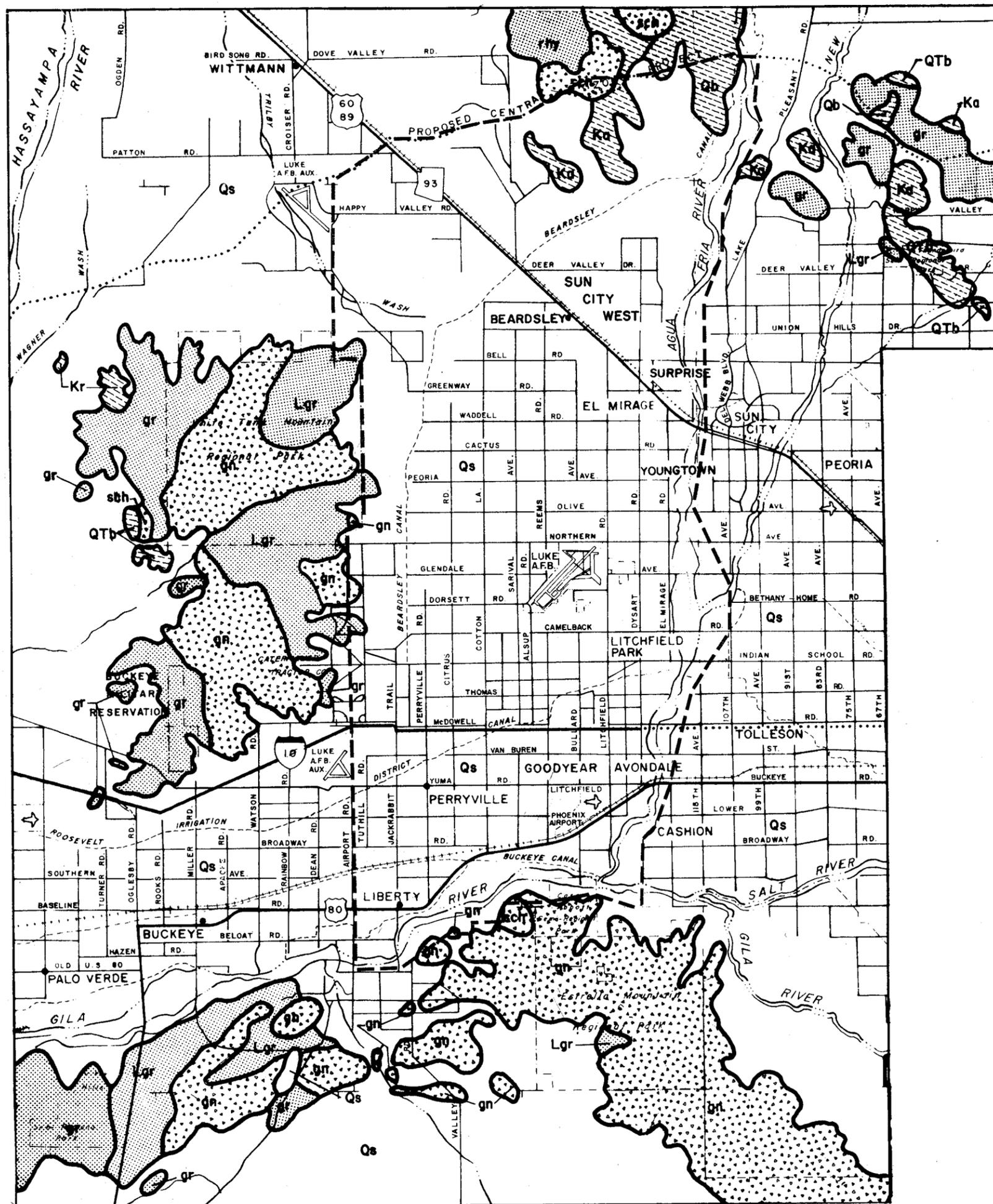
The alluvium which fills the basin consists of heterogeneous deposits of clay, sand, silt, gravel, and boulders which were derived from the surrounding bedrock. In general, these deposits are coarser near the mountains than in the central part of the basin. Significant deposits of evaporites are also present as well as caliche (USDI, Bureau of Reclamation, 1977).

FIGURE I-4

GEOLOGIC TIME SCALE



SOURCE: University of Arizona, Arizona Bureau of Mines, 1957.
Flawn, 1976.



LEGEND

IGNEOUS ROCKS

-  A. Extrusive - rocks from volcanoes and surface lava flows
 - Qb Basaltic flows, agglomerate, tuffs and cinders distinguished from older basalts by recognizable cinder cones, calderas, and other geomorphic evidence of youth
 - QTb Basaltic flows, agglomerate, tuff, and cinders
 - Ka Predominantly andesitic flows and tuffs
 - Kr Predominantly rhyolitic flows and tuffs
-  B. Intrusive - rocks from underground lava movements
 - Lgr Granite and related crystalline rocks such as quartz monzonite, grandiorite, quartz diorite, and some porphyry equivalents of these rocks.
 - rhy Rhyolite--Mainly flows and intrusive material, includes minor amounts of agglomerate and breccia.
 - gr Granite, and related crystalline rocks such as quartz monzonite, grandiorite, and quartz diorite.

SEDIMENTARY DEPOSITS

-  Qs Alluvial gravel, sand, and silt in flood plains, terraces, fans, and pediment cappings

METAMORPHOSED SEDIMENTARY AND VOLCANIC ROCKS

-  sch Yavapi series schist
- gn Granite gneiss

SOURCE: University of Arizona, Arizona Bureau of Mines, 1957.
 U.S.D.I., Geological Survey, 1969.

For additional information on subsurface geology see Chapter VI Ground-water Resources.

Significant Mineral Resources

MINERAL CONSTRUCTION MATERIALS

Sand and gravel deposits are present throughout the study area. They vary considerably, however, in quality and physical characteristics. Those with the greatest potential for use as construction materials are found in and along the stream beds of the Agua Fria and Gila Rivers (Moore and Varga, 1976). The deposits in these riverbeds offer a long term resource of importance to the entire Phoenix metropolitan region.

Most of the extraction and processing of sand and gravel within the study area to date has taken place along the Agua Fria River. The demand for continued access to these resources can be anticipated in the future.

Much of the study area south and east of the Beardsley Canal has excellent potential as a source of adobe materials. (Moore and Varga, 1976). No large-scale adobe processing operations exist at this time. However, one small brick making operation was identified during the land use survey of the area.

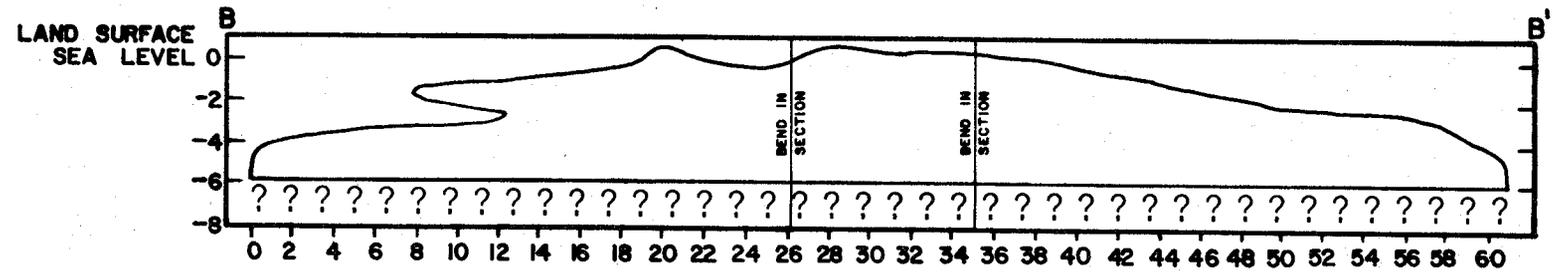
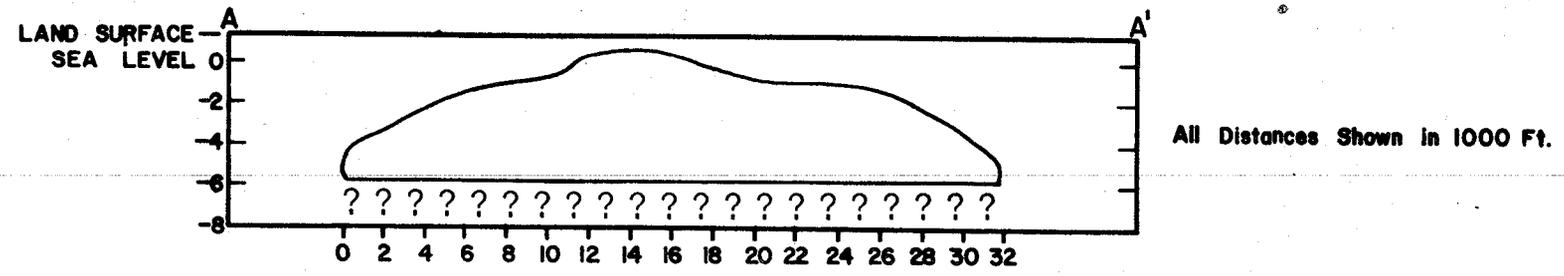
THE LUKE SALT BODY

A major body of salt, which is estimated to contain between 15 and 30 cubic miles of halite (rock salt), lies beneath the study area just south and east of Luke Air Force Base. While the origin of this deposit is unknown, it may be the result of a long standing saline lake which was formed millions of years ago. Its presence was confirmed by an exploratory well drilled in 1968 by the Arizona Salt Company and El Paso Natural Gas Company in Section 2 of Township 2 North, Range 1 West.

The salt body appears to have a bow shaped crest and a broad triangular base. The crest is marked by several local domes which have bowed and compacted the overlying sedimentary deposits. The low hills southeast of Luke Air Force Base are believed to be associated with the structural highs of the salt body which are within 1,000 feet of the land surface. Geophysical studies indicate that this deposit may extend to a depth of at least 6,900 feet and perhaps to as much as 9,000 feet (Eaton, Peterson, and Schumann, 1972).

Figure 1-5 shows a hypothetical model of the Salt Body. This corresponds to Map 4 which identifies the general location of the deposit. The model ignores the layer of anhydrite which caps the top of the salt body in some places.

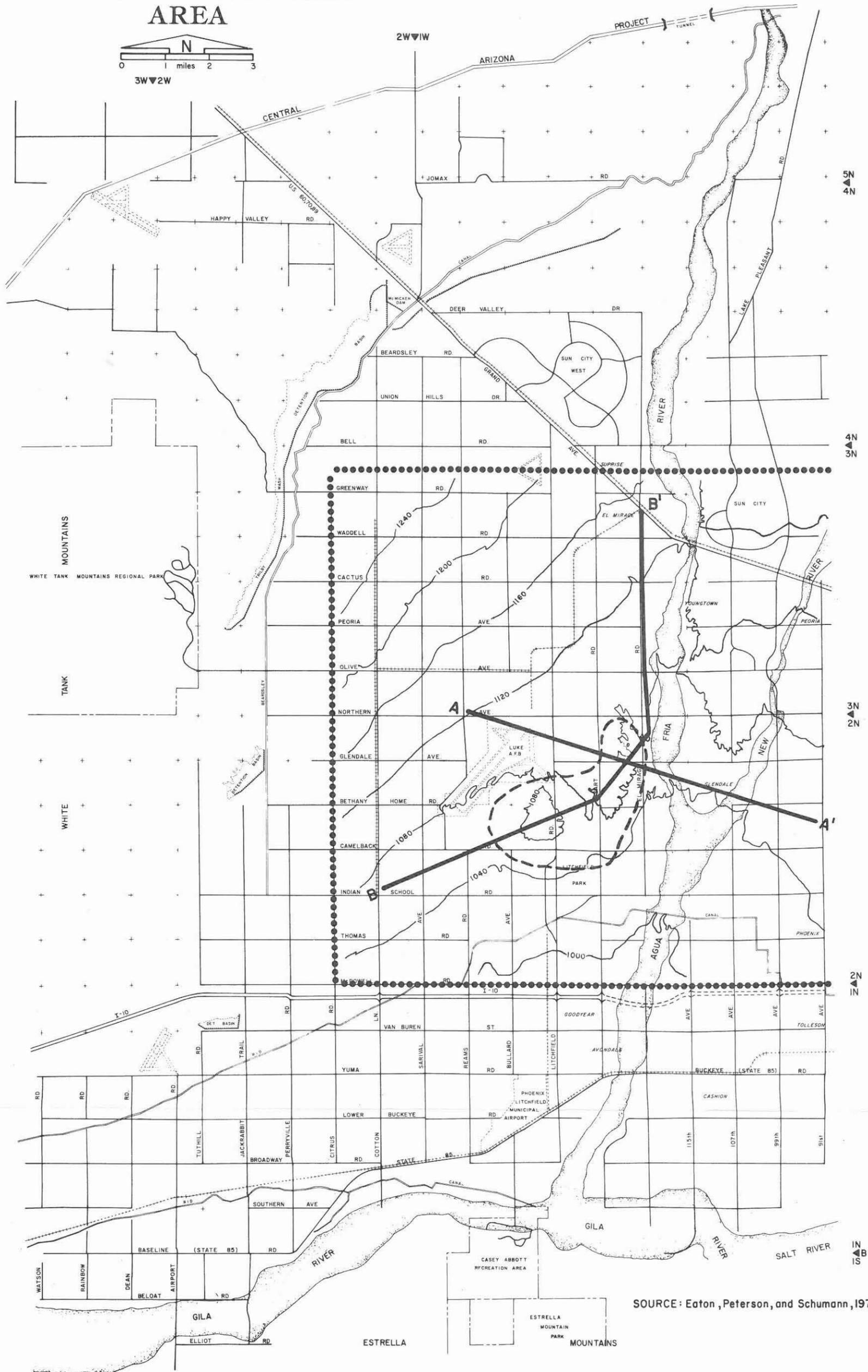
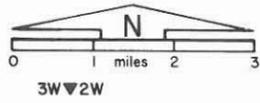
FIGURE I-5
HYPOTHETICAL MODEL OF THE LUKE SALT BODY



SOURCE : Eaton , Peterson , and Schumann , 1972.

WHITE TANKS AGUA FRIA AREA

M I W I E
HIEROGLYPHIC MOUNTAINS



SOURCE: Eaton, Peterson, and Schumann, 1972.

L
U
K
E

A ————— A'
MODEL CROSS SECTIONS
B ————— B'

APPROXIMATE BOUNDARY
OF THE UPPER 1000 FT.
OF THE SALT BODY

LUKE SALT BODY

MAP 4

Although the salt body does not generally yield water, it has a significant effect on the salinity of groundwater in the area and an indirect effect on the permeability of the alluvial fill as discussed in Chapter VI. The earth fissures near this area are probably related to the salt body and indicate that adjustments to the land surface are still occurring. Land subsidence and earth fissures are discussed in the next section of this chapter.

Salt from this deposit has been mined exclusively by the Southwest Salt Company since the late 1960's. The cattle feeding and water softening industries are major markets for the processed salt. The mining process involves pumping fresh water into the salt, then pumping the resulting brine to the surface where it is extracted from solar evaporation ponds. The subsurface caverns which result are used by the Cal Gas Company for storing propane gas.

LAND SUBSIDENCE AND EARTH FISSURES

Land subsidence has been identified in a number of areas in south central Arizona since about 1940. Most of this subsidence is associated with intensive ground water pumping (see Chapter VI Water Resources). Subsidence occurs when porous alluvial deposits are dewatered and the weight of the overlying material compresses the voids remaining between particles. Upon compression, alluvial deposits take up less space than before and the ground surface sinks.

The portion of the White Tanks-Agua Fria area known to be affected by land subsidence is shown on Map 5. The amount of subsidence is poorly documented. As of 1968, up to three feet was recorded in this area. This computes to an average rate of .01 foot of subsidence per foot of water level decline (Arizona Water Commission, 1978).

Earth fissures usually accompany land subsidence. The first indication of a fissure may be a hairline crack, a faint linear depression several feet long, or a series of holes. These intercept surface runoff and erode to form gullylike formations as water and eroded material travels downward. Usually, secondary gullies then erode the upslope side of fissure gullies causing them to widen. Fissures commonly are more than 1,000 feet long, 10 feet wide, and ten feet deep (Laney, 1978).

Earth fissures are actually tension cracks resulting from differential subsidence. They are commonly found along the edge of the subsiding area or paralleling major differences in the regional basin structure. In some cases, they may reflect the buried Basin and Range fault scarps (USDI, Bureau of Reclamation, 1977). The location of earth fissures identified in the White Tanks-Agua Fria area prior to 1977 are shown on Map 5.

Land subsidence and earth fissures are a cause for concern. When subsidence occurs the ground water storage capacity of the underlying alluvial deposits declines as the pore space in the alluvium is reduced. Subsidence also changes the slope of the land surface which affects irrigation systems, flood control projects, and local drainage patterns. Subsidence can also cause well casings to fracture or protrude from the land surface and damage surface structures. The primary hazard, however, is from earth fissures. Earth fissures have damaged highways, railroads, utilities, irrigation systems, sewage disposal facilities, farmland, recreational facilities, and private residential units in Arizona (Laney, 1978).

Damage to wells from earth fissures in the vicinity of the Luke Salt Body has already been documented. (Eaton, Peterson, and Schumann, 1972). Land subsidence and the accompanying earth fissure phenomenon will probably occur in the White Tanks-Agua Fria area as long as groundwater overdraft continues. The potential for increased damage in any expanding urban area is high since earth fissures may occur in previously unnoticed areas. At this time there is no way to predict exactly where or when they will occur (Laney, 1978).

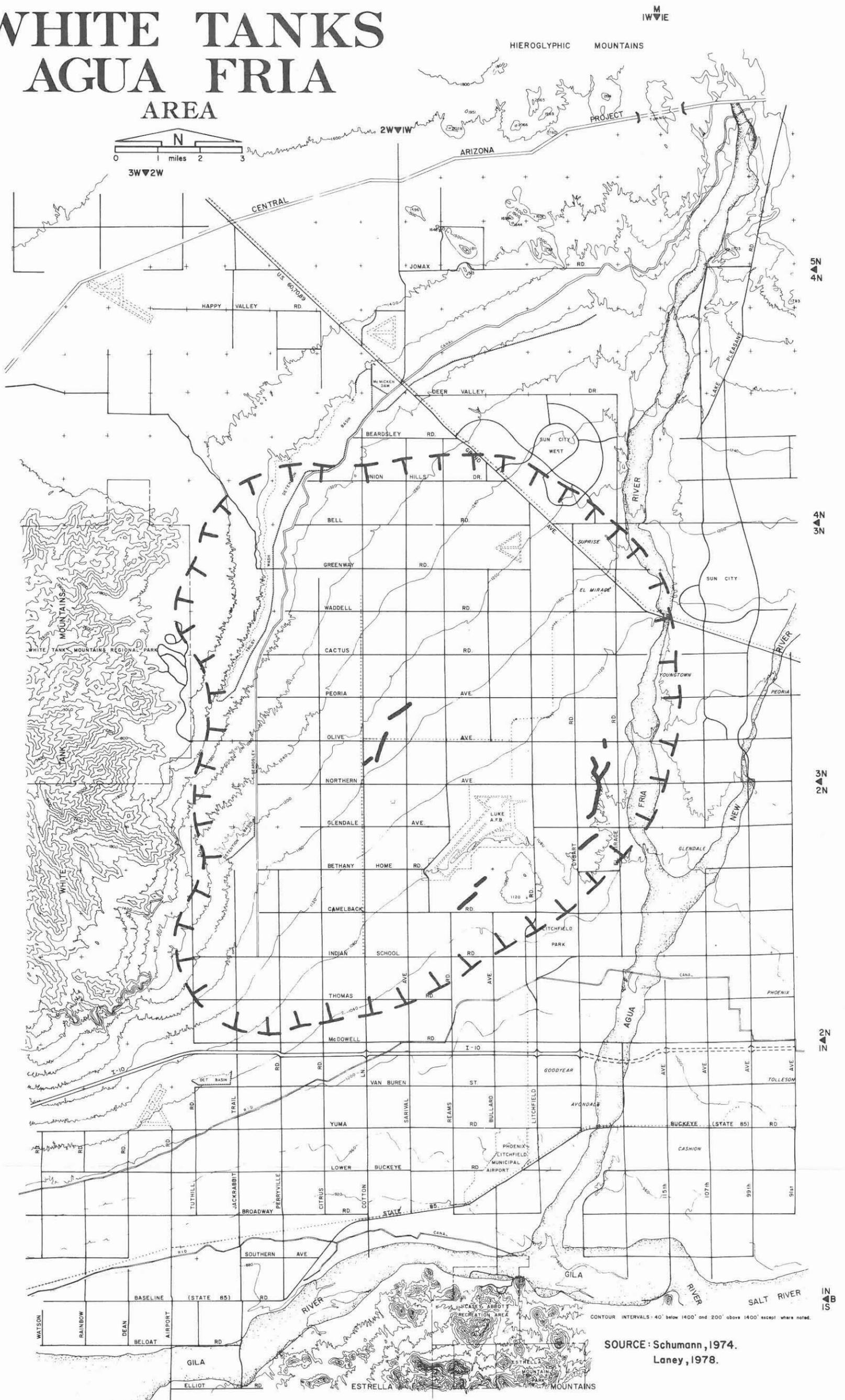
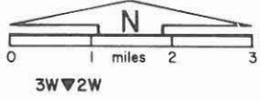
Earthquakes

Earthquakes occur when a sudden rupture in the earth's crust sends rock surfaces grinding past each other along a fault zone. The resulting shock waves are transmitted in all directions. The intensity of shaking at the earth's surface is dependant upon the extent of the break, the type of material through which the shock waves travel, and the distance from the source of the break. Damage can result not only from the initial shaking, but also from earthquake induced phenomenon such as rock falls on steep slopes, earth fissures in alluvium, and groundwater disturbances (University of Arizona, Arizona Bureau of Geology and Mineral Technology, 1979).

Maricopa County, Arizona is classified as Zone 2 on the seismic risk map used in the Uniform Building Code. (See Map 6). This map is based on the seismic history of the United States and known geologic conditions in Arizona. Within Zone 2, the potential exists for moderate damage from a major earthquake. Structural damage might be widespread, but it would be considerable only in poorly built or designed structures (International Conference of Building Officials, 1979, p. 145).

During the past century a few damaging earthquakes have occurred in Arizona near Flagstaff, Prescott, and Yuma. No record exists of earthquakes in central Maricopa County although the shock waves of earthquakes outside of this region have been felt. Among the most severe quakes on record is one which occurred in Sonora Mexico in 1887. This quake shook at least a 720,000 square mile area and affected most of Arizona to some extent. As a result of this quake, secondary rock falls were reported in the Sierra Estrella Mountains south-southeast of the study area (University of Arizona, Arizona Bureau of Geology and Mineral Technology, 1979).

WHITE TANKS AGUA FRIA AREA



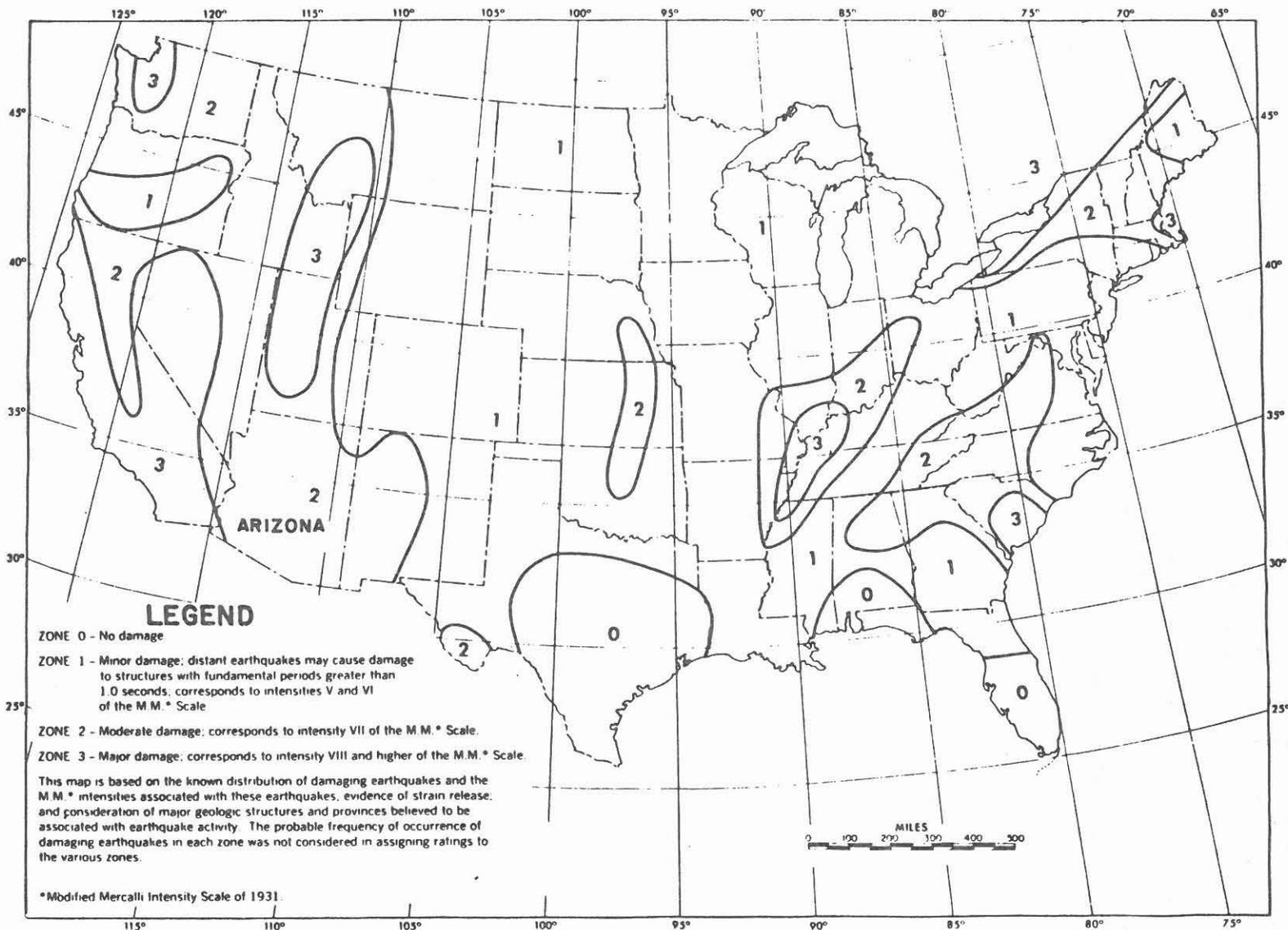
SOURCE: Schumann, 1974.
Laney, 1978.



LAND SUBSIDENCE AREA



EARTH FISSURES



SOURCE: Uniform Building Code, 1979.

SEISMIC RISK

MAP 6

The geologic map of Arizona shows no surface faults in the central Maricopa County area (Arizona Bureau of Mines and U.S. Geological Survey, 1969). Since the majority of earthquakes which have occurred in the Basin and Range province have been associated with known faults, this region appears to be relatively stable. Within the White Tanks-Agua Fria area, any visible evidence of fault lines has long been obscured by the process of erosion and sedimentation. A number of potential faults have been inferred from geophysical studies. However, no evidence exists to suggest they have been active in recent history (USDI, Bureau of Reclamation, 1977).

IV. SOILS

Soil forms in defineable layers called horizons. These differ in terms of mineral and organic content, thickness, and structural composition. Collectively, horizons make up the soil profile. The characteristics of the soil profile at any given location reflect the influence of the original parent material, climate, vegetation, topography, and time.

Soils Within The Area

The parent material for soils within the White Tanks-Agua Fria Area was derived from the surrounding highland bedrock. Over a period of centuries this bedrock has been weathered, transported by washes and streams, deposited, mixed with organic materials, and eroded in a never ending cycle of soil formation. A wide variety of metamorphic and igneous rocks make up this soil material as discussed in Chapter III Geology.

The topography of the area has influenced soil formation through its effect on erosion and deposition. Four primary land forms are characteristic of the study area: (1) mountains and buttes; (2) alluvial fans at the base of mountains; (3) valley plains; and (4) low stream terraces and floodplains located in or adjacent to stream channels. These landforms have influenced the number, thickness, and kind of soil horizons within the area as well as their lateral extent.

Soil associations found within the study area are shown on Map 7. A soil association represents a combination of different soils that occur in recognized repeating patterns. It does not show the specific type of soil at any particular location since soil depth, rock material, slope, and other characteristics often change quickly within the area. Soil associations do indicate broad patterns of soil development which are associated with major landforms.

The study area is characterized by loamy soils including sandy loams, clay loams, and gravelly loams. Those formed in recent alluvium range from a few hundred to a few thousand years old. Soils in stream channels and floodplains are the youngest and periodically receive fresh sediments. Soils formed in old alluvium may be up to several hundred thousand years old. Generally, where soils have formed in recent alluvium the older alluvium has either been eroded or covered by new deposits (Maricopa County Planning Department, 1977).

LEGEND

Soils Formed in Recent Alluvium

A

Gilman-Estrella-Avondale association: Nearly level loams and clay loams on valley plains and low stream terraces

B

Antho-Valencia association: Nearly level sandy loams on recent alluvial fans and valley plains

C

Carrizo-Brios association: Nearly level to gently sloping gravelly sandy loams and sandy loams in stream channels and on low stream terraces

Soils Formed in Old Alluvium

D

Rillito-Gunsight-Perryville association: Nearly level to moderately steep gravelly loams and loams on old alluvial fans and valley plains

E

Mohall-Laveen association: Nearly level loams and clay loams on old alluvial fans and valley plains

F

Laveen-Coolidge association: Nearly level sandy loams, loams, and clay loams on old alluvial fans and valley plains

G

Ebon-Pinamt-Tremant association: Nearly level to gently sloping gravelly loams, very cobbly loams, and gravelly clay loams on old alluvial fans at the base of mountains

H

Casa Grande-Harqua association: Nearly level to sloping, saline-alkali loams, sandy loams, and gravelly clay loams on valley plains

Soil of Mountains and Buttes

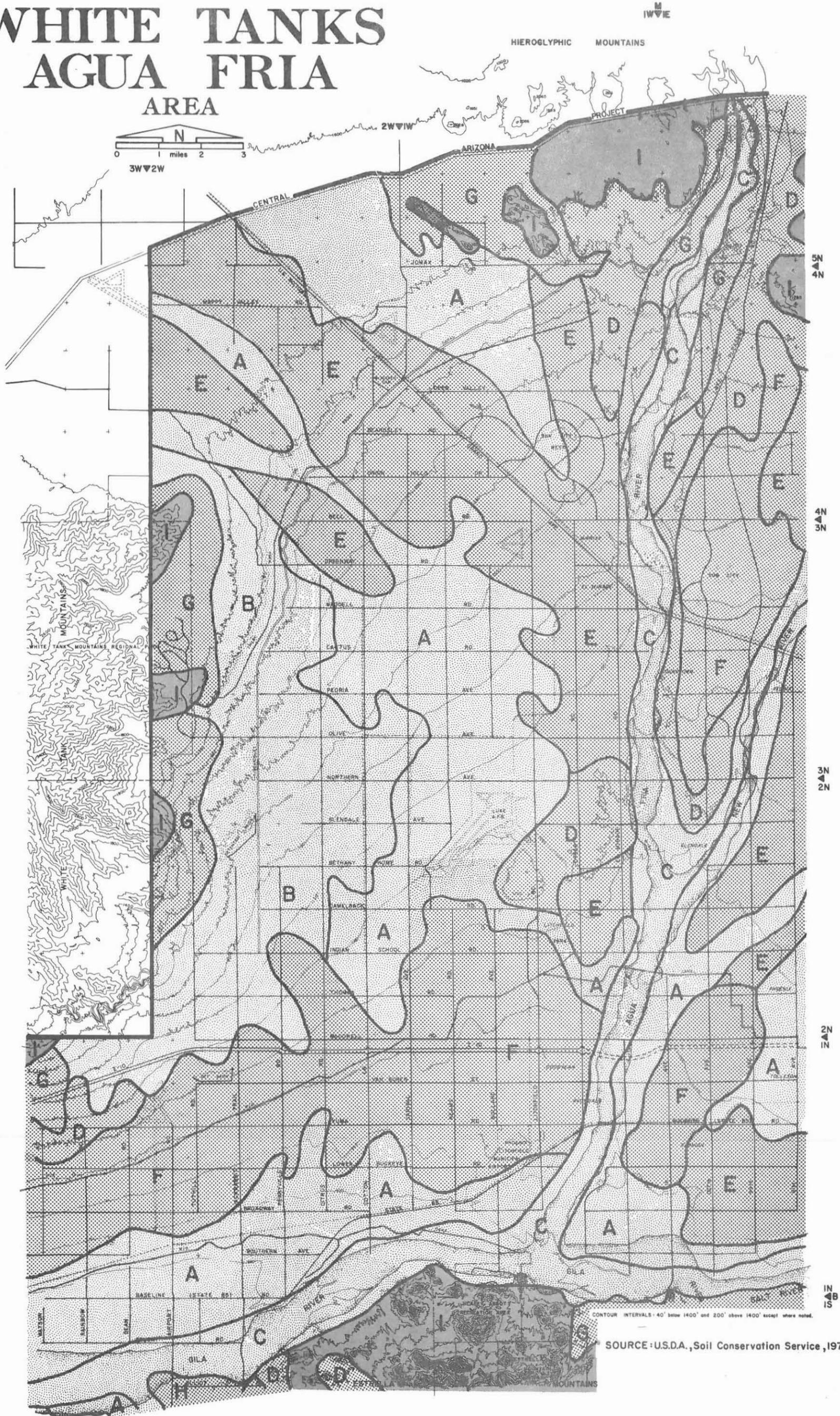
I

Cherioni-Rock outcrop association: Gently sloping to very steep very gravelly loams and Rock outcrop on mountains, buttes, and low hills

Source: USDA, Soil Conservation Service, 1977a.

WHITE TANKS AGUA FRIA

AREA



SEE LEGEND ABOVE

SOIL ASSOCIATIONS

MAP 7

Soil Limitations

The number of horizons in a soil profile, their thickness, the texture of each (relative amounts of stone, gravel, sand, silt, and clay), and other physical and chemical characteristics of soils allow their identification and classification. Certain properties of individual soil types influence their proper use and management. Important properties of soils include: permeability, compaction characteristics, shear strength, shrink swell potential, plasticity, salinity, susceptibility to erosion, corrosiveness, and amount and type of cementation.

The United States Department of Agriculture Soil Conservation Service (SCS) has classified and mapped soils throughout much of Maricopa County. By cross referencing soil use requirements with the properties of each soil, the SCS determined the potential limitations of individual soils for various types of land use. This information is often used by engineers, developers, farmers, and land use planners as a general guide to local soil conditions.

It is beyond the scope of this report to attempt to identify the suitability of soils within the White Tanks-Agua Fria area for all potential land uses. Instead, the limitations of local soils for septic tank absorption fields, dwelling unit construction, and irrigated agriculture were chosen to indicate general soil conditions within the area.

Portions of the study area which may pose constraints to the use of septic tanks and the construction of residential dwelling units are identified on Map 9. This map was developed by identifying the location of individual soils, grouping those with similar characteristics, and referencing the Soil Conservation Service interpretation of engineering properties for each group to determine potential limitations. Where soils were broadly defined the characteristics of the dominant soil are shown, but the area is noted to indicate that limitations may vary. Soils which could not be classified are identified as too variable to be rated.

The classifications of potential soil limitations shown on Map 9 are defined by the Soil Conservation Service as follows:

- Slight: Few or no limitations to use.
- Moderate: Limitations exist which reduce the desirability of the soil for the specified use. The cost of corrective measures and the need for careful planning, design, and management are important considerations.
- Severe: Properties or features are present which make these soils undesirable for the specified use. Limitations are serious enough that the cost of overcoming them may be too high to justify the intended use (USDA Soil Conservation Service, 1977a).

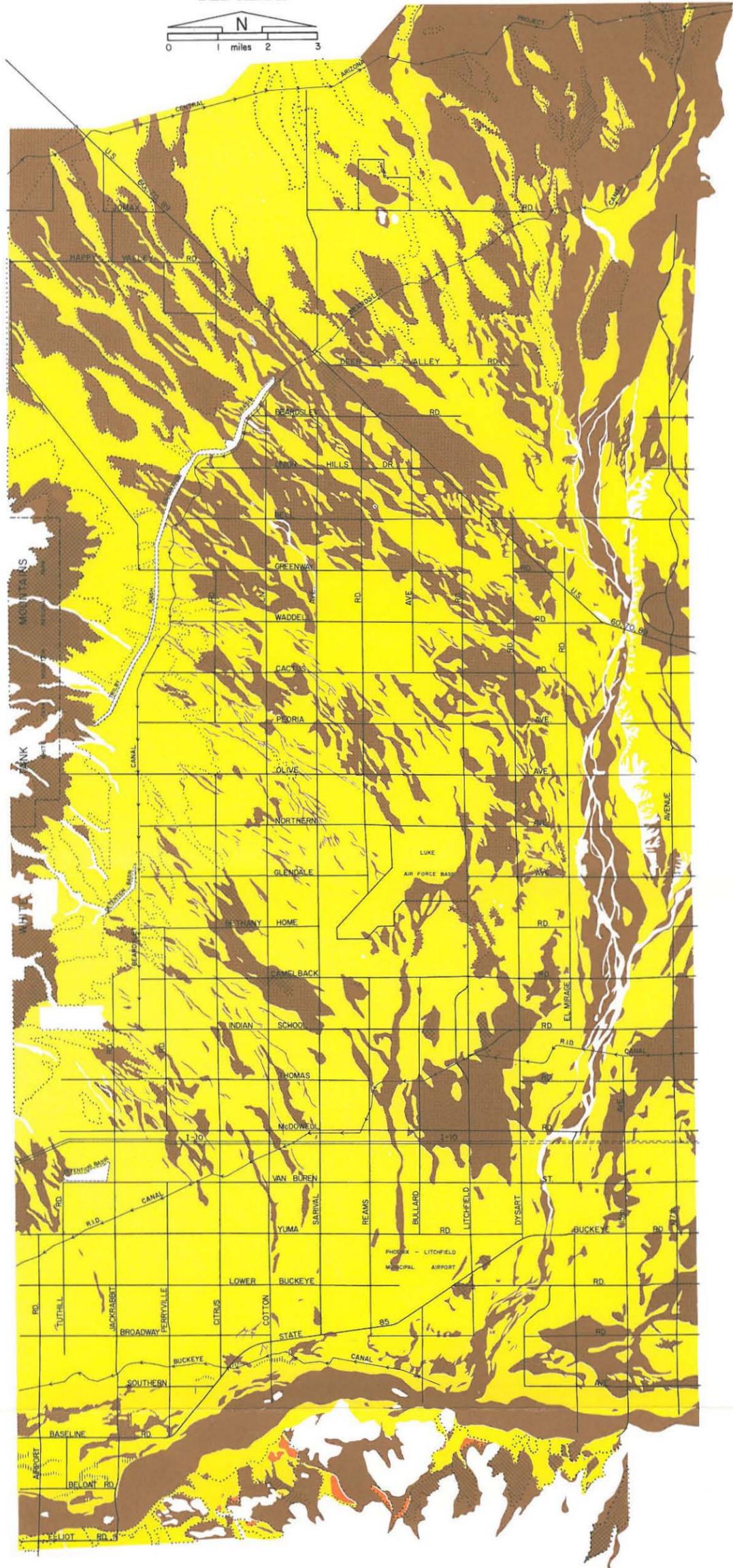
Impermeable soils, the presence of caliche, flooding hazards, shallow depths to bedrock, and significant slopes are the primary limitations to the use of septic tanks within the study area. Limitations to dwelling unit construction result from flooding hazards, shrink-swell potential, shallow depths to bedrock, steep slopes, and the presence of caliche deposits near the surface.

Map 9 is useful as a general guide to potential soil constraints within the area to a depth of 5 to 6 feet (U.S.D.A. Soil Conservation Service, 1977a). This information does not eliminate the need for on-site investigations prior to development since important soil properties may have been ignored due to the scale of mapping.

Most of the land used for agricultural purposes within the study area is classified as "Prime Farmland" by the Soil Conservation Service (USDA, Soil Conservation Service, 1977b). "Prime Farmland" is defined as land that is available for cropland or pastureland and is capable of economically producing sustained high crop yields when modern farming methods are used. Of course, crop suitability, crop yields, and irrigation requirements differ depending on local soil conditions and drainage characteristics (USDA, Soil Conservation Service, 1978).

Additional land within the study area might be suitable for cropland if an irrigation supply were available. However, rock outcrops, slopes in excess of 5%, and major drainageways would preclude much of the area from agricultural use even if a dependable water supply were available.

WHITE TANKS AGUA FRIA AREA



SOURCE: Prepared by the Maricopa County Department of Planning and Development from soil survey information provided by the United States Department of Agriculture, Soil Conservation Service, 1979.

LEGEND

CATEGORY

Degree of Limitations
slight
moderate
severe
unclassified

Septic Tank Absorption Fields





Dwellings without Basements





Note
Only the septic tank absorption field code is shown when soil limitations are the same for both categories.

..... Areas where soil limitations may be highly variable.

SOIL LIMITATIONS

V. DRAINAGE AND FLOOD CONTROL

Natural Drainage Characteristics

The majority of the study area drains in a south, southeasterly direction toward the Agua Fria and the Gila Rivers. An exception is the extreme southern part of the study area which drains northward to the Gila River.

Many small desert washes cross the study area north and west of the Beardsley canal and south of the Gila River (See Map 10). The natural drainage patterns in much of the rest of the area have been obscured or altered by urban development, irrigated farming, and flood control projects. Sheet flooding does not occur on a widespread basis due in part to the gentle slope of the land and the presence of farmland which allows the ponding and rapid infiltration of stormwater runoff.

The study area receives stormwater runoff from the surrounding region to the north as well as from the White Tank Mountains to the west. Trilby Wash, which enters the northwestern part of the study area, carries runoff from both the Hieroglyphic and Wickenburg Mountains as well as the north slopes of the White Tank Mountains. The extreme southern part of the study area drains a portion of the north slopes of the Estrella Mountains.

Stormwater Drainage Control

Localized drainage problems can result from either a high intensity thunderstorm that releases large volumes of rain within a short period of time, or from a gentle rain that lasts several days. A number of stormwater drainage control structures currently exist within the study area. The location of major structures is shown on Map 10.

McMicken Dam

Under natural conditions, stormwater drainage from the Trilby Wash area and the White Tank Mountains continued across the study area. In 1951, over 10 inches of rain fell on the upper watershed of Trilby Wash and resulted in severe flooding at Luke Air Force Base, Litchfield Park, and the Towns of Goodyear and Avondale (Maricopa County Office of Civil Defense, 1979). The flood damage from this storm exceeded 3 million dollars as crops, roads, and railroad tracks were inundated or destroyed (Maricopa County Planning Department, 1972).

The U.S. Soil Conservation Service constructed an earthen dam four miles long and 23 feet high in the Trilby Wash area in 1954. This structure was later incorporated into the nine mile long McMicken Dam which was completed by the U.S. Army Corps of Engineers in 1956 to protect Luke Air Force Base from flooding.

The Trilby Wash Detention Basin originally had a design capacity of 19,300 acre feet. It was constructed with an ungated outlet to allow controlled releases of water to the McMicken Dam Outlet Channel. The dam also has a gated pipe outlet for discharging water into the Beardsley Canal if necessary under severe runoff conditions. As designed, it would accommodate a 100 year flood for the watershed.

In 1975, fissures were discovered in McMicken Dam which were determined to be hazardous to its continued operation. The cause of the fissures is unknown. They may be the result of land subsidence, soil shrinkage, instability in the foundation of the dam, or a combination of factors. To eliminate the potential for a failure of the dam under flood conditions, the Corps of Engineers cut two additional ungated outlets in the dam in 1976. The northern breach is 110 feet wide and is located just south of Grand Avenue. The other breach is located one half mile to the south of the Union Hills Drive alignment and is 700 feet wide.

These breaches reduce the design capacity of the detention basin to the level of a 25 year storm. Runoff in excess of a 10 year intensity may result in flows through the new outlets. Consequently, the detention basin no longer functions as it was originally designed and offers only limited protection to the study area.

In the event of a 100 year storm, much of the study area would be subject to sheetflow with a depth of one to three feet. The extent of this sheetflow as estimated by the Army Corps of Engineers is shown on Map 10. The area affected by sheetflow from the north breach would include over 150 acres. Approximately 7,000 acres would be subject to flooding from the south breach. The path of flows from the south breach may be modified by the drainage control structures which cross its path.

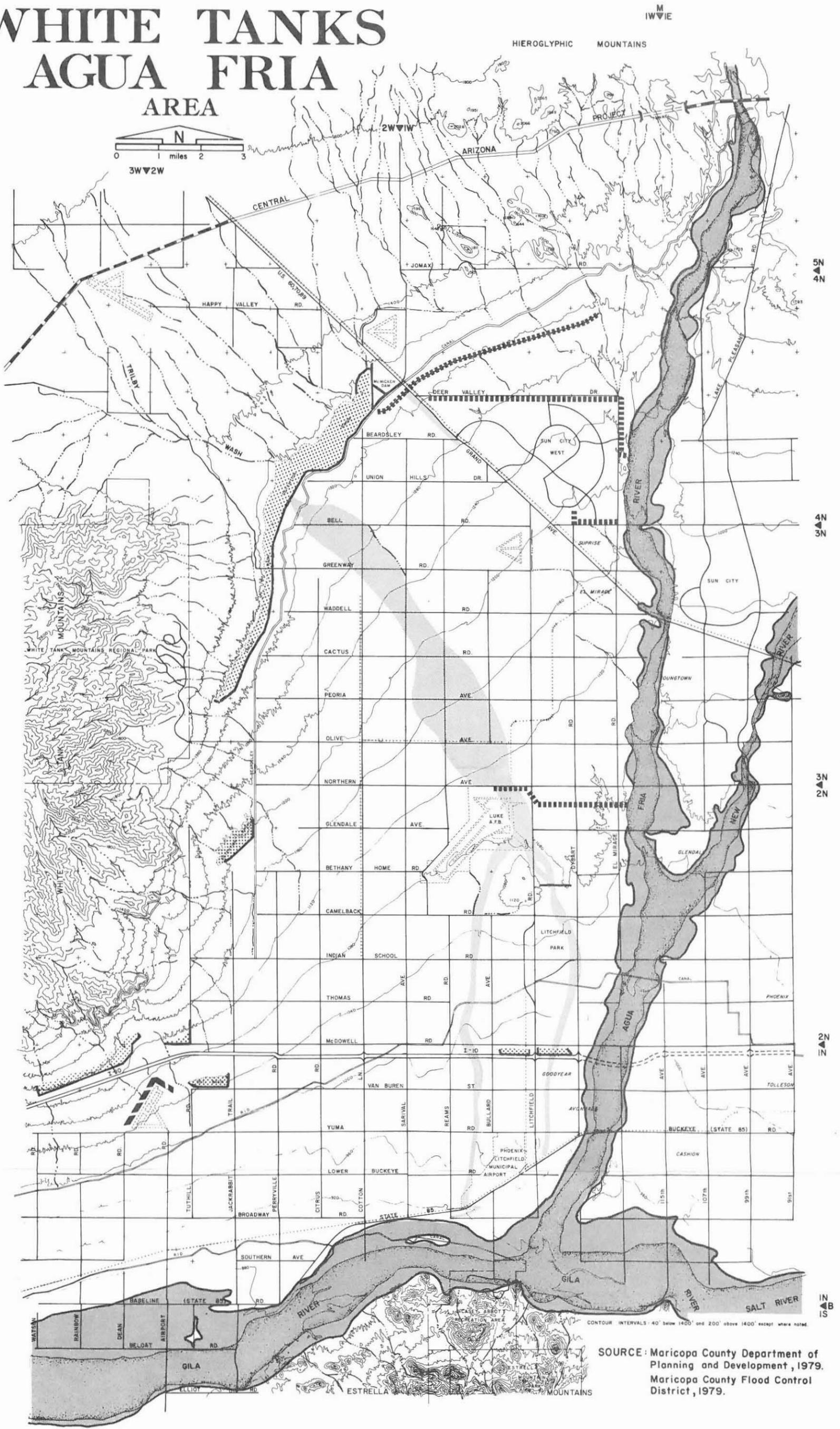
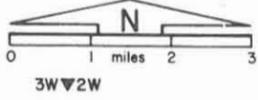
Sheet flooding from the breaches has occurred as recently as March, 1978. At that time, several fields sustained erosion damage and crop loss.

Legislation which would authorize the repair of McMicken Dam is currently in the United States Congress. The original repair cost was estimated at 7.7 million dollars. However, the dam has sustained additional damage from recent floods which may increase the estimated repair cost (Maricopa County Flood Control District, 1979).

WHITE TANK DAMS 3 AND 4

In 1954 the Soil Conservation Service supervised the construction of two small flood detention structures in the western part of the study area. White Tanks Dam #3 is located west of the Beardsley Canal near the Glendale Avenue alignment. White Tanks #4 is located north of Van Buren Street between Tuthill Road and Jackrabbit Road. Both are designed to control runoff from the nearby White Tank Mountains in the event of a 100 year storm. White Tanks #3 was designed with a capacity of 2,665 acre feet while White Tanks #4 had a design capacity of 1,036 acre feet.

WHITE TANKS AGUA FRIA AREA



SOURCE: Maricopa County Department of Planning and Development, 1979.
Maricopa County Flood Control District, 1979.

LEGEND

- 100 YEAR FLOODPLAIN
- 100 YEAR SHEET FLOW
- DETENTION AREA
- DETENTION STRUCTURE
- DIVERSION STRUCTURE
- DRAINAGE CHANNEL

The original design capacity of White Tanks #4 has been altered by siltation and earth excavations which occurred during the construction of Interstate-10. Its current holding capacity is unknown (Maricopa County Flood Control District, 1979).

OTHER DRAINAGE CONTROLS

A number of other major drainage control structures currently exist within the study area. They are as follows:

- *The McMicken Dam Outlet Channel is an earthlined channel varying in width from 20 feet to 50 feet. It is designed to carry flows ranging from 4,450 cubic feet per second (cfs) to 14,000 cfs from McMicken Dam and runoff from adjacent drainage areas along its course to the Agua Fria River. It spills into a natural wash which eventually joins the El Mirage channel near Sun City West.
- *The El Mirage Channel is located along the eastern boundary of Sun City West. This improved channel carries flows from the Deer Valley Road channel and the McMicken Dam Outlet Channel to the Agua Fria River.
- *The Deer-Valley Road Drainage Channel runs east along the south side of Deer Valley Road from Reems Road to the El Mirage Channel. It is designed to carry sheet flows from the north and protects Sun City West from high seasonal runoff.
- *The Bell Road Drainage Channel is located on the north side of Bell Road east of Dysart Road. Portions of Sun City West drain into this channel which empties into the Agua Fria River north of the Bell Road bridge.
- *The Dysart-Agua Fria Drain is a concrete lined diversion channel which provides drainage for Luke Air Force Base and the surrounding area east of the base. The channel runs from the base east to the Agua Fria River approximately one-half mile north of Glendale Avenue.
- *The Litchfield Park Retention Structure is located north of Litchfield Park between Litchfield Road and Dysart Road. It is designed to protect Litchfield Park from local sheet flows. The structure has overflow spillways on either side as well as a piped outlet. In the event of a 100 year storm this structure would not completely protect Litchfield Park against flows from Trilby Wash.
- *Interstate-10 Stormwater Detention Structures are located north of the Interstate between Bullard Road and Dysart Road and just west of the study area near Dean Road. They are designed to protect the Interstate from a 50 year storm. Overflows from the Bullard structure would drain on its east side toward the Agua Fria River. Overflows from the Dean Road structure would drain to the southeast to Tuthill Road and then south towards the Gila River.

*The Caterpillar Tractor Company has several small detention basins on its proving grounds. A major one is located at McDowell and Tuthills Roads.

*The Granite Reef Aqueduct of the Central Arizona Project currently extends from Grand Avenue to the Agua Fria River. Construction west of Grand Avenue is currently underway. Culverts will carry stormwater runoff across this subsurface canal and into the study area at the same location as natural washes did previously. South of the canal, runoff will spread out over vacant desert land. Some concentration of runoff will occur, but this is not expected to have any significant impacts on areas downslope. Baffles have been installed to minimize the effects of concentrating the drainage flows.

The Agua Fria and Gila Rivers

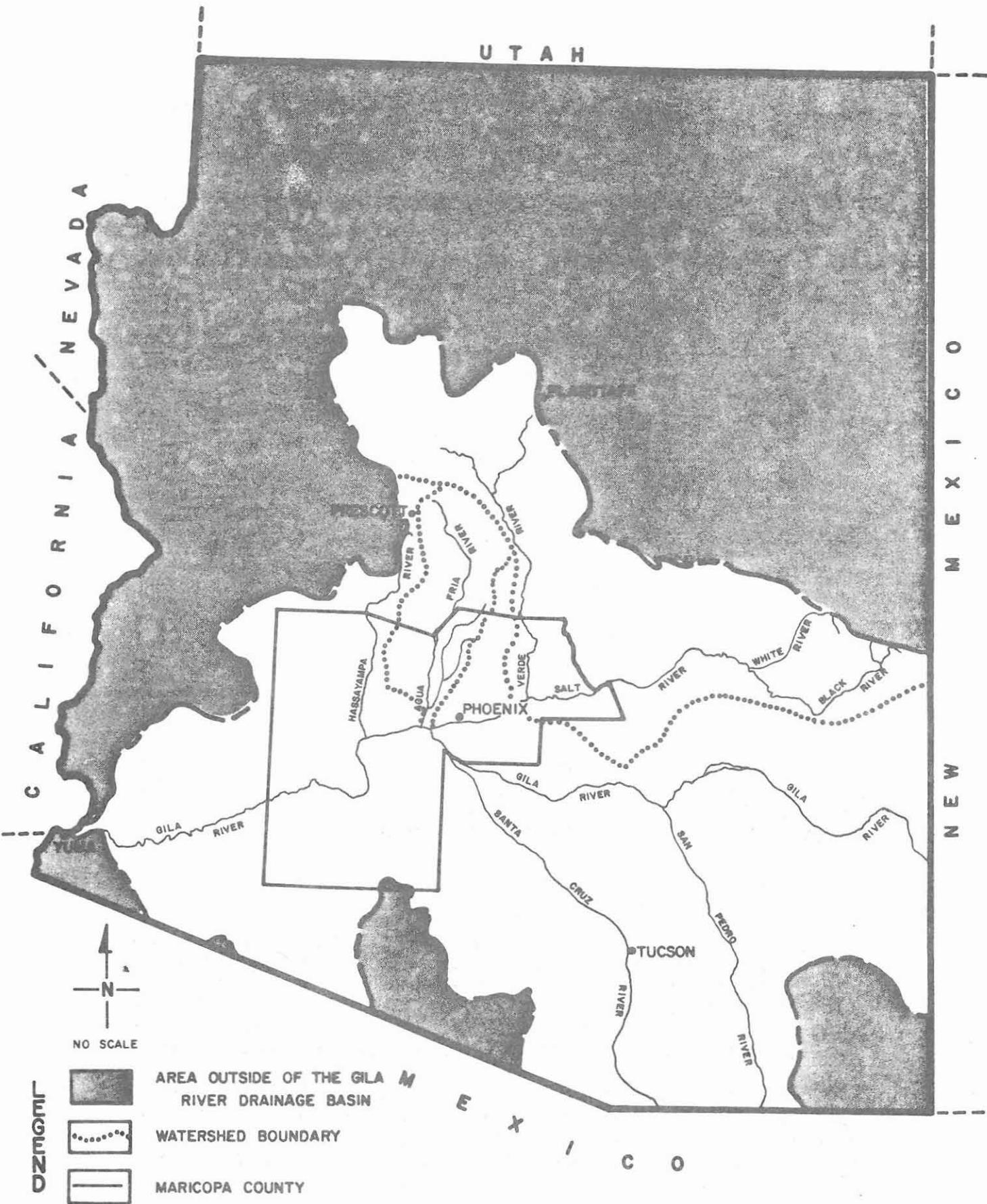
Maricopa County is located within the Gila River drainage basin. This basin covers approximately 54,000 square miles and extends as far north as the San Francisco Peaks near Flagstaff, east to the continental divide in New Mexico, and south into Mexico (AORCC, 1963). It includes both the Agua Fria River watershed and the Salt-Verde watershed. These drain mountainous areas to the north and east of Maricopa County. The Salt, Verde, Gila, and Agua Fria Rivers converge in central Maricopa County. Combined they flow toward the Colorado River near Yuma. (See Map 11).

The study area includes the Gila River on the south and the Agua Fria River on the east. The historic flows of these rivers were primarily the result of upper watershed runoff and snow melt. These natural flows are now controlled by dams and diversion structures built upstream from the study area to provide irrigation water. Today, both riverbeds are normally dry except during periods of local high seasonal runoff, or when the lack of storage capacity requires the release of floodwaters from upstream impoundments. The pools of water along portions of the Salt-Gila River result from wastewater treatment plant effluent, urban stormwater runoff, and return flows from irrigated agriculture.

HISTORY OF FLOODING

The upstream impoundments which regulate the flows of the Agua Fria and Gila Rivers were constructed to provide dependable supplies of irrigation water. They also provide incidental flood control, but that is not their primary function.

Flooding along the Agua Fria and Gila Rivers has been infrequent since the construction of upstream impoundments. Unfortunately, the Phoenix metropolitan area has experienced four major floods within the last two years.



SOURCE: A.O.R.C.C., 1967.

GILA RIVER BASIN

MAP II

Natural flows on the Salt River and its major tributary the Verde River are controlled by a series of dams and reservoirs under the jurisdiction of the Salt River Project. The South Gila River joins the Salt River about three miles east of the study area. It is regulated by Coolidge Dam which is located on the San Carlos Indian Reservation. Flooding along the Gila River is primarily the result of releases from impoundments on the Salt-Verde River by the Salt River Project. Since Coolidge Dam was built in 1928, relatively minor flows from the South Gila have reached the study area. Flows from the Agua Fria River also contribute to the flows of the Gila as it passes through the study area.

There are no gauging stations on the Gila River within or near the study area. Consequently, accurate information on past flows does not exist. Based on flood records for the Salt River, major floods have been infrequent. A record flow of 300,000 cfs was recorded on the Salt River below the Verde River in 1891. It is considered to be the standard project flood for the watershed. Since the construction of the Salt River Project dams and reservoirs, there have been only 10 releases in excess of 50,000 cfs. Four of the largest flows occurred between 1978 and 1980 (See Table 1-1).

TABLE 1-1
 MAJOR FLOWS IN THE SALT RIVER
 1978-1980

<u>DATE</u>	<u>LOCATION</u>	<u>ESTIMATED FLOW (in Cfs)</u>
March-April, 1978	Below Granite Reef Dam	113,000
December, 1978	Jointhead Dam Phoenix	140,000
January, 1979	Below Granite Reef Dam	77,800
February, 1980	Below Granite Reef Dam	170,000

Source: Maricopa County Flood Control District, 1980.

The Agua Fria River drains an area of about 2,340 square miles. Its flow is controlled by Waddell Dam which forms Lake Pleasant five miles north of the study area. The dam is owned and operated by the Maricopa County Municipal Water Conservation District #1. Since runoff from 60 percent of the watershed flows into Lake Pleasant, flooding along the Lower Agua Fria is due primarily to releases from Waddell Dam.

New River, the Agua Fria's major tributary, is presently unregulated. New River joins the Agua Fria near Camelback Road. Together with its major tributary Skunk Creek, it drains an area of about 340 square miles. High seasonal runoff in the New River Mountains can compound flood conditions along the lower Agua Fria River.

Limited information is available on the historic flows of the Agua Fria River. Since 1889, the largest flows recorded were 80,000 cfs and 105,000 cfs in 1917 and 1919 respectively. (U.S. Army Corps of Engineers, 1968). Waddell Dam was built in 1927. Since then, releases from the upper watershed have been infrequent and until recently involved only a few thousand cfs (Maricopa County Flood Control District, 1980).

Four of the largest floods in recent history for the Agua Fria River occurred between March, 1978 and February, 1980. The estimated flows for these floods are shown in Table 1-2.

TABLE 1-2
MAJOR FLOWS IN THE AGUA FRIA RIVER
1978-1980

<u>DATE</u>	<u>LOCATION</u>	<u>ESTIMATED FLOW (In Cubic Feet Per Second)</u>
March, 1978	Waddell Dam	18,000
	Grand Avenue	9,810
	State Route 85	13,100*
December, 1978	Waddell Dam	60,000
	State Route 85	30,000
January, 1979	Waddell Dam	20,000
February, 1980	Waddell Dam	66,600
	State Route 85	42,000**

*Flow of New River at Bell Road was 12,000 cfs.

**Flow of New River at New River was 20,000 cfs.

Source: Maricopa County Flood Control District, 1980.

FLOODPLAIN CHARACTERISTICS

Generally speaking, the riverbeds of both the Agua Fria River and the Gila River are relatively shallow with wide floodplains. Map 10 shows the location of the 100 year river floodplains. These cover over 24,000 acres or 38.5 square miles of the study area.

A 100 year flood occurs on the average once in every 100 years. Within any 100 year period it may occur several times or not at all.

South of Waddell Dam, the floodplain of the Agua Fria River ranges from a few hundred feet to approximately 1.7 miles in width. The widest point is located in the general vicinity of Camelback Road near the mouth of New River. A 100 year storm would result in a flow of about 100,000 cfs near Camelback Road (U.S. Army Corps of Engineers, 1968).

During the recent floods of 1978-1980 the limits of this floodplain were exceeded along portions of the river. Studies are currently underway by the Maricopa County Flood Control District to redefine this floodplain.

The Gila River floodplain ranges from about one mile to almost two and a half miles in width. Dense vegetation is found along portions of the riverbed. This causes siltation and blocks the flow of floodwaters. It is believed to have increased flooding along portions of the river (See Chapter VII Vegetation and Wildlife).

FLOODPLAIN DEVELOPMENT

Much of the floodplain within the study area is used for irrigated agriculture or related land uses. Scattered rural residential development is located in floodprone areas adjacent to both riverbeds.

Four sand and gravel extraction sites are located in the 100 year floodplain of the Gila riverbed. A portion of the Casey Abbott Recreation Area is also located within the floodplain.

Development along the Agua Fria River has been more extensive. The 100 year floodplain includes developed portions of the Town of El Mirage and the City of Avondale. It also includes three major landfills. Eleven sand and gravel operations are located within this floodplain as well as numerous stockpiles and excavation sites.

Two unincorporated residential areas are also located within the floodplain of the Agua Fria River. "Hound Dog Acres" is located south of Jomax Road and contains approximately 30 dwellings. "Rose Garden Lane" consists of about 20 dwelling units located just north of the Beardsley Road alignment. Both areas have suffered considerable damage from recent floods.

Regional Flood Control Projects

NEW RIVER AND PHOENIX CITY STREAMS FLOOD CONTROL PROJECT

The New River and Phoenix City Streams Flood Control Project was authorized by the Federal Flood Control Act of 1965. Implementation is primarily the responsibility of the U.S. Army Corps of Engineers. Major projects identified in the master plan which will have an impact on the study area include Adobe Dam, New River Dam, and the Arizona Diversion Channel (U.S. Army Corps of Engineers, 1975).

The proposed Arizona Diversion Channel will provide Phoenix, Glendale, and Peoria with additional protection against 100 year storms by diverting floodwaters which naturally flow across the metropolitan area to Skunk Creek. This channel will be located north of and almost parallel to the Arizona Canal and extend from 40th Street in Phoenix to Skunk Creek just south of Bell Road. Right of way acquisition is currently underway.

Adobe Dam is currently under construction on Skunk Creek near Deer Valley Road about one mile west of Interstate-17. When completed, the dam will detain floodwaters and release them at a controlled rate through an ungated outlet. Adobe Dam is intended to protect the area downstream from a standard project flood and partly compensate for the floodwaters which will be added to Skunk Creek by the Arizona Diversion Channel.

The proposed New River Dam will be located on the New River about 8 miles upstream from its confluence with Skunk Creek. Construction is tentatively scheduled to begin in 1983. The dam will detain floodwaters and release them through an ungated outlet thereby protecting the area downstream from a standard project flood. This dam, in conjunction with Adobe Dam, will more than offset the effect of the Arizona Diversion Canal downstream from the confluence of Skunk Creek and New River under average conditions.

The plan also calls for a flowage easement to be acquired along the Agua Fria River from New River to the Gila River. This easement would approximate the 100 year floodplain with all of the planned projects in place. Land use would be restricted within the flowage easement to ensure the continued operation of the planned projects under diverted flow conditions. Several levees would also be constructed in the vicinity of Avondale to protect existing development along the floodplain fringe. Channelization of the Agua Fria River from New River to the Gila River is not proposed by the plan.

The construction of Adobe and New River Dams will improve flooding conditions along the lower Agua Fria River. However, because the planned projects will detain upstream floodwaters and release them at a controlled rate over a period of many days, the existing dip road crossings may be impassible for extended periods of time.

INTERSTATE-10 DRAINAGE CHANNEL

Interstate-10 will disrupt natural drainage patterns as it crosses the Phoenix metropolitan area east of the study area. A large interceptor storm drain has been planned in conjunction with the freeway to collect stormwater and carry it west to the Agua Fria River.

This drainage channel will be located along the north side of the freeway alignment and have a capacity of 10,000 cubic feet per second. It will empty into the Agua Fria River near McDowell Road. A detention structure east of the River will slow flows from the channel prior to their release (Maricopa County Flood Control District, 1980).

THE GILA RIVER CHANNEL CLEARING

The Gila Channel Clearing Project is intended to reduce flooding along the Gila River caused by siltation and dense vegetation within the riverbed. Eventually, a 1,000 foot wide channel will be cleared from 91st Avenue to Gillespie Dam. The cost of the project will be shared by the State of Arizona and Maricopa County.

The Maricopa County Flood Control District has already begun to clear a channel 300 feet wide along a seven mile stretch of the river north of Gillespie Dam. The second phase of the clearing will take place from 91st Avenue to 123rd Avenue. The District is in the process of acquiring the necessary land rights from the Arizona Game and Fish Department, the Arizona Land Department, and the Gila River Indian Community for this phase.

The rest of the riverbed between 91st Avenue and Gillespie Dam, including that segment within the study area, is essentially under the control of the U.S. Fish and Wildlife Service. (See Chapter VI Vegetation and Wildlife). An environmental impact statement will be required before the proposed clearing can proceed. This is necessary to resolve potential conflicts between the proposed clearing and the use of the riverbed as a natural wildlife area (U.S.D.I., Bureau of Reclamation, 1980).

THE CENTRAL ARIZONA WATER CONTROL STUDY

In 1968, the U.S. Congress authorized the construction of Orme Dam or a suitable alternative as part of the Central Arizona Project (CAP). Orme Dam was to be located at the confluence of the Salt and Verde Rivers. It was intended to provide storage capacity for CAP water as well as flood control for the Phoenix area. A draft environmental impact statement was prepared for Orme Dam in 1976 which identified a number of concerns related to the project and its location. Subsequently, President Carter recommended that Orme Dam be eliminated from the CAP in April, 1977.

The Central Arizona Water Control Study (CAWCS) was begun by the Bureau of Reclamation in July, 1978 to investigate alternatives to Orme Dam. The U.S. Army Corps of Engineers was assigned the task of flood control planning and analysis. The project's schedule calls for a preferred plan to be selected by October, 1981. A final environmental impact statement will be filed in 1982 clearing the way for implementation of the preferred plan. One of the alternatives calls for the construction of a new Waddell Dam to provide storage for CAP water (Water and Power Resource Services, 1981).

VI. GROUNDWATER

In any semi-arid environment the quantity, quality, distribution, and cost of water resources can have a profound effect on land use and economic development. The primary source of water within the White Tanks-Agua Fria area, and within Maricopa County as a whole, is groundwater. These underground reserves are supplemented by natural river flows, impoundment diversions, treated sewage effluent, and groundwater imports which are used for irrigation in portions of the study area (See Part V Public Services).

The study area is located within the western Salt River Valley sub-basin of the Phoenix Active Management Area (AMA). The future withdrawal and use of groundwater within this area is subject to regulation by the Arizona Department of Water Resources according to the 1980 Arizona Groundwater Management Act.

Subsurface Geology

The White Tanks-Agua Fria Area encompasses an alluvium filled basin that is partially surrounded by bedrock on the north, south, and west. Alluvial filled gaps in the bedrock occur north and south of the White Tanks Mountains. The basin extends to the east as part of the western Salt River Valley.

The alluvial fill is the principal source of groundwater in the area. The surrounding bedrock is essentially non-water bearing and provides only localized supplies of groundwater of limited quantity. Three general layers of alluvial deposits have been identified in the basin: 1) an upper alluvial unit, 2) a middle fine-grained unit, and 3) the lower conglomerate unit. Each has separate aquifer characteristics. Subsurface profiles of the basin are shown in Appendix A.

The upper alluvial unit is the major source of groundwater for the basin. The sedimentary deposits in this layer are generally unconsolidated and groundwater is unconfined, although confined or perched conditions may occur locally. This layer ranges in thickness from a few feet near bedrock at the edges of the basin to over 1,200 feet near Luke Air Force Base (U.S.D.I., Bureau of Reclamation, 1977).

The middle fine-grained unit generally borders the upper alluvial unit and acts as a partial aquiclude. That is, the sedimentary deposits in this layer are highly impermeable and thus impede the flow of groundwater. Groundwater in this unit generally occurs under confined conditions. The unit ranges in thickness from a few feet near the edges of the basin to 1,500 feet or more in the deeper portions of the Basin. In some parts of the study area this unit may be absent from the edge of the basin (U.S.D.I. Bureau of Reclamation, 1977).

The middle fine-grained unit is characterized by a fine sand and silty clay upper section, a mid-section with silt, clay, and evaporites, and a lower section made up primarily of evaporites. Evaporites are sedimentary rocks, primarily gypsum, that usually originate from the evaporation of salt water in an enclosed basin (MAG 208 Water Quality Management Program, 1979). The Luke Salt Body is located in this unit as described in Chapter III Geology. The evaporites in this unit have a significant effect on water quality in the area.

The lower conglomerate unit is an additional source of groundwater for the area. It may have already been penetrated by deep wells along the edges of the basin. The top of this unit generally follows the middle fine-grained unit. Groundwater is generally confined, but where the middle fine-grained unit is absent water levels may be comparable to those in the overlying upper alluvial unit. The thickness of this unit ranges from a few feet near bedrock at the edges of the basin to a few thousand feet in the deeper parts of the basin (U.S.D.I., Bureau of Reclamation, 1977).

Distribution of Groundwater

In 1973, an estimated 14 million acre feet of recoverable groundwater was stored beneath the study area to a depth of 1,200 feet. Additional water is available at greater depths throughout much of the area. Although a substantial amount of groundwater is present, its spatial distribution and depth varies widely. A map showing the distribution of major groundwater reserves within the area is contained in Appendix B.

The amount of groundwater stored in 1973 ranged from approximately 39,000 acre feet per square mile to 80,000 acre feet per square mile. Less than 9% of the groundwater in storage is located between 0 and 300 feet below the land surface. Approximately 40% is located between 300 feet and 700 feet, and roughly 50% is between 700 feet and 1,200 feet in depth. The most significant, relatively shallow reserves are located in the southern part of the area between the Gila River and the Roosevelt Irrigation District Canal and near Litchfield Park. These estimates are useful for relative comparisons on an areawide basis, but should not be construed to indicate the supply available to local wells.

Well Yields

Wells tapping the upper alluvial unit are generally capable of yielding from several hundred gallons of water per minute to a few thousand gallons of water per minute (gpm). Variations result from differences in well depth, type of well casing, and local geologic conditions (U.S. Environmental Protection Agency, 1979).

Wells normally produce 1,000 gpm or more in the central part of the basin. Near the basin boundaries, production decreases to a few tens or a few hundred gallons per minute. The surrounding mountain masses are essentially non water bearing, but may yield 0-60 gpm per well in some localized areas (Arizona Water Commission, 1978).

A well yield of 1,000 gpm or greater is preferred for efficient irrigation practices. High well yields are also desirable for municipal use, but yields as low as 200 gpm may be suitable since above ground storage facilities are normally used (Arizona Water Commission, 1975).

Depth to Groundwater

The water table within the White Tanks-Agua Fria area ranges from less than 100 feet below land surface near the Gila River to over 500 feet northwest of Luke Air Force Base. The depth to water in 1977 is shown on Map 12.

The practical pumping limit for agriculture is generally considered to be 700-1,000 feet. A depth of 1,200 feet is considered to be the maximum for municipal wells (Arizona Water Commission 1975). Generally, these limits are dictated by pumping costs and pump efficiencies. The practical depth in local areas depends on well construction, aquifer yields, and water quality.

Seasonal changes in pumping rates cause local fluctuations in groundwater levels. Generally, there is a short term decline from a spring peak to a fall low with subsequent recovery the following spring. Both seasonal and long term fluctuations also respond to wet and dry climate cycles. Recharge from occasional stream flow can cause a significant increase in the groundwater level in nearby wells.

Groundwater Overdraft

Groundwater pumpage in excess of recharge has resulted in groundwater level declines throughout the study area. From 1923 to 1977 groundwater levels declined less than 50 feet near the Gila River to over 300 feet in the central part of the basin (See Map 13).

The decline in water levels from 1923-1977 was most severe north of the Roosevelt Irrigation District Canal where it averaged 5 feet per year. Relatively small long term declines occurred along and north of the Gila River where small localized groundwater expressions exist. Undoubtedly, these declines would have been even greater if not for the availability of irrigation water imports to the area.

Most of this decline is the result of intensive pumping for irrigated agriculture which began after 1940. Statewide, agriculture accounts for approximately 90% of total groundwater pumpage (Ross, 1978). Approximately one third of all irrigation water conveyed may be returned as potential recharge. Recharge from natural sources appears to be insignificant (U.S.D.I., Bureau of Reclamation, 1977).

A substantial amount of water infiltrates to become useable recharge when flooding occurs along the major riverbeds. This, along with the reduction in groundwater pumpage in some irrigation districts due to the availability of surface water, often slows or even reverses groundwater level declines in some areas. The water level in some wells near the riverbeds has risen as much as 10-20 feet since 1964 (U.S.D.I., Bureau of Reclamation, 1977).

Groundwater pumping in excess of natural recharge has caused a decline in water levels throughout central Maricopa County. The average decline in other parts of the County are compared with those of the study area in Table 1-3.

TABLE 1-3
AVERAGE GROUNDWATER LEVEL DECLINES
IN SELECTED AREAS OF THE SALT RIVER VALLEY
(1923-1977)

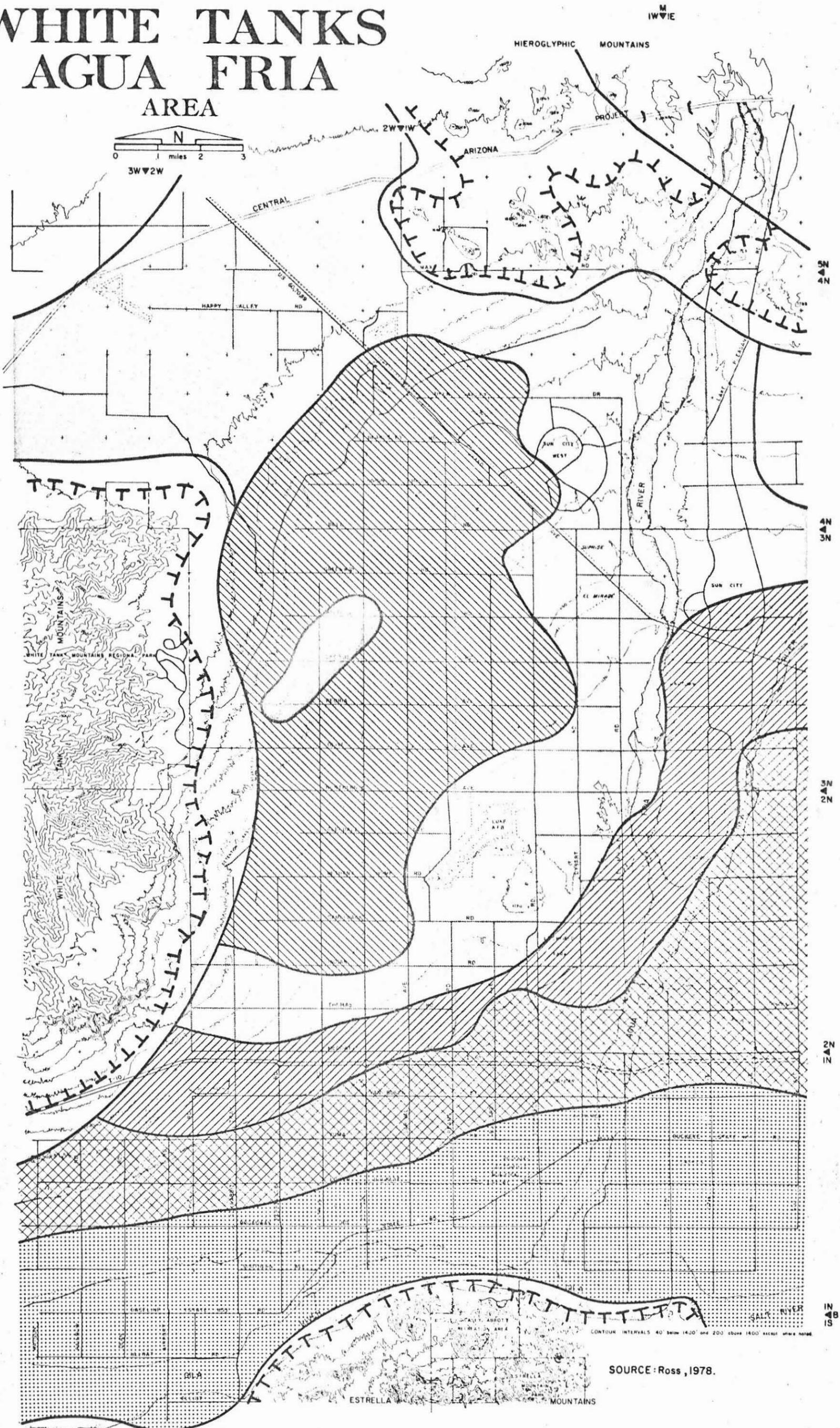
<u>AREA</u>	<u>AVERAGE DECLINE (In Feet)</u>
1. White Tanks-Agua Fria Area North of the Roosevelt Irrigation District Canal	250
2. Phoenix, Glendale, Tolleson Area	150
3. Buckeye	less than 50
4. Near Scottsdale, east of Mesa, Queen Creek Area	more than 250
5. Chandler-Gilbert Area	150
6. Southwest of Chandler	less than 100
7. Deer Valley Area	250

Source: (Arizona Water Commission, 1978, IX-8)

Historically, groundwater movement in the basin underlying the White Tanks-Agua Fria area was from the north, northeast, and east to the west and southwest. Subsurface inflow occurred primarily under the Gila and Agua Fria River channels and through the alluvial gap north of the White Tank Mountains. Subsurface outflow was under the Gila River channel south of the White Tank Mountains (U.S.D.I., Bureau of Reclamation, 1977).

WHITE TANKS AGUA FRIA

AREA

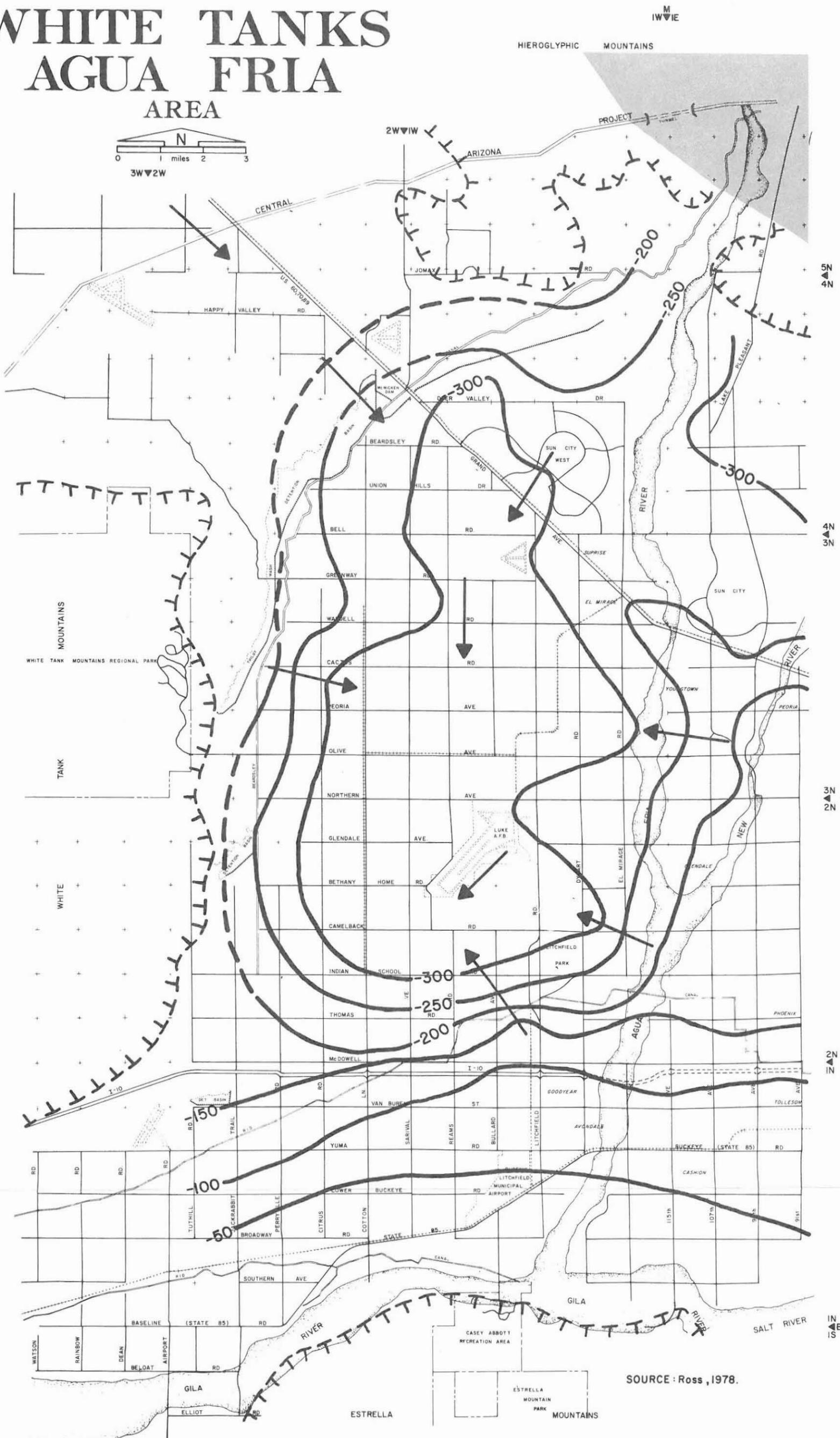
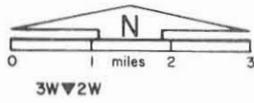


SOURCE: Ross, 1978.

LEGEND		LESS THAN 100 FEET		300-400 FEET		APPROXIMATE BOUNDARY OF THE MAIN WATER BEARING UNIT	
		100-200 FEET		400-500 FEET		NO DATA	
		200-300 FEET		BELOW 500 FEET			

DEPTH TO GROUNDWATER

WHITE TANKS AGUA FRIA AREA



SOURCE: Ross, 1978.

LEGEND

— 300 —

LINE OF EQUAL WATER LEVEL CHANGE

APPROXIMATE BOUNDARY OF THE MAIN WATER BEARING UNIT

→

GROUNDWATER FLOWS

■

NO DATA AVAILABLE

CHANGE IN GROUNDWATER LEVELS
1923-1977

MAP 13

Today, as a result of large scale groundwater pumping and the subsequent groundwater overdraft, a large depression cone has developed north and west of Luke Air Force Base. Groundwater flow has been diverted toward this major depression as shown on Map 13, and subsurface outflow from the basin has been substantially reduced or even eliminated (U.S.D.I., Bureau of Reclamation, 1977).

The depression cone near Luke Air Force Base is the combined result of low permeability and groundwater overdraft. It will continue to expand in the future as long as intensive groundwater pumping occurs. Well yields will decrease at an increasing rate as the water table declines. The rate of water table decline will increase even if the volume of water pumped is held constant (U.S.D.I. Geological Survey, 1964).

Groundwater Quality

The usefulness of a water supply is limited by its quality. The level of contaminants which can be tolerated varies according to the intended use. Certain characteristics which might make a water supply undesirable for human consumption may be acceptable for agricultural or industrial uses. Water quality can be improved through treatment. However, the cost and feasibility of overcoming severe water problems can be prohibitive. In some cases poor quality water can be diluted with water from other sources to allow its use without costly treatment.

Water quality can be affected by inorganic, organic, microbiologic, and radiological contaminants from either natural or man-made sources. The most significant concern within the study area at this time appears to be the presence of inorganic contaminants.

Significant concentrations of fluorides, nitrates, and dissolved solids have been identified in groundwater within the study area. The distribution of salinity, nitrate, fluoride, and hardness north of Luke Air Force Base is due primarily to the quality of groundwater recharge and the composition of the subsurface basin deposits. South of Luke Air Force Base it is a combination of natural sources, recharge from the Gila River, and irrigation water (MAG 208 Water Quality Management Program, 1979).

Generally speaking, there are four levels of groundwater quality within the study area. In downward succession they are:

1. Shallow perched water bodies of poor quality in the upper alluvial unit;
2. the upper alluvial unit which contains unconfined water of varying quality;
3. the middle fine grained unit containing semi-confined water of poor quality; and
4. the lower conglomerate unit containing groundwater of relatively good quality in comparison to the middle fine grained unit (U.S.D.I., Bureau of Reclamation, 1977).

Water enters a well from all sections of the aquifer open to the well base. The water discharged from a well is often a composite of water of varying quality from different depths. Groundwater quality can depend not only on well depths, but also on well yields and pump discharge rates.

FLUORIDE

The U.S. Environmental Protection Agency (EPA) and the Arizona Department of Health Services (ADHS) have adopted primary drinking water regulations that set standards for contaminants which could affect the health of consumers. These are applicable to all public drinking water supplies. The maximum contaminant level for fluorides is 1.4 milligrams per litre (mg/l) for the Phoenix area (MAG 208 Water Quality Management Program, 1979).

Fluoride concentrations in excess of 1.0 mg/l are common over much of the area west of the Agua Fria River. These concentrations are probably due to local geologic factors such as the presence of the White Tank Mountains and the middle fine-grained alluvial unit. Available data suggests that the fluoride content of wells often increases with depth (MAG 208 Water Quality Management Program, 1979). The distribution of fluoride within the area is shown by Map 14. This map represents conditions in selected high capacity wells during 1975-1976.

NITRATES

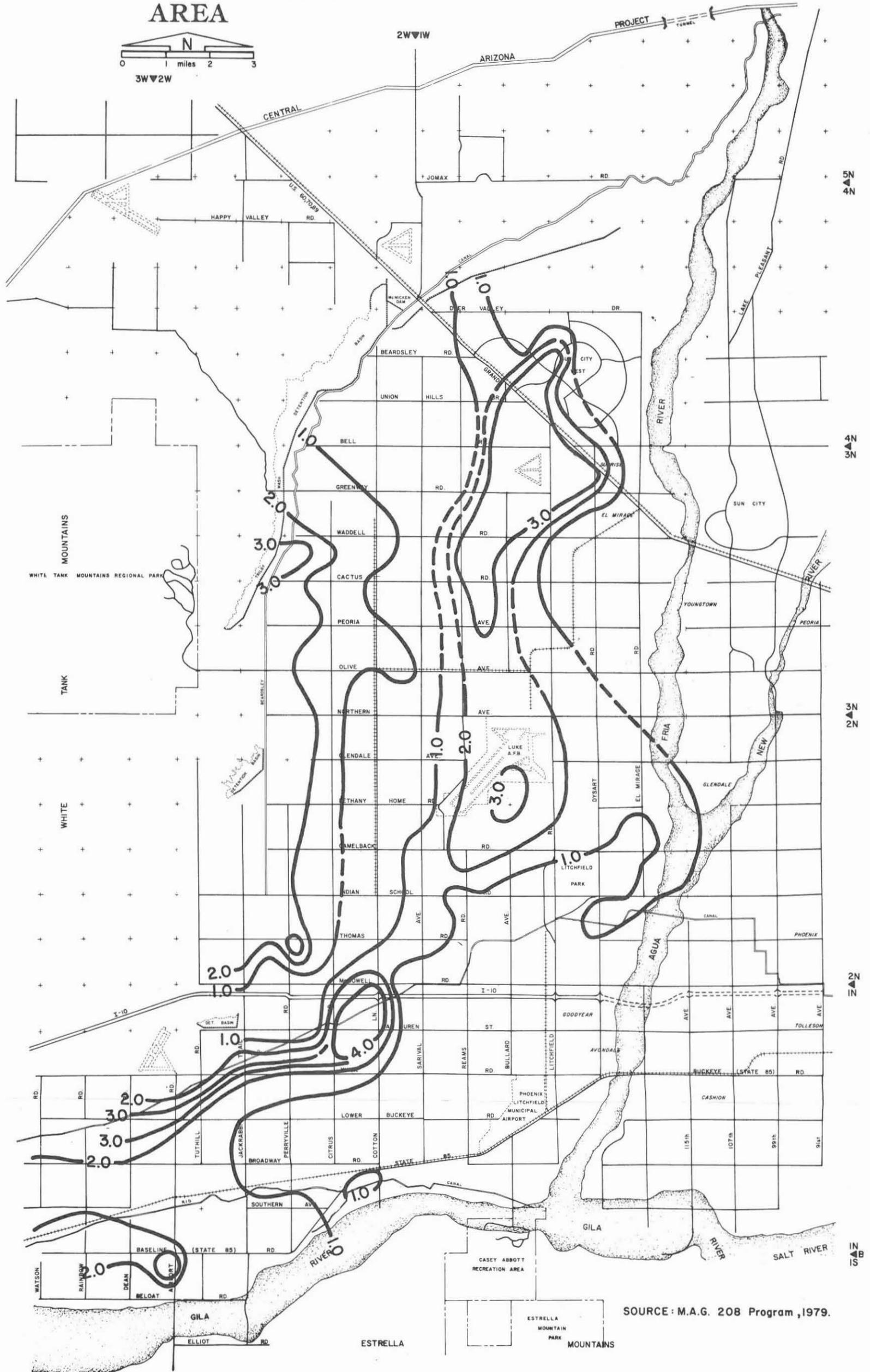
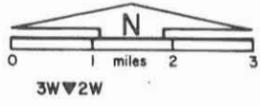
The primary drinking water regulations adopted by EPA and ADHS set a maximum contaminant level for public drinking water supplies of 45 milligrams per litre of nitrate. Nitrate concentrations within the study area are generally low north of Luke Air Force Base. Nitrate levels increase toward the Gila River. Nitrate levels of 45 milligrams per litre and greater occur south of Indian School Road. The distribution of nitrate concentrations within the area suggest a soil or geologic origin rather than poor quality recharge from the Gila River (MAG 208 Water Quality Management Program, 1979).

Wells that do not tap the middle fine grained unit or significant evaporite deposits generally show relatively constant levels of nitrate with depth. This occurs above the middle fine-grained unit in the central part of the area, near the edges of the basin beyond the extent of the middle fine-grained unit, and above the lower conglomerate unit. Nitrate levels in the lower conglomerate unit are generally lower than those in the overlying strata (MAG 208 Water Quality Management Program, 1979).

Nitrate concentrations in wells from 600 to 1,000 feet deep have been increasing south of Luke Air Force Base near Goodyear Farms. These wells tap the middle fine-grained unit. The downward movement of shallow high nitrate water into the producing zone of wells appears to be the primary cause. As water levels decline, the middle fine-grained unit may contribute more nitrate to well water. Some northward movement of high nitrate groundwater may also be occurring (MAG 208 Water Quality Management Program, 1979).

WHITE TANKS AGUA FRIA AREA

M I W I E
M I E R O G L Y P H I C M O U N T A I N S



SOURCE: M.A.G. 208 Program, 1979.

Contours Represent Milligrams Per Litre in Selected Large Capacity Wells in 1975-76

FLUORIDE CONTENT OF WELL WATER

Nitrate levels have also increased in wells along the Buckeye Canal. This is probably due to the use of sewage effluent for irrigation, and the percolation of sewage effluent from the river channel. Water from numerous wells in the Roosevelt Irrigation District have also shown increased nitrate levels both east and west of Jackrabbit Road. The major cause appears to be the northerly movement of high nitrate groundwater from adjacent areas (MAG 208 Water Quality Management Program, 1979).

TOTAL DISSOLVED SOLIDS

Total dissolved solids (TDS) refers to the quantity of salt or minerals in solution in water. Water use can be limited both by the level of concentration, and by the type of salt and mineral solids in solution. Generally speaking, water that contains less than 500 milligrams per litre of TDS is preferred for use as a public drinking water supply. Water containing greater quantities usually does not constitute a health hazard, but treatment is required to overcome bad taste when concentrations exceed 1,000 milligrams per litre (Kister, 1974).

The upper limit of TDS for livestock is about 5,000 milligrams per litre (Kister, 1974). The yields of most crops are affected when water contains excessive concentrations of TDS or a specific substance such as chloride. Since each crop has different tolerance levels no specific standard identifies the limit for crop production. These vary with the stage of plant growth and soil type.

As a general rule, concentrations of total soluble salts of less than 500 mg/l have no detrimental effects; sensitive crops may be affected between 500 and 1,000 mg/l; most crops are affected between 1,000 and 2,000 mg/l; and only salt tolerant crops grown on permeable soils are feasible when concentrations exceed 2,000 mg/l (Arizona Water Commission, 1975, p. 49). Above 3,000 mg/l, agricultural use is usually limited, although the harmful accumulation of salts can sometimes be compensated for by the addition of soil amendments under careful management practices (Kister, 1974).

Generally, the greater the concentration of TDS in irrigation water the more water which must be applied. Larger water applications are necessary to leach salts out of the plant root zone. This results in increased application costs.

The level of total dissolved solids in groundwater within the White Tanks-Agua Fria area varies both in area and in depth. The primary sources of dissolved solids are evaporite deposits and recharge water from the Gila River. The distribution of TDS within the area is indicated by Map 15. This map represents conditions in 1965. Schmidt's recent studies parallel these findings (MAG 208 Water Quality Management Program, 1979).

Generally speaking, water in the upper alluvial unit averages less than 500 mg/l of TDS north and west of Luke Air Force Base. Salinity increases to the south to over 3,000 mg/l near the Gila River.

Historically, groundwater in the northern part of the study area originated from mountain front recharge and streamflow seepage from the Agua Fria River. Both sources have been low in salinity. Groundwater in the southern part of the study area has been influenced by streamflow seepage from the Gila River which has always been high in TDS. The current sewage effluent flows in the Salt-Gila River are also characterized by relatively high concentrations of TDS. The TDS level of sewage effluent averages 800 milligrams per litre. This is still lower than natural river flow concentrations (MAG 208 Water Quality Management Program, 1979).

Locally, perched water tables may result in higher concentrations of total dissolved solids than those found in the main aquifer. This condition is especially prevalent where the percolation of irrigation return flows has occurred. Evaporation often causes return flows to have a higher level of TDS than the original water applied.

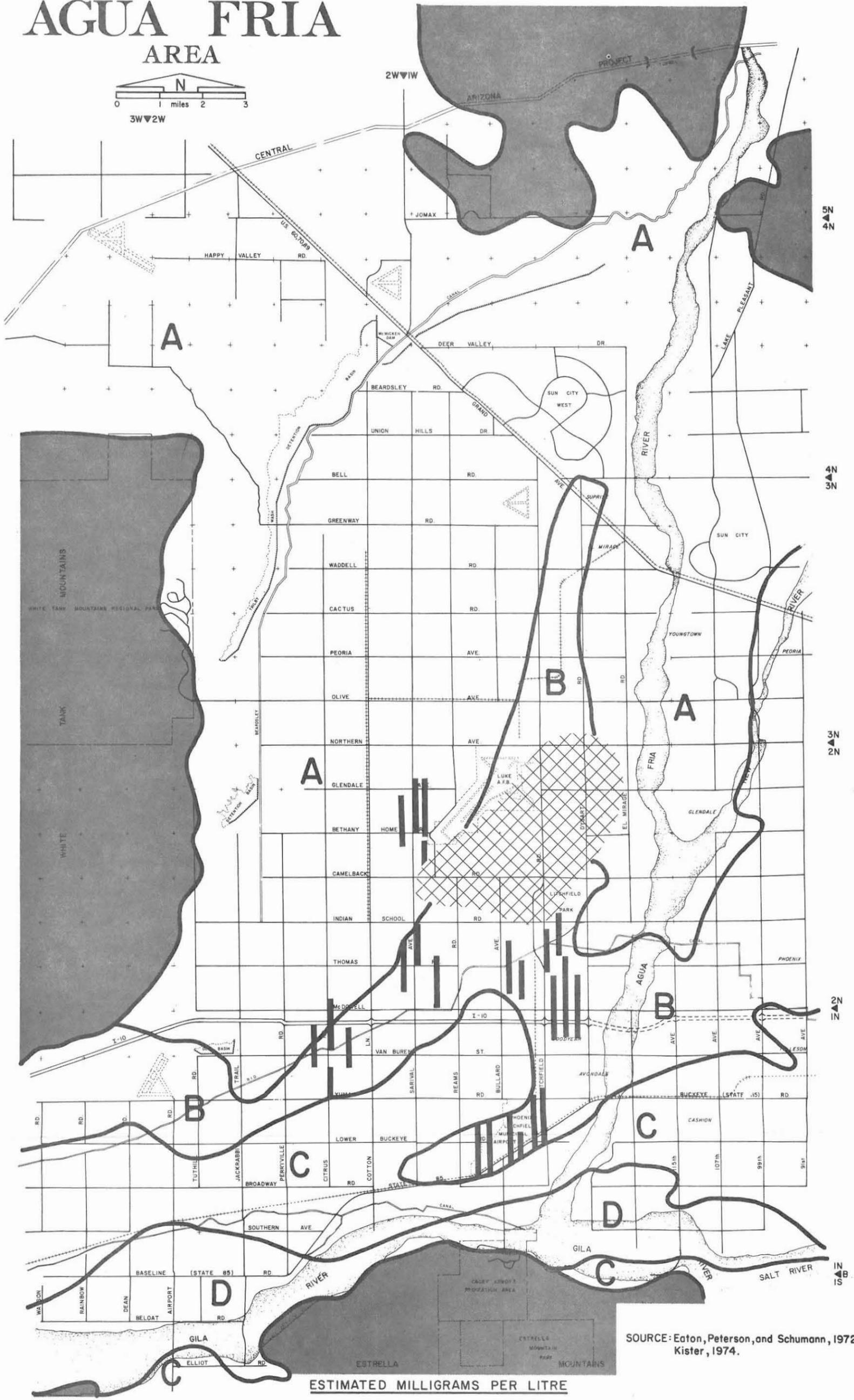
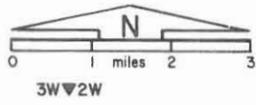
The presence of significant evaporite deposits generally deteriorates the quality of water as pumping depths increase. Increases in salinity usually occur between depths of 800 and 1,300 feet in the central part of the area. This increase is attributed to the middle fine grained unit and significant evaporite deposits, mainly gypsum and sodium chloride. Salinity levels increase at a depth of about 1,300 feet near Luke Air Force Base. TDS commonly exceeds 5,000 mg/l below depths of 1,500 feet where massive evaporite deposits are present (MAG 208 Water Quality Management Program, 1979).

The Luke Salt Body is discussed in detail in Chapter III Geology. The upper part of the salt body has a significant effect on the salinity of groundwater in local wells. A large area of high salinity groundwater overlies this formation. The level of TDS ranges from 500 to over 9,000 mg/l. Few wells produce water in this area below 900 feet due to its poor quality. The salt body itself is generally non-water bearing (Eaton, Peterson, and Schumann, 1972).

A predominant pattern for wells not tapping the middle fine grained unit is one of relatively constant salinity with depth. This occurs near the edges of the basin beyond the extent of the middle fine grained unit above the lower conglomerate unit. A pattern of decreasing salinity with depth is predominant around the edges of the basin. Southwest of Goodyear, the salinity of groundwater is known to be less in the lower conglomerate unit than groundwater in the overlying alluvial unit. Deep wells whose casings are not perforated in the upper part of the upper alluvial unit produce water of lower salinity than do shallow wells tapping this zone (MAG 208 Water Quality Management Program, 1979).

WHITE TANKS AGUA FRIA AREA

HIEROGLYPHIC MOUNTAINS



SOURCE: Eaton, Peterson, and Schumann, 1972.
Kister, 1974.

LEGEND

ESTIMATED MILLIGRAMS PER LITRE				
A	LESS THAN 500	C	1,000-3,000	
B	500-1,000	D	MORE THAN 3,000	
III	OVER 1,000 AT DEPTHS GREATER THAN 500-750 FEET		[Cross-hatched box]	500 TO OVER 9,000
			[Solid grey box]	ROCKS WITH LIMITED STORAGE CAPACITY

DISSOLVED SOLIDS IN GROUNDWATER

MAP 15

The level of dissolved solids in groundwater within the study area has remained relatively constant throughout recent history. Major factors contributing to this stability include: the seepage of irrigation water from canals which has relatively low levels of dissolved solids, precipitation of salt in the top soil and alluvial deposits, and local well construction. However, since 1966, a trend of increasing salinity has been identified in an area bounded by Van Buren Street on the north, Broadway Road on the south, Airport Road on the west, and the Agua Fria River on the east. This increase in salinity can be attributed to the direction of groundwater flow in the study area which is causing poor quality groundwater near the Gila River to move northward. Throughout the southern portion of the study area wells from 0 to 500 feet in depth have shown a marked increase in salinity averaging from 40 to 140 mg/l annually (MAG 208 Water Quality Management Program, 1979).

HARDNESS

Hardness is caused by the calcium and magnesium content of water. Hardness reduces the effectiveness of soap and causes incrustation on pipes, utensils, and appliances that come into contact with heated water. Hardness is not considered a health hazard. For water supplies that contain more than 150-170 mg/l of hardness a water softening system may be desirable (Osterkamp, 1976). Hard water is common in the eastern and southern parts of the study area. Concentrations of 1,000 milligrams per litre or more of hardness are present in the area between the Gila River and Interstate-10 where high levels of TDS are present. The distribution of hardness appears to be related to natural geologic factors within the area rather than to recharge (MAG 208 Water Quality Management Program, 1979).

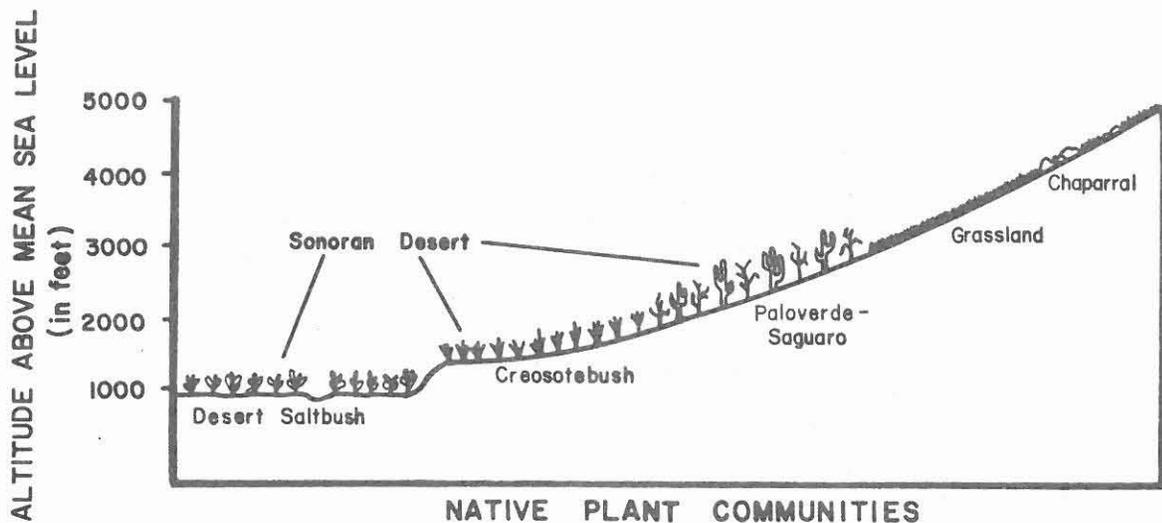
VII. VEGETATION AND WILDLIFE

Vegetation

The White Tanks-Agua Fria area is located within the Sonoran Desert region of Arizona. Paloverde-saguaro, creosotebush, and desert saltbush are the native plant communities in this arid region. Scattered areas of deciduous riparian forest also occur.

The native vegetation of the Sonoran Desert extends to altitudes of about 3,000 feet where the slope of the terrain is gentle, and to about 4,500 feet on steep southerly slopes. The type of vegetation present changes with altitude as shown in Figure 1-6. Riparian vegetation occurs along stream channels and their associated terraces, and in other areas with sufficient water (Turner, 1974).

FIGURE 1-6
NATIVE PLANT COMMUNITIES



SOURCE: Turner, 1974.

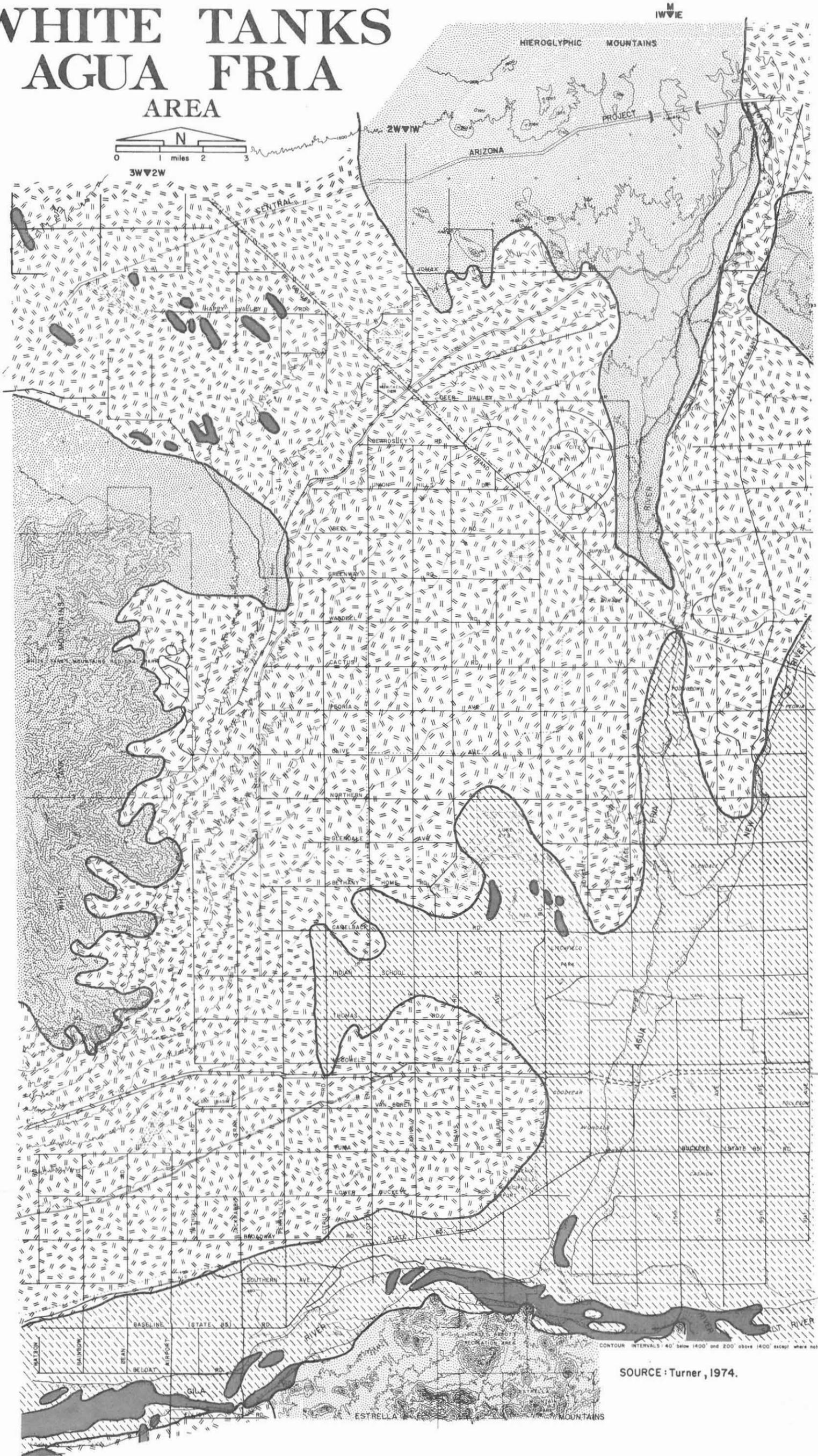
The generalized pattern of natural vegetation within the White Tanks-Agua Fria area is shown on Map 16. A description of each plant community is contained in Table 1-4. The natural vegetative pattern has been significantly altered by urban development and irrigated crop land.

TABLE 1-4
CHARACTERISTICS OF NATURAL VEGETATION

TYPE VEGETATION	DESCRIPTION	GENERAL LOCATION
Paloverde-Saguaro Community	Composed of small trees, such as foothill paloverde and ironwood; shrubs, such as creosote and bursage; and the giant saguaro and several other species of cacti such as the fishhook cactus, hedgehog cactus, cholla, and prickly pear. Probably the most scenic local desert vegetation. Once disturbed it is likely to be invaded by desert broom, species of mustard, and annual grasses.	Outwash plains and dry mountain slopes above the creosotebush community.
Creosotebush Community	Creosotebush is the dominant plant often accompanied by white bursage or a coarse bunchgrass called big galleta. The even stature and spacing of the plants and the simplicity of the community produces a monotonous, uniform landscape. The larger shrubs, cacti, and trees are absent, except along washes where ironwood, mesquite, paloverde, and catclaw may persist.	Flat terrain on slightly tilted plains and lower outwash plains surrounding mountains. These areas are more arid than those occupied by the Paloverde-Saguaro Community.
Desert Saltbush Community	Desert saltbush is the dominant plant. This gray 2 to 5 foot tall shrub grows in thick stands along with seep weed and pickle weed. Other saltbush species such as chasimo may be present. Mesquite is a common subordinate species and saguaro cactus is a rare member of the community. Areas that support this community are monotonous in appearance because of the uniform composition of the vegetation.	Alluvium filled valleys and the bottomlands along the Salt-Gila River. Because of extensive agricultural development, this vegetation is now rare in the bottomlands.
Deciduous Riparian Forest	At altitudes below 4,000 feet mesquite, catclaw, desert willow, and blue paloverde prevail, although other species are often present such as willows and cottonwoods. Salt cedar was introduced by man in the 1930's. The plants may be tall and grow in dense stands. Maximum height and density are attained in habitats of abundant moisture.	Along stream channels and their terraces and in areas of shallow groundwater or other water source. Salt Cedar has become prominent along stream channels. Mesquite is common in artificially created habitats such as irrigation overflows and in stormwater retention areas.

Source: Turner, 1974.

WHITE TANKS AGUA FRIA AREA



SOURCE: Turner, 1974.

LEGEND

- | | | | | | |
|---------------------------|--|---------------------|-------------------------------------|--|---|
| SONORAN DESER COMMUNITIES | | PALOVERDE - SAGUARO | DECIDUOUS RIPARIAN FOREST COMMUNITY | | SALT CEDAR, MESQUITE, COTTONWOOD, WILLOW, and other RIPARIAN SPECIES. |
| | | CREOSOTE BUSH | | | |
| | | DESERT SALT BUSH | | | |

GENERALIZED NATURAL VEGETATION

The majority of the area south and east of the Beardsley Canal and north of the Gila River was traditionally occupied by the creosotebush and desert saltbush communities. Today, most of this area has been cultivated or developed for urban use. Mesquite trees and other riparian species now grow in man-made habitats such as irrigation overflows and stormwater retention areas. Exotic trees and grasses have been introduced in many of the urban communities.

Salt Cedar has become a dominant species along much of the Gila River and has replaced many of the native riparian species. Vegetation in the river is primarily supported by the ponding of wastewater effluent discharged from the 91st Avenue and 23rd Avenue wastewater treatment plants in Phoenix. Much of this flow is diverted at the Buckeye Irrigation Canal heading. Consequently, flows between Bullard Avenue and the south extension discharge canal are sporadic with irregular flows. Sewage effluent flows are augmented by periodic irrigation tailwater overflows, stormwater runoff, and groundwater seepage from the shallow water table downstream from Jackrabbit Road (U.S. Environmental Protection Agency, 1979).

The most scenic and least disturbed natural plant community within the area is the paloverde-saguaro community. This is found in the White Tank Mountains, the Sierra Estrella Mountains, and in the north-northeastern part of the area. Only scattered low density development has occurred in these areas, and little irrigated cropland is present. Much of this scenic vegetation has been preserved within the boundaries of White Tank Mountain Park, the Casey Abbot Recreation Area, and Estrella Mountain Park.

Wildlife

A great diversity of wildlife exists within the White Tanks-Agua Fria area, although traditional habitats, which are closely dependant upon native plant communities, have been altered. Common desert species are present to some extent in all of the natural plant communities. The richest habitats exist in the remaining paloverde-saguaro and desert riparian plant communities. Agricultural cropland and urban areas also provide habitats for certain adaptable species.

Large animal species are generally absent from the area. Some are present in the immediate vicinity, however. White Tank Mountain Regional Park is known to harbor mule deer. Portions of the Sierra Estrella Mountains may provide habitat for bighorn sheep and javelina. The Hieroglyphic Mountains are frequented by javelina and mule deer. Mule deer may frequent the area west of the Beardsley Canal and the extreme north-eastern part of the study area. Javelina may extend into the north-eastern part of the area near the Agua Fria River (Arizona Game and Fish Department, 1979).

Areas of intense urban development and agricultural activity usually have limited wildlife populations although some species flourish under these conditions. Cropland, which constitutes approximately 40% of the study area, provides food and nesting areas for many species of songbirds such as redwinged and brewers blackbirds, cowbirds, sparrows, and meadow-larks, as well as game birds such as white winged doves, mourning doves, and gambel quail.

The vegetation resulting from desert washes, retention areas, and the surface impoundments associated with irrigated agriculture support a wider variety of wildlife than might otherwise be found in the area. This is especially true for game birds such as the mourning dove, whitewing dove, and gambel quail.

The major riparian plant communities along the Salt-Gila River from 91st Avenue to Gillespie Dam provide nesting, feeding, and resting sites for significant populations of shorebirds, waterfowl, gamebirds, and other wildlife. One particularly rich area between 91st Avenue and Bullard Avenue provides habitat for bird species such as the least bittern, ruddy duck, virginia rail, and long billed marsh wren which breed in only a few areas of Arizona. These river habitats are subject to periodic destruction from flooding (U.S. Army Corps of Engineer, 1978).

No threatened or endangered wildlife species depend wholly on habitats within the study area. The Yuma Clapper Rail, which is considered an endangered species, was sighted just outside of the area along the Gila River near 107th Avenue in 1970 and near El Mirage Road and the river bottom in 1976. It is unknown if this species has established a habitat in the study area. Recent flooding along the river has temporarily destroyed the habitat for this and other species (U.S. Environmental Protection Agency, 1979).

The Arizona Game and Fish Department maintains a wildlife management area in the riverbed near 115th Avenue and has an agreement with the City of Phoenix which guarantees effluent discharge to support the area. The Arizona State Parks Board has proposed a natural area in the riverbed from 91st Avenue to 115th Avenue. The Fred J. Weiler Greenbelt extends along the Gila River from 91st Avenue to beyond the Arizona-California border (U.S. Environmental Protection Agency, 1979).

The Fred J. Weiler Greenbelt is a federally designated special use area for wildlife and represents the cooperative efforts of the U.S. Department of the Interior Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Commission. It is the result of several federal actions, one of which, Public Land Order 1015, specified that certain public lands under the jurisdiction of the Department of the Interior were to be reserved for use by the Arizona Game and Fish Commission in connection with the Gila River waterflow project. Additional lands may be reserved in the future for greenbelt use (Arizona Game and Fish Department, 1979).

VIII. AIR QUALITY

Air quality can be impaired by dust, fumes, gas, mists, odors, smoke, or vapors of both man-made and natural origin. When present in significant quantities for sufficient periods of time, air pollutants can be injurious to human, plant, and animal life, cause property damage, interfere with outdoor activities, or deteriorate the visual quality of the atmosphere. Among the most serious pollutants nationwide are carbon monoxide, photochemical oxidants, sulphur dioxide, nitrogen dioxide, and particulate matter.

The Phoenix metropolitan area, as defined by the Maricopa Association of Governments, has been classified by the U.S. Environmental Protection Agency as a nonattainment area for carbon monoxide, photochemical oxidants, and total suspended particulates. The area meets standards for sulphur oxides and nitrogen oxides. Pollutant concentrations in this area vary according to time, location, and climatic conditions. Generally speaking, the highest concentrations are observed in the heavily urbanized parts of the region including Phoenix, Scottsdale, Mesa, and Glendale.

Vehicular traffic is responsible for the overwhelming majority of air quality problems in this region. The relative contribution of vehicular traffic to both particulate and chemical pollutant levels is shown in Table 1-5.

TABLE 1-5

SOURCE OF AIR POLLUTANTS WITHIN THE PHOENIX METROPOLITAN AREA

<u>SOURCE</u>	<u>PERCENTAGE OF POLLUTANTS</u>	
	<u>Carbon Monoxide</u>	<u>Hydrocarbons*</u>
Vehicular Traffic	94.9	55.9
Airports/Railroads	4.1	3.6
Large Point Sources	0.1	8.3
Area Sources	0.9	32.2
	<u>100.0</u>	<u>100.0</u>
	<u>Particulates</u>	
Traffic on unpaved roads	49.6	
Traffic on paved roads	16.0	
Disturbed desert	18.3	
Construction	7.8	
Other	8.3	
	<u>100.0</u>	

*Photochemical Oxidants

Source: U.S. Conference of Mayors, 1980.

The majority of the White Tanks-Agua Fria area is within the nonattainment area. Due to the rural nature of the study area, carbon monoxide and photochemical oxidants are not a major problem at this time. Concentrations of total suspended particulates may be a local problem as a result of farming and construction activity and traffic on unpaved roads (Source: Maricopa County Health Department, 1979a).

IX. HISTORICAL RESOURCES

The first known permanent settlers in Maricopa County were the Hohokam Indians. These people are believed to have migrated from Mexico around 200 to 300 A.D. into much of central and southern Arizona. Their agrarian culture flourished in the Salt River Valley until about 1400 to 1450 A.D. when they abandoned the Valley for unknown reasons.

The Hohokam initially planted their crops on the river terraces and depended on the periodic flooding of the Gila and Salt Rivers to irrigate their fields. Later, canal irrigation was introduced. Over 250 miles of canals were eventually built in the Phoenix metropolitan area.

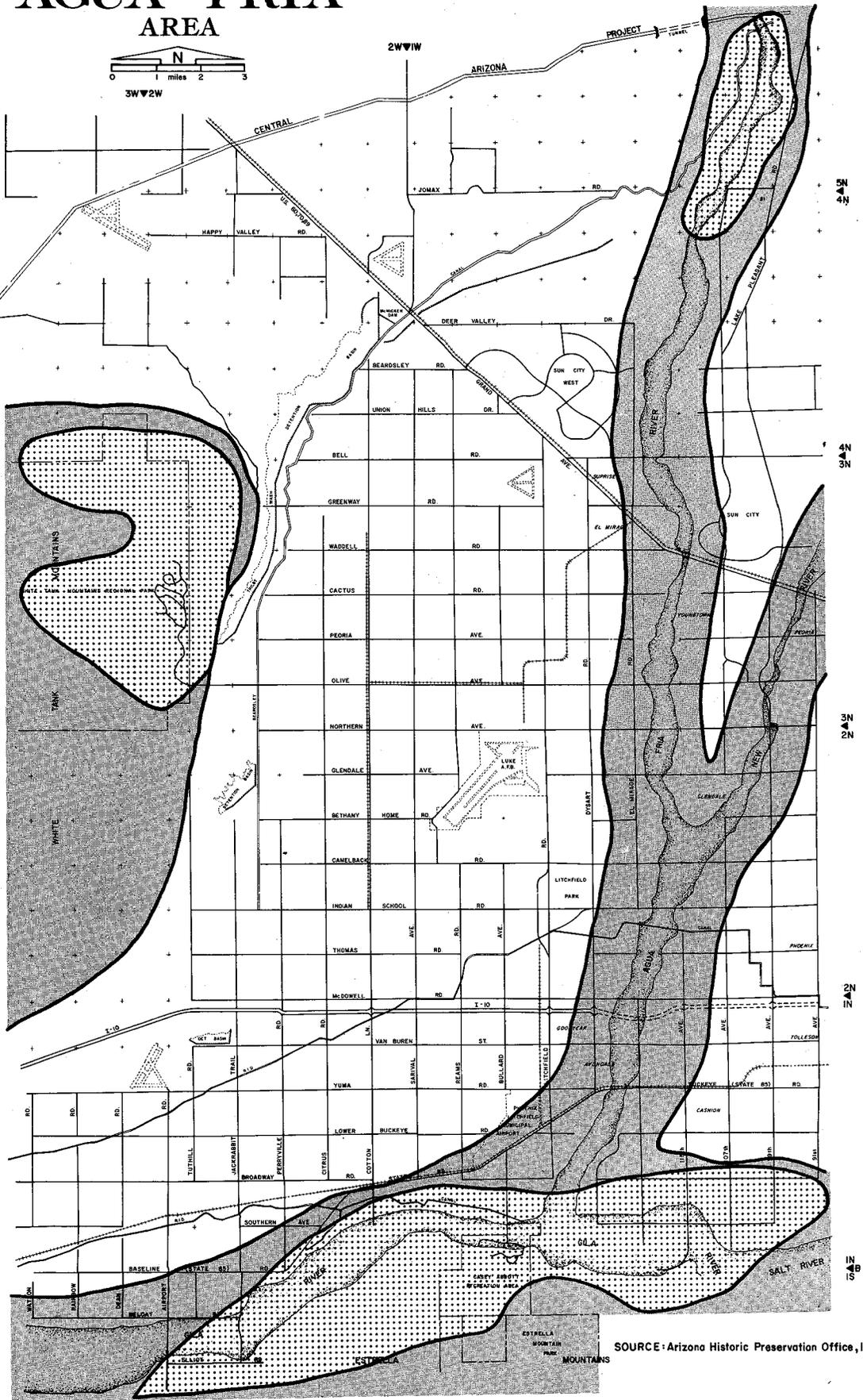
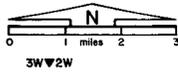
At the earliest stages of development, the Hohokam lived in small farming communities which were widely distributed over the region. As cultural development continued, they gradually became concentrated into fewer and larger villages. Some of the most characteristic traits of the Hohokam include: wattle and daub houses with sunken floors, cremation of the dead, the construction of large earthen structures such as platform mounds and ball courts, and the manufacture of clay figurines, shell and stone jewelry and tools, and painted pottery (Arthur Beard Engineers, Inc., 1978).

Over 800 Hohokam sites have been recorded within the Salt River Valley. The majority of these sites are located along major rivers, their tributaries, and adjacent low lying stream terraces. These remains vary from seasonal villages to large permanent habitation sites. Many have been destroyed by urbanization and agricultural development, or badly vandalized. A small percentage have been preserved or carefully studied.

A complete survey of all potential archaeological sites in Maricopa County has never been completed. However, preliminary studies indicate that the potential for significant archaeological resources is extremely high in certain portions of the study area. These are shown on Map 17. Identified sites are located just outside of the study area in White Tank Mountain Regional Park, Estrella Mountain Park, and near Cashion.

WHITE TANKS AGUA FRIA AREA

HIEROGLYPHIC MOUNTAINS



LEGEND

- EXTREMELY HIGH
- HIGH
- MEDIUM-LOW

SOURCE: Arizona Historic Preservation Office, 1980.

SELECTED REFERENCES

- Arizona Game and Fish Department. Personal communication with Bob Barsch, October, 1979.
- Arizona Outdoor Recreation Coordinating Commission (AORCC). A Plan For Outdoor Recreation In Arizona, 1967.
- Arizona Historic Preservation Office, Arizona State Parks Board. Personal communications with Thomas Rothweiler, January, 1980.
- Arizona State University, Office of State Climatologist. Climate and Energy in Central Arizona, preliminary version, June, 1978.
- Arizona Water Commission, 1975. Arizona State Water Plan, Phase I Inventory of Resources and Uses, July, 1975.
- _____. 1978. Projected Water Uses, Supplies, and Groundwater Conditions In Selected Basins In Arizona, draft report, April, 1978.
- Arthur Beard Engineers, Inc. and Camp, Dresser, and McKee. Existing Environmental Setting, Memorandum No. 1, A report to the Maricopa Association of Governments, April 7, 1978.
- Eaton, Gordon P., Donald L. Peterson, and Herbert H. Schumann. Geophysical, Geohydrological, and Geochemical Reconnaissance of the Luke Salt Body, Central Arizona, U.S.D.I., Geological Survey Professional Paper 753, 1972.
- Flawn, Peter. Environmental Geology, Conservation, Land Use Planning, and Resource Management, Harper and Row, 1970.
- International Conference of Building Officials. Uniform Building Code, 1979.
- Kister, L. R.. Dissolved Solids Content of Groundwater in the Phoenix Area, Arizona, U.S.D.I., Geological Survey Folio Map I-845 G, 1974.
- Laney, Raymond, and Winikka. Water Level Declines, Land Subsidence, and Earth Fissures In South Central Arizona, U.S.D.I., Geological Survey, Water Resources Investigation 78-83, June, 1978.
- Maricopa Association of Governments (MAG) 208 Water Quality Management Program Groundwater Quality In The Major Basins of Maricopa County, December, 1979.
- Maricopa County Department of Health Services, 1979 a. Personal communication, Bureau of Air Pollution Control, April, 1979.
- _____, 1979 b. Air Pollution In The Valley of the Sun An Overview.

- Maricopa County Department of Planning and Development. Zoning District Maps Maricopa County Unincorporated Area, 1979.
- Maricopa County Flood Control District, 1979. Personal communications with Dave Johnson and Jack Levitt, August, 1979.
- _____, 1980. Personal communication with Dave Johnson, April, 1980.
- Maricopa County Planning and Zoning Department, 1972. A Report Upon West Central Maricopa County, Volume II.
- _____, 1975. Generalized Slope Characteristics, Maricopa County, Arizona, preliminary worksheets.
- _____, 1977. Soil Associations, Maricopa County, Arizona.
- _____, 1978. Luke Area Development Guide, draft report, September, 1978.
- Maricopa County Office of Civil Defense. Maricopa County Peacetime Disaster Plan, 1979.
- Moore, Richard T. and Robert J. Varga. Mineral Construction Materials in the Phoenix Area, Arizona, U.S.D.I., Geological Survey, Folio Map I-845-J, 1976.
- National Oceanic and Atmospheric Administration (NOAA). Personal communication, Phoenix, Arizona, December, 1979.
- Osterkamp, W.R.. Map Showing Depth To Water In Wells In The Phoenix Area, Arizona, U.S.D.I., Geological Survey Folio Map I-845-D, 1972.
- Osterkamp, W.R., and P. P. Ross. Map Showing Distribution of Recoverable Groundwater In The Phoenix, Area, Arizona, U.S.D.I., Geological Survey Folio Map I-845-K, 1976.
- Ross, P. P.. Maps Showing Groundwater Conditions In The Western Part of the Salt River Valley Area, Maricopa County, Arizona, U.S.D.I., Geological Survey Water Resources Investigation 78-40, 1977.
- Schumann, H. H.. Land Subsidence and Earth Fissures in Alluvial Deposits in the Phoenix Area, Arizona, U.S.D.I., Geological Survey Map I-845-H, 1974.
- Turner, R.M. Map Showing Vegetation in the Phoenix Area, Arizona U.S.D.I., Geological Survey Folio Map I-845-I, 1974.
- University of Arizona, Arizona Bureau of Geology and Mineral Technology. "Earthquakes," Fieldnotes, Volume 9, Number 1, March, 1979.
- University of Arizona, Arizona Bureau of Mines. Geologic Map of Maricopa County, Arizona, 1957.
- U.S. Army Corps of Engineers, 1968. Floodplain Information, Agua Fria River, Maricopa County, Arizona, Los Angeles District, 1968.

- _____, 1975. Gila River Basin New River and Phoenix City Streams, Arizona. Proposed Plan For Flood Control and Recreational Development, Los Angeles District, October, 1975.
- _____, 1978. Maricopa Association of Governments Draft Environmental Assessment, U.S. Environmental Protection Agency Draft Environmental Impact Statement on Point Source Metro Phoenix Alternatives for MAG 208 Water Quality Management Plan, November, 1978.
- U.S. Conference of Mayors. Urban Air: Notes on Reconciling Community Development, Economic Development, Air Quality, and Transportation, preconference handbook, January, 1980.
- U.S. Department of Agriculture, Soil Conservation Service, 1977 a. Soil Survey of Maricopa County, Arizona, Central Part, September, 1977.
- _____, 1977 b. Prime Farmland In Central Maricopa and Eastern Maricopa - Northern Pinal Soil Survey Areas, Maricopa County, Arizona, Map Sheets 2 and 4, June 1977.
- _____, 1978. Important Farmlands of Maricopa County, Arizona.
- _____, 1979. Personal communication with Bart Ambrose and Don White Phoenix, Arizona.
- U.S. Department of Interior, Bureau of Reclamation, 1977. Central Arizona Project Geology and Groundwater Resources Report, Maricopa County and Pinal County, Arizona, Volume I, Bureau of Reclamation, Lower Colorado Region, Arizona Projects Office, Phoenix, Arizona, October, 1977.
- _____, 1980. Central Arizona Water Control Study Newsletter, January, 1980.
- U.S. Department of Interior, Geological Survey 7.5 Minute Series Topographic Quadrangles, various years.
- _____, 1964. Geology and Groundwater of the Luke Area, Maricopa County, Arizona, Geological Survey Water Supply Paper 1779-D, 1964.
- _____, 1969. Geologic Map of Arizona.
- U.S. Environmental Protection Agency. Final Environmental Impact Statement Maricopa Association of Governments Point Source Metro Phoenix 208 Wastewater Management Plan, July, 1979.
- Water and Power Resource Services. Central Arizona Water Study, Stage II Report, Arizona Projects Office, March, 1981.

**S
O
C
I
O

E
C
O
N
O
M
I
C

S**

I. POPULATION GROWTH IN MARICOPA COUNTY

Past Population Growth

The population of Maricopa County in 1979 was estimated to be 1,453,000. This represents 55.2 percent of the estimated resident population of the State of Arizona which is 2,631,000 (DES, 1979).

In 1940, the population of Maricopa County was just over 186,000. This represented 37 percent of the total population of the State of Arizona. Since 1940, the majority of the State's unprecedented population growth has taken place in Maricopa County.

The County's population increased 78 percent between 1940 and 1950, then doubled between 1950 and 1960. It has more than doubled since 1960. The County is expected to have a population of almost 1.5 million by 1980 (See Table 2-1).

TABLE 2-1

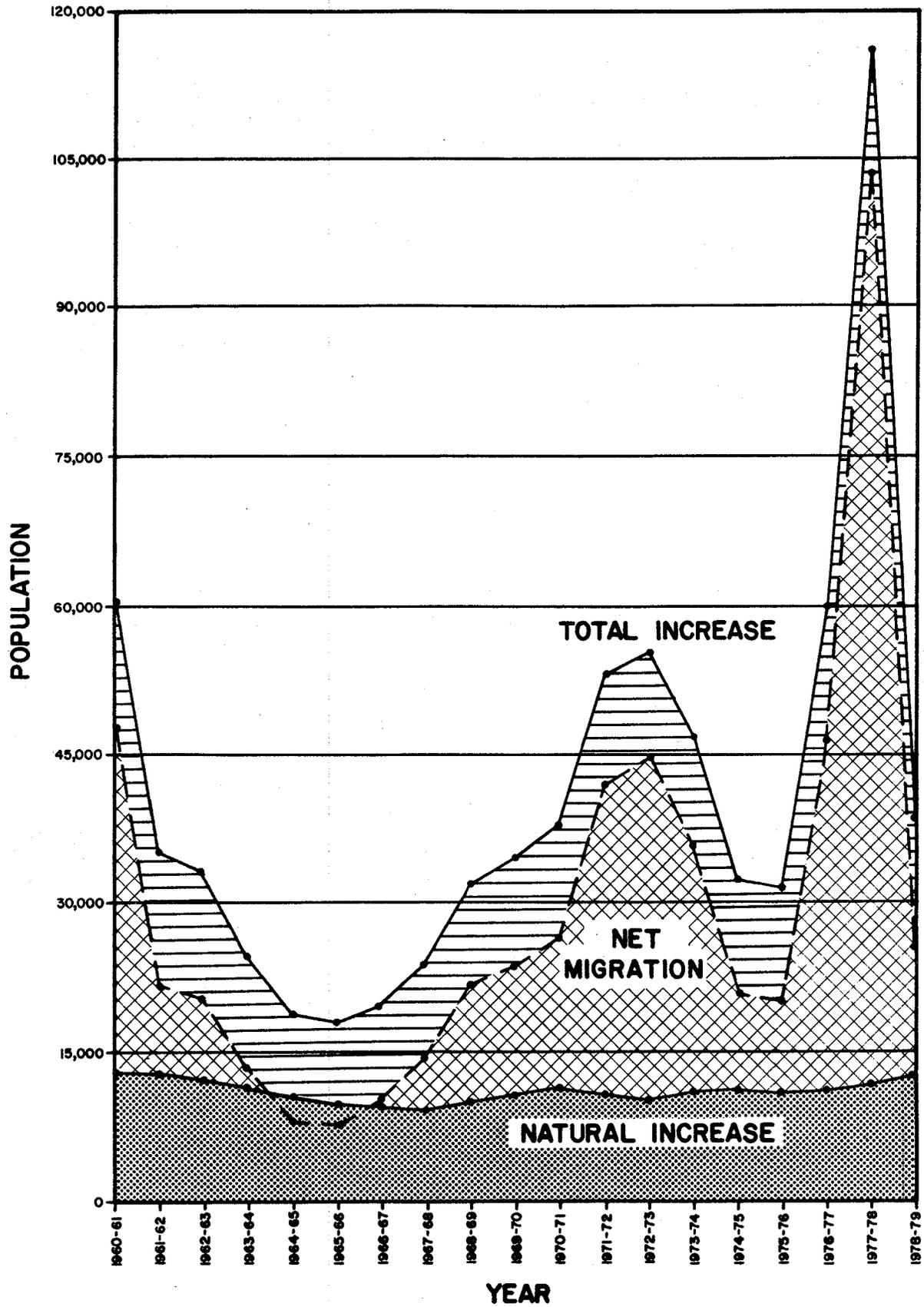
POPULATION GROWTH MARICOPA COUNTY, ARIZONA 1900-1980

YEAR	TOTAL POPULATION	PERIOD	CHANGE	
			NUMBER	PERCENT
1900(1)	20,457			
1940(1)	186,193	1900-1940	165,736	810.2
1950(1)	331,770	1940-1950	145,577	78.2
1960(1)	663,510	1950-1960	331,740	100.0
1970(2)	971,228	1960-1970	307,718	46.4
*1980(3)	1,490,100	1970-1980	518,872	53.4
	*Projection	1960-1980	826,590	124.6

Sources: (1) Maricopa County Planning Department, 1971.
 (2) U.S. Bureau of the Census, 1979
 (3) Arizona Department of Economic Security, 1979.

FIGURE 2-1

POPULATION INCREASE BY COMPONENTS MARICOPA COUNTY, ARIZONA



SOURCE: Arizona Statistical Abstract, 1979.

The majority of the County's population growth has been the result of net migration. Local growth has been heavily influenced by the nationwide movement of people to the "sunbelt states" of the west and southwest. As shown by Figure 2-1, the percentage of the total population increase due to net migration has varied widely over the years. This component of population change appears to reflect national and local economic conditions. In comparison, the natural increase in population has remained relatively stable due in part to declining birth rates.

Contrary to popular opinion, Maricopa County has not received a disproportionate amount of retirement immigration. The Arizona Department of Economic Security estimates that about 15 to 17 percent of immigration is due to retirees. By comparison, 40 percent of the yearly immigration to Maricopa County is employment migration. Younger persons, both single and married, typically, have a greater tendency to relocate than do persons in the older age groups (DES, 1980).

Future Population Growth

Population projections prepared by the Arizona Department of Economic Security indicate that the County's rapid population growth will continue in the future, although the rate of growth is expected to decline. Between 1980 and the year 2000 the population of Maricopa County is projected to increase from 1,490,100 to 2,443,000. This increase of 952,900 (64%) compares with an increase of 826,590 (125%) between 1960 and 1980. The County's share of the total population within Arizona will increase to 57.1% by the year 2000 (See Table 2-2).

Net migration will continue to be responsible for the majority of the County's population growth in the foreseeable future. Continued immigration will require, and result from, continued economic expansion. By the year 2000, 75 percent of total immigration is expected to be related to employment (DES, 1980).

TABLE 2-2

PROJECTED POPULATION GROWTH
MARICOPA COUNTY, ARIZONA
1980-2000

YEAR	TOTAL POPULATION	PERIOD	CHANGE	
			NUMBER	PERCENT
1980	1,490,100			
1990	1,895,500	1980-1990	405,400	27.2
2000	2,443,000	1990-2000	547,500	28.9
		1980-2000	952,900	63.9

Source: Arizona Department of Economic Security, 1979

Distribution of Population Growth

The overwhelming majority of population growth in Maricopa County has taken place in the Phoenix metropolitan area. This trend is expected to continue. To illustrate the distribution of past and projected population growth, the Maricopa Association of Governments (MAG) Urban Planning Area was divided into ten subareas. (See Map 18). These roughly correspond to local jurisdictional interests and are based on MAG's designated municipal and local planning areas. The remainder of the County was lumped into a single category. Note that Subarea 1 includes the majority of the White Tanks-Agua Fria Area.

POPULATION GROWTH 1970-1980

In 1970, approximately 66% of the total County population was located in subareas 4, 7, and 9. Together, subareas 4 and 7 accounted for almost half of this total (See Figure 2-2).

All of the subareas experienced significant growth during the 1970's with the exception of Subarea 7, which declined in population. By 1980, increases ranging from 32% in area 8 to over 500% in Subarea 2 are anticipated (See Table 2-3)

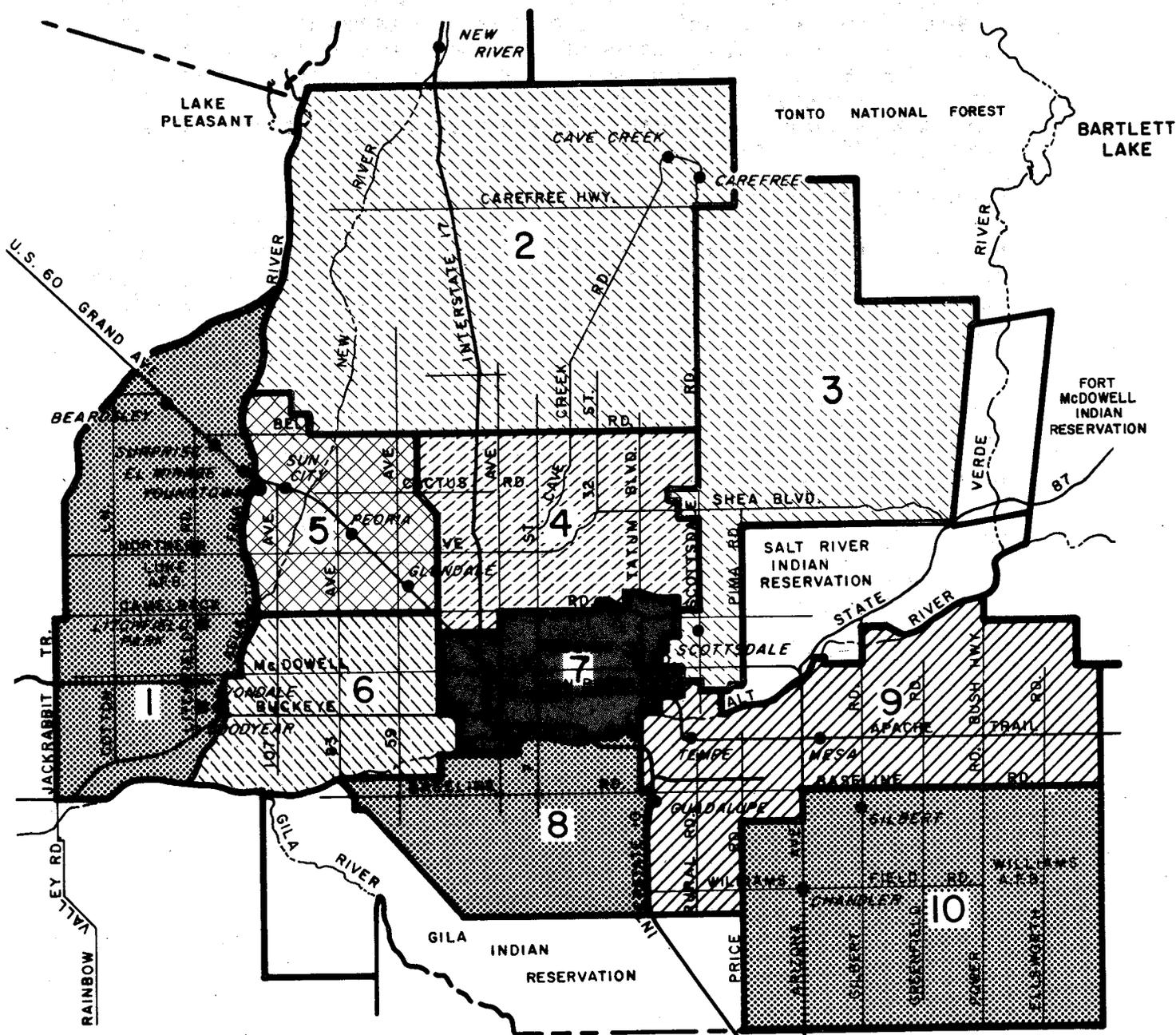
TABLE 2-3
DISTRIBUTION OF POPULATION GROWTH
WITHIN MARICOPA COUNTY
1970-1980

SUBAREA	1970 POPULATION	PROJECTED 1980 POPULATION	CHANGE 1970-1980		PERCENT OF TOTAL COUNTY INCREASE
			NUMBER	PERCENT	
1	24,446	36,245	11,799	48.3	+2.3
2	8,282	52,400	44,118	533.7	+8.5
3	69,085	100,500	31,415	45.5	+6.0
4	219,691	347,100	127,409	59.0	+24.5
5	61,438	153,600	92,162	150.0	+17.1
6	66,575	100,805	34,230	51.4	+6.6
7	269,525	258,300	-(11,225)	-(4.2)	-(2.1)
8	49,651	65,600	15,949	32.1	+3.1
9	155,500	304,300	148,800	95.7	+28.6
10	26,737	47,300	20,563	76.9	+3.9
Remainder	18,826	23,950	5,124	27.2	+1.0
	969,756	1,490,100	520,344	53.65	99.5*

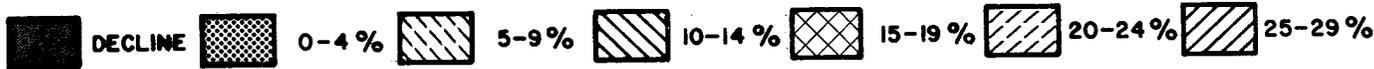
*Error due to rounding

NOTE: The 1970 population estimate for Maricopa County was recently revised by the U.S. Census Bureau to 971,228. This resulted from an adjustment of census tract populations within the City of Phoenix and is insignificant for relative comparison purposes.

Sources: U.S. Bureau of the Census, 1972
MAG Transportation Planning Office, 1980.



LEGEND



**SUBAREA PERCENTAGE OF TOTAL COUNTY
POPULATION GROWTH 1970-1980**

The majority of the County's population growth since 1970 has taken place in areas 4, 5, and 9. This indicates a general movement of population to the north and northwest parts of the Phoenix metropolitan area and to the east Mesa area. By 1980, Areas 1, 8, and 10 will have received less than 5% of the County's total growth over the last decade. About 1% of the County's total growth between 1970 and 1980 took place outside of the metropolitan area (See Map 18).

POPULATION GROWTH 1980-2000

Population projections prepared by MAG indicate that the population of the metropolitan area will increase 64 percent between 1980 and the year 2000. Increases will range from about 1% in Subarea 7 to over 200% in Subareas 1, 2, and 10 (See Table 2-4).

Future population growth is expected to be more evenly distributed within the metropolitan area than in the past. Significantly, each of Subareas 1, 2, and 10 are projected to receive over 10% of the total County growth between 1980 and the year 2000. Approximately two percent of the total growth is expected to occur in the non-metropolitan area.

By the year 2000, Subareas 4, 5, 7, and 9 are expected to contain approximately 60% of the total County population. Changes in the percentage of total County population in each subarea between 1970 and 2000 are shown in Figure 2-2. Note that the percentage of the County's total population in Subareas 1, 2, 4, 7, and 10 will increase significantly between 1980 and the year 2000.

TABLE 2-4

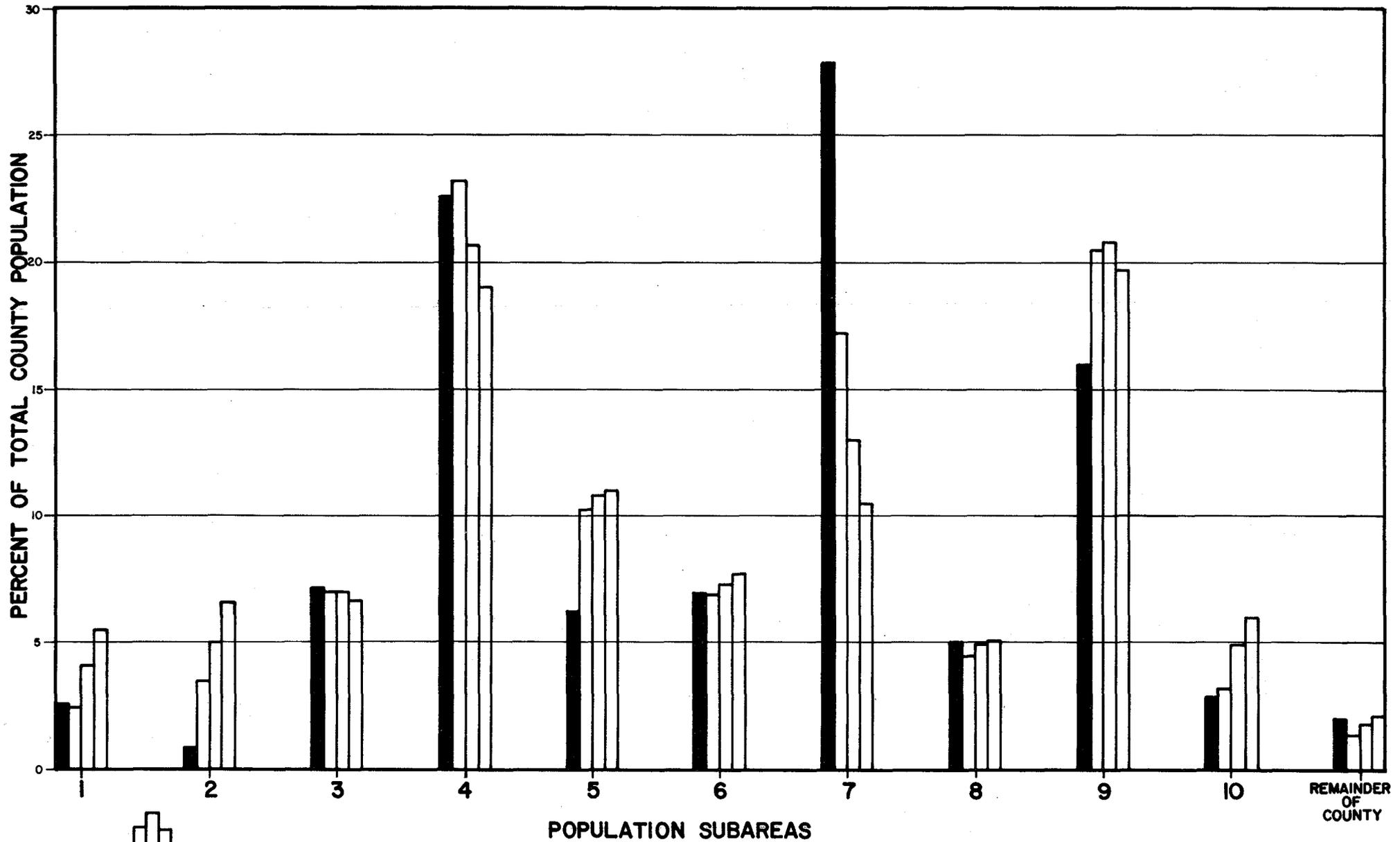
DISTRIBUTION OF PROJECTED POPULATION GROWTH BY SUBAREA
MARICOPA COUNTY, ARIZONA
1980-2000

SUBAREA	PROJECTED POPULATION			CHANGE 1980-1990		CHANGE 1980-2000		PERCENT OF TOTAL COUNTY INCREASE 1980-2000
	1980	1990	2000	NUMBER	PERCENT	NUMBER	PERCENT	
1	36,245	78,720	137,050	42,475	117.18	100,805	278.12	10.58
2	52,400	94,750	162,200	42,350	80.82	109,800	209.54	11.52
3	100,500	132,700	163,500	32,200	32.04	63,000	62.69	6.61
4	347,100	392,200	466,200	45,100	12.99	119,100	34.31	12.50
5	153,600	203,000	270,000	49,400	32.16	116,400	75.78	12.21
6	100,805	138,030	187,650	37,225	36.92	86,845	86.15	9.11
7	258,300	245,700	255,500	-(12,600)	-(4.87)	-(2,800)	-(1.08)	-(.29)
8	65,600	91,000	124,000	25,400	38.71	58,400	89.02	6.13
9	304,300	394,800	489,200	90,500	29.74	184,900	60.76	19.40
10	47,300	91,800	145,600	44,500	94.08	98,300	207.82	10.32
Subtotal	1,466,150	1,862,700	2,400,900	396,550	27.05	934,750	63.75	98.09
Rest of County	23,950	32,800	42,100	8,850	36.95	18,150	75.78	1.90
TOTAL	1,490,100	1,895,500	2,443,000	405,400	27.21	952,900	63.95	99.99*

*Error due to rounding

Source: MAG Transportation Planning Office, 1980.

FIGURE 2-2
 SUBAREA PERCENTAGE OF TOTAL COUNTY POPULATION
 1970-2000



SOURCE: Maricopa County Department of Planning and Development, 1979.

1970
 1980
 1990
 2000

II. POPULATION GROWTH WITHIN THE WHITE TANKS-AGUA FRIA AREA

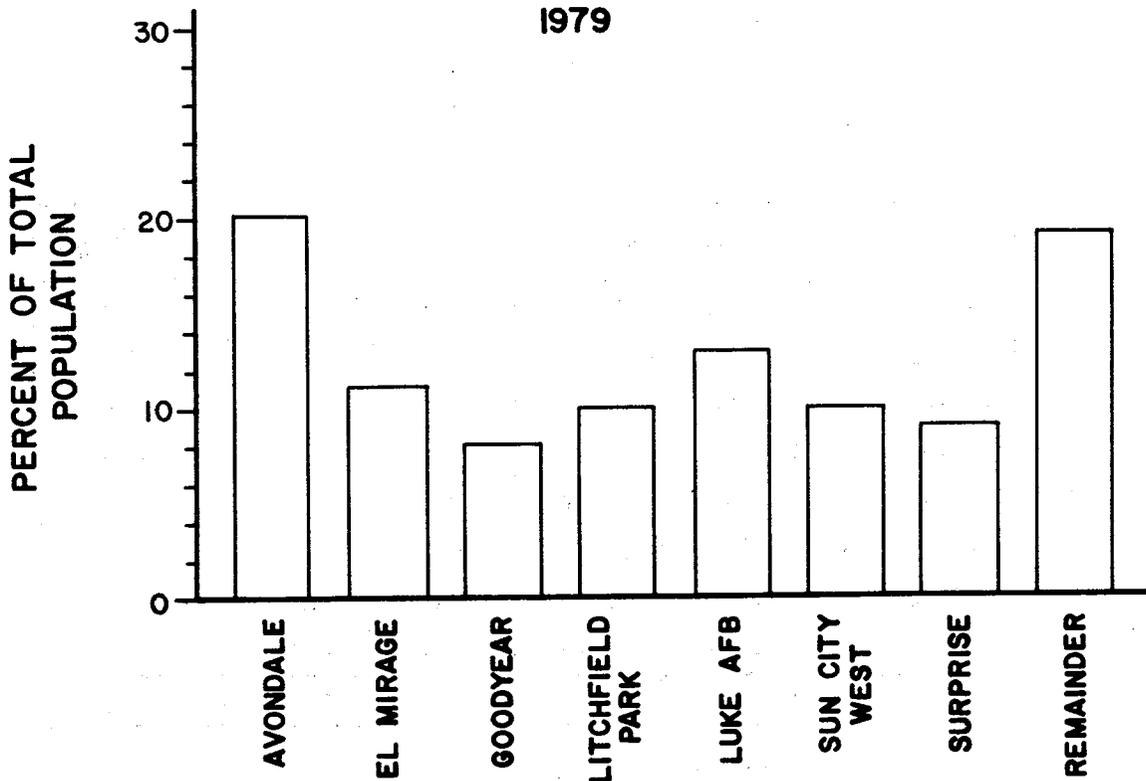
Existing Population

The estimated population of the White Tanks-Agua Fria area in October, 1979 was 35,918. This represented 2.5 percent of the total estimated population of Maricopa County, which was 1,453,000 in 1979.

The majority of the study area's population is located within the major communities and at Luke Air Force Base. The distribution of population is as follows: Avondale 7,130, El Mirage 3,800, Goodyear 2,745, Litchfield Park 3,627, Luke Air Force Base 4,540, Sun City West 3,675, and Surprise 3,400. The remaining 7,001 residents were scattered throughout the study area. (See Figure 2-3). The large amount of agricultural cropland and vacant desert in the study area results in a very low overall population density of 112 persons per square mile.

FIGURE 2-3

DISTRIBUTION OF POPULATION WHITE TANKS-AGUA FRIA AREA 1979



Past Population Growth

In 1970, an estimated 25,364 persons lived within the study area. This represented 2.6 percent of the County total of 971,228.

Between 1970 and 1979, the population of the study area increased by 10,000 persons to 35,918. This 42 percent increase compares to an increase of 49.7 percent for Maricopa County during this same time period. The study area received approximately 2 percent of the total County growth between 1970 and 1979.

Table 2-5 shows the estimated change in population between 1970 and 1979 by major community. The incorporated communities received about 24 percent of the total growth as follows: Avondale 4.3 percent, El Mirage 5.1 percent, Goodyear 5.6 percent, and Surprise 9.2 percent. The major unincorporated communities of Litchfield Park and Sun City West together accounted for 52 percent of the total with Litchfield Park receiving 17 percent and Sun City West receiving 35 percent. Significant growth also took place in the southwest and northwest parts of the area as well as southeast of Luke Air Force Base.

Portions of the study area lost population. Included were the older neighborhoods in Avondale and Goodyear as well as Luke Air Force Base. This can be attributed to several factors including the maturing of neighborhoods, the removal of older dwelling units, and current trends toward smaller household size.

TABLE 2-5
CHANGE IN POPULATION
WHITE TANKS-AGUA FRIA AREA
1970-1979

COMMUNITY	POPULATION		CHANGE		PERCENT OF TOTAL CHANGE
	1970	1979	NUMBER	PERCENT	
Avondale	6,672 ¹	7,130 ²	458	6.9	4.3
El Mirage	3,266 ¹	3,800 ²	534	16.3	5.1
Goodyear	2,149 ¹	2,745 ²	596	27.7	5.6
Litchfield Park	1,664 ¹	3,627 ³	1,785	96.9	16.9
Luke AFB	5,047 ¹	4,540 ⁴	-(507)	-(10.0)	-(4.8)
Sun City West	0	3,675 ³	3,675	NA	34.8
Surprise	2,427 ¹	3,400 ²	973	40.1	9.2
Remainder	4,139	7,001 ³	3,040	76.7	28.8
TOTAL	25,364	35,918	10,554	41.6	99.9

- Sources: 1) U.S. Census Bureau, 1972.
2) Arizona Department of Economic Security, 1979b.
3) Maricopa County Department of Planning and Development, 1979.
4) Luke Air Force Base, 1979.

The majority of population growth within the study area was the result of immigration by out of state retirees and people from the greater Phoenix area. The single most significant growth factor has been the development of Sun City West since 1977.

Future Population Growth

The White Tanks-Agua Fria area is expected to experience a significant increase in population during the next 20 years. Current population projections indicate that over 140,000 persons will live within the area by the year 2000. This represents an increase of about 105,000 persons (292%) from the estimated 1979 population. If these projections are realized, the study area will receive over ten percent of the total population growth in Maricopa County between 1980 and the year 2000.

These projections suggest that substantial changes will take place within the study area over the next twenty years. Land use, the economy, housing, social characteristics, transportation needs, and the demand for public services and facilities will be affected. The area will also increase in importance from a regional standpoint. The majority of population growth within the area will result from immigration.

Approximately 40 percent of the total population growth within the study area during the next 20 years will occur between 1980 and 1990. By 1990, the population of the area will more than double reaching 81,620. The majority of this increase will occur after 1985 (See Table 2-6).

TABLE 2-6

PROJECTED POPULATION GROWTH WITHIN THE
WHITE TANKS-AGUA FRIA AREA
1979-2000

YEAR	TOTAL POPULATION	PERIOD	CHANGE		PERCENT OF TOTAL INCREASE
			NUMBER	PERCENT	
1979	35,918*				
1980	39,645	1979-1980	3,727	10.4	3.5
1985	55,207	1980-1985	15,562	39.2	14.8
1990	81,620	1985-1990	26,413	47.8	25.2
1995	108,835	1990-1995	27,215	33.3	25.9
2000	140,900	1995-2000	32,065	29.5	30.5
*Existing Estimate		1979-2000	104,982	292.3	99.9

Source: 1) Maricopa Association of Governments Transportation Planning Office, 1980.

The selected population projections for the study area are based on those approved by the Maricopa Association of Government (MAG) for local and municipal planning areas. The boundaries of MAG's planning areas which overlap the study area are shown on Map 19. The adopted population projections for each planning area are shown by five year increments in Table 2-7.

Since MAG's planning areas do not coincide exactly with the boundaries of the study area, a number of modifications and assumptions were made. They are as follows:

- *The MAG projection for the Avondale area was further defined in conjunction with MAG officials to identify the increase in population expected west of the Agua Fria River.
- *Other boundary inconsistencies along the Agua Fria River and the Gila River were considered insignificant.
- *It was assumed that the northern and western portions of the study area which are outside of the MAG urban planning area would experience the same average annual numeric increase in population between 1980 and the year 2000 as between 1970 and 1979.

TABLE 2-7
DISTRIBUTION OF FUTURE POPULATION GROWTH
WHITE TANKS-AGUA FRIA AREA
1980-2000

PLANNING AREA		1980	1985	1990	1995	2000	CHANGE 1980-2000	
							NUMBER	PERCENT
Avondale*	Total	7,145	8,207	9,270	11,235	13,200	6,055	84.74
	(49)	4,195	5,232	6,270	8,160	10,050	5,855	139.57
	(52)	2,950	2,975	3,000	3,075	3,150	200	6.78
El Mirage	(14)	3,950	6,000	7,600	10,100	12,900	8,950	226.58
Glendale (Luke AFB)	Total	7,100	7,500	7,900	8,000	8,700	1,600	22.53
	(36)	4,900	5,000	5,000	5,000	5,100	200	4.08
	(37)	2,200	2,500	2,900	3,000	3,600	1,400	63.64
Goodyear	(51)	3,700	5,000	12,100	19,100	26,000	22,300	602.70
Litchfield Park	(38)	3,200	4,900	8,900	13,600	18,500	15,300	478.12
Sun City West	(11)	6,500	13,900	23,900	32,300	44,600	38,100	586.15
Surprise	Total	4,050	4,900	6,400	8,100	9,800	5,750	142.00
	(13)	3,450	3,700	4,700	5,900	7,000	3,550	102.90
	(12)	600	1,200	1,700	2,200	2,800	2,200	366.67
Remainder of MAG Region	Total	2,000	2,350	2,650	3,050	3,400	1,400	70.00
	(10)	400	450	450	550	600	200	50.00
	(50)	1,600	1,900	2,200	2,500	2,800	1,200	75.00
Area Outside of MAG Region		2,000	2,450	2,900	3,350	3,800	1,800	90.00
TOTAL		39,645	55,207	81,620	108,835	140,900	101,255	268.41

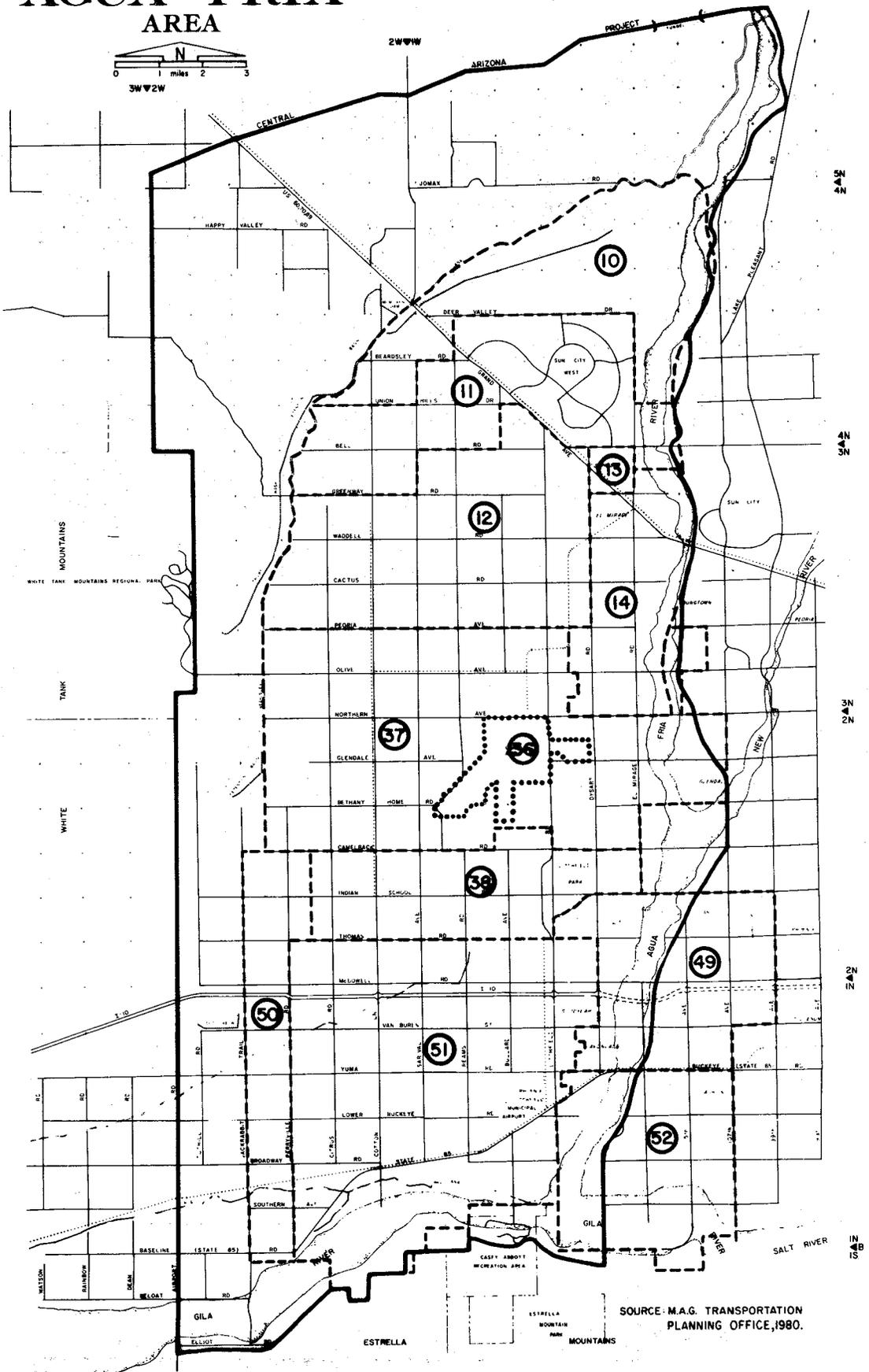
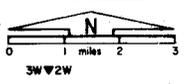
*Includes only that portion west of the Agua Fria River.

Source: Maricopa Association of Governments Transportation Planning Office, 1980.

WHITE TANKS AGUA FRIA AREA

MEROGLYPHIC MOUNTAINS

1W1E



SOURCE: M.A.G. TRANSPORTATION PLANNING OFFICE, 1980.

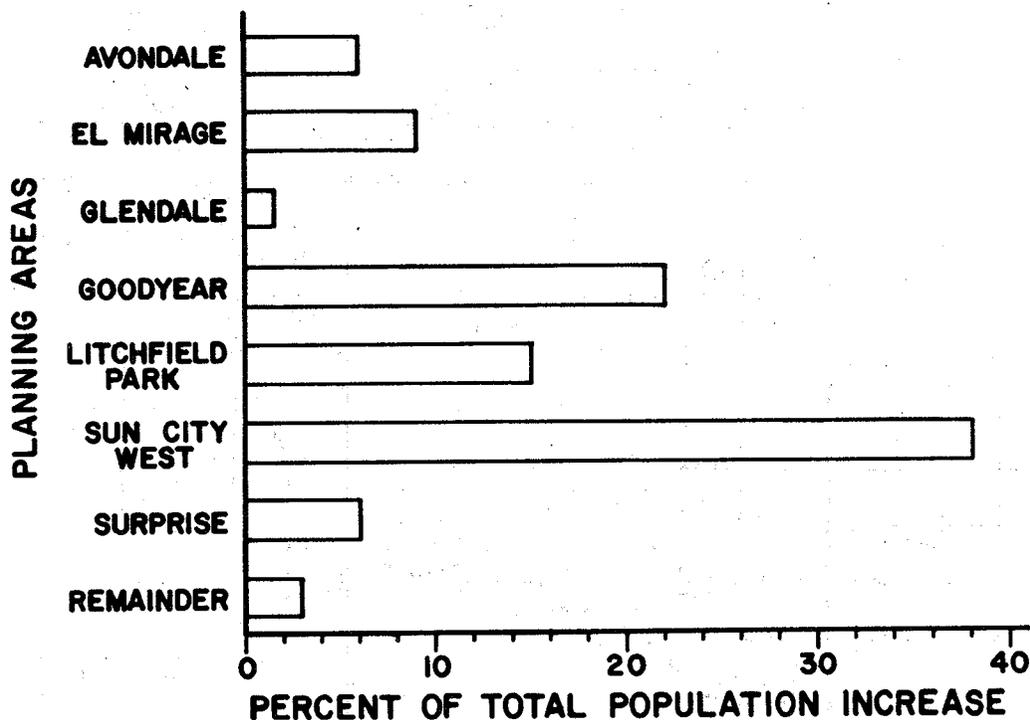
(SEE TABLE 2-7)

As shown by Figure 2-4, residential development in the Sun City West, Litchfield Park, and Goodyear Planning areas will be responsible for the majority of population growth within the study area through the year 2000.

Sun City West alone will receive almost 40% of the total projected increase between 1980 and the year 2000. This projection assumes that the Del Webb Company will eventually expand its development south of Grand Avenue. Sun City West Phase I has a design capacity of 32,500. Consequently, about 7,000 people are anticipated south of Grand Avenue sometime between 1990 and the year 2000.

The Litchfield Park area is expected to receive about 15 percent of the total population increase. The Goodyear planning area will be responsible for 22 percent of the total. These projections anticipate an accelerated demand for residential development in the southern part of the study area once Interstate-10 is completed. Improved access to the Phoenix metropolitan area will also increase the demand for housing in the Avondale planning area. However, the majority of Avondale's future residential development will take place east of the Agua Fria River and outside of the study area.

FIGURE 2-4
DISTRIBUTION OF PROJECTED POPULATION GROWTH
WHITE TANKS-AGUA FRIA AREA
1980-2000



Sun City West will be responsible for almost half of the total population growth within the study area to 1985. After 1985, population growth in the Litchfield Park and Goodyear planning areas will increase when Interstate-10 is completed as far as 51st Avenue. The relative significance of the population projections for each major planning area are shown by Table 2-8.

TABLE 2-8

POPULATION PROJECTIONS FOR PLANNING AREAS
 WITHIN THE WHITE TANKS-AGUA FRIA AREA
 BY FIVE YEAR INCREMENTS
 1980-2000

PLANNING AREA	PERCENT OF TOTAL POPULATION INCREASE				
	1980-85	1985-1990	1990-1995	1995-2000	1980-2000
Avondale	6.82	4.02	7.22	6.13	5.98
El Mirage	13.17	6.06	9.19	8.73	8.84
Glendale	2.57	1.51	0.37	2.18	1.58
Goodyear	8.35	26.88	25.72	21.52	22.02
Litchfield Park	10.92	15.14	17.27	15.28	15.11
Sun City West	47.55	37.86	30.86	38.36	37.62
Surprise	5.46	5.68	6.25	5.30	5.68
Remainder	5.14	2.84	3.12	2.49	3.16
TOTAL	99.99*	99.99*	100.00	99.99*	99.99*

*Error due to rounding.

The future gross population density will remain low within the study area due to its relatively large size. If the MAG based population projections are achieved, it will increase from 111 persons per square mile in 1979 to 449 persons per square mile by the year 2000. Densities within some individual planning areas will increase dramatically, however.

III. POPULATION CHARACTERISTICS WITHIN THE WHITE TANKS-AGUA FRIA AREA

This chapter compares the characteristics of the population within the White Tanks-Agua Fria area with those of Maricopa County as a whole. Addressed are ethnic composition, age, income, unemployment, and levels of education.

Information on the entire study area population is not available. Recent estimates of the characteristics of some major communities are available from the Arizona Department of Economic Security. Otherwise, the 1970 census is the only source of information. This is limited since the study area overlaps census tracts which cover larger areas of Maricopa County.

Ethnic Composition

The ethnic composition of major communities within the White Tanks-Agua Fria area is shown by Table 2-9. Specific information for Sun City West is not available.

Major concentrations of minorities are found in the communities of Avondale, El Mirage, and Surprise. The percentage of the total population of these communities made up by minorities is significantly higher than that of Maricopa County as a whole. Litchfield Park and Goodyear are predominantly white communities as is Sun City West. Minorities account for approximately 18 percent of the population at Luke Air Force Base.

Age Composition

The estimated age structure within major communities in the White Tanks-Agua Fria area is shown in Table 2-10. Specific information for Sun City West is not available.

The percentage of the population in the 0-19 age bracket in the communities of El Mirage, Avondale, and Surprise is significantly higher than in Maricopa County as a whole. Over half of the population in El Mirage and Surprise is in this category. The Town of Goodyear closely approximates the County, while Luke Air Force Base and Litchfield Park are below the County average.

The age category 20-64 is considered the working age group. Less than half of the population in the communities of Avondale, El Mirage, and Surprise falls into this category. The percentage of the population in this category in Goodyear, Litchfield Park, and Luke Air Force Base exceeds that for Maricopa County as a whole.

TABLE 2-9
 ESTIMATED ETHNIC COMPOSITION WITHIN MAJOR COMMUNITIES
 WHITE TANKS-AGUA FRIA AREA
 July, 1978

	TOTAL POPULATION	WHITE		SPANISH AMERICAN		BLACK		INDIANS		OTHERS	
		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Avondale	7,130	3,021	42.4	3,450	48.4	621	8.7	NA	-	38	0.5
El Mirage	3,800	1,287	33.9	2,310	60.8	187	4.9	NA	-	16	0.4
Goodyear	2,745	2,570	93.6	NA	-	147	5.3	NA	-	28	1.0
Litchfield Park	3,195	3,174	99.3	NA	-	-	-	NA	NA	21	0.6
Luke Air Force Base	7,630	6,244	81.8	600	7.9	639	8.4	NA	-	147	1.9
Surprise	3,400	977	28.7	2,315	68.1	106	3.1	NA	-	2	0.1
Sun City West	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maricopa County	1,415,000	1,414,200	80.6	205,200	14.5	44,400	3.1	15,700	1.1	8,500	0.6

Source: Arizona Department of Economic Security, 1979b.

TABLE 2-10

ESTIMATED AGE STRUCTURE WITHIN MAJOR COMMUNITIES
 WHITE TANKS-AGUA FRIA AREA
 July, 1978

	ESTIMATED POPULATION	AGE GROUP							
		Under 5		5 to 19		20 to 64		Over 65	
		NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Avondale	7,130	785	11.0	2,410	33.8	3,435	48.2	500	7.0
El Mirage	3,800	525	13.8	1,575	41.4	1,535	40.4	165	4.3
Goodyear	2,745	285	10.4	650	23.7	1,660	60.5	150	5.5
Litchfield Park	3,195	120	3.8	825	25.8	2,115	66.2	135	4.2
Luke Air Force Base	7,630	390	5.1	1,740	22.9	5,435	71.1	65	0.8
Surprise	3,400	450	13.2	1,400	41.2	1,400	41.2	150	4.4
Sun City West	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maricopa County	1,415,000	123,250	8.7	361,300	25.5	768,725	54.3	161,725	11.4

Source: Arizona Department of Economic Security, 1979b.

With the exception of Sun City West, all of the major communities within the study area have less than 10 percent of their total population in the over 65 age group. This compares to 11.4 percent for Maricopa County as a whole.

Sun City West is a retirement community. Its continued development will have a significant impact on the future age distribution within the study area. Approximately one third of the study area population is projected to be located in Sun City West by the year 2000.

Income

Recent income data is available only for the communities of Avondale, El Mirage, and Luke Air Force Base. In 1978, the estimated median family income was \$11,444 in Avondale, \$9,648 in El Mirage, and \$17,295 at Luke Air Force Base. This compares to \$18,820 for Maricopa County as a whole. (Arizona Department of Economic Security, 1979c).

In 1970, the average annual income within the study area was lower than that for Maricopa County as a whole. Income levels within the communities of Avondale, El Mirage, and Surprise were significantly lower than the County average. Higher incomes were found in Census Tract 610 which includes Litchfield Park, at Luke Air Force Base, and in the Town of Goodyear. The boundaries of census tracts within the area are shown by Map 20 (See Table 2-11).

TABLE 2-11

INCOME LEVELS
WHITE TANKS-AGUA FRIA AREA
1970

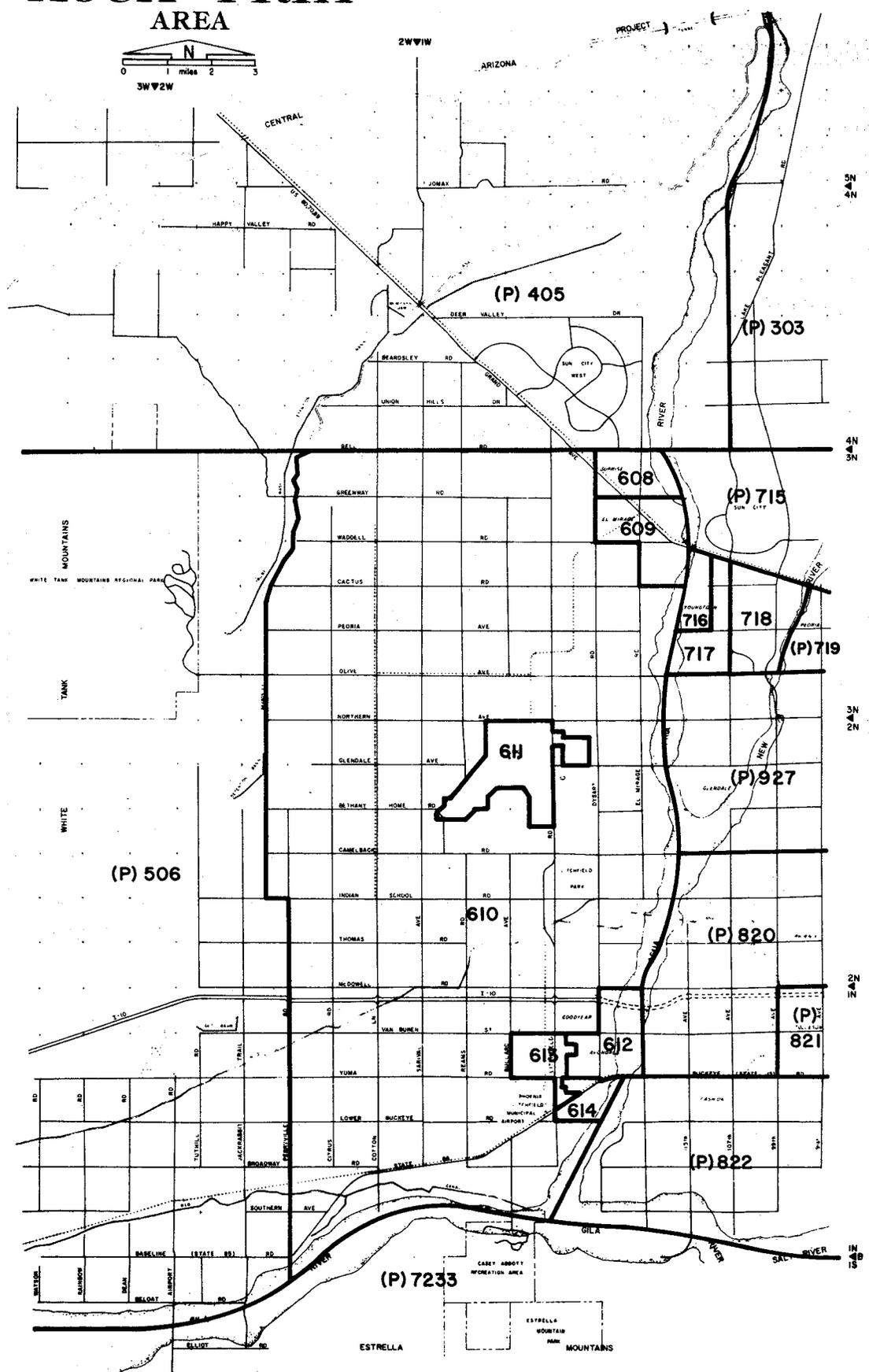
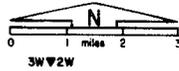
CENSUS AREA	ANNUAL INCOME	
	MEDIAN INCOME (in dollars)	MEAN INCOME (in dollars)
608 (Surprise)	4,933	6,066
609 (El Mirage)	5,131	5,774
610	10,763	13,339
611 (Luke AFB)	9,198	9,918
612 (Avondale)	7,250	7,787
613 (Goodyear)	8,767	9,464
614 (Avondale)	5,017	5,749
Total Area*	NA	8,729
Maricopa County	8,071	9,494

*Represents 93.6 percent of the total study area population in 1970.

Source: U.S. Bureau of the Census, 1972.

WHITE TANKS AGUA FRIA AREA

HIEROGLYPHIC MOUNTAINS



012-CENSUS TRACT NUMBER (P)-PARTIAL CENSUS TRACT

1970 CENSUS TRACTS

MAP 20

Education Levels

Recent information on education levels within the study area is not available. In 1970, less than one half of the study area's population was made up of high school graduates. In comparison, 60 percent of the total population of Maricopa County had received a high school diploma. The lowest levels of education were found in the communities of El Mirage, Avondale, and Surprise. Census tracts which contained Luke Air Force Base, Litchfield Park, and the Town of Goodyear had education levels which were above the County average (See Table 2-12). The boundaries of Census Tracts are shown on Map 20.

TABLE 2-12

EDUCATION LEVELS
WHITE TANKS-AGUA FRIA AREA
1970

CENSUS AREA	MEDIAN SCHOOL YEARS COMPLETED	PERCENT OF HIGH SCHOOL GRADUATES
608 (Surprise)	7.1	10.6
609 (El Mirage)	7.4	13.8
610	12.4	61.0
611 (Luke AFB)	12.7	86.5
612 (Avondale)	11.8	48.7
613 (Goodyear)	12.6	72.2
614 (Avondale)	7.7	16.4
Study Area*	NA	46.7
Maricopa County	12.3	60.1

*Represents 93.6 percent of the entire study area Population

Source: U.S. Bureau of the Census, 1972.

Unemployment

The average annual rate of unemployment in major communities within the study area is shown by Table 2-13. Information is not available for Litchfield Park.

The rate of unemployment in Maricopa County ranged from 7.5 percent in 1977 to 5.9 percent in 1980. The level of unemployment within the Town of Goodyear paralleled that of Maricopa County during this time period. Unemployment rates in the communities of Avondale, El Mirage, and Surprise were more than double those in Maricopa County during this time period. Unemployment rates in Surprise were slightly higher than the other two communities.

TABLE 2-13

UNEMPLOYMENT IN MAJOR COMMUNITIES
WHITE TANKS-AGUA FRIA AREA
1977-1980

COMMUNITY	AVERAGE ANNUAL PERCENT			
	1977	1978	1979	1980
Avondale	15.0	11.0	9.2	12.2
El Mirage	15.7	11.6	9.6	12.8
Goodyear	7.1	5.2	4.2	5.7
Litchfield Park	NA	NA	NA	NA
Surprise	16.8	12.4	10.4	13.7
Maricopa County	7.5	5.1	4.4	5.9

Source: Arizona Department of Economic Security, 1980.

IV. THE ECONOMY OF MARICOPA COUNTY

History of Economic Development

Agriculture was the dominant economic force in Maricopa County from the late 1860's through the 1950's. The regional economy began to change during World War II when a number of defense oriented manufacturing plants and military air bases introduced new forms of employment. World War II was followed by increased urban development, phenomenal population growth, the immigration of new manufacturing firms, and increased tourism. As a result, the economy of Maricopa County changed from an agricultural-commercial orientation to a diversified industrial-commercial base typical of a major metropolitan area.

Existing Conditions

EMPLOYMENT BY SECTOR

Over one half million persons were employed in Maricopa County in 1978. This represented approximately 40 percent of the County's total population, and over 60 percent of the total employment within the State of Arizona (Arizona Department of Economic Security, 1979d).

Employment in Maricopa County is well diversified. The leading employment sectors are trade, services, government, and manufacturing in that order. The County provides the majority of jobs within the State of Arizona in all employment sectors except for agriculture, government, and mining (See Table 2-14).

ECONOMIC BASE

Two markets provide income and employment within any economy. The local market, which consists of firms and residents within the region, and the export market, which is made up by firms and residents outside of the region. In theory, local market activities are the result of whatever level of income and demand the region may have achieved from its export activities. A region must produce and export goods or services to an outside market in order to increase local income. A local economy cannot grow by simply circulating its own local income.

Those export activities that bring money into the local economy from outside of the region are called basic. Non-basic economic activities serve the local market and circulate total income.

In 1978, 31 percent of the total employment in Maricopa County was considered to be "basic" by the Arizona Department of Economic Security. Agriculture and military employment is primarily basic. Over 75 percent of all manufacturing employment is engaged in basic production. Employment in this sector alone accounts for almost 40 percent of the basic employment in Maricopa County (See Table 2-16).

TABLE 2-14

COMPARISON OF EMPLOYMENT BY SECTOR
IN THE STATE OF ARIZONA AND MARICOPA COUNTY
1978

EMPLOYMENT SECTOR	STATE OF ARIZONA		MARICOPA COUNTY		
	NUMBER	PERCENT OF TOTAL	NUMBER	PERCENT OF TOTAL	PERCENT OF STATE TOTAL
Agriculture	24,276	2.6	10,002	1.8	41.2
Mining	19,585	2.1	200	0.04	1.0
Construction	68,700	7.4	43,200	7.6	62.9
Manufacturing	125,070	13.4	92,100	16.2	73.6
Utilities	44,800	4.8	26,700	4.7	59.6
Trade	214,095	22.9	143,000	25.2	66.8
Fire	49,650	5.3	38,000	6.7	76.5
Services	170,740	18.3	108,000	19.0	63.2
Government	217,104	23.2	105,440	18.6	48.6
Civilian	(35,996)		(13,058)		
Military	(25,794)		(9,640)		
Local	(155,314)		(82,742)		
TOTAL	934,020	100.0	566,642	99.8	60.7

Source: Arizona Department of Economic Security, 1979d.

The current ratio of basic to non-basic employment within the County is 1:2.2. That is, two non-basic jobs result from every basic sector job.

A number of factors have contributed to a healthy economy in Maricopa County. Among them are the following:

Rapid Population Growth. Maricopa County is one of the fastest growing metropolitan areas in the United States. The phenomenal immigration of people and new firms has resulted in a constant inflow of income earned in other parts of the nation. This in turn, has created a demand for new construction and services both public and private.

An Isolated Market Area. There are few other easily accessible markets for consumers in the Phoenix metropolitan area. This helps to reduce leakage of earned income from the County and establishes the Phoenix area as a major economic center.

A Strong Tourist Industry. Maricopa County has a large tourist industry. Non-basic activities are supported by the demands of both local residents and the seasonal tourist population.

A Large Number of Retirees. The lifestyle of retired persons calls for many services. A strong growth in non-basic employment has accompanied the growth in retirement communities. Transfer payments such as Social Security add unearned income to the local economy.

A Relatively Young Population. The median age of the Phoenix metropolitan area has remained relatively young. Consequently, a large proportion of the population is in age brackets with a high tendency to spend earned income.

A Growing Industrial Base. The immigration of industries and the start up of new firms has helped to diversify the local economy. The Phoenix area has become known as a center for electronic industries and related research activities.

MAJOR INCOME PRODUCERS

The three leading income producing industries in Maricopa County are manufacturing, tourism, and agriculture in that order.

Manufacturing

Manufacturing is by far the leading income producer adding over 2.6 billion dollars to the local economy in 1977 (Valley National Bank, 1980 p. 29). Manufactured goods are classified into durable products and non-durable products. Durable goods include: stone, clay, and glass products, primary and fabricated metals, machinery, wood products, and building materials. Non-durable items include: food and kindred products, apparel, and printing and publishing.

Over 75 percent of the manufacturing employment in Maricopa County is involved in the production of durable goods. Over 50% of all manufacturing employment produces machinery, predominantly electrical components. The durable market is more sensitive to national business cycles, local construction cycles, and U.S. Department of Defense contracts than is the production of non-durables.

Tourism and Travel

The distribution of employment by industrial sector does not indicate the importance of the tourism and travel activities to the local economy. Over half of the tourism and travel expenditures in Arizona take place in Maricopa County. Expenditures for lodging, food, transportation, and other goods and services totals over 1.6 billion dollars annually (Valley National Bank, 1980). Tourism and travel activities are less seasonal than they once were, but are still heavily winter oriented in the Phoenix metropolitan area.

Agriculture

Maricopa County has the highest gross farm income of any County in Arizona. In 1978 total cash receipts from agriculture totaled over 545 million dollars. The County produces the largest amount of crops and livestock in the State, and is the fifth largest County nationwide. Crops grown include cotton, alfalfa and other hay, grains, vegetables, citrus, flowers, and exotic trees, shrubs, and grasses used for urban landscaping (Arizona Crop and Livestock Reporting Service, 1980).

Over time, agriculture has become a capital intensive industry. Consequently, the comparatively low figures for agricultural employment misrepresent the continued importance of this industry to the County's economy. Farming activities support a large number of agribusiness enterprises.

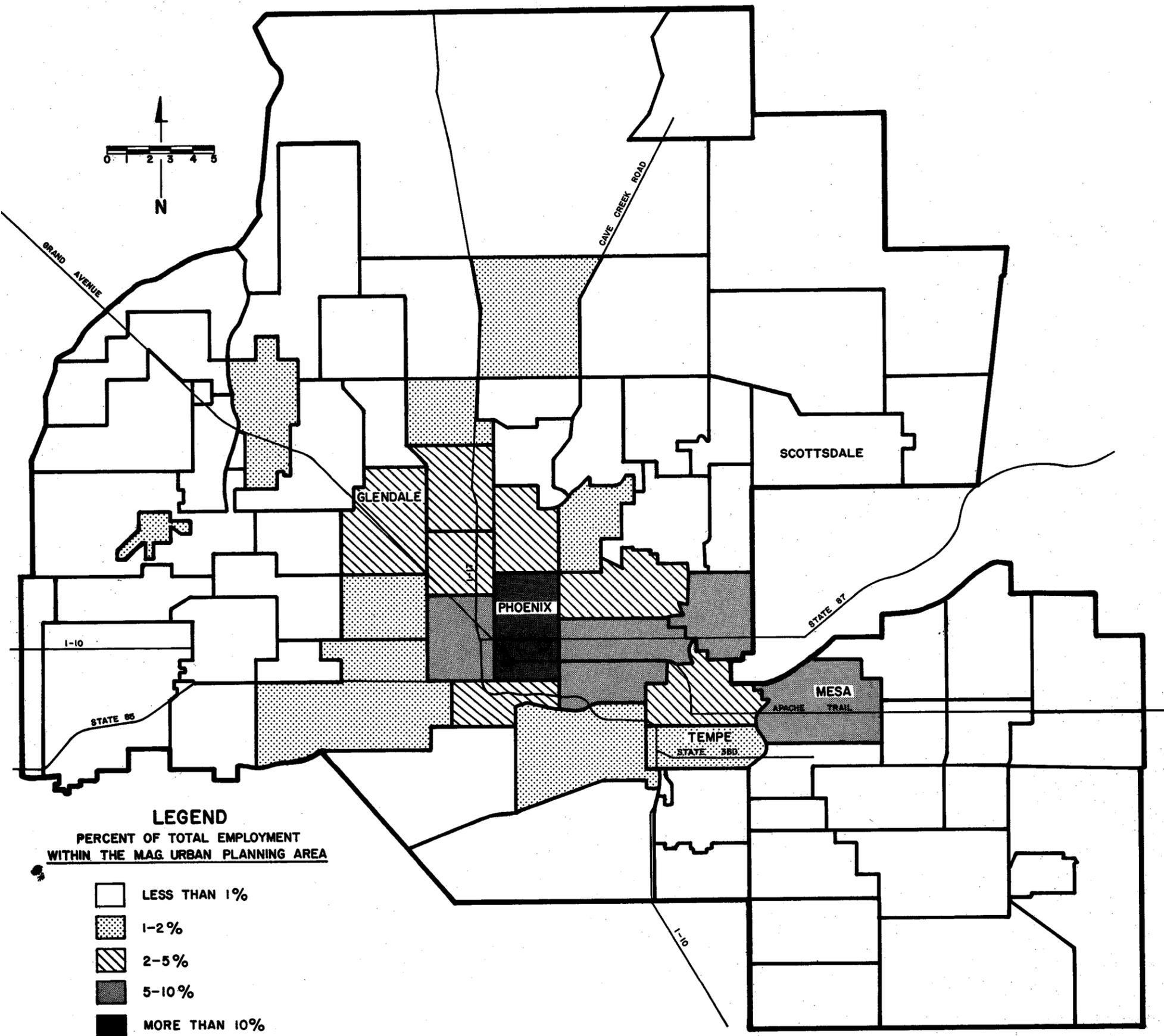
The processing of agricultural products provides additional jobs. These are not included as agricultural employment, but are considered as manufacturing employment.

DISTRIBUTION OF EMPLOYMENT

The Phoenix metropolitan area has historically been the center of economic activity in Maricopa County. Today, it is still responsible for over 80% of the County's total employment.

The distribution of employment within the Phoenix metropolitan area is shown by Map 21. The heaviest concentration of employment is centralized in the City of Phoenix. The expansion of employment activities has generally followed the major regional transportation corridors. In recent years, significant growth in employment has taken place along Interstate-17, State Route 360, and State Route 85.

It is not uncommon for people to live and work in different parts of the metropolitan area. Consequently, a high degree of economic interaction is present among local communities.



SOURCE: M.A.G. TRANSPORTATION PLANNING OFFICE, 1980.

DISTRIBUTION OF EMPLOYMENT—1978

MAP 21

Future Conditions

EMPLOYMENT BY SECTOR

By the year 2000, over one million people will be employed in Maricopa County. This will represent 43 percent of the total County population.

Employment projections from the Arizona Department of Economic Security indicate that the majority of jobs within the State of Arizona will continue to be found in Maricopa County. By sector, the percentage of total State employment within the County will be similar to that which currently exists with one major exception; the percentage of the State's agricultural employment located in Maricopa County is expected to decline by 8 percent (See Table 2-15).

Figure 2-5 compares the existing distribution of employment in Maricopa County with that projected for the year 2000. These projections indicate that the manufacturing and trade sectors will continue to increase in importance while agriculture, finance insurance and real estate, and government employment is expected to decrease. The percentage of total employment in the construction, utilities, and service sectors will remain similar.

The economy of Maricopa County is still maturing unlike that of many older metropolitan areas in the nation. Employment projections from the Arizona Department of Economic Security indicate that the number of workers engaged in basic activities will increase slightly to 33 percent of total employment by the year 2000. Manufacturing will continue to be a strong driving force in the economy. By the year 2000, manufacturing employment will be over 80 percent basic and will represent almost 50 percent of the total basic employment in the County (See Table 2-16).

Factors which will contribute to a healthy future economy include the following:

- *Local industries are growing to national significance.
- *The region is gaining an increasing portion of certain industries particularly science and electronics industries.
- *The Phoenix area is becoming known as a center for electronic industries. Continued growth in science and electronic firms can be expected.
- *Maricopa County and the State of Arizona are becoming a large consumer market. The local market is reaching a volume sufficient to justify the production of products to supply local consumers.
- *The movement of people and industries to the southwest is expected to continue. This will continue to increase the consumer market and bring income earned elsewhere into the region.

TABLE 2-15

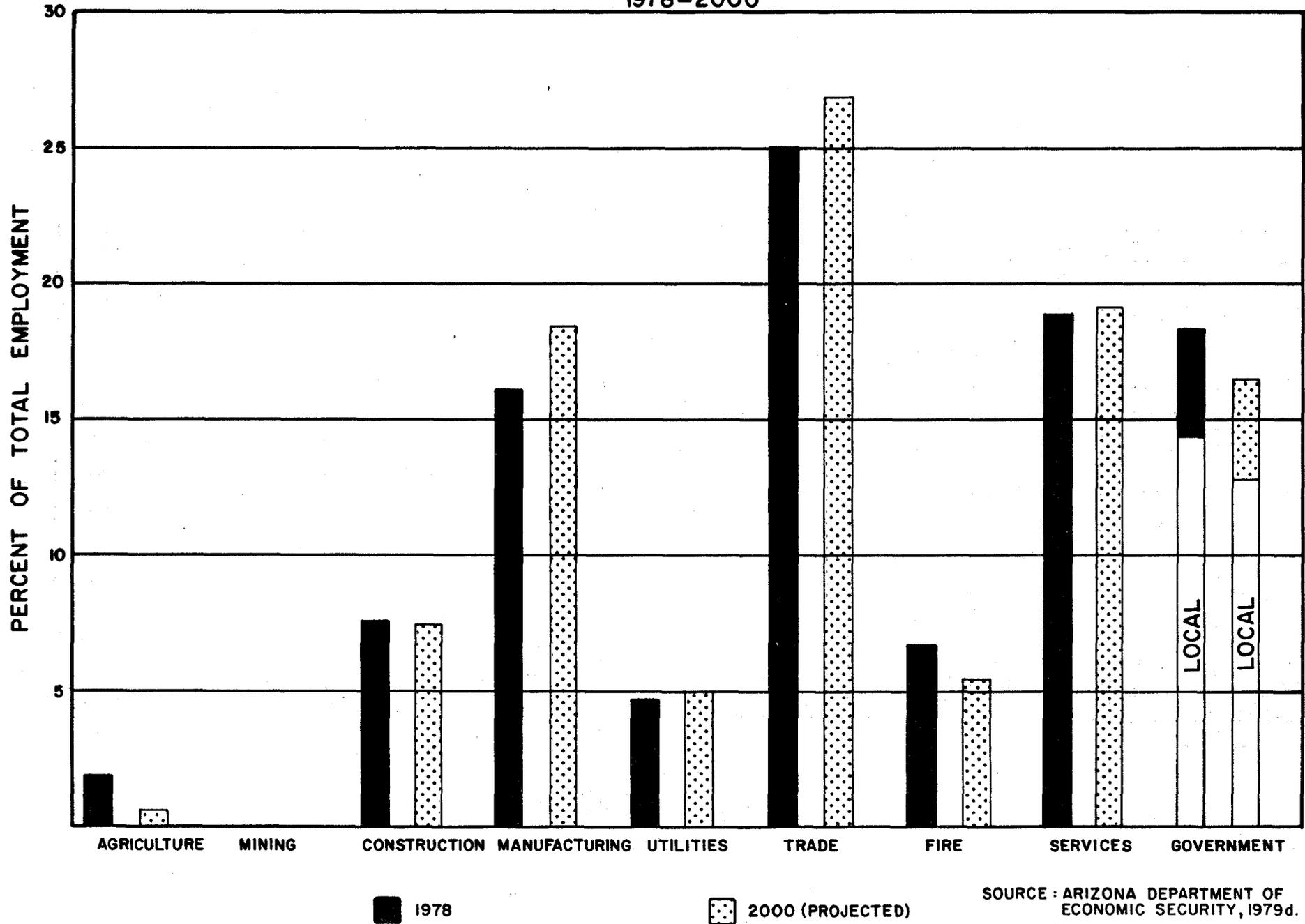
COMPARISON OF PROJECTED EMPLOYMENT BY SECTOR
 WITHIN THE STATE OF ARIZONA AND MARICOPA COUNTY
 2000

EMPLOYMENT SECTOR	STATE OF ARIZONA		MARICOPA COUNTY		
	NUMBER	PERCENT OF TOTAL	NUMBER	PERCENT OF TOTAL	PERCENT OF STATE TOTAL
Agriculture	17,614	1.0	5,861	0.6	33.3
Mining	29,863	1.7	811	0.08	2.7
Construction	122,560	7.2	79,060	7.5	64.5
Manufacturing	275,313	16.1	195,445	18.5	71.0
Utilities	85,976	5.0	53,728	5.1	62.5
Trade	424,267	24.8	283,637	26.9	66.8
Fire	78,543	4.6	58,314	5.5	74.2
Services	324,943	19.0	204,267	19.3	62.9
Government	351,822	20.6	174,866	16.6	49.7
Civilian	73,273		28,694		
Military	25,794		9,640		
Local	252,755		136,532		
TOTAL	1,710,899	100.0	1,055,988	100.0	61.7

Source: Arizona Department of Economic Security, 1979d.

FIGURE 2-5
 PROJECTED CHANGES IN EMPLOYMENT BY SECTOR

MARICOPA COUNTY, ARIZONA
 1978-2000



SOURCE: ARIZONA DEPARTMENT OF
 ECONOMIC SECURITY, 1979d.

TABLE 2-16

PROJECTED CHANGE IN BASIC EMPLOYMENT BY SECTOR
 MARICOPA COUNTY, ARIZONA
 1978-2000

EMPLOYMENT SECTOR	1978			1990			2000		
	TOTAL EMPLOYMENT	BASIC EMPLOYMENT		TOTAL EMPLOYMENT	BASIC EMPLOYMENT		TOTAL EMPLOYMENT	BASIC EMPLOYMENT	
		NUMBER	PERCENT		NUMBER	PERCENT		NUMBER	PERCENT
Agriculture	10,002	10,002	100.0	7,473	7,473	100.0	5,861	5,861	100.0
Mining	200	97	48.5	482	130	27.0	811	130	16.0
Construction	43,200	3,500	31.2	62,250	12,500	20.1	79,060	3,000	3.8
Manufacturing	92,100	69,709	75.7	138,195	109,690	79.4	195,445	160,041	81.8
T.C.P.U.*	26,700	2,104	7.8	38,965	2,690	6.9	53,728	3,302	6.1
Trade	143,000	38,871	27.2	206,304	63,392	30.7	283,637	95,290	33.6
F.I.R.E.**	38,000	6,345	16.7	47,444	7,878	16.6	58,314	9,435	16.2
Services	108,000	20,923	19.4	151,787	35,320	23.3	204,267	54,642	26.7
Government	105,440	105,440	13.6	137,211	15,801	11.5	174,866	17,420	10.0
(Civilian)	(13,058)	(4,127)	(31.6)	(20,019)	(5,234)	(26.1)	(28,694)	(6,381)	(22.2)
(Military)	(9,640)	(9,640)	(100.0)	(9,640)	(9,640)	(100.0)	(9,640)	(9,640)	(100.0)
(Local)	(82,742)	(556)	(0.7)	(107,552)	(927)	(0.9)	(136,532)	(1,399)	(1.0)
TOTAL	566,642	175,884	31.0	790,111	254,874	32.2	1,055,988	349,121	33.1

*Transportation, Communication, and Utilities

**Finance, Insurance, and Real Estate

Source: Arizona Department of Economic Security, June, 1979d.

V. THE ECONOMY WITHIN THE WHITE TANKS-AGUA FRIA AREA

Existing Conditions

The local economy is intricately linked to that of the larger Phoenix metropolitan area. Major employers within the study area provide jobs for outside commuters. A large percentage of local residents work in the surrounding region (particularly those employed in trade and service employment). The surrounding region also accomodates much of the demand for goods and services generated within the area.

EMPLOYMENT BY SECTOR

Approximately 15,000 persons were employed within the White Tanks-Agua Fria area in 1978. This represents about 2.6 percent of the total employment in Maricopa County. The distribution of employment within the study area is shown by Table 2-17. The leading sectors are government, manufacturing, and services in that order. Government is responsible for over half of the total employment within the area.

TABLE 2- 17

MAJOR EMPLOYMENT BY SECTOR WHITE TANKS-AGUA FRIA AREA

EMPLOYMENT SECTOR	NUMBER OF EMPLOYEES	PERCENT OF TOTAL
Agriculture	217	1.4
Mining	-	-
Construction	460	3.2
Manufacturing	2,530	16.9
T.C.P.U.*	208	1.4
Trade	823	5.5
(Wholesale)	(137)	(0.9)
(Retail)	(686)	(4.6)
F.I.R.E.**	218	1.4
Services	2,179	14.5
Government	8,368	55.8
TOTAL	15,003	100.1***

*Transportation, Communication, and Utilities

**Finance, Insurance, and Real Estate

***Error Due to Rounding

Source: 1) Arizona Department of Economic Security, 1978.

2) Arizona Department of Economic Security, 1980b.

Employment by sector within the study area is compared to that of Maricopa County by Figure 2-6. Note that the percentage of employment in manufacturing and agriculture within the study area closely approximates that for Maricopa County as a whole. The percentage of employment in other sectors is considerably lower except for government which is significantly higher.

Employment in Avondale is dominated by the service and trade sectors. These are responsible for 46 percent and 20 percent respectively of the total employment in this community. Manufacturing contributes to 13 percent of the total.

Employment in Goodyear is dominated by manufacturing. This sector provided 82 percent of the employment in this community in 1978.

The combined employment in Surprise and El Mirage is somewhat diversified. Major sectors include: Agriculture (30%), Services (24%), Government (21%), and Trade (18%) (Arizona Department of Economic Security, 1978 and 1980b).

MAJOR EMPLOYERS

Ninety-six percent of government employment is provided by Luke Air Force Base. Luke provides over 8,000 positions for civilian and military personnel. This represented 1.4 percent of the total employment in Maricopa County in 1978.

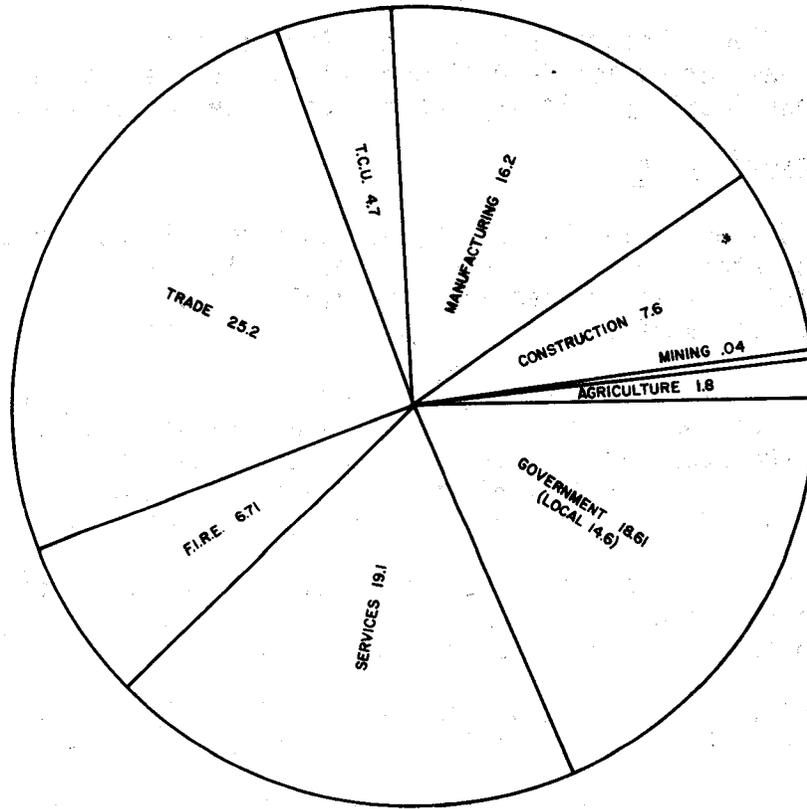
Major manufacturing firms within the study area include:

<u>FIRM</u>	<u>TYPE</u>	<u>LOCATION</u>	<u>NO. EMPLOYEES</u>
Unidynamics	electro-mechanical and explosively actuated components, systems, and subsystems	Goodyear	200
Goodyear Aerospace Corporation	radar reconnaissance systems, military personnel and equipment shelters, plastics for aerospace structures, and commercial products	Goodyear	1,493
H & U Inc.	womens sportswear	Avondale	120
Tektron A Division of Adapto, Inc.	torpedo components, precision bearings, aerospace components	Goodyear	100
Caterpillar	testing of heavy earth-moving equipment	Indian School Rd. and Jackrabbit Tr.	85

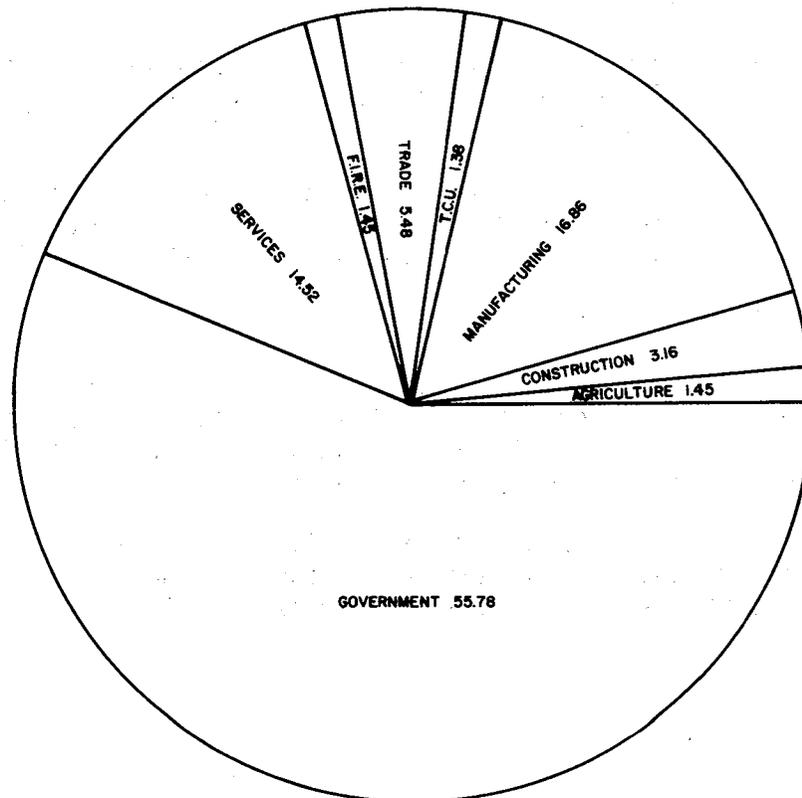
Source: Phoenix Metropolitan Chamber of Commerce, 1978.

FIGURE 2-6

DISTRIBUTION OF EMPLOYMENT BY SECTOR, 1978



MARICOPA COUNTY, ARIZONA



WHITE TANKS-AGUA FRIA AREA

SOURCE: Arizona Department of Economic Security 1978 and 1980b.

The Wigwam Resort in Litchfield Park is a major service employer. It has earned Mobile Oil Corporation's 5 star rating as a nationally known facility. It is closed during the summer months.

ECONOMIC BASE

As discussed in Chapter IV, economic activities are classified into two categories: basic and non-basic. The majority of employment within the study area is basic employment. Military employment as well as manufacturing and agriculture are primarily basic activities.

The small percentage of total employment in agriculture does not reflect the importance of farming and related activities to the economy of the study area. Over 14 percent of the total cropland in Maricopa County is located within the study area. Major crops include cotton, citrus, flowers, and vegetables (See Chapter IV).

Much of the non-basic activity generated by basic employment takes place outside of the study area. This is particularly true with regards to trade and service activities.

Employment in the trade sector is relatively low within the study area. This is the result of a number of factors:

- 1) the study area population has not reached the threshold necessary for extensive commercial development;
- 2) the low income levels in some local communities affect the purchasing power within the study area and local market demands;
- 3) much of the demand for goods and services is met by established commercial areas in the surrounding metropolitan region; and
- 4) a large percentage of local employees commute to work in the area. Their earned income is spent outside of the area and does not contribute to local market demands.

FUTURE CONDITIONS

As population growth continues, the threshold needed to support a wider range of trade and service activities will be established. An increase in market demands will help to create a more balanced economy and also result in additional job opportunities.

The continued development of Sun City West will increase the number of transfer payments and unearned income in the local economy. Increased demand for trade and services can be expected.

Many new jobs will be added to the employment base within the area in the near future. New employers include: Quakermaid, a Division of Tapan Industries, 150 employees, in Goodyear; and the Arizona Correctional Training Facility, 600 jobs, at Cotton Lane and McDowell Road. Goodyear Aerospace Corporation also plans to expand its existing facility in Goodyear.

The completion of Interstate-10 should increase the demand for industrial development along its corridor. This will increase the potential for additional manufacturing enterprises in the future.

The amount of irrigated farmland within the area is expected to decline as urban development continues. However, agriculture and related activities will undoubtedly remain an important part of the local and regional economy within the foreseeable future.

SELECTED REFERENCES

- Arizona Crop and Livestock Reporting Service, 1980. Arizona Agricultural Statistics 1979, April, 1980.
- Arizona Department of Economic Security (DES), 1979. Personal Communications, Office of Planning, 1979.
- _____, 1979b. "Compilation of City Population by Age, Race, and Sex", Office of Planning, January, 1979.
- _____, 1979c. "Median Family Income For Cities of 2,500 or More 1976-1978", Office of Planning, Population Statistics Unit, December, 1979.
- _____, 1979d. "Population and Employment Projections, July, 1978", Statistics Unit, April, 1980.
- _____, 1980b. "Labor Market Information, March, 1980.
- _____, 1978. "Labor Market Information", 1978.
- U.S. Bureau of the Census, 1972. General Population Characteristics, Arizona. Department of Commerce, July, 1972.
- _____, 1972b. Census of Population and Housing, 1970 Census Tracts Final Report PHC (1) - 160, Phoenix, Arizona SMSA, 1972.
- _____, 1979. Notice of revised census figures for 1970.
- Luke Air Force Base, 1979. Personal communication, August, 1979.
- Maricopa Association of Governments (MAG) Transportation Planning Office, 1980. Guide For Regional Development and Transportation, July 23, 1980.
- Maricopa County Department of Planning and Development, 1979. White Tanks-Agua Fria Land Use Survey, October, 1979.
- Maricopa County Planning and Zoning Department, 1971. Part II of the Comprehensive Plan for Maricopa County, second printing, 1971.
- Phoenix Metropolitan Chamber of Commerce, 1978. 1978 Directory of Arizona Manufacturers, 1978.
- University of Arizona, 1979. Arizona Statistical Abstract, the Division of Economic and Business Research, College of Business and Public Administration, University of Arizona, 1979.
- Valley National Bank, 1979. Arizona Statistical Review, September, 1980.

LAND USE AND DEVELOPMENT

I. LAND OWNERSHIP

Public Land Ownership

Approximately 25 percent of the land within the study area is under public control. (See Table 3-1). Major landholders include the Arizona Land Department, the U.S. Bureau of Land Management, the Maricopa County Municipal Water Conservation District #1, Maricopa County, the U.S. Department of Defense, the City of Phoenix, and the Buckeye Irrigation District. The location of major public landholdings is shown on Map 22.

TABLE 3-1

MAJOR PUBLIC LAND OWNERSHIP WITHIN THE WHITE TANKS-AGUA FRIA AREA

JURISDICTION	ACRES	PERCENT OF TOTAL PUBLIC OWNERSHIP	PERCENT OF TOTAL STUDY AREA
State of Arizona	31,545	62.76	15.5
Bureau of Land Management	7,585	15.09	3.72
Maricopa County Municipal Water Conservation District #1	3,595	7.15	1.77
Maricopa County	3,020	6.01	1.48
Department of Defense	2,120	4.22	1.04
City of Phoenix	1,320	2.63	0.65
Buckeye Irrigation District	1,080	2.14	0.53
TOTAL	50,265	100.00	24.60

Private Land Ownership

There are at least 30 separate private landholdings of 500 or more contiguous acres within the study area. Together, these represent 43,570 acres or 22 percent of the total land area. This does not include additional large landholdings which may be held in trust by title companies. The largest landholding, which belongs to the Goodyear Tire and Rubber Company, is over 10,000 acres. (See Map 23).

II. LAND USE

The majority of land within the study area is currently undeveloped or used for agriculture. Urban development is concentrated in the eastern half of the study area in the incorporated cities and towns, the unincorporated communities of Litchfield Park and Sun City West, and near Luke Air Force Base. Farm related residences, large lot residential development, and "mini-farms" are scattered throughout the study area.

A pocket map showing the general pattern of existing land use is located in the back of this report. It is based on a land use survey conducted during September and October, 1979. The total acreage of land use within each major category is shown by Table 3-2.

TABLE 3-2

EXISTING LAND USE
WHITE TANKS-AGUA FRIA AREA

CATEGORY	ACRES	SQUARE MILES	PERCENT OF TOTAL AREA
Residential	3,996.6	6.24	2.0
Commercial	871.8	1.36	0.4
Industrial	4,381.9	6.85	2.2
Public/Quasi-Public	5,969.1	9.32	3.0
Agriculture	78,854.6	123.21	39.2
Transitional	1,347.3	2.10	0.7
Miscellaneous	4,351.5	6.80	2.2
Vacant	101,184.6	158.10	50.3
TOTAL	200,957.4	314.00	100.0

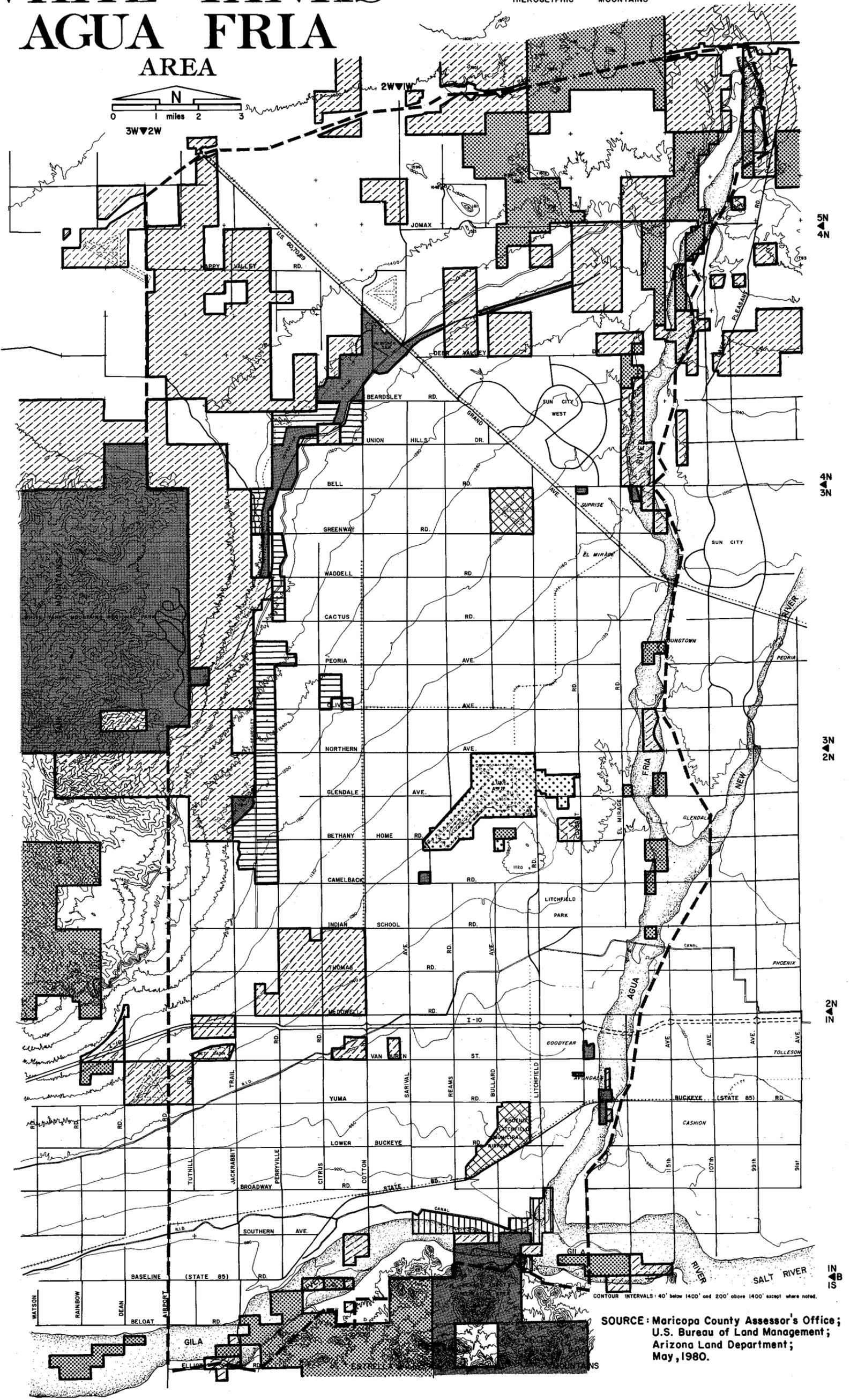
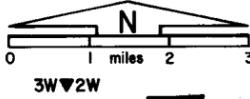
VACANT: Approximately 50 percent of the land within the study area is undeveloped at this time. The "vacant" category includes natural desert areas, riverbeds, and detention basins, as well as vacant properties in developed areas.

AGRICULTURE: About 39 percent of the study area is devoted to agriculture. Most of the land within this category is irrigated cropland which was either in production in October, 1979 or showed recent evidence of farming activity. Also included in this category are related uses such as tailwater ponds, seasonal farmworker camps, feedlots, dairies, and equipment and crop storage areas.

WHITE TANKS AGUA FRIA AREA

M
IWVIE

HIEROGLYPHIC MOUNTAINS



SOURCE: Maricopa County Assessor's Office;
U.S. Bureau of Land Management;
Arizona Land Department;
May, 1980.

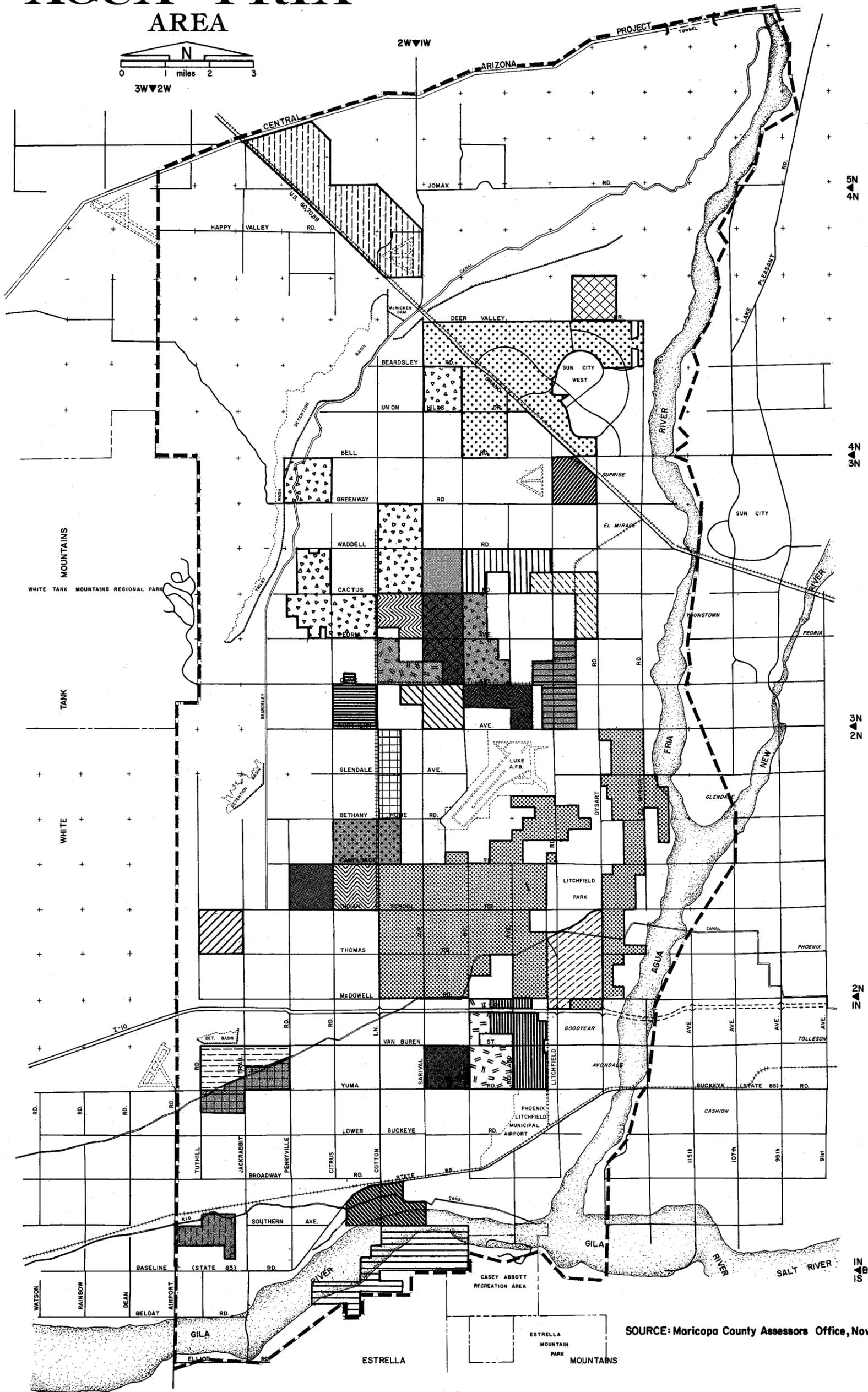
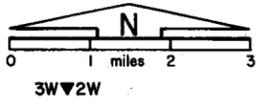
- | | | | | |
|--------|---------------------------|-----------------|-----------------------|-----------------------------|
| JUN 80 | BUREAU of LAND MANAGEMENT | MARICOPA COUNTY | M.C.M.W.C.D. #1 | BUCKEYE IRRIGATION DISTRICT |
| | ARIZONA LAND DEPARTMENT | CITY of PHOENIX | DEPARTMENT of DEFENSE | STUDY AREA BOUNDARY |

WHITE TANKS AGUA FRIA

AREA

M
1W1E

HIEROGLYPHIC MOUNTAINS



SOURCE: Maricopa County Assessors Office, Nov. 1979.

NOTE:

EACH PATTERN SHOWS SINGLE OR UNIFIED OWNERSHIP OF 500 OR MORE CONTIGUOUS ACRES. THIS MAP DOES NOT SHOW PROPERTY HELD IN TRUST BY TITLE COMPANIES.
--- STUDY AREA BOUNDARY

MAJOR PRIVATE LAND OWNERSHIP

MAP 23

RESIDENTIAL: Only two percent of the study area is devoted to residential development. This includes single family and multiple family residences in both the urbanized and rural portions of the study area. About half of the acreage in this category is located in the urbanized portion of the study area.

COMMERCIAL: Commercial development is concentrated in the urbanized communities. A limited number of businesses provide highway commercial services, agricultural services, and primary goods and services in the rural areas. Two major shopping centers are located in the Town of Goodyear. Additional shopping centers are currently under development in Sun City West. Western Avenue (Yuma Road) serves as the "downtown" area for Avondale.

The Commercial land use category includes retail trade and services, personal and business services, professional offices, and hotels, motels, resorts, and travel trailer parks. Also included in this category was specialized commercial development. This includes the dormant harness race track at Cotton Lane, the commercial dragstrip which periodically operates in the northwest part of the study area, and several dog kennels. Together, these special commercial facilities account for 582.6 acres of the 871 acres utilized for commercial purposes. If these uses are excluded, the amount of commercial acreage within the study area drops to 0.1 percent of the total land area.

INDUSTRIAL: Industrial development is scattered throughout the area along major roads and railroad tracks, in the Agua Fria riverbottom, and near Phoenix-Litchfield Airport. This category of land use includes activities involving wholesale and storage; manufacturing, assembly, processing, and packaging; research and development; salvage, natural resource extraction, and heavy equipment testing. Much of the industrial land use is farm related and includes fertilizer and chemical storage, cotton gins, and packing sheds.

The Caterpillar Tractor Company proving grounds located in the western part of the study area accounts for 1,900 of the 4,300 acres in the industrial land use category. The numerous sand and gravel operations in the Agua Fria riverbed also make a significant contribution to this category.

PUBLIC/SEMI PUBLIC: Public and semi-public land uses account for three percent of the total study area. This category includes schools, churches, cemeteries, fraternal lodges, major medical facilities, government offices, wastewater treatment facilities, police and fire stations, post offices, libraries, community centers, landfills, electrical power plants and substations, parks and recreation facilities, Phoenix-Litchfield Municipal Airport, Luke Air Force Base, and miscellaneous facilities such as gun clubs and hunting preserves. Luke Air Force Base, Phoenix-Litchfield Airport, and the Casey Abbot Recreation Area account for over 60 percent of the land within this category.

MISCELLANEOUS: The miscellaneous land use category includes right-of-ways for railroads, major canals, and major streets and highways as well as private airstrips. These constitute over two percent of the study area.

TRANSITIONAL: The transitional category includes lands which were changing use or were under development in October, 1979. Included is the Arizona Correctional Training Center on Cotton Lane, the developing portion of Sun City West, and the most recent subdivision in Litchfield Park. Over 1,300 acres are included in this category.

III. ZONING

Existing Zoning

The unincorporated portion of the study area is under the jurisdiction of Maricopa County. Land use within incorporated areas is controlled by the zoning ordinance of the respective city or town. Existing zoning within the unincorporated area is shown on Map 25.

The County has 27 separate zoning districts. These include: three rural districts, six single family residential districts, four multiple family districts, five commercial districts, three industrial districts, and six airport districts. The County also provides for special use permits, planned unit developments, and a senior citizen overlay zoning district. Table 3-3 shows the total acreage of each zoning district within the study area.

There are a number of discrepancies between land use and zoning within the study area. The most significant involves the land zoned for commercial use, which far exceeds the amount of land actually used for commercial development. Over 1,000 acres are zoned commercial in the unincorporated area alone. By comparison, only 289 acres within the entire study area are devoted to commercial use at this time.

The C-2 zoning along Grand Avenue and the C-3 zoning at intersections along Cotton Lane and Litchfield Road was instituted when the County first adopted a zoning ordinance over 20 years ago. Over 95 percent of the land in these areas is vacant or underused at this time. A substantial amount of vacant commercial zoning is also found in Litchfield Park.

RURAL: Of the 186,000 acres subject to County zoning, 96 percent are zoned Rural-43. The majority of these lands are either vacant or devoted to agriculture and large lot residential use. 4,000 acres are subject to special use permits.

SINGLE FAMILY RESIDENTIAL: Single family residential districts encompass 2,800 acres (1.5%) of the County zoned lands. The majority of single family residential zoning is found in Sun City West and Litchfield Park. The R1-7 zoning in Sun City West accounts for over 60% of this acreage. Litchfield Park contains a mixture of R1-8, R1-10, and R1-18 zoning.

MULTIPLE FAMILY RESIDENTIAL: Less than one percent of the unincorporated area is included in a multiple family residential district. The majority of multiple family zoning is found in Sun City West and Litchfield Park. Sun City West has R-3 zoning while Litchfield Park has R-4 and R-5 zoning. Much of the R-5 zoning is vacant throughout the study area.

COMMERCIAL: Commercial zoning includes 1,000 acres (0.6%) of the unincorporated area. It is predominantly C-2 and C-3 zoning. Most of the commercial zoning is found in Litchfield Park and Sun City West, in a 200 foot strip along the south side of Grand Avenue, and at intersections along Cotton Lane and Litchfield Road.

TABLE 3-3

SUMMARY OF EXISTING ZONING
 WHITE TANKS-AGUA FRIA AREA†
 April, 1980

ZONING DISTRICT	ACRES	SQUARE MILES	PERCENT OF TOTAL UNINCORPORATED AREA**
Rural-190	0.0	0.0	0.0
Rural-70	0.0	0.0	0.0
Rural-43 S.U.	3,985.5	6.2	2.1
Rural-43	174,659.4	272.9	93.7
RURAL SUBTOTAL	178,644.9	279.1	95.8
R1-35	302.8	0.5	0.2
R1-18	482.9	0.7	0.2
R1-10	138.5	0.2	0.1
R1-8	121.6	0.2	0.1
R1-7	1,759.3	2.7	0.9
R1-6 S.U.	29.9	0.05	0.01
R1-6	33.3	0.05	0.02
SINGLE FAMILY RESIDENTIAL SUBTOTAL	2,868.3	4.4	1.5
R-2	0.0	0.0	0.0
R-3	622.3	1.0	0.3
R-4	376.8	0.6	0.2
R-5 S.U.	10.9	0.02	0.01
R-5	452.1	0.7	0.2
MULTIPLE FAMILY RESIDENTIAL SUBTOTAL	1,462.1	2.32	0.7
C-0	0.0	0.0	0.0
C-S	5.2	0.01	0.003
C-1	17.1	0.03	0.01
C-2	708.8	1.1	0.4
C-3	371.7	0.6	0.2
COMMERCIAL SUBTOTAL	1,102.8	1.7	0.6
IND-1	0.0	0.0	0.0
IND-2	247.2	0.4	0.1
IND-3	169.9	0.3	0.1
INDUSTRIAL SUBTOTAL	417.1	0.7	0.2
AD I	110.8	0.2	0.05
AD II	953.3	1.5	0.5
AD III	881.6	1.4	0.5
AD IV	0.0	0.0	0.0
AD V	0.0	0.0	0.0
AD VI	0.0	0.0	0.0
AIRPORT DISTRICT SUBTOTAL	1,945.7	3.1	1.0
GRAND TOTAL**	186,440.9	291.3	99.8***

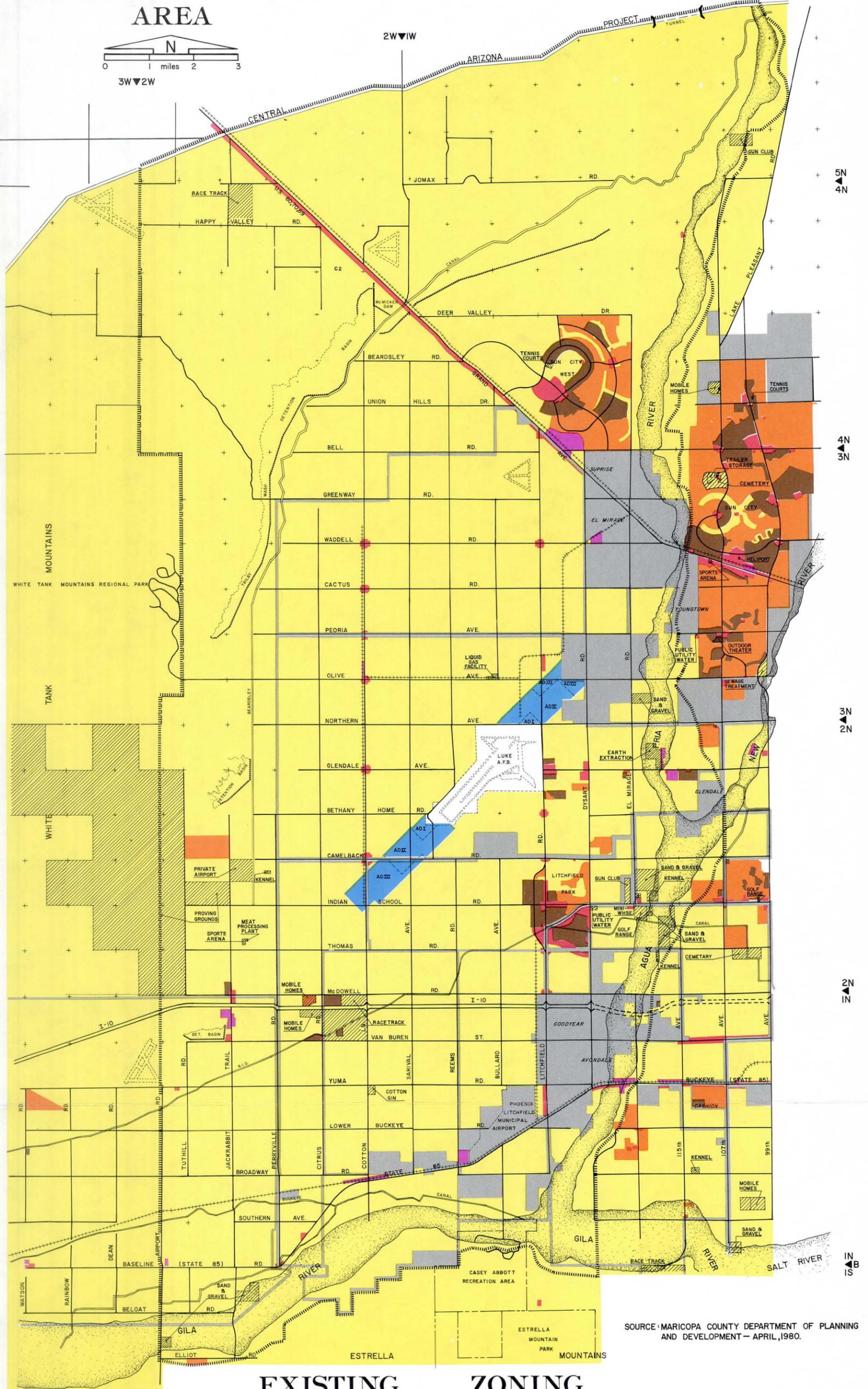
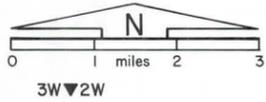
NOTES: *Unincorporated area only
 **Does not include Luke Air Force Base
 ***Error due to rounding

Source: Maricopa County Department of Planning and Development, April, 1980.

WHITE TANKS AGUA FRIA AREA

M. IWIE

HIEROGLYPHIC MOUNTAINS



SOURCE: MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT - APRIL, 1980.

EXISTING ZONING LEGEND

- | | | | |
|---------------------------|-----------------------------|-------------|-------------------|
| Rural Residential | Multiple Family Residential | Industrial | Airport Districts |
| Single Family Residential | Commercial | Special Use | Incorporated Area |
- Study Area Boundary
 MAP 25

INDUSTRIAL: Approximately 417 acres are zoned industrial. IND-2 and IND-3 zoning is scattered along major roads, railroad tracks, and in the Agua Fria River bottom.

AIRPORT DISTRICTS: Over 1,900 acres are included in Airport Districts I, II, and III. These zoning districts correspond with crash hazard areas located off the ends of the runways at Luke Air Force Base (See Chapter VI).

History of Rezoning

The Maricopa County Board of Supervisors approved 51 requests for rezoning within the study area between 1970 and 1979. This resulted in a change of zoning on over 8,500 acres or 13.3 square miles. The overwhelming majority of these requests involved the granting of a special use permit in a Rural-43 zoning district, or a change in zoning from Rural-43 to a more intense use. A complete history of rezoning between 1971-1979 is contained in Appendix C. This information is summarized in Table 3-4.

Over one third of the total acreage rezoned involved a special use permit in a Rural-43 zone. The Caterpillar Tractor Company Proving Grounds accounts for 1,920 acres of the 2,918 acres within this category. Special Use Permits for the extraction and processing of sand and gravel resources were responsible for approximately 660 acres.

Approximately 24 percent of the total acreage rezoned was changed to a single family residential zoning district. Sun City West accounted for over 84 percent of the acreage in this category.

Zoning changes which resulted in multiple family residential districts accounted for about 10 percent of the total acreage rezoned. These changes were limited to Sun City West and Litchfield Park. Of the 900 acres rezoned to multiple family use, 610 were in Sun City West.

Commercial and industrial rezonings accounted for less than 10 percent of all acreage rezoned. The majority of commercial zone changes took place in Sun City West and Litchfield Park. Of the 260 acres rezoned for industrial use, 172 were for the Bell Industries associated with Sun City West.

In 1978, over 1,900 acres were rezoned to Airport Districts I, II, and III through an initiative by the Maricopa County Planning and Zoning Commission. This represents 22 percent of the total acreage rezoned between 1970 and 1979.

Approximately one third of the total acreage rezoned between 1971 and 1979 is located in Sun City West. In contrast, only 6 percent of the acreage rezoned is located in Litchfield Park. Much of Litchfield Park was zoned for urban development prior to 1971.

TABLE 3-4
SUMMARY OF REZONING
1971-1979*

ZONING CHANGED TO	ACREAGE REZONED				
	LITCHFIELD PARK	SUN CITY WEST	REMAINDER	TOTAL	% OF TOTAL ACREAGE
Rural-43 Special Use	0.0	6.9	2,911.5	2,918.4	34.0
Single Family Residential	45.5	1,759.3	269.3	2,074.1	24.2
Multiple Family Residential	304.6	610.0	0.0	914.6	10.6
Commercial	217.3	244.9	9.6	471.8	5.5
Industrial	0.0	172.1	88.4	260.5	3.0
Airport District	0.0	0.0	1,945.7	1,945.7	22.7
TOTAL	567.4	2,793.2	5,224.5	8,585.1	100.0

*Unincorporated area only

As growth continues, the rate at which irrigated farmland and vacant desert is converted to urban use will increase. Much of the study area is zoned Rural-43. This zoning will not accommodate the future demand for housing within the area. Additional requests for commercial and industrial rezonings can also be expected. The number and type of requests for rezoning within the unincorporated area will depend somewhat on the annexation and development policies of local cities and towns.

IV. HOUSING

Existing Housing

Excluding military housing at Luke Air Force Base, there were 11,443 housing units within the study area in October, 1979 (Maricopa County Department of Planning and Development, 1979). This represents less than two percent of the estimated 600,064 housing units in Maricopa County (Maricopa County Housing Committee, 1979).

The majority of housing units within the area are located in the major communities. The total is distributed as follows: Sun City West 24 percent, Avondale 20 percent, Litchfield Park 11 percent, El Mirage 9 percent, Goodyear 8 percent, and Surprise 7 percent. The other 20 percent is scattered throughout the study area. The number of dwelling units by type within each major community is shown in Table 3-5.

Conventional single family detached units account for almost 70 percent of the total housing inventory. Mobile homes represent 13 percent of the total, while multiple family units account for 18 percent. The majority of multiple family units are located in Avondale, Goodyear, Litchfield Park and Sun City West. Mobile homes account for a significant percentage of the total housing in Avondale (20%), El Mirage (11%), Surprise (16%), and the unincorporated portion of the study area (35%).

Mobile homes are primarily concentrated in mobile home parks in the City of Avondale. They are scattered throughout the towns of El Mirage and Surprise on individual lots as well as in mobile home parks. With the exception of one mobile home park containing 53 units, all mobile homes in the unincorporated area are located on individual lots or parcels.

Approximately 7 percent of the housing units identified in October, 1979 were under construction, but substantially complete. New construction was predominantly single family units. Over 95 percent of these units were located in Sun City West.

Information on housing unit vacancies within the study area is limited. Vacancy rates appear to be low, averaging slightly over one percent. An exception is Sun City West where vacancy rates as high as 40 percent may be present (Maricopa County Department of Planning and Development, 1979).

Additional housing for military personnel is provided at Luke Air Force Base. Barracks on the main base house unmarried servicemen and can accommodate approximately 1,300 persons. Family housing is located east of the main base. Of the 875 units provided for married housing, 150 are duplexes and the rest are single family units (Luke Air Force Base, 1980). The Base relies on local communities for the majority of its housing needs.

TABLE 3-5

INVENTORY OF HOUSING UNITS
WHITE TANKS-AGUA FRIA AREA

COMMUNITY	TOTAL UNITS		SINGLE FAMILY		MULTIPLE FAMILY*		TOTAL UNITS UNDER CONSTRUCTION**
	NUMBER	PERCENT OF TOTAL	CONVENTIONAL DETACHED	MOBILE HOMES	TWO FAMILY	THREE FAMILY OR MORE	
Avondale	2,323	20.3	1,332	463	493	35	0
El Mirage	1,045	9.1	865	111	69	0	7 (SF)
Goodyear	912	8.0	620	0	292	0	0
Litchfield Park	1,287	11.2	883	1	403	0	14 (SF)
Luke AFB	***	***	***	***	***	***	***
Sun City West	2,731	23.9	1,951	0	628	152	750(SF) 47(2F)
Surprise	837	7.3	683	136	18	0	3 (SF)
Balance	2,308	20.1	1,487	806	13	2	16 (SF)
TOTAL	11,443	99.9	7,821	1,517	1,916	189	837
PERCENT OF TOTAL		100	68.4	13.3	16.7	1.6	7.3

*Temporary Housing for seasonal farmworkers not included.
 **Units under construction are included in each category.
 ***Units at Luke Air Force Base are not included.

Source: Maricopa County Department of Planning and Development, October, 1979.

Housing Conditions

Housing conditions vary considerably within the study area. Survey information is available for the incorporated communities only. As shown by Table 3-6, a significant percentage of the housing units in these communities are substandard. This reflects in part the age of the housing stock, the quality of original construction, and local socio-economic conditions.

TABLE 3-6

SUMMARY OF HOUSING CONDITIONS IN INCORPORATED COMMUNITIES

COMMUNITY	PERCENT OF TOTAL UNITS		
	SUBSTANDARD	SFR	NSFR
Avondale	50.0	45.1	4.9
El Mirage	62.7	58.5	4.2
Goodyear	30.6	30.6	0.0
Surprise	61.5	50.3	11.2

SFR: Housing Units Suitable For Rehabilitation

NSFR: Housing Units Not Suitable For Rehabilitation

Source: Willdan and Associates, 1979.

Change in Housing Units 1970-1979

The number of housing units within the study area doubled between 1970 and 1979 increasing from 5,701 to 11,443. In comparison, the total number of housing units in Maricopa County increased by 267,856 units or 80.6 percent during this same time period. The study area accounted for approximately two percent of the total County increase (Maricopa County Housing Committee, 1979.)

Table 3-7 shows the change in the number of housing units between 1970 and 1979 by defined subareas. Subarea boundaries are shown on Map 24.

The development of Sun City West since 1977 accounted for almost 50% of the total increase in housing units within the area between 1970 and 1979. Increases within other major communities were as follows: Litchfield Park 12 percent, Avondale 8 percent, El Mirage 4 percent, Goodyear 3 percent, and Surprise 5 percent. Subareas 1, 18, 20, 22, 32, 33, and 34 each received over 1 percent of the total increase. The decrease in housing units in some subareas may be explained by the movement of mobile homes, the demolition of older units, and the removal of units from floodprone areas.

TABLE 3-7

DISTRIBUTION OF CHANGE IN TOTAL HOUSING UNITS
1970-1979

AREA	NUMBER OF HOUSING UNITS		CHANGE		PERCENT OF TOTAL AREA CHANGE
	1970	1979	NUMBER	PERCENT	
1	32	239	207	646.9	3.61
2	16	36	20	125.0	0.35
3	9	43	34	377.8	0.59
4	0	0	0	0.0	0.00
5	20	52	32	160.0	0.56
6	9	16	7	77.8	0.12
7 (Sun City West)	0	2,731	2,701	NA	47.57
8	24	22	(-2)	(-8.3)	(-0.03)
9	0	0	0	0.0	0.00
10	0	0	0	0.0	0.00
11	5	58	53	1,060.0	0.92
12	73	74	1	1.4	0.02
13 (Surprise)	551	837	286	51.9	4.98
14	0	3	3	NA	0.05
15 (El Mirage)	799	1,045	246	30.8	4.28
16	33	59	26	78.8	0.45
17	26	27	1	3.8	0.02
18	180	331	151	83.9	2.63
19 (Luke AFB)	*	*	*	*	*
20	102	164	62	60.8	1.08
21	8	63	55	687.5	0.96
22	71	213	142	200.0	2.47
23	17	17	0	0.0	0.00
24	49	64	11	22.4	0.19
25 (Litchfield Pk)	583	1,287	704	120.0	12.26
26	29	11	(-18)	(-62.1)	(-0.31)
27 (Avondale)	737	1,207	470	63.8	8.19
28 (Avondale)	1,143	1,116	(-27)	(-2.4)	(-0.47)
29 (Goodyear)	0	239	239	NA	4.16
30 (Goodyear)	724	673	(-51)	(-7.0)	(-0.89)
31	10	18	8	80.0	0.14
32	50	110	60	120.0	1.04
33	77	234	157	203.9	2.73
34	251	358	107	42.6	1.86
35	42	60	18	42.9	0.31
36	27	35	8	0.3	0.14
TOTAL	5,701	11,443	5,741	100.7	99.98**

*Does not include Luke Air Force Base

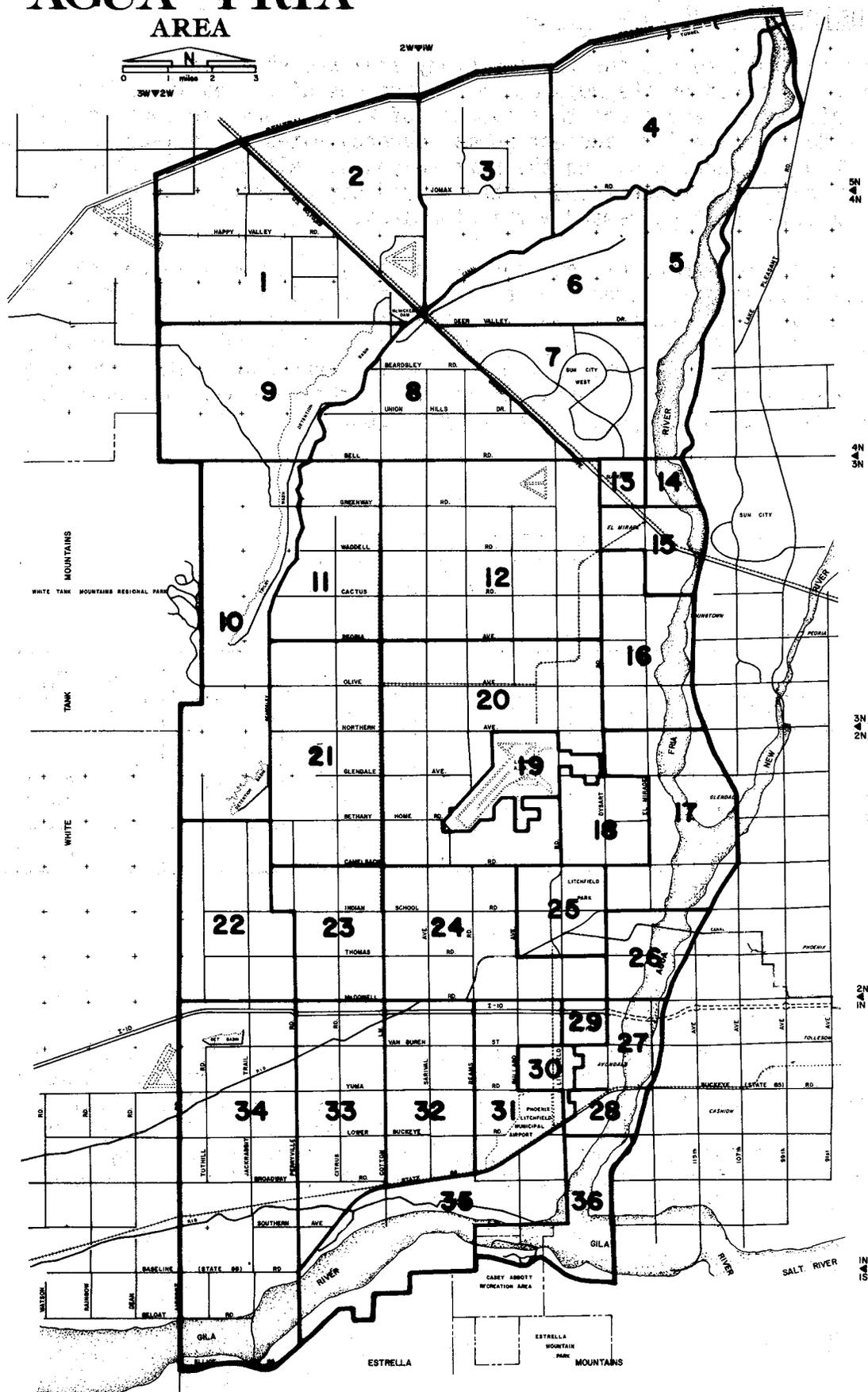
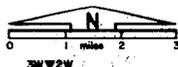
**Error due to rounding

Source: Maricopa County Department of Planning and Development, October, 1979

WHITE TANKS AGUA FRIA AREA

HIEROGLYPHIC MOUNTAINS

1WVE



INDEX MAP TO TABLE 3-7

Housing Unit Projections

Housing unit projections for the study area are shown in Table 3-8. These are based on the population projections discussed in Part II of this report and a constant average of 2.8 persons per housing unit. They do not take into account normal vacancy rates or replacement units which may be needed during the next 20 years. Although useful to illustrate long range trends, they should not be used as an estimate of existing housing demand within the area.

A significant number of new housing units will be required in order to accommodate the projected population growth within the study area. The number of units are expected to double from 1980 to 1990, then increase again by 70 percent by the year 2000. This will result in an additional 36,000 housing units within the area by the year 2000. The percentage of the County's total housing units within the area will increase from 2.6% in 1980 to 5.8 percent in the year 2000.

TABLE 3-8

HOUSING UNIT PROJECTIONS WHITE TANKS-AGUA FRIA AREA 1980-2000

YEAR	TOTAL HOUSING UNITS	PERIOD	CHANGE		PERCENT OF TOTAL INCREASE
			NUMBER	PERCENT	
1980	14,159				
1990	29,150	1980-1990	14,991	105.9	41.4
2000	50,321	1990-2000	21,171	72.6	58.5
		1980-2000	36,162	255.4	99.9*

*Error due to rounding

Public Housing

The Maricopa County Housing Authority (MCHA) administers most of the low rent public housing within the County. The MCHA currently manages 70 units within the study area: 40 units in Avondale and 30 units in El Mirage. The MCHA has also made application for an additional 80 units to be located in El Mirage (30) and Surprise (50). The City of Avondale has its own housing authority which owns 205 public housing units (Willdan and Associates, 1980,)

V. SUBDIVISIONS

A total of 93 subdivisions were recorded within the unincorporated portion of the study area as of April, 1980. They range in size from 1.4 acres to 640 acres. Of the total, 18 were recorded prior to 1950, 8 were recorded between 1950 and 1960, 21 were recorded between 1960 and 1970, and 45 were recorded after 1970. Sun City West includes 19 subdivisions, while Litchfield Park accounts for 27. A complete record of existing subdivisions is contained in Appendix D.

Approximately 10,487 acres (16.4 square miles) have been subdivided within the area. This results in a total of 16,328 lots of which 5,198 have been developed.

Counties in Arizona were not authorized to adopt and enforce subdivision regulations until 1971. Following the approval of state enabling legislation, the first subdivision regulations for the unincorporated area of Maricopa County became effective on March 1, 1973. Subdivisions recorded prior to that time were created without the benefit of formal review procedures and standards. In some cases, these subdivisions may not meet current zoning and development standards. The original "Ramola" subdivisions within the area, which are characterized by long and narrow lots, are a case in point.

According to State law, a subdivision in the unincorporated area is defined as a division of land into four or more lots or parcels any of which is less than 36 acres in size (ARS 32-210). Parcels divided into three lots or less, and land divided into parcels greater than 36 acres in size, are considered to be minor land divisions which are exempt from subdivision requirements. Minor land divisions are commonly referred to as parcel splits. Although the majority of the existing residential development in the study area has taken place in recorded subdivisions, a number of small residential areas have developed through parcel splitting.

VI. LAND USE AROUND MAJOR AIRPORTS

Three primary concerns are normally addressed as part of land use planning around airports: 1) the potential for inflight accidents; 2) the noise generated by aviation activities; and 3) potential hazards to aircraft operations. Land use in the vicinity of airports is controlled by local government and the height and obstruction criteria enforced by the Federal Aviation Administration (FAA).

Two major airports are located within the study area: Luke Air Force Base and Phoenix-Litchfield Municipal Airport. A third facility, Luke Auxilliary Field #1, is located just outside of the study area along its western boundary. These facilities have areawide and regional significance. The noise levels generated by aircraft operations and the crash hazard around military airports is considered in this report.

Many small private airfields are also located within the study area. Most of these are used primarily for crop dusting operations. They are not discussed in this chapter due to their limited scale of operation.

Luke Air Force Base

Luke Air Force Base was established as an Army Air Corps training field during World War II. Since 1942, it has operated continuously except between 1946 and 1951.

Today, Luke trains advanced combat crews in tactical jet fighters. Training takes place primarily in the F-15 Eagle, the F-4 Phantom, and the F-104 Star Fighter aircraft.

Luke uses two parallel runways which have a northeast-southwest orientation. Runway activity is regulated to a northeasterly flow about 65 percent of the time. (Luke Air Force Base, 1976).

The flight paths used by Luke's aircraft are shown on Map 26. The type and number of aircraft using each track, the frequency of use, flight altitudes, power settings, and the time of day of flight activity varies considerably. The majority of local training flights take place northwest of the Base. Most flights take place between 7 a.m. and 10 p.m.

Development in and around the study area has caused significant changes in Luke's flight patterns and approach rules in recent years. The Base has also limited the number of nighttime missions and implemented noise suppressors for routine engine ground run-ups. Both Sun City and Litchfield Park have been a source of complaints regarding noise in the past.

ACCIDENT POTENTIAL

In 1973, the U.S. Air Force conducted a study of inflight accidents involving military aircraft. The purpose of this study was to determine where most accidents occur and how large of an impact area was likely to result from any single accident.

This study determined that:

- *accident potential increases significantly near the extended runway centerline;
- *nearly 61 percent of all accidents occur during the landing phase as compared to 39 percent for the take-off phase;
- *the average impact area per accident was 5.06 acres. (Luke Air Force Base, 1976).

Through subsequent analysis, the Air Force identified a corridor which contained the maximum percentage of accidents within the smallest area. This "crash hazard area" extends 15,000 feet from the threshold at both ends of a runway. It was further divided into an expanded clear zone and two accident potential zones.

The Clear Zone is 2,000 feet wide and extends 3,000 feet from the runway threshold along the runway centerline. APZ I is 3,000 feet wide and extends 5,000 feet from the end of the Clear Zone. APZ II is also 3,000 feet wide and extends 7,000 feet from the end of APZ I. The location of each zone within the study area is shown by Map 27.

Within the Clear Zone the risk is so high as to prohibit reasonable economic use of the land. It is Air Force policy to request from the U.S. Congress the authorization and appropriations needed to acquire the necessary real property interests in these zones (Luke Air Force Base, 1976.)

APZ I is less critical than the Clear Zone, but possesses a significant risk factor. The level of risk in APZ II is lower than that in APZ I, but still significant. The potential for accidents outside of the Clear Zone, APZ I and APZ II is not significant enough to warrant special attention.

Land use guidelines developed by the Air Force for APZ I and APZ II provide criteria for determining land uses which are compatible with the respective level of risk within these areas. Basically, land uses should be avoided which:

- a. have high residential densities;
- b. have high labor intensity;
- c. concentrate people, especially for extended periods of time;

- d. concentrate people who are unable to respond to emergency situations (i.e., children, the handicapped, the elderly, etc.);
- e. involve activities which have explosive, flammable, toxic, corrosive, or other hazardous characteristics; or that
- f. pose hazards to aircraft operations. (Luke Air Force Base, 1976).

Ideally, there should be no people intensive uses in either APZ. This increases the risk by placing more people in areas where there may ultimately be an aircraft accident.

The Air Force suggests that the level of risk in APZ I is compatible with a wide variety of industrial, manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agricultural uses. Compatible uses in APZ II include those recommended for APZ I, personal and business services, and retail trade. The intensity and scale of personal and business service and retail trade activities should be limited. High density offices and large restaurants are inappropriate. Residential use, if allowed at all, should not exceed one unit per acre (Luke Air Force Base, 1976).

The existing land use pattern around Luke Air Force Base is dominated by irrigated farmland. Only limited development has taken place to date. Development within the defined crash hazard areas is summarized as follows:

Clear Zone:	No development
APZ I:	6 single family residences 12 mobile homes F.O.P. Lodge
APZ II:	13 single family residences 3 mobile homes.

HIGH NOISE LEVELS

A measurement of the noise environment at any given location must consider not only the effect of single events, but the cumulative effect of all events and the time of day in which these events occur. The method of noise measurement recommended by the U.S. Environmental Protection Agency is the Day-Night Average Sound Level (L_{dn}). This represents the average hourly sound level with a 10 decibel (dB) weighing for all nighttime noise events. The weighing of nighttime events accounts for the fact that noise is generally more annoying during the quiet nighttime hours.

The Ldn for any given location is calculated through an extensive data collection process and the use of standardized computer programs. Equal value points are connected to form contour lines. A detailed discussion of this methodology is contained in Luke and Williams Air Force Base Noise Contour Measurement Study (J.J. Van Houten and Associates, 1979).

Noise level contours around Luke Air Force Base are shown on Map 27. These contours were defined by a private consultant under contract with Maricopa County from 1977-1979. They are based on both standardized computer analysis and actual field measurements taken at specific locations within the study area.

These contours define the Day-Night Average Sound Level typical during Monday through Friday averaged on an annual basis. They represent the best fit of the line and should not be considered precise boundary lines.

The noise contours around Luke are primarily the result of daily in-flight training activities. Engine ground run-up activity is conducted within sound suppressor cells and normally does not affect these contours. The effect of ground runups during suppressor breakdowns was not considered. Non-jet and other base operations are insignificant.

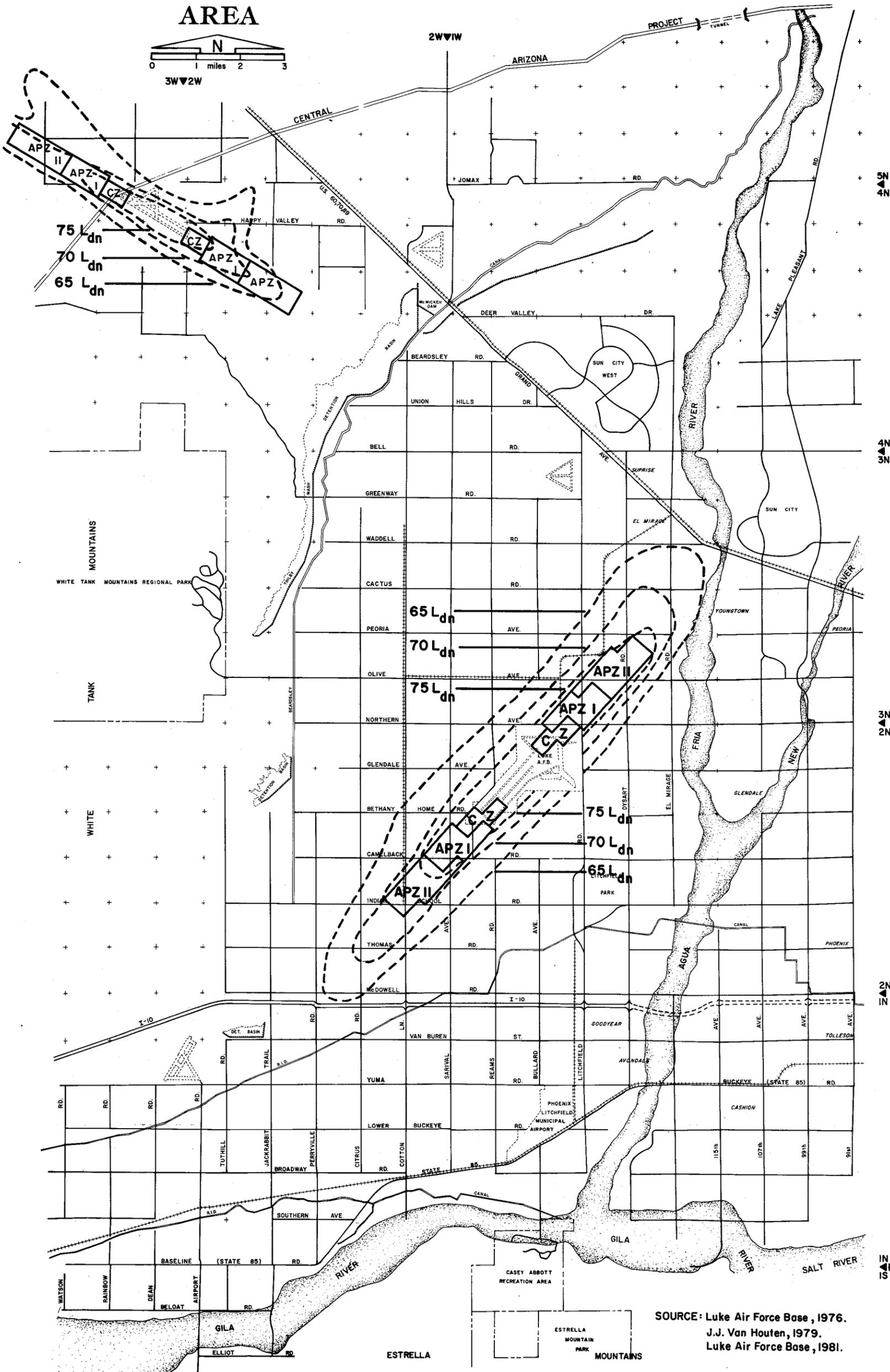
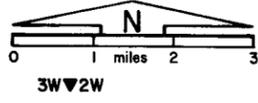
As shown by Map 27, much of the study area is subject to sound levels in excess of a Ldn of 65 dB. Irrigated farmland and vacant desert dominates the land use pattern around the Base. However, a significant amount of non-agricultural development was present in 1979. This is summarized as follows:

<u>Ldn (dB)</u>	<u>NUMBER OF RESIDENTIAL UNITS</u>	<u>OTHER NON-AGRICULTURAL LAND USES</u>
65-70	22 Single Family 23 Mobile Homes	El Mirage School Arizona Correctional Training Center Luke AFB Housing Luke AFB Hospital
70-75	49 Single Family 5 Mobile Homes	Dysart School
Over 75	11 Single Family 11 Mobile Homes	Western Academy for Boys F.O.P. Lodge

WHITE TANKS AGUA FRIA AREA

M
I WVE

MICROLYPHIC MOUNTAINS



WHITE TANK MOUNTAINS REGIONAL PARK

TANK

WHITE

SOURCE: Luke Air Force Base, 1976.
J.J. Van Houten, 1979.
Luke Air Force Base, 1981.

JUN 80

NOISE CONTOURS

ACCIDENT POTENTIAL ZONE

HIGH NOISE AND CRASH HAZARD AREAS

MAP 27

High noise lowers the quality of life by causing annoyance and interfering with daily activities. Response to high noise levels varies considerably among individuals. It is affected by individual perceptions, background noise levels, and the type of activity being engaged in at the time. People are more likely to make complaints regarding the source of the noise as sound levels increase. Generally, the following effects can be anticipated:

L _{dn} (dB)	RESPONSE
55-65	Noise levels may interfere with outdoor activities and cause annoyance in places where quiet is important.
65-70	Noise may occasionally interfere with indoor activities, but few complaints.
70-75	Complaints may be made.
Over 75	Vigorous and repeated complaints are likely leading to concerted group action.

Sources: National Academy of Sciences, 1977
ADOT, Transportation Planning Division ____.

High noise levels have been associated with hearing loss and other physical, mental, and behavioral health problems. The U.S. Environmental Protection Agency has determined that long term exposure to environmental noise levels greater than a L_{dn} of 75 dB could be harmful (J.J. Van Houten and Associates, 1979 p. 23). It is assumed that significant adverse effects do not occur below this level (National Academy of Sciences, 1977).

Land use compatibility with various levels of airport noise is related to the activities associated with a particular use. Certain land use activities are more sensitive to noise than others. Guidelines for land use planning have been suggested by numerous agencies. Figure 3-1 identifies guidelines developed by J. J. Van Houten and Associates for Maricopa County.

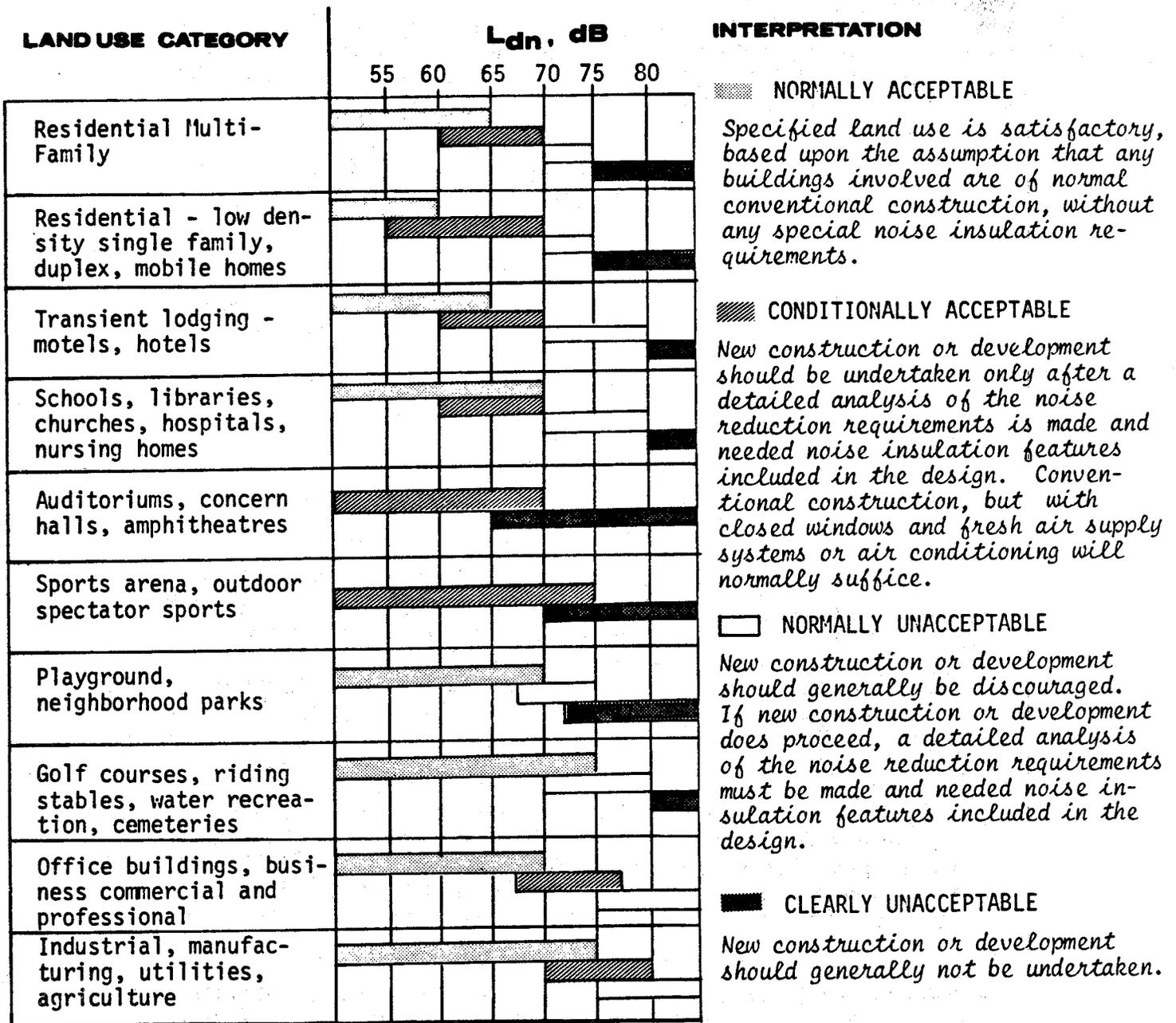
Land uses may be compatible in high noise areas with appropriate sound attenuation measures. Recommended exterior to interior noise level reductions are shown by Table 3-9.

Residential

Most guidelines do not recommend residential use where the Day-Night Average Sound Level equals or exceeds 75 decibels. Few restrictions are indicated where the L_{dn} is less than 65 decibels. Between L_{dn} 65-75 there is a lack of consensus.

FIGURE 3-1

SUGGESTED LAND USE GUIDELINES FOR HIGH NOISE AREAS



Source: Van Houten and Associates, 1979.

Where significant noise levels are present, the potential impact depends on the amount of time spent outdoors and the insulation of structures. Based on criteria published by the U.S. Environmental Protection Agency, exterior living spaces should generally be excluded from locations where the Ldn exceeds 70 dB. The interior Ldn in residences should not exceed 45 dB. Conventional construction provides about 20 dB of noise reduction. Consequently, sound attenuation measures may be necessary to maintain an interior Ldn of 45 dB where the exterior Ldn exceeds 65 dB (J.J. Van Houten and Associates, 1979, p. 23).

Areas with an Ldn of 65-75 dB may not qualify for Federal mortgage insurance in residential categories. In many cases, approval by the U.S. Department of Housing and Urban Development (HUD) requires noise attenuation measures, the approval of HUD's regional administrator, and an environmental impact statement (U.S. Department of Housing and Urban Development, ____.)

Industrial

Industrial activities such as warehousing, manufacturing, resource extraction, and utilities are usually compatible with high noise areas. Uses which require low noise levels, such as research and development, are exceptions. Noise attenuation measures are often recommended for those portions of buildings used for office use, to receive the public, or with low background noise levels.

Commercial

Retail trade and personal and business service uses are compatible up to an Ldn of 70 dB. They are generally incompatible where the Ldn exceeds 80 dB. Between these levels attenuation should be included in occupied buildings.

Public/Semi-Public

This category includes a variety of uses such as schools, churches, and hospitals. These uses should generally be located where the Ldn is less than 65 dB since many of them require a quiet environment. Sound attenuation may be necessary when the Ldn exceeds 65 dB.

Recreational

Certain outdoor recreational activities are compatible with high noise levels. However, when the Ldn exceeds 75 dB, noise may limit the ability to enjoy some activities. Buildings such as golf course club houses should be sound attenuated in high noise areas. Facilities such as neighborhood parks and playgrounds should be located in a low noise environment.

Agriculture

Agricultural activities are generally compatible with all noise levels. Livestock farming and breeding is an exception which often requires a quieter noise environment.

TABLE 3-9

SUGGESTED SOUND LEVEL REDUCTIONS
FOR STRUCTURES IN HIGH NOISE AREAS

ACTIVITIES AND LAND USES	Noise Impact Zone**			
	less than L _{dn} 65 dB	L _{dn} 65 to 70 dB	L _{dn} 70 to 75 dB	L _{dn} 75 dB*** and Greater
Residential - Single Family, Multi-Family Mobile Homes	P	NLR 25	NLR 30	N
Educational, Institutional, Hospitals Convalescent Homes	P	NLR 25	NLR 30	N
Hotels & Motels (Transit Lodging)	P	NLR 25	NLR 30	NLR 35
Assembly & Communication	P	P	NLR 25	NLR 30
Retail - Food, General Merchandise	P	P	NLR 25	NLR 30
Retail - Restaurants, Eating and Drinking Places	P	P	NLR 25	NLR 30
Office, Commercial, Personal Business & Professional Services	P	P	NLR 25	NLR 30

P: Permitted with conventional construction

N: Land use not permitted

* Noise Level Reduction: Difference between the exterior L_{dn} and interior L_{dn}

** Noise Impact Zone: Range of Day-Night Sound Level

*** Noise Level Reductions greater than 35 dB may be necessary for a project if the noise impacted area is greater than an L_{dn} of 80 dB.

Source: Van Houten and Associates, 1979.

Luke Auxilliary Field #1

Luke Auxilliary Field #1 is located 13 miles northwest of Luke Air Force Base just outside of the study area. The field was originally acquired as a training facility during World War II. Today, the field is used by military aircraft to practice Ground Control Approach (GCA) and Instrument Land System (ILS) approaches.

The facility is used by military aircraft from Luke and Williams Air Force Base and the Arizona Air National Guard. The runways are inactive and are not used for take offs and landings. Approaches to the field follow a northwest, southeast orientation. The flight paths used by aircraft making approaches to Luke Auxilliary Field #1 are shown on Map 26. The type and number of aircraft, flight altitudes, number of flights, power settings, and the time of day of flights along each track varies.

The location of crash hazard and high noise areas for Luke Auxilliary #1 are shown on Map 27. The nature and purpose of these designations were discussed in detail in the section on Luke Air Force Base. The noise contours shown were defined by the U.S. Air Force. All of the land within these high noise and crash hazard areas is either vacant or used for grazing purposes.

Phoenix-Litchfield Municipal Airport

Phoenix-Litchfield Municipal Airport was originally a U.S. Navy Air Strip. It began operation in 1943. Today, it is a basic transport class general aviation airport owned and operated by the City of Phoenix (See Part IV. Transportation, Chapter IV).

Phoenix-Litchfield has a single runway with a northeast-southwest orientation. A 2,000 foot displaced threshold on the northeast end of the runway effectively shortens the runway so that aircraft maintain higher altitudes over the Town of Goodyear. This helps to reduce noise impacts on the populated areas of the Town (City of Phoenix, 1978).

Noise contours have not been developed for Phoenix-Litchfield. The most significant noise impacts appear to be contained on-site. Land use south and west of the airport consists of irrigated farmland, vacant floodplain, scattered large lot residential, and industrial development. Developed portions of the Town of Goodyear are located to the east and northeast. Complaints from residents about high noise levels do occur (Kleinschmidt, 1980).

VII. CITIES AND TOWNS

Municipal Planning Areas

Until 1980, cities and towns in Arizona could "strip annex" unincorporated lands without limitation. Most of the cities and towns in Maricopa County have used strip annexations to define their area of future interest. These strips are often only 10 feet wide. The unincorporated lands within their boundaries remain under the jurisdiction of Maricopa County.

Section 9-471 of the Arizona Revised Statutes was amended in 1980 to prevent future strip annexations outside of those areas already strip annexed. No provisions were included to eliminate the existing strip annexations or prevent additional annexations within those areas already strip annexed. A city or town may incorporate lands by obtaining signatures from the owners of 51 percent of the total assessed valuation of the property to be annexed. State Law does not require a public hearing or review by other jurisdictions prior to annexation.

The local communities of Avondale, El Mirage, Goodyear, and Surprise have each strip annexed portions of the study area. The Town of Buckeye, the City of Glendale, and the City of Phoenix also have strip annexations within the area. Most of these annexations took place between 1975 and 1980.

Over 50 percent of the White Tanks-Agua Fria area has been strip annexed. In comparison, less than 10 percent of the area has been block annexed. (See Table 3-10). Map 28 shows the planning area defined by the outermost strip annexations of each municipality. It ignores strip annexations within the outermost boundaries.

Future Land Use Plans

Each of the local municipalities within the study area have adopted a future land use plan for all or a portion of their area of interest. Detailed information regarding these plans is available from the respective city or town. Each is summarized as follows:

AVONDALE

The future Land Use Plan proposed in the Avondale Comprehensive Plan Update is shown by Map 29. This land use plan was adopted by the Avondale City Council in 1981. It has a 20 year time horizon and assumes that almost all of the land within the city's planning area will be developed by the year 2000. The plan calls for areas west of the Agua Fria River to be developed first. Residential densities are defined as follows: low density allows a maximum of 4 dwelling units per unit acre and medium density allows a maximum of 20 dwelling units per net acre (City of Avondale, 1980).

TABLE 3-10

ANNEXATIONS
 WITHIN THE WHITE TANKS-AGUA FRIA AREA
 As of April 1, 1980

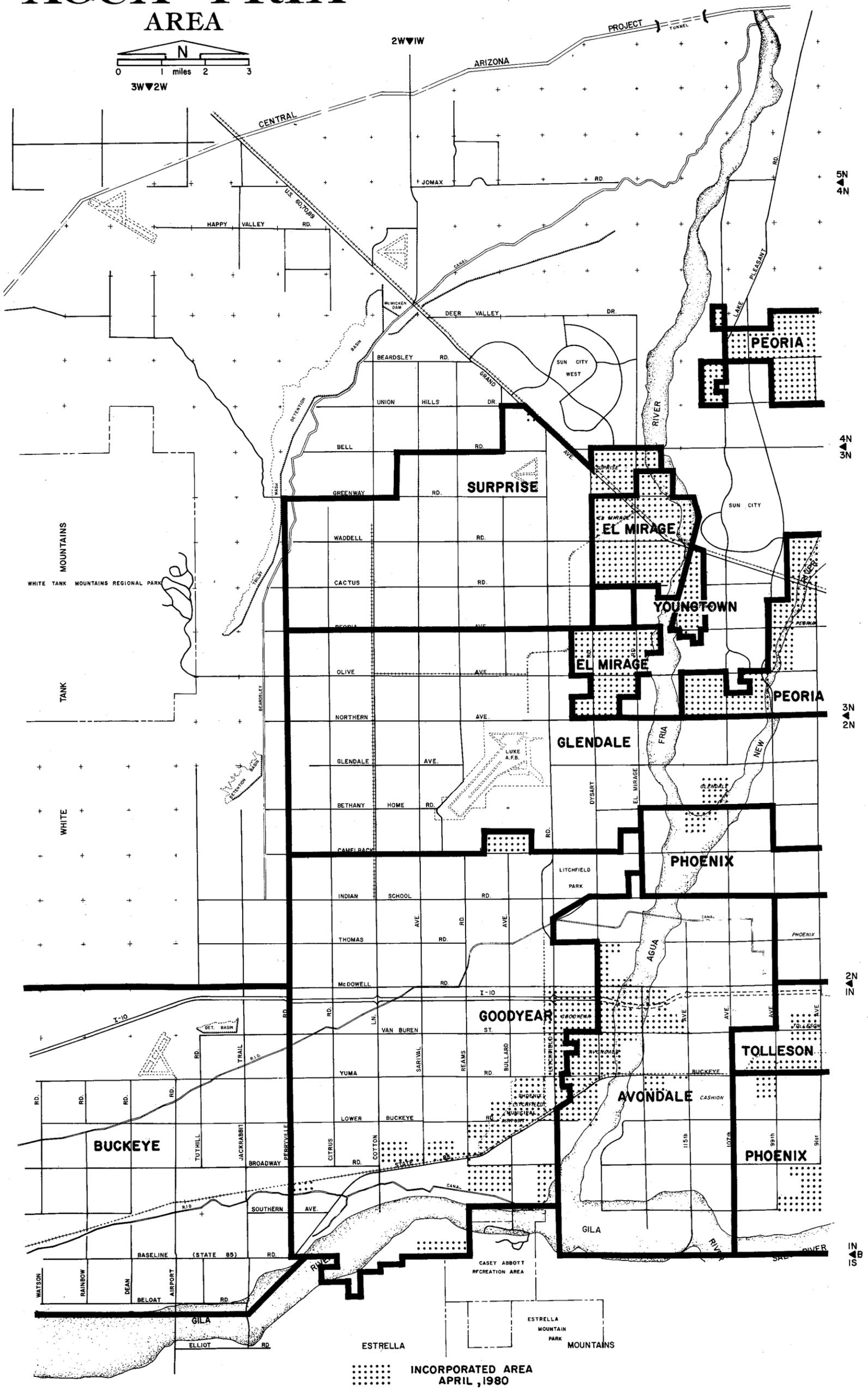
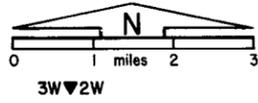
CITY OR TOWN	INCORPORATED AREA*			AREA ENCOMPASSED BY STRIP ANNEXATION		
	ACRES	SQUARE MILES	% OF STUDY AREA	ACRES	SQUARE MILES	% OF STUDY AREA
Avondale	2,420.0	3.8	1.19	7,990.4	12.5	3.93
Buckeye	0.0	0.0	0.0	11,890.9	18.6	5.84
El Mirage	5,055.8	7.9	2.48	5,066.9	7.9	2.49
Glendale	166.6	0.3	0.08	25,841.9	40.4	12.70
Goodyear	3,635.5	5.7	1.79	37,891.8	59.2	18.62
Peoria	134.7	0.2	0.07	0.0	0.0	0.00
Phoenix	171.0	0.3	0.08	2,347.9	3.7	1.15
Surprise	832.2	1.3	0.41	17,790.9	27.8	8.74
Youngtown	164.6	0.3	0.08	0.0	0.0	0.00
TOTAL	12,580.4	19.8	6.18	108,820.7	170.1	53.47

*Does not include independant strip annexations

WHITE TANKS AGUA FRIA AREA

M
WVIE

HIEROGLYPHIC MOUNTAINS



..... INCORPORATED AREA
APRIL, 1980

EL MIRAGE

An interim land use plan for the Town of El Mirage was adopted by City officials in 1980. (See Map 30). It includes lands outside of the town's strip annexed area. The plan shows a mix of residential densities ranging from a maximum of 2.5 dwelling units per acre to a maximum of 25 dwelling units per acre. Areas with a Day-Night Average Sound Level of 75 decibels or greater, and areas with a defined crash hazard, have been proposed for low intensity, non-residential development under a planned area development concept (Town of El Mirage, 1980).

TOWN OF GOODYEAR

The Goodyear Comprehensive Plan was adopted by Town officials in 1976. (See Map 31). It does not include all of the area within the Town's strip annexation. The plan envisions an ultimate population for the planning area of about 94,000. Residential categories are defined as follows: large lot, 1.1 units per gross acre; low density, 2.8 units per gross acre; medium density, 6.4 units per gross acre; high density, 12.0 units per gross acre; and mobile homes, 6.4 units per gross acre. These figures represent average residential densities. (Town of Goodyear, 1976). Town officials are currently in the process of updating this plan.

TOWN OF SURPRISE

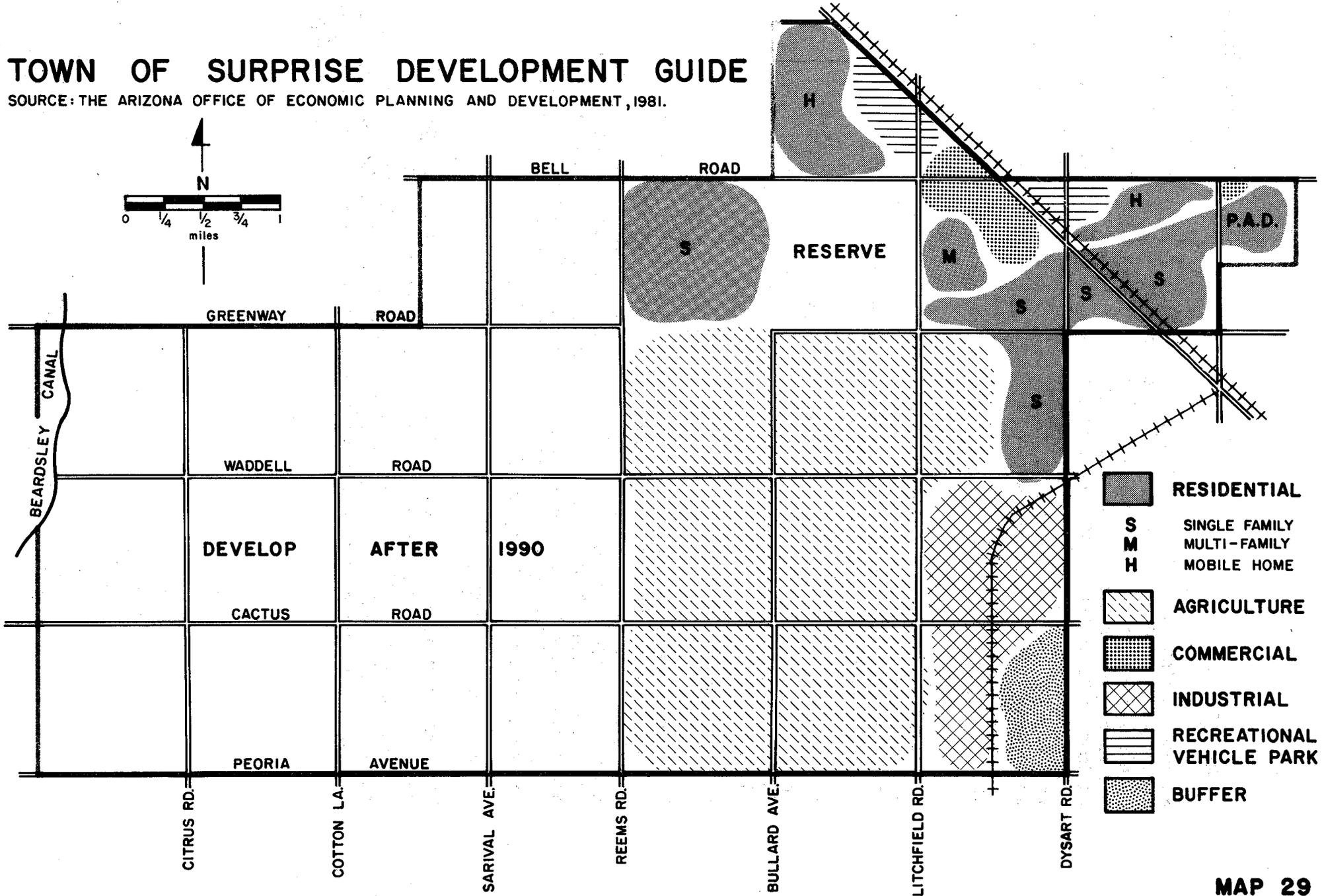
The Surprise Development Guide was adopted by Town officials in 1981 and has a horizon date of 1990. The general land uses shown by Map 32 do not indicate the proposed acreages for each type of use, but rather general development areas. No residential densities are indicated. The development guide shows a commercial core south of Grand Avenue and an industrial reserve along the Sante Fe Branchline. Development in the western half of the subarea is not indicated until after 1990. (Arizona Office of Economic Planning and Development, 1981).

PLANS OF OTHER JURISDICTIONS

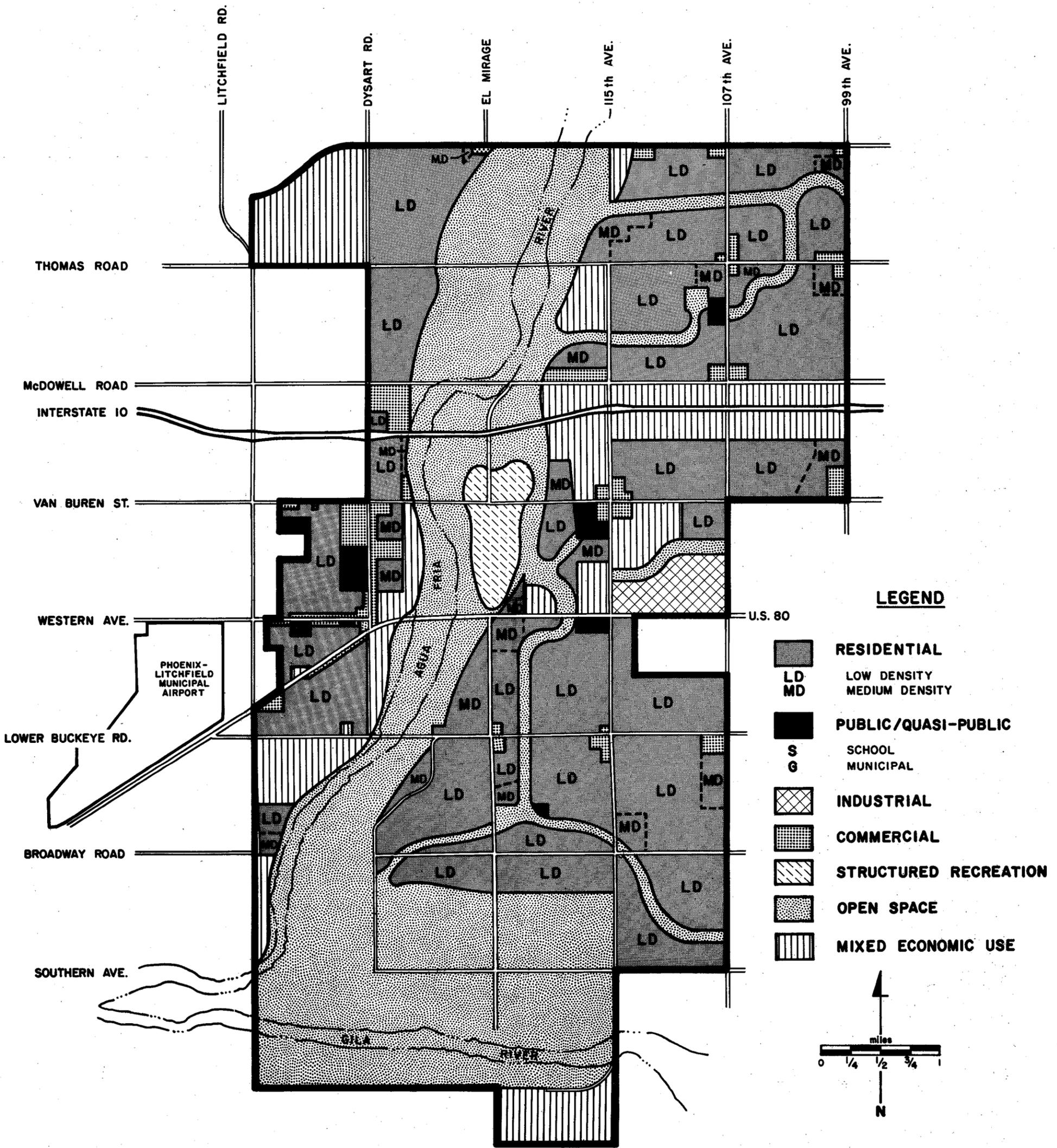
The Town of Buckeye is currently in the process of preparing a general plan for its strip annexed area. The draft "Interim Plan for the City of Phoenix" shows that portion of the study area strip annexed by Phoenix to develop after 1985. (City of Phoenix, 1979). Glendale does not have a plan for its strip annexed area west of the Agua Fria River.

TOWN OF SURPRISE DEVELOPMENT GUIDE

SOURCE: THE ARIZONA OFFICE OF ECONOMIC PLANNING AND DEVELOPMENT, 1981.

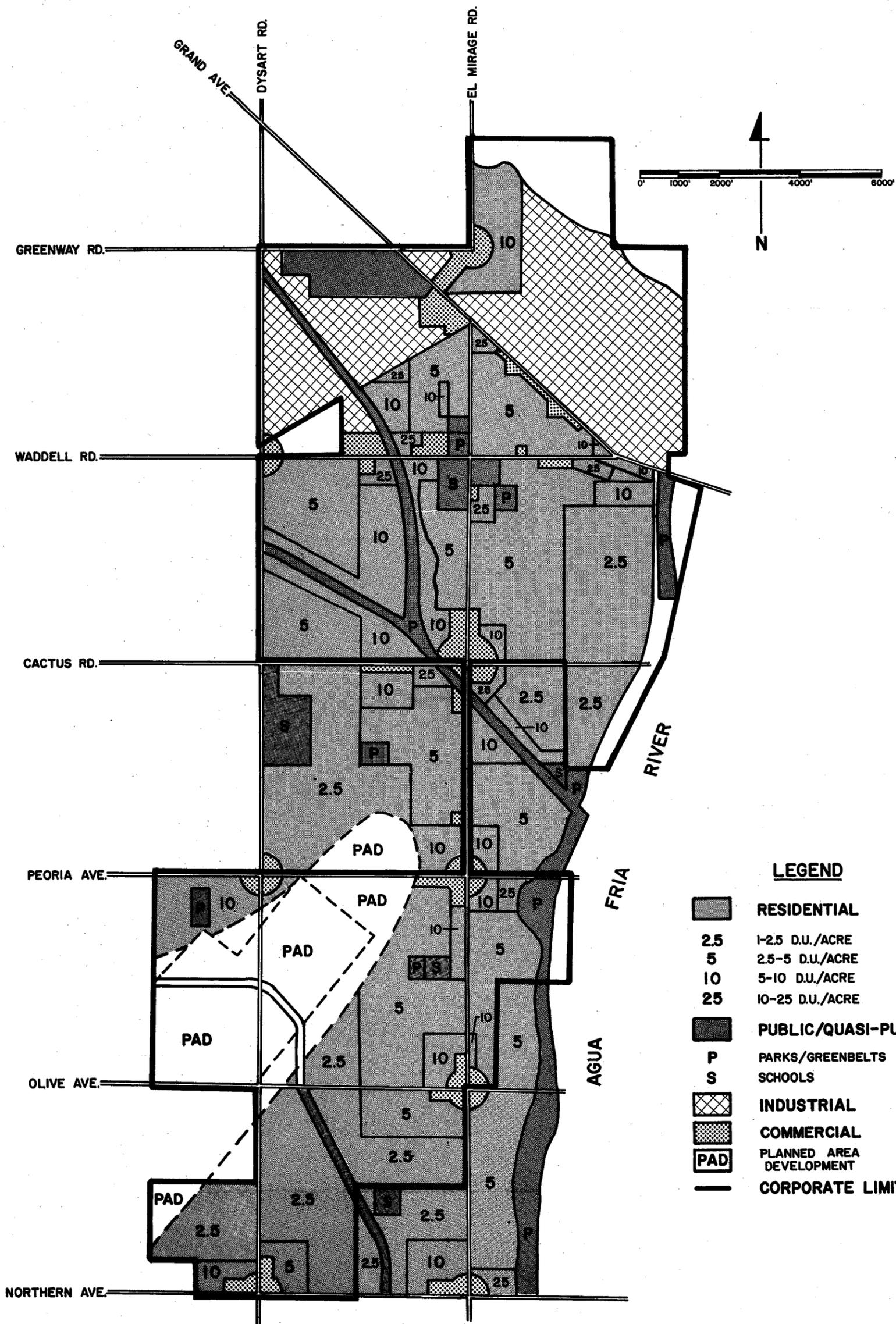


-  RESIDENTIAL
- S** SINGLE FAMILY
- M** MULTI-FAMILY
- H** MOBILE HOME
-  AGRICULTURE
-  COMMERCIAL
-  INDUSTRIAL
-  RECREATIONAL VEHICLE PARK
-  BUFFER

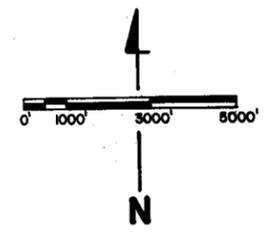
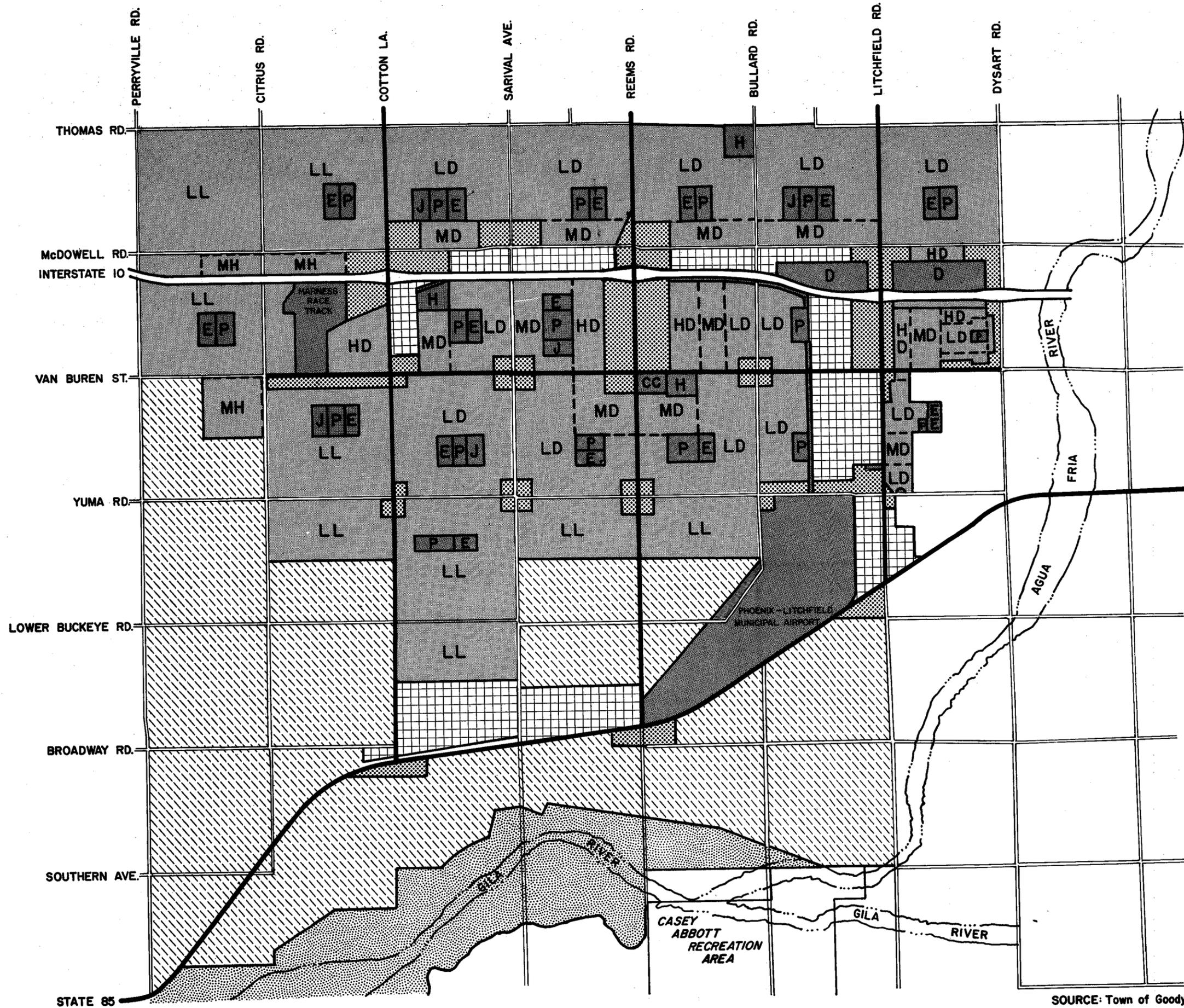


CITY OF AVONDALE LAND USE PLAN

MAP 30



TOWN OF EL MIRAGE COMPREHENSIVE PLAN



LEGEND

- RESIDENTIAL
- LL LARGE LOT
- LD LOW DENSITY
- MD MEDIUM DENSITY
- HD HIGH DENSITY
- MH MOBILE HOMES
- PUBLIC/QUASI-PUBLIC
- P PARKS
- E ELEMENTARY SCHOOL
- J INTERMEDIATE SCHOOL
- H SENIOR SCHOOL
- CC CIVIC CENTER
- D DETENTION BASIN
- AGRICULTURE
- INDUSTRIAL
- COMMERCIAL
- FLOODPLAIN
- MAJOR ARTERIALS

SOURCE: Town of Goodyear, 1976.

TOWN OF GOODYEAR COMPREHENSIVE PLAN

VIII. APPROVED LARGE SCALE DEVELOPMENTS

Large scale developments encompass several hundred to several thousand acres. A number of large scale developments have been approved by Maricopa County within or near the study area. Information on each development is summarized in Table 3-11.

TABLE 3-11

APPROVED LARGE SCALE DEVELOPMENTS IN OR NEAR THE WHITE TANKS-AGUA FRIA AREA*

Development	Developer	Date Approved	Gross Acreage	Design Population	Status
Country Meadows	Design Master Homes	10/76	672	7,600	In Progress
Desert Tree	Sunora Development Company	3/76	1,430	11,500	Not under Construction
Litchfield Park**	Litchfield Park Properties	8/66	12,000	90,000	In Progress
Sun City	Del E. Webb Development Co.	1959	9,000	55,000	Essentially Complete
Sun City West**	Del E. Webb Development Co.	12/77	5,700	32,500	In Progress
Villa de Paz	Southwest Projects	8/70	600	9,000	In Progress

*Approved by the Maricopa County Board of Supervisors.

**Located within the White Tanks-Agua Fria Area.

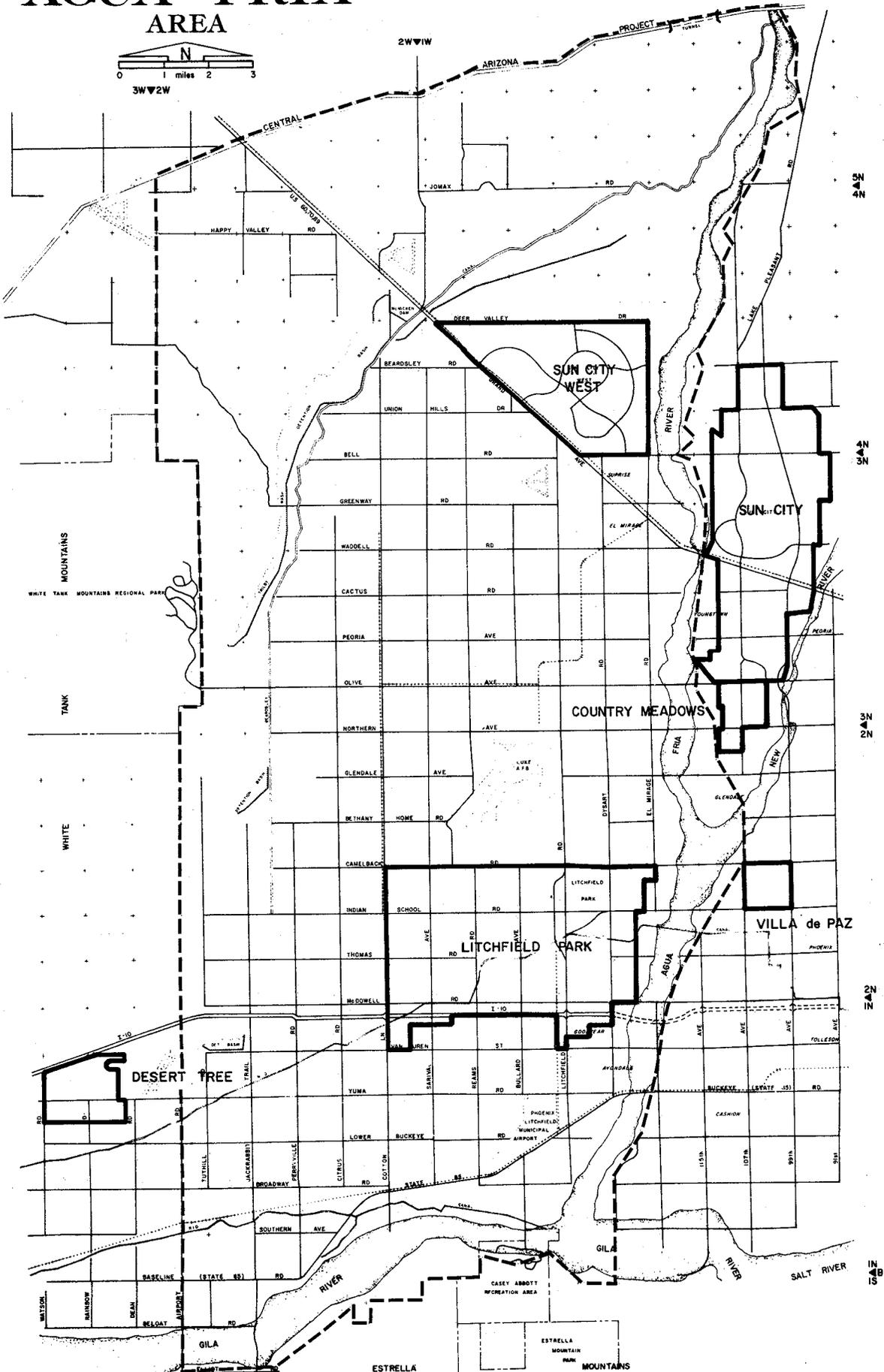
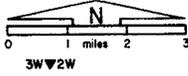
Maricopa County Planning and Zoning Department, 1977.

Map 33 shows the location of these developments. Litchfield Park and Sun City West are located within the White Tanks-Agua Fria area. Each is discussed in detail in the following sections.

WHITE TANKS AGUA FRIA

HIEROGLYPHIC MOUNTAINS

AREA



--- STUDY AREA BOUNDARY

APPROVED LARGE SCALE DEVELOPMENTS

MAP 33

Litchfield Park

The "General Plan for Litchfield Park" encompasses approximately 12,000 acres. It was approved in concept by the Maricopa County Board of Supervisors on August 15, 1966. The approved future land use plan is shown by Map 34.

The plan calls for the development of a new town with a design population of 75,000 to 100,000 people. As approved, the town will consist of six residential communities each containing a variety of housing types with a broad range of prices. Each community will house 15,000 to 20,000 people. The nucleus of each community will be a combination high school and community shopping area which serves as an activity center for educational, social, commercial, and community activities.

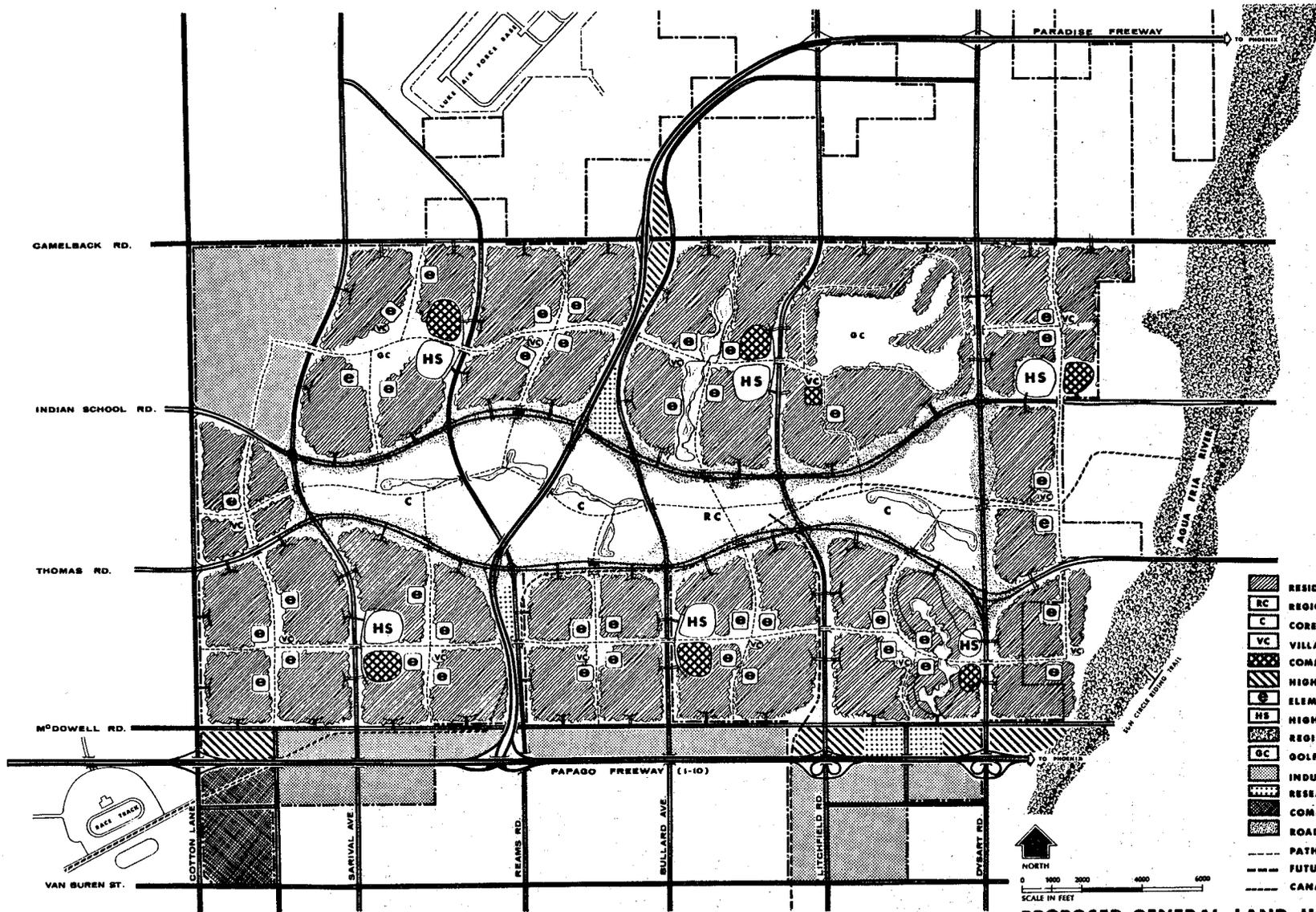
Each community will be made up of two "villages". A village will include about one square mile and have a population of 7,500-10,000 people. Villages will be comprised of individual neighborhoods containing 1,900 to 2,800 people. Each village will include a focal point such as a lake, a golf course, or a park.

The six residential communities will surround a core area which accommodates activities too specialized to be contained by any one community. Potential core area uses include a college, a hospital complex, a regional shopping center, restaurants, parks, motels, churches, high density residential, commercial services, and recreation facilities.

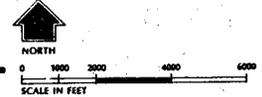
The plan calls for variations in the grid system of arterial roads. A pathway system woven throughout the town will provide for pedestrian, bicycle, and electric cart movement.

Industrial uses are planned adjacent to Interstate-10 on the south side of McDowell Road, and in the northwest corner of development near the end of runways at Luke Air Force Base.

The first village is nearing completion. Although the plan calls for the initial phase of development to take place entirely east of Litchfield Road, the next phase of development will take place west of Litchfield Road around the new 18 hole golf course (Crowell, 1980). Development within the core area is currently taking place west of the Indian School Road bypass between Litchfield Road and Dysart Road.



- RESIDENTIAL NEIGHBORHOOD
- REGIONAL COMMERCIAL
- CORE AREA
- VILLAGE COMMERCIAL
- COMMUNITY COMMERCIAL
- HIGHWAY COMMERCIAL
- ELEMENTARY SCHOOL
- HIGH SCHOOL
- REGIONAL PARK
- GOLF COURSE
- INDUSTRIAL
- RESEARCH & DEVELOPMENT
- COMMERCIAL RECREATION
- ROAD SCAPE
- PATHWAY SYSTEM
- FUTURE TRANSIT
- CANAL



LITCHFIELD PARK

PROPOSED GENERAL LAND USE PLAN

MAP 34

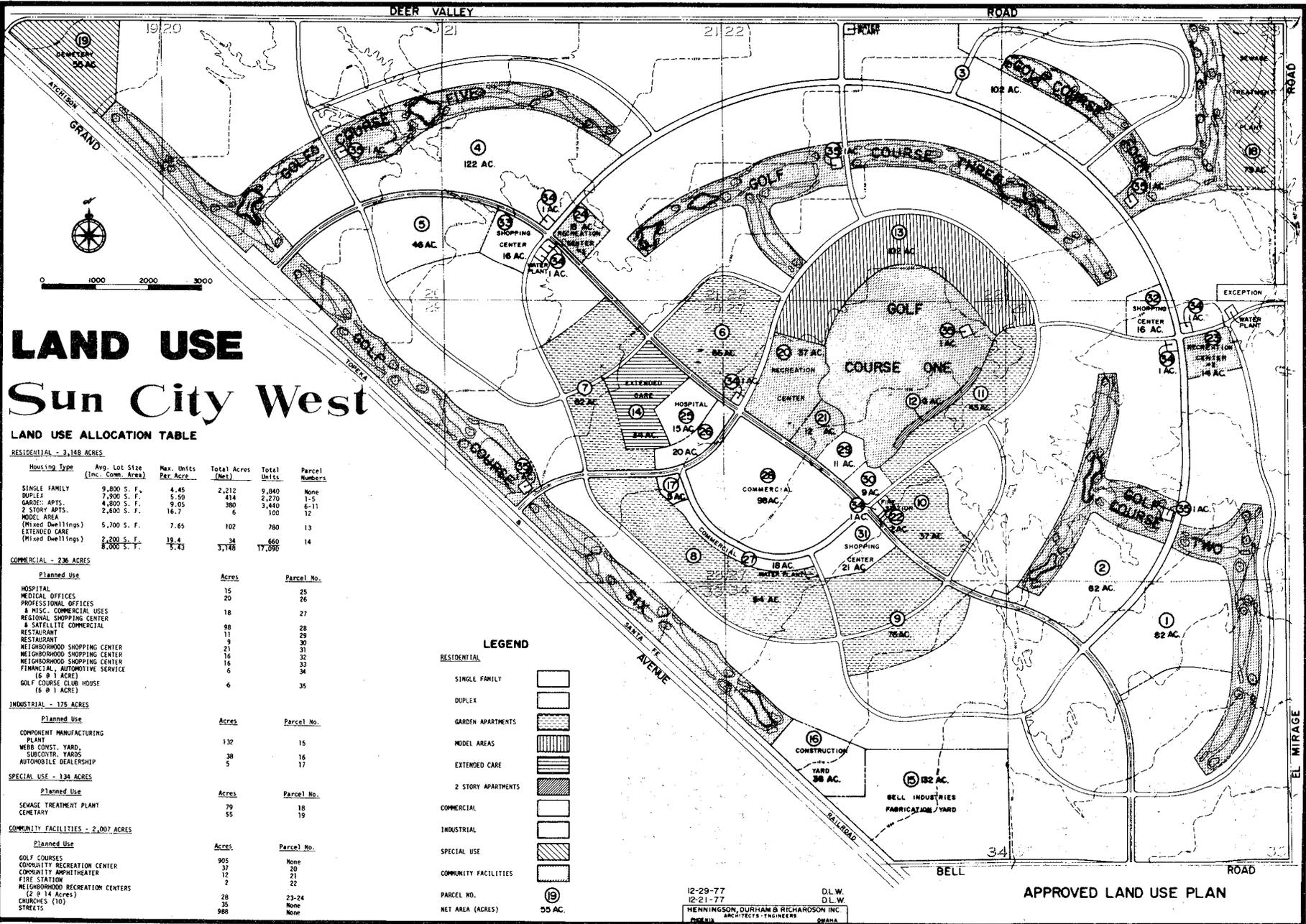
Sun City West

The Sun City West Master Plan includes 5,700 acres. It was approved by the Maricopa County Board of Supervisors in December, 1977. The approved land use concept is shown by Map 35.

Sun City West is a self contained retirement community which offers a wide range of services and facilities for its residents. The proposed plan includes six full length golf courses, a community recreation center and two neighborhood centers, a 7,000 seat amphitheatre, a fire station, a cemetery, medical and professional offices, a nursing home and extended care facilities, and community and neighborhood shopping. The community is based around a central core which contains the major commercial areas and community facilities. A detailed break down of land use by category is shown on Map 35. The plan calls for a major deviation in the section line road system.

A total of 17,060 housing units will be provided. Of these 9,486 will be single family units, 5,810 will be multi-family units, and 660 will be extended care units.

The Del Webb Company intends to develop a total of 13,000 acres. The approved master plan for Sun City West represents Phase I of this project. The Del Webb Company originally expected Phase I to be completed in seven to nine years. Phase II will be located south of Grand Avenue. The combined design population of Phase I and II was originally estimated at 32,500. A master plan for Phase II has not been submitted for review and approval to date.



LAND USE Sun City West

LAND USE ALLOCATION TABLE

Housing Type	Avg. Lot Size (Inc. Comm. Area)	Max. Units Per Acre	Total Acres (Net)	Total Units	Parcel Numbers
SINGLE FAMILY DUPLEX	9,800 S. F.	4.45	2,212	9,840	None
GARDE: APTS.	7,900 S. F.	5.50	414	2,270	1-5
2 STORY APTS.	4,800 S. F.	9.05	380	3,440	6-11
MODEL AREA	2,600 S. F.	16.7	6	100	12
(Mixed Dwellings)	5,700 S. F.	7.65	102	780	13
EXTENDED CARE (Mixed Dwellings)	2,200 S. F.	19.4	34	660	14
	8,000 S. F.	5.43	3,748	17,090	

Planned Use	Acres	Parcel No.
HOSPITAL	15	25
MEDICAL OFFICES	20	26
PROFESSIONAL OFFICES	18	27
4 MISC. COMMERCIAL USES	98	28
REGIONAL SHOPPING CENTER	11	29
RESTAURANT	9	30
NEIGHBORHOOD SHOPPING CENTER	21	31
NEIGHBORHOOD SHOPPING CENTER	16	32
NEIGHBORHOOD SHOPPING CENTER	16	33
FINANCIAL, AUTOMOTIVE SERVICE (6 @ 1 ACRE)	6	34
GOLF COURSE CLUB HOUSE (6 @ 1 ACRE)	6	35

Planned Use	Acres	Parcel No.
COMPONENT MANUFACTURING PLANT	132	15
WEBB CONST. YARD, SUBCONTR. YARDS	38	16
AUTOMOBILE DEALERSHIP	5	17

Planned Use	Acres	Parcel No.
SEWAGE TREATMENT PLANT	79	18
CEMETARY	55	19

Planned Use	Acres	Parcel No.
GOLF COURSES	905	None
COMMUNITY RECREATION CENTER	37	20
COMMUNITY AMPHITHEATER	12	21
FIRE STATION	2	22
NEIGHBORHOOD RECREATION CENTERS (2 @ 14 ACRES)	28	23-24
CHURCHES (10)	35	None
STREETS	988	None

LEGEND

RESIDENTIAL	
SINGLE FAMILY	[Pattern]
DUPLEX	[Pattern]
GARDEN APARTMENTS	[Pattern]
MODEL AREAS	[Pattern]
EXTENDED CARE	[Pattern]
2 STORY APARTMENTS	[Pattern]
COMMERCIAL	[Pattern]
INDUSTRIAL	[Pattern]
SPECIAL USE	[Pattern]
COMMUNITY FACILITIES	[Pattern]
PARCEL NO.	(9)
NET AREA (ACRES)	55 AC.

12-29-77 D.L.W.
 12-21-77 D.L.W.
 HEENINGSON, DURHAM & RICHARDSON INC.
 ARCHITECTS-ENGINEERS
 DENVER, COLORADO

APPROVED LAND USE PLAN

SELECTED REFERENCES

- Arizona Department of Transportation (ADOT) "Planning for Airport Noise Impacts", Transportation Planning Division, no date.
- Arizona Land Department, 1980, Land Ownership Maps, May, 1980.
- Arizona Office of Economic Planning and Development, 1981. Town of Surprise, Arizona Development Guide, February, 1981.
- City of Avondale, 1981. Avondale Comprehensive Plan Update, draft, prepared by Willdan and Associates, September, 1980.
- City of Phoenix, 1978. Phoenix-Litchfield Municipal Airport Environmental Impact Assessment, Report, prepared for the City of Phoenix Engineering and Aviation Departments by Henningson, Durham, and Richardsen, Inc. Consultants, July, 1978.
- _____, 1979. Interim Plan For The City of Phoenix to the Year 1985, draft, 1980.
- Del E. Webb Company, 1977. Development Master Plan for Sun City West Phase I, file copy, Maricopa County Department of Planning and Development.
- Gruen and Associates, 1966. Proposed General Plan for Litchfield Park Area Maricopa County, Arizona, prepared for the Goodyear Tire and Rubber Company by Victor Gruen and Associates, March, 1966.
- Kleinschmidt, 1980. Personal communication with Ernie Kleinschmidt, Manager, Town of Goodyear, April, 1980.
- Luke Air Force Base, 1976. Air Installation Compatible Use Zone Report (AICUZ), for Luke Air Force Base, Arizona, March, 1976.
- _____, 1980. Personal communication, March, 1980.
- _____, 1981. Air Installation Compatible Use Zone Report Luke Air Force Auxilliary Field #1, Arizona, July, 1981.
- _____, 1982. Personal communication, Capt. Ron Gagne, January, 1982.
- Maricopa County Assessors Office, 1979. Microfiche, November, 1979.
- _____, 1980. Microfiche, May, 1980.
- Maricopa County Department of Planning and Development, 1979. White Tanks-Agua Fria Land Use Survey, October, 1979.
- _____, 1980. Zoning Maps For The Unincorporated Portion of Maricopa County, April, 1980.
- Maricopa County Housing Committee, 1979, "Maricopa County Housing Study", 1979.

- Maricopa County Planning and Zoning Department, 1977. Existing Large Scale Development In Maricopa County, February, 1977.
- National Academy of Sciences, 1977. Noise Abatement Policy Alternatives For Transportation, A Report to the U.S. Environmental Protection Agency, National Research Council, National Academy of Sciences, 1977.
- Town of El Mirage, 1980. Interim Land Use Master Plan For El Mirage, Arizona draft report, prepared by A. Wayne Smith and Associates, April 29, 1980.
- Town of Goodyear, 1976. Urban Planning and Management Assistance Project Goodyear Comprehensive Planning Program Report, prepared for the Town of Goodyear by C. Howard Miller and Associates, December, 1976.
- U.S.D.I., Bureau of Land Management, 1980. Land Ownership Maps, May, 1980.
- U.S. Department of Housing and Urban Development _____. "Urban Development Noise Standards", HUD Circular 1390.2, date unknown.
- Van Houten and Associates, 1979. Luke and Williams Air Force Base Noise Contour Measurement Study for Maricopa County, Arizona, January, 1979.
- Willdan and Associates, 1979., Urban County Housing and Socioeconomic Study, final draft, April, 1980.

**T
R
A
N
S
P
O
R
T
A
T
I
O
N**

I. STREETS AND HIGHWAYS

Existing Conditions

THE MAJOR ROAD SYSTEM

The major road network within the study area is an extension of the section line grid system used throughout the Phoenix metropolitan region. In addition to section line roads, U.S. 60-70-89 (Grand Avenue), State Route 85, and Interstate-10 accommodate local, regional, and statewide travel within the area. The existing system of streets and highways is shown on Map 36.

Of the 362 miles of major roads within the area, about 65 percent have an improved surface consisting of road mix, asphaltic concrete, concrete, or penetration chip seal. The remaining unimproved surfaces are either gravel or dirt. Interstate-10, U.S. 60-70-89, and State Route 85 account for over 30 miles or almost 10% of the major road network within the area.

There are approximately 21 miles of four lane section line roads within the area. Roads with four travel lanes extending east of the Agua Fria River include Bell Road, Glendale Avenue, Grand Avenue, and State Route 85. Other improved roads have two travel lanes which vary in width and design.

Interstate-10 is a grade separated, divided four lane freeway which links the Phoenix metropolitan area to Los Angeles and the west coast. It is currently completed as far east as Dysart Road where traffic must exit. Interchanges are located at Jackrabbit Trail, Cotton Lane, Litchfield Road, and Dysart Road.

Until recently, five bridges were located along the Agua Fria River at Bell Road, Grand Avenue, Glendale Avenue, Indian School Road, and State Route 85. Floodwaters destroyed the Bell Road bridge and severely damaged the Indian School Road bridge in February, 1980. Efforts are currently underway to repair or replace these structures. Dip crossings through the riverbed are located at other section line roads which cross the river.

Access across the Gila River is provided by dip crossings at Airport Road, Jackrabbit Trail, and Bullard Avenue. A low flow bridge at Jackrabbit Road is badly silted and is inaccessible during floods. It will be removed in the future.

The majority of the roads within the study area are under the jurisdiction of Maricopa County. Exceptions include State Route 85, U.S. 60-70-89, and Interstate-10, which are primarily the responsibility of the Arizona Department of Transportation, and those segments of section line roads within incorporated areas which have been annexed and are maintained by the respective cities and towns.

A general review of existing right-of-way information indicates that there are numerous gaps in public right-of-way along section lines within the area. Where right-of-way does exist, it is often inadequate in terms of current County standards for section line roads. Many of the roads within the rural portions of the area have never been accepted for maintenance by the Maricopa County Highway Department (Maricopa County Highway Department, 1979b).

TRAFFIC VOLUMES

Average daily traffic volumes on major streets within the study area are shown on Map 37. These estimates represent typical weekday traffic movements during a 24 hour period. They do not identify traffic volumes which occur during unusual conditions such as construction, floods, or major public events. They also do not represent weekend traffic to regional parks which may be substantial on some roads.

Traffic volumes are greatest on Grand Avenue, State Route 85, Interstate-10, and major section line roads in the eastern half of the study area. This reflects both the amount of through traffic within the area and the relationship of the study area to the greater Phoenix metropolitan area. Major traffic generators include Sun City West, Litchfield Park, Luke Air Force Base, and the incorporated cities and towns within the area. Routes carrying over 10,000 vehicles daily include State Route 85, Dysart Road between State Route 85 and Interstate-10, Glendale Avenue east of Luke Air Force Base, and Litchfield Road between Glendale Avenue and the main entrance to Luke Air Force Base.

Since Interstate-10 is not completed east of Dysart Road, both Litchfield Road and Dysart Road carry large volumes of traffic north and south to major east-west routes. This traffic flow should decrease in the future when the freeway is completed east of the Agua Fria River.

Future Street and Highway Plans

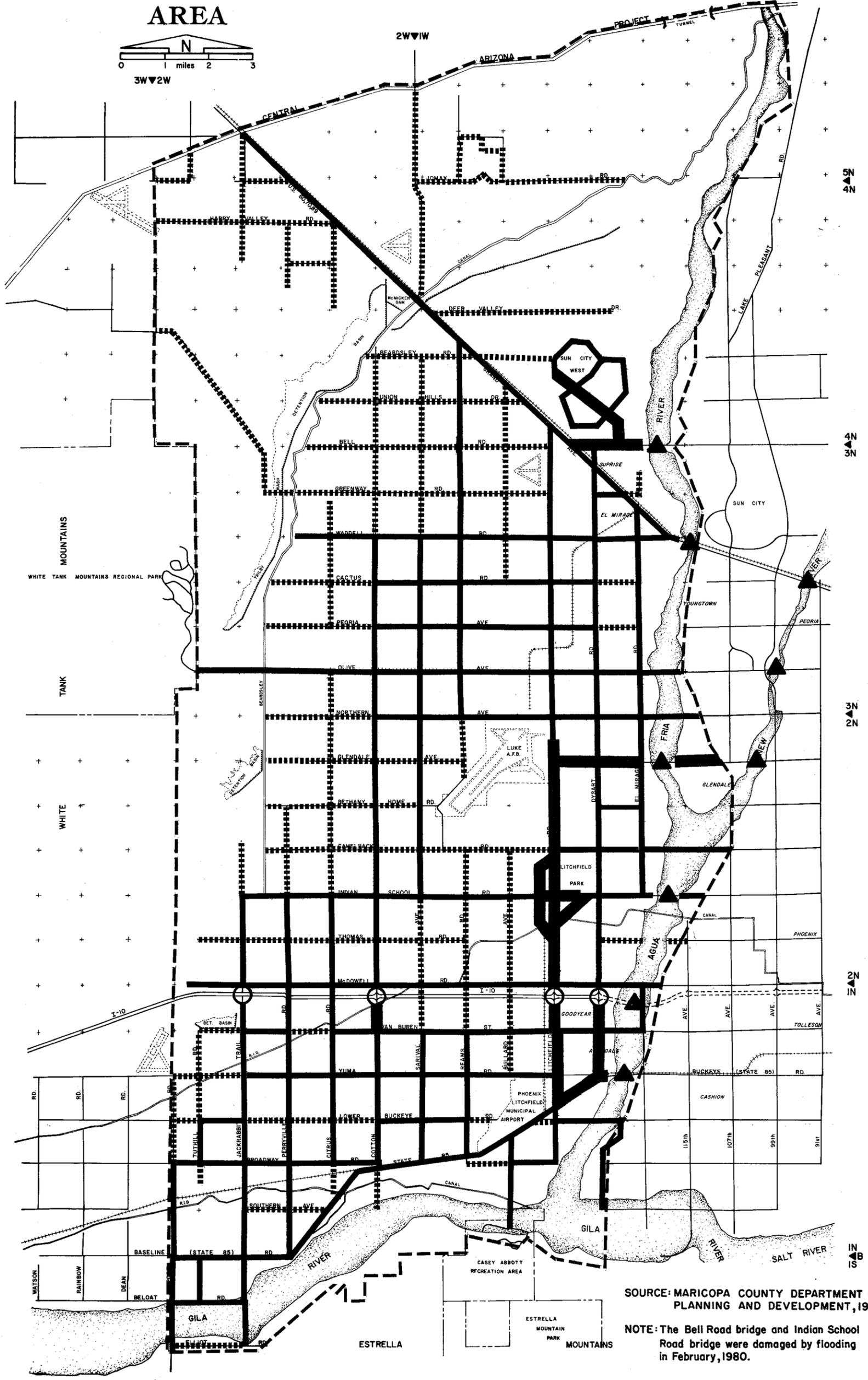
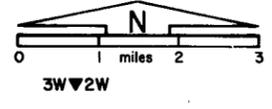
The Regional Council of the Maricopa Association of Governments annually reaffirms the street and highway portion of the Long Range Transportation System Plan for Maricopa County. Map 38 shows the plan as adopted by the Regional Council on January 30, 1980. This plan provides a basis for route location studies and more detailed five year improvement programs. It is made up of three basic components: section line roads, existing and committed freeways, and planned transportation corridors.

SECTION LINE ROADS

The backbone of the street and highway plan is the mile square grid system of major streets. These streets currently carry over 70 percent of all daily travel region-wide and will continue to carry over half of all daily travel even if freeway/expressway plans are fully implemented (MAG Transportation Planning Office, 1980).

WHITE TANKS AGUA FRIA AREA

M I W V E
HIEROGLYPHIC MOUNTAINS



LEGEND

- INTERSTATE
- IMPROVED 2 LANE
- IMPROVED 4 LANE
- UNIMPROVED SURFACE
- INTERCHANGE
- ▲ BRIDGE
- - - STUDY AREA BOUNDARY

SOURCE: MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT, 1979.

NOTE: The Bell Road bridge and Indian School Road bridge were damaged by flooding in February, 1980.

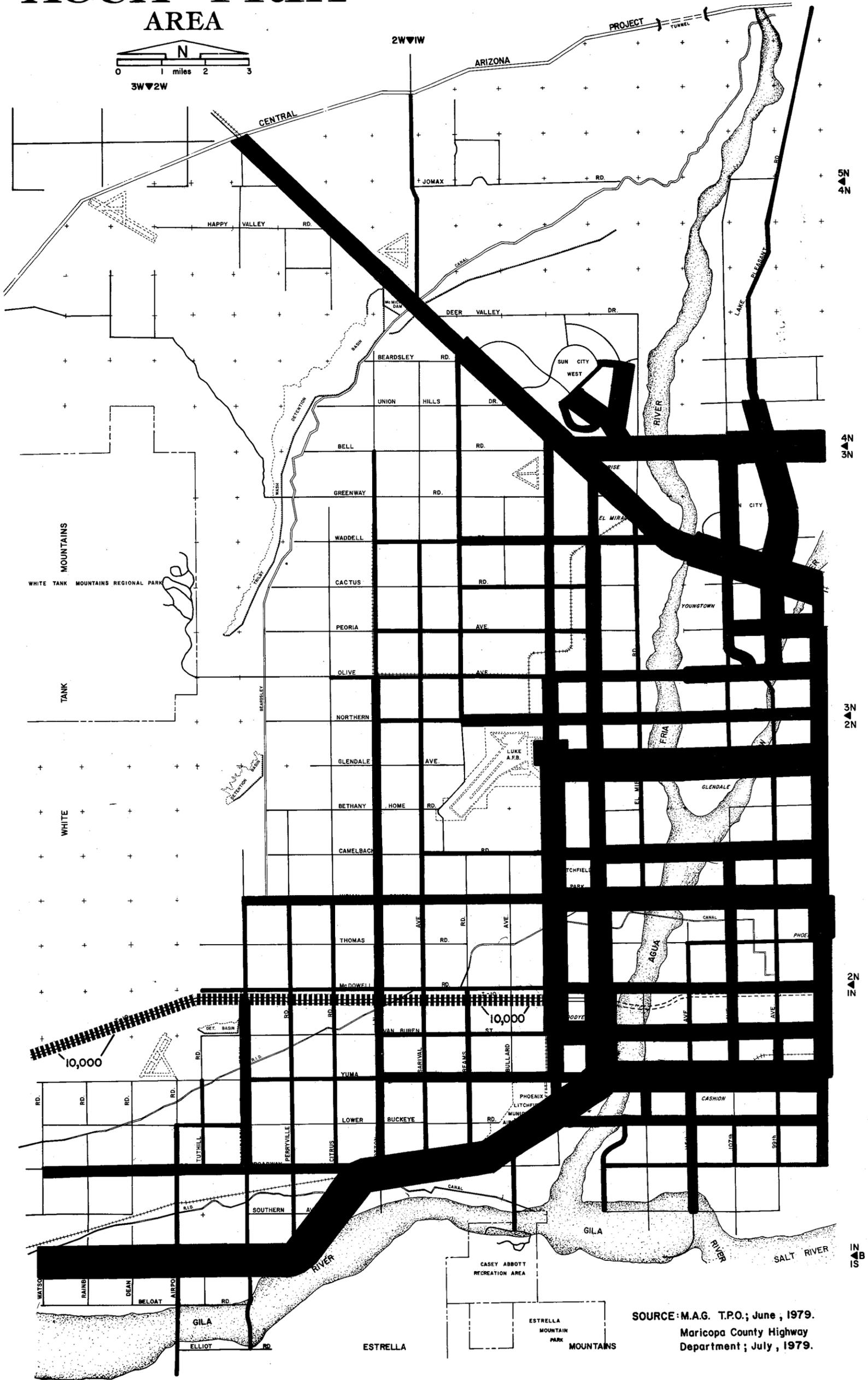
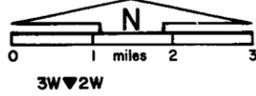
MAJOR ROAD SYSTEM

MAP 36

WHITE TANKS AGUA FRIA AREA

IWVE

HIEROGLYPHIC MOUNTAINS



LEGEND

- 100-1000 VEHICLES
- 1000-3000 VEHICLES
- 3000-6000 VEHICLES
- 6000-10,000 VEHICLES
- GREATER THAN 10,000 VEHICLES
- ||||| INTERSTATE 10 VOLUMES 10,000

SOURCE: M.A.G. T.P.O.; June, 1979.
Maricopa County Highway Department; July, 1979.

Section line roads emphasized within the study area are as follows:

East-West Streets

Beardsley Road
Bell Road
Waddell Road
Olive Avenue
Northern Avenue
Glendale Avenue
Camelback Road
Indian School Road
Thomas Road
McDowell Road
Van Buren Road
Yuma Road
Broadway Road

North-South Streets

Jackrabbit Trail
Perryville Road
Cotton Lane
Sarival Avenue
Reems Road
Litchfield Road
Dysart Road

EXISTING AND COMMITTED FREEWAYS

The existing freeway system in Maricopa County consists of Interstate-17 (Black Canyon Freeway), Interstate-10 (Maricopa Freeway), State Route 360 (Superstition Freeway) and Interstate-10 which now ends at Dysart Road. The Arizona Department of Transportation has committed to build the following segments of freeway in the future.

- *Interstate-10 (Papago Freeway) from Dysart Road through central Phoenix to the Maricopa Freeway;
- *State Route 360 (Superstition Freeway) from Country Club Drive eastward to U.S. 60; and
- *State Route 143 (Hohokam Expressway) from the Maricopa Freeway to Sky Harbor Airport.

Interstate-10 was originally planned for completion in the early 1970's. It's progress has been slowed by years of controversy over its alignment, and most recently, concern for archaeological sites located in its path. Interstate-10 is currently programmed to be completed to 51st Avenue in Phoenix by 1984-1985. Between Dysart Road and 51st Avenue interchanges will be located at 115th Avenue, 99th Avenue, and every mile thereafter.

The freeway will be completed to 91st Avenue by 1983. However, the Arizona Department of Transportation does not plan to open the freeway to traffic east of the Agua Fria River until it is completed to 51st Avenue. This will avoid excessive traffic flows on 91st Avenue in Tolleson. This decision is open to further study. The time frame for completing Interstate-10 from 51st Avenue to Interstate-17 has not been finalized. It is doubtful if it will occur before 1990 (Ross, 1980).

PLANNED TRANSPORTATION CORRIDORS

The Transportation System Plan identifies a system of travel corridors which have been accepted as part of the State Highway System. It is expected that these corridors will be developed as freeways, expressways, parkways, busways, or a combination of these facilities. However, neither the type of facilities nor their precise location has been determined. Included are the Squaw Peak Corridor, the East Papago Corridor, the Paradise Corridor, and the North Loop Corridor.

All of these corridors will be needed to handle travel demand within the region by the year 2000. They have been recommended for completion in the mid 1990's. New funding sources will be needed to finance the construction of these planned corridors since it is unlikely that Federal funds will be available, and current state and local revenues are inadequate. Additional major projects which are not currently part of the plan may be needed by the year 2000 (Maricopa Association of Governments Transportation Planning Office, 1980).

The western portion of the north loop corridor, although located east of the Agua Fria River, could have a significant impact on the study area. In conjunction with the completion of Interstate-10, it would greatly improve access between the study area and the rest of the Phoenix metropolitan region.

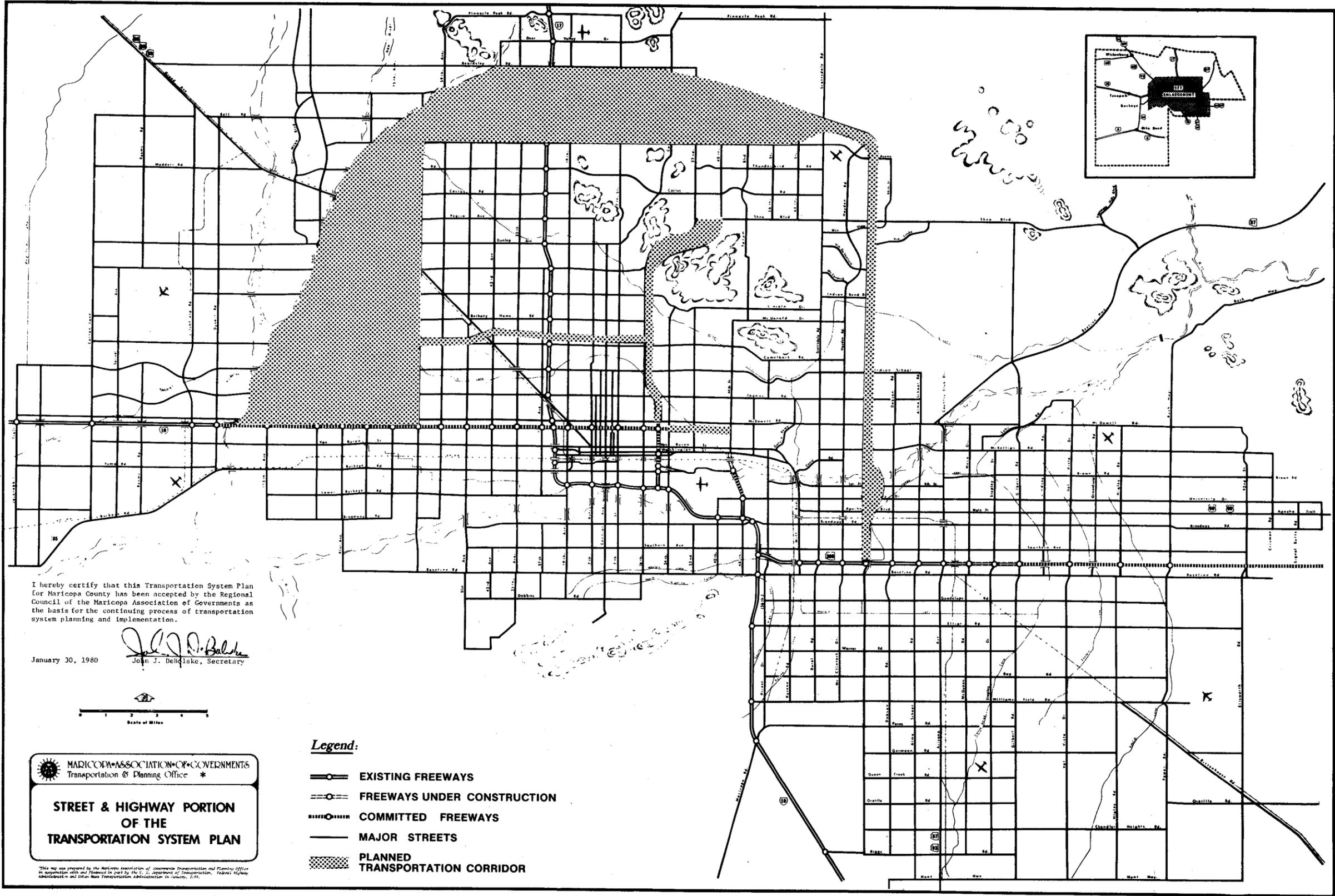
FUTURE TRAFFIC VOLUMES

Forecasts prepared by the Maricopa Association of Governments Transportation Planning Office indicate that traffic volumes on major roadways within the study area will increase substantially by the year 2000 (See Map 40.) These forecasts are based on a number of assumptions including the following:

- *The completion of all projects identified by the Long Range Transportation System Plan.
- *A population of 2.35 million people in Maricopa County (adopted by MAG Regional Council in April, 1979).
- *Approximately three percent of all daily travel will be carried by public transit.
- *An urbanized area which conforms to the MAG Regional Development Guide.

East-West Routes

I-10 will be the major east-west route in the southern half of the study area with average daily traffic volumes ranging from 24,000 vehicles near the western boundary to over 59,000 vehicles at the Agua Fria River. State Route 85 will carry volumes similar to those existing in 1979. Segments of U.S. 60-70-89 will carry as much as 41,000 vehicles daily reflecting increased travel demand from the full development of Sun City West.



I hereby certify that this Transportation System Plan for Maricopa County has been accepted by the Regional Council of the Maricopa Association of Governments as the basis for the continuing process of transportation system planning and implementation.

January 30, 1980
 John J. DeBalske, Secretary



MARICOPA ASSOCIATION OF GOVERNMENTS
 Transportation & Planning Office *

**STREET & HIGHWAY PORTION
 OF THE
 TRANSPORTATION SYSTEM PLAN**

- Legend:**
- EXISTING FREEWAYS
 - FREEWAYS UNDER CONSTRUCTION
 - COMMITTED FREEWAYS
 - MAJOR STREETS
 - ■ ■ ■ ■ PLANNED TRANSPORTATION CORRIDOR

This map was prepared by the Maricopa Association of Governments Transportation and Planning Office in cooperation with and financed in part by the U. S. Department of Transportation, Federal Highway Administration and State Road Transportation Administration in Maricopa County, AZ.

All of the major east-west section line roads will carry additional traffic with Glendale Avenue remaining a dominant arterial. The completion of Thomas Road and Beardsley Road through the Agua Fria riverbed would result in additional links to the region east of the study area. Both McDowell Road and Van Buren Street will serve as collectors for Interstate-10. Bell Road will increase in importance as development takes place south of Grand Avenue.

North-South Routes

The major north-south routes will continue to be Litchfield Road and Dysart Road. In addition, El Mirage Road will increase in importance. Other major north-south routes could carry up to 5,000 vehicles daily.

Transportation Improvement Programs

Map 41 shows the location of programmed improvements to the major street and highway system within the study area for the period 1981-1985. The projects for fiscal year 1981 represent the committed improvements of all jurisdictions. Those for later fiscal years reflect current priorities for future improvements which are subject to change annually by each jurisdiction.

FISCAL YEAR 1981-1982

Major projects for fiscal year 1981 include the construction of new bridges over the Agua Fria River at Bell Road, Camelback Road, and McDowell Road, and the repair of the Indian School Road bridge. New bridges will be constructed over the Gila River at Bullard Road and Tuthill Road. All of these bridges will be completed by 1983 or before. Portions of Perryville Road, Camelback Road, and Lower Buckeye Road will be paved. The construction of Interstate 10 east of the Agua Fria River will also begin.

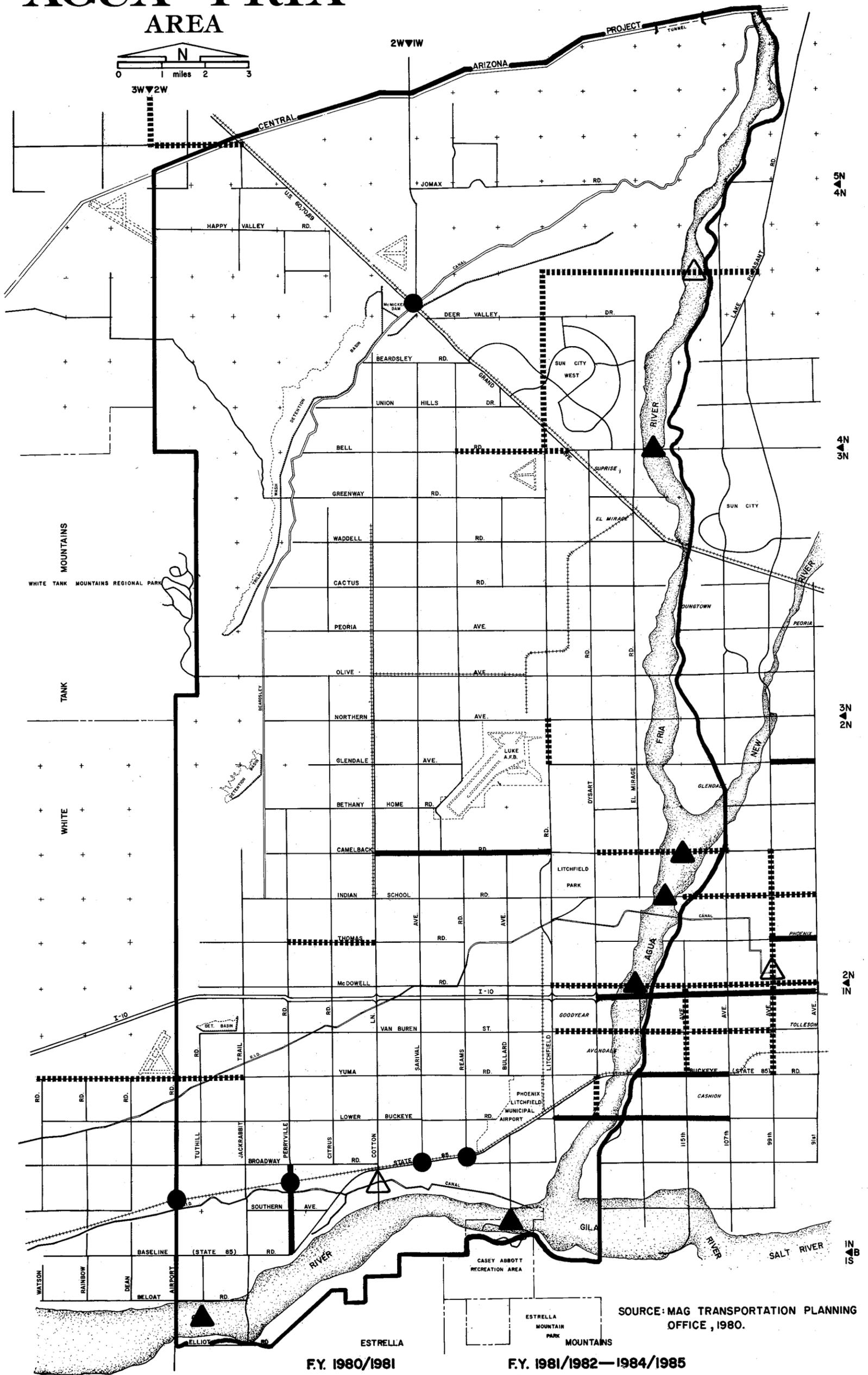
FISCAL YEARS 1982-1985

Major improvements programmed for this time period include the paving or repaving of portions of Yuma Road, Bell Road, Thomas Road, Van Buren Street, Camelback Road, Litchfield Road, Dysart Road, and McDowell Road. A new bridge will be constructed on Cotton Lane at the Buckeye Canal. Work will continue on Interstate-10, which should be completed to 51st Avenue and open to traffic by 1985. A new bridge over the Agua Fria River along the Pinnacle Peak Road alignment also is programmed. Pinnacle Peak Road will be constructed from Lake Pleasant Road to the Litchfield Road alignment. Litchfield Road will be constructed through Sun City West from Grand Avenue to the Pinnacle Peak Road alignment.

WHITE TANKS AGUA FRIA AREA

M I W V E

HIEROGLYPHIC MOUNTAINS



SOURCE: MAG TRANSPORTATION PLANNING OFFICE, 1980.

- | | | |
|---------------|-----------------------|---------------------------------|
| LEGEND | F.Y. 1980/1981 BRIDGE | F.Y. 1981/1982—1984/1985 BRIDGE |
| | RAILROAD CROSSING | RAILROAD CROSSING |
| | STREET IMPROVEMENTS | STREET IMPROVEMENTS |
| | | |

II. BUS SERVICE

Public Transit

The study area is not served by local fixed route transit service at this time. Four commuter bus routes operated by the Phoenix Transit System serve the Palo Verde Nuclear Generating Station and pass through the study area. These routes enter the area via Thomas Road, Northern Avenue, and Indian School Road, then take Litchfield Road to Interstate-10. Three of these routes may provide limited service to the Avondale-Goodyear area. The other is an express route.

Recreation Centers Incorporated, which is controlled by the Property Owners and Residents Association of Sun City West, will provide bus service in Sun City West in the future (Donaldson, 1979). There are no other plans for local transit operations.

The City of Phoenix Transit System currently has fixed routes which are radially oriented to the central area of Phoenix. Its primary service area extends to 83rd Avenue between Thomas Road and Indian School Road. Future plans for the system could change service to a grid pattern along the major street system. The expansion of the primary service area west of the Agua Fria River to serve the Avondale-Goodyear area and Sun City West is proposed by the year 2000 in the Maricopa Association of Governments (MAG) long range transit plan.

A commuter route to serve Luke Air Force Base has been suggested, but no definite plans exist at this time (Alvarez, 1979)

Commercial Bus Lines

Inter-city and statewide bus service is provided by Continental Trailways and the Greyhound Bus Lines. Both bus lines travel State Route 85 and U.S. 60-70-89 (Grand Avenue) through the study area. Service is provided between Phoenix and El Mirage, Goodyear, Avondale, and Surprise.

III. RAILROADS

Regional Service Characteristics

The Phoenix metropolitan area is served by the Atchison, Topeka, and Santa Fe Railroad and the Southern Pacific Railroad. The principal route of the Santa Fe is from Chicago to Los Angeles by way of northern Arizona. The Southern Pacific runs from Louisiana to Southern California with its mainline passing through southern Arizona.

The main routes of the Santa Fe and Southern Pacific do not pass through the Phoenix metropolitan area. Instead, both railroads serve the Phoenix area with Class B mainline extensions. The Southern Pacific extension runs west from the mainline at Welton, through Phoenix, and then south to the mainline at Eloy. The Santa Fe extension runs south from Ashfork and terminates in Phoenix.

As shown by Map 42, the Santa Fe mainline parallels Grand Avenue. The Southern Pacific mainline passes through the communities of Goodyear, Avondale, Tolleson, downtown Phoenix, downtown Tempe, downtown Mesa, and Gilbert.

Passenger service in the metropolitan area is provided by AMTRAK on the Southern Pacific Railroad line. Both east bound and westbound service is provided 3 times a week. The only passenger terminal is located in downtown Phoenix. An estimated 14,000 passengers used the Phoenix Station in 1978 (Arizona Department of Transportation, 1979a).

The majority of rail traffic in the Phoenix area is the result of freight service. As shown by Table 4-1 the amount of goods shipped from the Phoenix area is small in comparison to the amount received. Lumber, food, petroleum, and farm products are the major type of goods received. Rail service primarily serves local personal consumption demand rather than local manufacturing activities within the region.

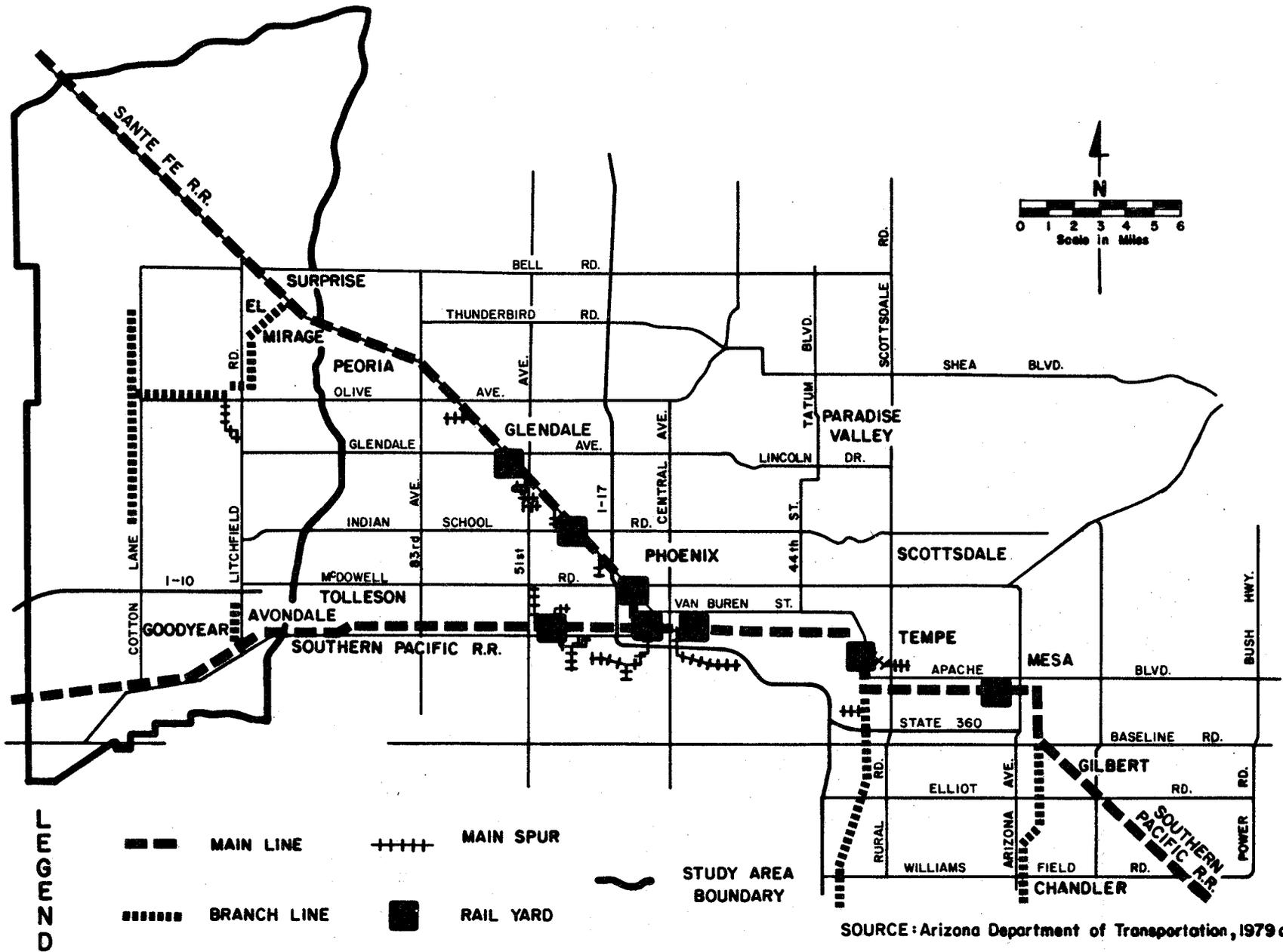
Very little of the rail traffic in the Phoenix area is through traffic. The numerous rail yards within the Phoenix area serve as the only connection between the rail networks in northern and southern Arizona. There are nine rail yards in the Phoenix area which vary in size and activity. (See Map 42). Six are located on Southern Pacific lines; the remaining three serve the Santa Fe line. The Southern Pacific main yard is located between 7th Street and 16th Street. Mobest, the Santa Fe main yard, is located between McDowell Road and Filmore Street. The other heavily used yard is the Santa Fe Glendale yard. It is located between Glendale Avenue and Bethany Home Road.

TABLE 4-1

CAROLOADS SHIPPED AND RECEIVED BY RAILROAD
PHOENIX METROPOLITAN AREA, 1978

Commodity Type	Santa Fe		Southern Pacific	
	Shipped	Received	Shipped	Received
Farm Products	1,217	5,792	2,371	2,792
Metallic Ores	0	0	0	3,463
Non-metallic Ores	0	300	2,142	1,390
Food and Kindred	2,648	5,795	861	8,543
Lumber and Wood	0	14,154	402	4,849
Chemicals and Allied	129	1,018	682	842
Petroleum	1,024	6,081	10	2,514
Primary Metal Products	0	579	2,141	2,391
Waste and Scrap	452	3,200	1,809	4,387
Coal	0	0	0	0
Pulp, Paper and Allied	975	2,310	77	3,702
Stone, Clay and Glass	0	6,972	0	2,827
All Others	1,693	12,834	1,019	10,219
TOTAL	8,138	59,035	11,514	47,919

Source: Arizona Department of Transportation, 1979 a.



PHOENIX METROPOLITAN AREA RAIL FACILITIES

MAP 42

Local Service Characteristics

Both the Santa Fe and the Southern Pacific Class B main lines pass through the White Tanks-Agua Fria area. The Santa Fe consists of a line running parallel along the north side of Grand Avenue. The Southern Pacific has a line which travels through the southern part of the study area north of State Route 85.

Two branchlines are located within the study area: the Santa Fe Ennis Branchline and the Southern Pacific Litchfield Branchline. A rail spur connects Luke Air Force Base with the Ennis Branchline.

There is daily activity on the Ennis Branchline. Potential rail users include Luke Air Force Base, the Cal-Gas storage facility, Caterpillar Tractor Company, building contractors, and agricultural shippers (Atkinson, Topeka, and Santa Fe Railroad, 1979). Approximately 3,000 carloads, accounting for 300,000 tons of materials, are shipped or received annually. Ninety-eight percent of these carloads serve the Cal-Gas liquid petroleum gas storage facility on Olive Avenue near Reems Road. (Arizona Department of Transportation, 1979a). That portion of the branchline which parallels Cotton Lane has seen little use in recent years (Arizona Department of Transportation, 1979b)

There are a number of major industries located along the Litchfield Branchline, but only one carload was received in 1978 and none were shipped. The Southern Pacific Railroad officially abandoned 2.01 miles of this branchline from McDowell Road to Indian School Road in 1978 (Arizona Department of Transportation, 1979a).

Future Rail Plans

The Arizona State Rail Plan was completed by the Arizona Department of Transportation in 1978. This plan identified the need for an examination of the urban rail problems in the Phoenix metropolitan area. Subsequently, the Phoenix Urban Rail Study was begun to identify basic problems and the possible actions which might be taken to improve rail service in this region.

There are several existing conditions which constrain rail activity in the Phoenix area. The high rate of rail-highway accidents along Grand Avenue delays rail operations and increases railroad liability costs. The lack of track signalization in the Grand Avenue corridor requires slow train speeds. The heavy auto traffic surrounding the existing rail yards necessitates restrictions that slow yard operations.

The Phoenix Urban Rail Study determined that the final approach to solving Phoenix rail problems will probably require a combination of rail improvements, grade separations, and system management. Among the conclusions reached were the following:

- *the reduction in rail-highway conflicts which would result from the complete removal of track along upper Grand Avenue

is not justified since the cost of relocating users would be high, political difficulties would be encountered, and the industrial development efforts in several communities might be affected.

*the feasibility of consolidating and relocating the Phoenix rail yards, and constructing an additional rail route along Cotton Lane, should be further investigated since railroad owners, railroad users, and highway users could potentially benefit from the changes (Arizona Department of Transportation, 1979, b).

IV. PUBLIC AIRPORTS

Existing Facilities

Twenty-four public use airports serve Maricopa County. Eleven of these are publically owned and accomodate the majority of aviation demand. Their location is shown on Map 43.

SKY HARBOR INTERNATIONAL AIRPORT

Sky Harbor International Airport accomodates all of the scheduled passenger and air cargo flights provided by commercial airlines in Maricopa County. It also serves general aviation demand. Sky Harbor is located about 25 miles east of the study area in the City of Phoenix.

PHOENIX-LITCHFIELD MUNICIPAL AIRPORT

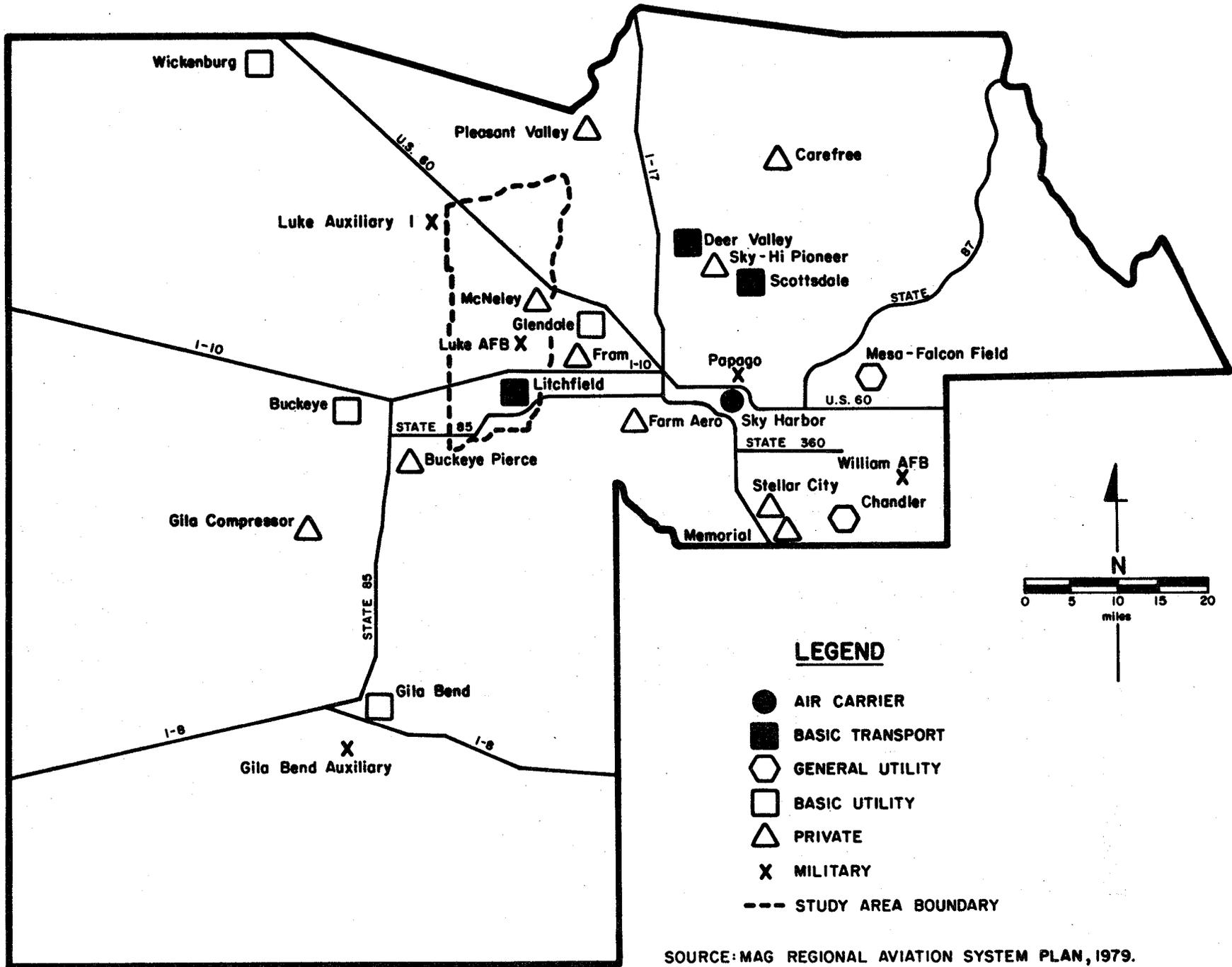
Phoenix-Litchfield Municipal Airport is located within the Town of Goodyear at the intersection of State Route 85 and Litchfield Road. Originally a U.S. Navy facility, it has been owned and operated by the City of Phoenix since 1968. This is a Basic Transport Class General Aviation airport capable of handling turbojet aircraft up to 60,000 pounds. This includes most business, corporate, and executive jets (City of Phoenix, 1978). Space currently exists for 184 based aircraft. 144,900 annual operations (take-offs and landings) were recorded in 1979 (Federal Aviation Administration, 1980).

Phoenix-Litchfield offers complete facilities and services for all classes of users from single engine propeller aircraft to executive jets. Existing facilities include a single paved runway 6,500 feet long and 150 feet wide, a parallel taxiway, an FAA control tower which operates between 6:00 A.M. and 10:00 P.M. on weekdays, markings suitable for a basic transport airport, and aircraft tie downs and hangars. Services included a complete line of aviation fuels, major aircraft and engine repair, charter flights, aircraft rental, flight school, and 24 hour fire and security services (City of Phoenix, 1978).

Phoenix-Litchfield accomodates a number of businesses including Fuller Aviation, PSA (training for German airline pilots), Sperry Flight Systems and Testing Facility, Parker Hanifin (a parts manufacturer), Litchfield Aviation, and a restaurant.

McNELEY AVIATION

McNeley Aviation is a privately owned dirt airstrip located north of Waddell Road and east of Dysart Road near the Town of El Mirage. Although used primarily for crop spraying operations, it is available for public use and has space for five based aircraft. In 1977, it handled 3,500 general aviation operations (MAG Transportation and Planning Office, 1979c).



MAJOR AIRPORTS IN MARICOPA COUNTY

MAP 43

Future Improvements

Phoenix-Sky Harbor

Projects planned and under construction will allow Sky Harbor to accommodate all of the air carrier operations forecast to occur within Maricopa County during the next 20 years. This includes an increase in passenger activity from 5.9 million in 1978 to the 17 million forecast to use the facility by the year 2000. Consequently, no new air carrier outlets are planned in Maricopa County prior to the year 2000 (MAG Transportation and Planning Office, 1979c).

Phoenix-Litchfield Airport

The Federal Aviation Administration (FAA) has designated Phoenix-Litchfield as a reliever airport to Phoenix-Sky Harbor. A reliever airport is one that handles general aviation air traffic that may otherwise congest a nearby air-carrier airport. In the future, Phoenix-Litchfield will accommodate aviation demand from the surrounding region as well as local activity.

By 1990 annual operations are projected to increase to 290,900. Planned improvements include a terminal building, T-hangers, aircraft shades, and additional airport ramp parking. The City of Phoenix has abandoned plans to build a second runway (MAG, Transportation and Planning Office, 1979c).

Glendale Municipal Airport

The City of Glendale plans to replace the existing Glendale Municipal Airport with a new parallel runway facility. The proposed site is located just outside of the study area near 107th Avenue and Glendale Avenue. The proposed facility should be operative between 1985 and 1990. The existing Glendale Airport will be closed (MAG Transportation Planning Office, 1979c).

SELECTED REFERENCES

- Alvarez, 1979. Personal communication, Lt. Al Alvarez, Luke Air Force Base, March, 1979.
- Arizona Department of Transportation, 1979a, Arizona State Rail Plan 1979 Update, July, 1979.
- _____, 1979b. Phoenix Urban Rail Study, preliminary draft, July 1979.
- Atkinson, Topeka, and Sante Fe Railroad, 1979. Personal communication.
- City of Phoenix, 1978. Phoenix-Litchfield Municipal Airport Master Plan Report, July, 1978.
- Donaldson, 1979. Personal communication, George Donaldson, Del E. Webb Development Co., March, 1979.
- Federal Aviation Administration, 1980, Aviation Forecasts Phoenix, Arizona, draft report, January, 1980c.
- Maricopa Association of Governments (MAG) Transportation and Planning Office, 1980. Guide For Regional Development and Transportation July 23, 1980.
- _____, 1980b. Transportation Improvement Program, draft report, September, 1980.
- _____, 1979. "1978 Average Weekday Traffic", published map, June, 1979.
- _____, 1979b. "Estimated Year 2000 Average Weekday Traffic", published map, June, 1979.
- _____, 1979c. Regional Aviation System Plan, September, 1979.
- Maricopa County Department of Planning and Development, 1979. White Tanks-Agua Fria area land use survey, October, 1979.
- Maricopa County Highway Department, 1979. Computer printouts of regular location traffic counts, June, 1979.
- _____, 1979b. Computer printouts of right-of-way information, June, 1979.
- _____, 1979c. Personal communications, July, 1979.
- Ross, 1980. Personal communication, Bill Ross, Chief Engineer, Arizona Department of Transportation, 1980.

PUBLIC SERVICES AND FACILITIES

I. ELECTRIC POWER, GAS, AND TELEPHONE SERVICE

Electric Power Service

Arizona Public Service Company (APS) provides electric power service within the study area. Its service area lies west of the New River prior to its confluence with the Agua Fria River, and west of the Agua Fria River from that point south to the Gila River. The Salt River Project provides electric service to areas east of this boundary. The major electrical transmission and distribution system within the study area is shown on Map 39.

APS uses 69,000 volt overhead lines for its distribution network. These distribution lines serve local substations from which smaller feeder lines serve local consumers.

The high voltage lines which cross the study area are primarily used for transmitting power between outside terminal points. These lines interconnect neighboring utilities as well as carry electrical power from various generation points. The major north-south transmission line corridor follows the Agua Fria River. The major east-west corridors are between Lower Buckeye Road and Broadway Road, Thomas Road and Indian School Road, and near Beardsley Road. The Beardsley Road corridor is the location of a new 500 kv line extending from the Palo Verde Nuclear Generating Station to the Westwing substation. This corridor is projected to have additional lines added in the future.

There are fourteen substations within the study area. Two additional substations are planned in the Sun City West area. The existing substation in Litchfield Park will be relocated sometime in the near future.

The service extension policy of APS is registered with the Arizona Corporation Commission. Generally speaking, APS will extend electrical service to new areas whenever it is economically feasible to do so. A line extension charge may be assessed if certain criteria are not met.

Natural Gas

Natural gas service is provided to the study area by the Arizona Public Service Company (APS). Service east of the Agua Fria River is the responsibility of the Salt River Project. APS purchases its gas supply from the El Paso Natural Gas Company whose line passes through the study area.

The major network of natural gas lines within the study area is shown on Map 39. The majority of these were established prior to the natural gas moratorium of 1976. Recent extensions for natural gas service have been made to serve industrial users which often require high pressure lines. Major users of natural gas within the study area include Goodyear Aerospace, the Del Webb Company's component assembly plant, and several sand and gravel operations.

Fluctuations in the availability of natural gas and increasing costs may limit future residential gas service to areas where lines already exist. For outlying areas, propane gas service is available from local suppliers.

Telephone Service

Telephone service within the study area is provided by the Mountain States Telephone and Telegraph Company. Service is available throughout the study area except for a small portion located west of the Beardsley Canal and south of Grand Avenue. This area consists primarily of vacant state trust lands.

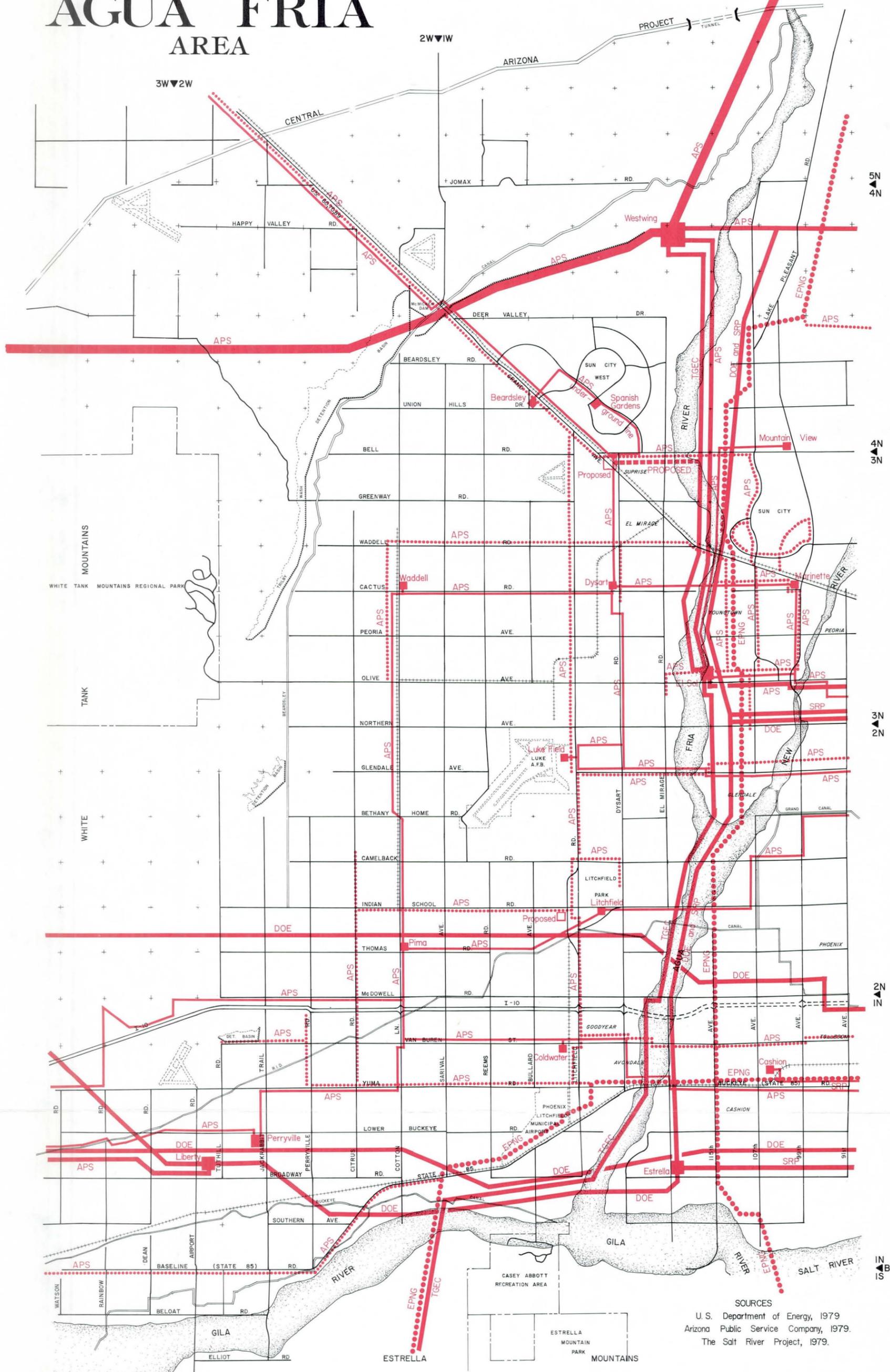
The study area includes four service districts: Sun City West, Litchfield Park, Goodyear-Avondale, and Buckeye. Existing telephone switching facilities within the area include a permanent facility on Grand Avenue near Union Hills Drive and a temporary facility located near McDowell Road and Perryville Road.

The most recent service additions to the study area have been directed at providing service for Sun City West. Permanent telephone switching facilities are currently planned for the southwestern part of the study area, and the area near the new State Prison which is currently under construction. Additional residential service features are scheduled to be phased into most of the developed portion of the study area over the next five years. This will result in a service level comparable to that of the overall Phoenix Metropolitan area (Thomas, 1979 and Winn, 1980).

WHITE TANKS AGUA FRIA AREA

M
I W I E

HIEROGLYPHIC MOUNTAINS



SOURCES
U.S. Department of Energy, 1979
Arizona Public Service Company, 1979.
The Salt River Project, 1979.

TYPE	CAPACITY	LINE	SUBSTATION
Electrical	69,000 volts		
	161,000 - 345,000 volts		
	500,000 volts.		
Natural Gas	Less than 6 inch diameter.		
	Greater than 6 inch diameter		

ROUTES of HIGH CAPACITY PUBLIC UTILITY LINES

II. WATER SERVICE

Water is distributed within the White Tanks-Agua Fria area by 1) private domestic water franchises; 2) municipal water systems; and 3) irrigation districts. There are also numerous private wells within the study area which provide both domestic and irrigation water to individual parcels of land.

Domestic Water Service Areas

Domestic water within the area is supplied by local wells. The boundaries of domestic water service areas are shown on Map 44. These include both municipal service areas and private water franchises. In addition, private wells provide domestic water for Luke Air Force Base and individual households throughout the study area.

Municipal water supplies are provided within the incorporated limits of Surprise, El Mirage, Avondale and Goodyear. Surprise currently receives its water supply from El Mirage.

There are twenty-six private water companies authorized to serve portions of the study area at this time. Each company is franchised by the Maricopa County Board of Supervisors and issued a Certificate of Convenience and Necessity by the Arizona Corporation Commission. Private water companies are also licensed by the Maricopa County Health Department which conducts inspections on a regular basis.

Private water companies within the study area are listed in Table 5-1. They vary in the size of their service area from only a few acres to several thousand acres. Many serve only small scattered developments, and some are inoperative at this time.

Private water companies are classified as public utility corporations. Their service rates are set by the Arizona Corporation Commission which also establishes rules and regulations governing the operation and business transactions of these companies. Municipal service rates are set by the respective city or town.

The Arizona Groundwater Management Act, adopted in July, 1980, prohibits the approval of new subdivisions unless an assured 100 year water supply is available. This determination is made by the Arizona Department of Water Resources according to established procedures. Water service areas within the study area which have a 100 year supply at this time are shown in Table 5-1.

TABLE 5-1

WATER SERVICE AREAS WITHIN
THE WHITE TANKS-AGUA FRIA AREA
IN 1979

PRIVATE WATER FRANCHISES

- | | |
|---|--------------------------------------|
| 1. Sabrosa Water Company | *14. Litchfield Park Service Company |
| 2. Beardsley Ranchitos | 15. Adaman Mutual Water Company |
| *3. Sun City Water Company | 16. Arizona Water Company |
| 4. Wilhoit Water Company | 17. Los Ranchitos De Los Conejos |
| 5. Clearwater Company | 18. Joe D. Garcia |
| 6. Cool Well Water Company | *19. White Tanks Water Company |
| *7. Sun City West Utilities Company | *20. Rio Vista Water Company |
| 8. Sun Shadows Water Company | 21. Bohne Water Company |
| 9. Citizens Utility Company | 22. Latkin Cattle Company |
| 10. Dysart Water Company | 23. Rigby Water Company |
| *11. Consolidated Water Utilities, Inc. | 24. Sunny Boy Water Company |
| 12. Northern Water Company | 25. Northwest Water Company |
| 13. Tierra Buena Company | 26. Valley Utilities Company |

MUNICIPAL WATER SERVICE AREAS

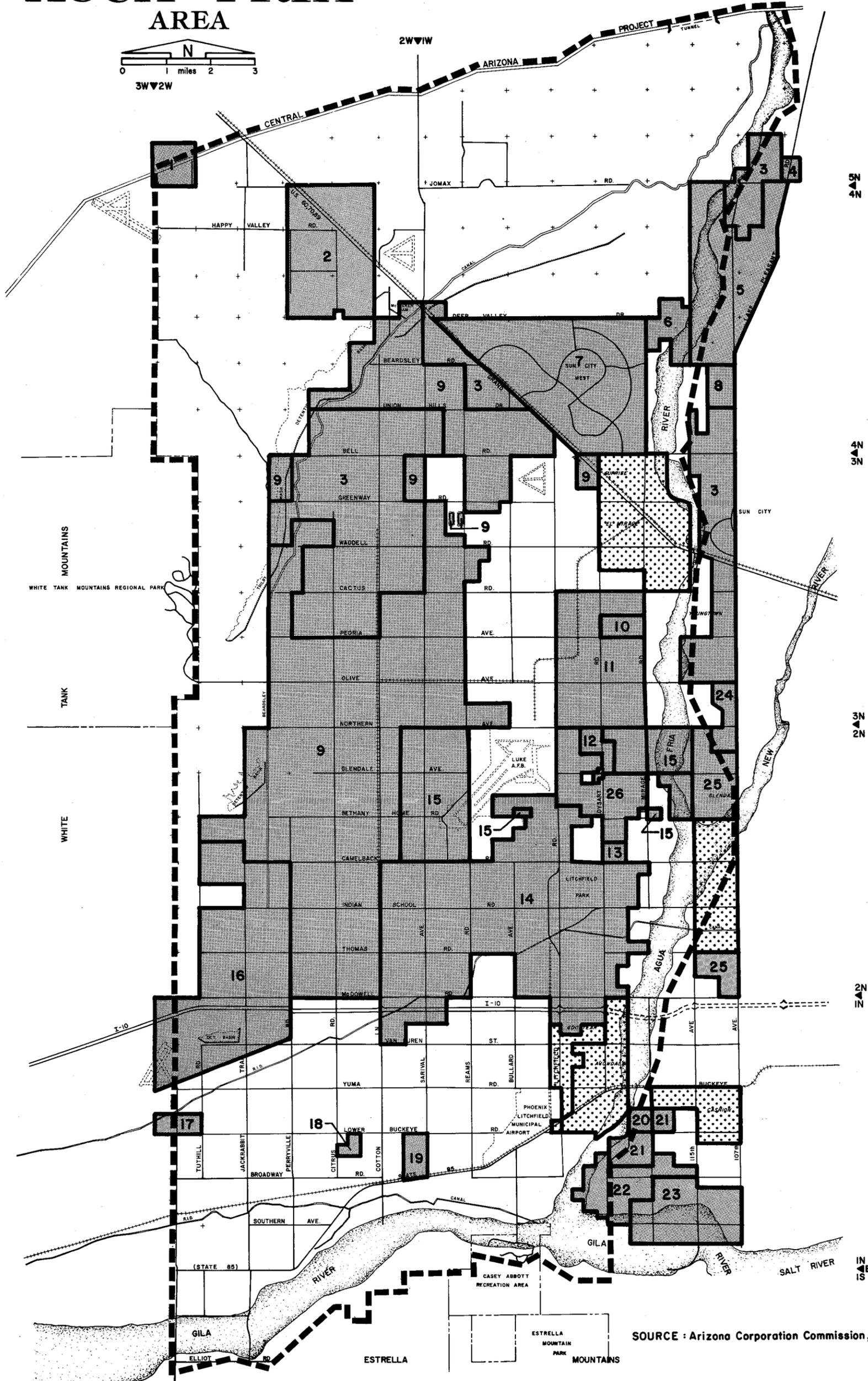
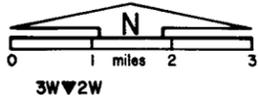
Avondale
El Mirage
*Goodyear
Surprise

*Indicates an assured 100 year water supply.

Source: Arizona Corporation Commission, August, 1979.
Arizona Department of Water Resources, September, 1980.

WHITE TANKS AGUA FRIA AREA

M I W V E
HIEROGLYPHIC MOUNTAINS



SOURCE : Arizona Corporation Commission, 1979.

PRIVATE WATER FRANCHISE MUNICIPAL SERVICE

Irrigation Districts

Irrigation districts are municipal corporations with broad power and purpose. This includes: the purchase or acquisition of water rights, owning and selling real estate and property, the construction of facilities, generation of electricity, appropriation of water for power generation and irrigation, taxing and charging for services, appropriating money, and providing the district with water, electricity, and other public conveniences generally provided by municipalities. They also have the power of eminent domain (University of Arizona, 1978).

The majority of the study area is covered by four irrigation districts. They are: the McMicken Irrigation District, the Maricopa County Municipal Water Conservation District #1, the Roosevelt Irrigation District, and the Buckeye Conservation and Drainage District. Only the Maricopa County Municipal Water Conservation District #1 is located entirely within the study area. The location of each district and major canals are shown on Map 45.

All of these irrigation districts depend on groundwater supplies, but only the McMicken Irrigation District relies solely on groundwater pumped within the area. The Maricopa County Municipal Water Conservation District #1 uses diversions from the Agua Fria River via the Beardsley Canal, the Roosevelt Irrigation District uses groundwater imported from east of the Agua Fria River via the Roosevelt Irrigation District Canal, and the Buckeye Irrigation District uses a combination of natural river flows, impoundment diversions, and wastewater effluent via the Buckeye Canal (Arizona Water Commission, 1978).

The Central Arizona Project

The Central Arizona Project (CAP) will carry Colorado River water from Lake Havasu to central and southern Arizona. The first deliveries to the Phoenix area from the Granite Reef Aqueduct are scheduled to take place in 1985.

The Central Arizona Water Conservation District is a multi-county service district which is authorized to contract with the Secretary of the Interior for CAP water and to recoup the costs of the project which must be repaid to the Federal government. The District has both administrative and general powers necessary to control and distribute water from the CAP. These include: 1) the assessment of an ad valorem tax on taxable property within the District; 2) contracting with the Federal government; and 3) subcontracting with CAP water users both inside and outside the District (University of Arizona, 1978).

Water from the CAP must be allocated to the Indian Reservations as well as non-Indian municipal, industrial, and agricultural contractors in the project area. Indian Reservations have first right to CAP water. They are followed by municipal and industrial users. Non-Indian farmers have last right to CAP water. The ultimate authority for allocation of CAP water rests with the U.S. Secretary of the Interior.

A significant amount of controversy surrounds the current Indian allocations. As a result, the final allocations of CAP water to individual service contractors has not been made to date. Potential contractors which serve the study area include the following:

Private Water Companies

Arizona Water Company
Citizens Utility Company
Clearwater Company
Consolidated Utility Company
Litchfield Park Service Company

Irrigation Districts

McMicken
Maricopa County Municipal Water
Conservation District #1

Municipal Service Areas

Avondale
Goodyear

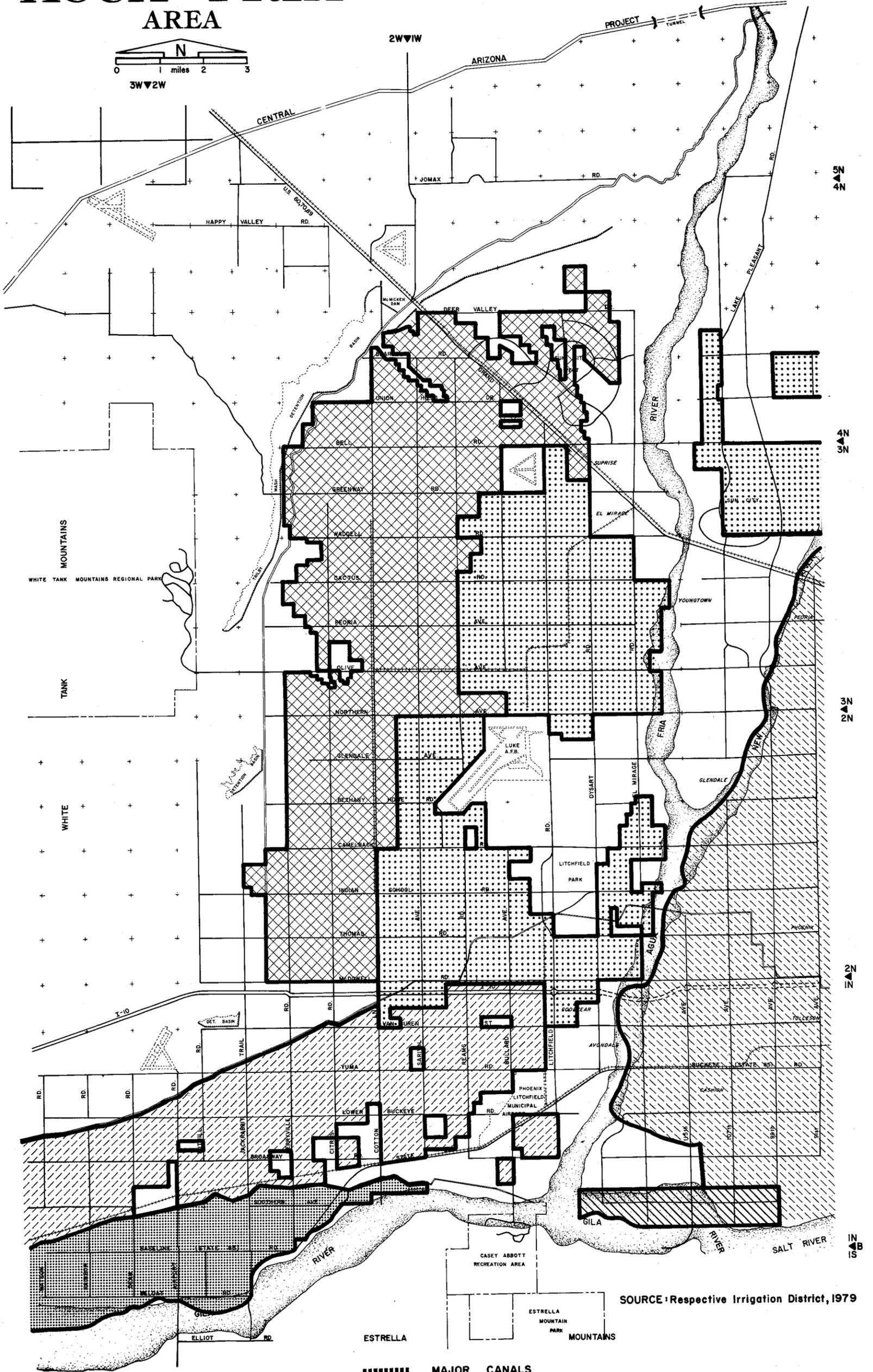
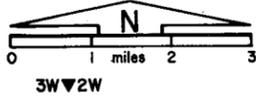
Source: Arizona Department of Water Resources, 1980.

The Beardsley Canal offers a potential means of distributing CAP water within the study area.

WHITE TANKS AGUA FRIA AREA

M
WVE

HIEROGLYPHIC MOUNTAINS

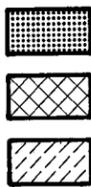


SOURCE: Respective Irrigation District, 1979

D ZWZD



McMICKEN IRRIGATION DISTRICT "3"
SALT RIVER PROJECT AGRICULTURE
IMPROVEMENT & POWER
ST. JOHNS IRRIGATION DISTRICT



BUCKEYE CONSERVATION & DRAINAGE DISTRICT
MARICOPA COUNTY MUNICIPAL WATER
CONSERVATION DISTRICT No. 1
ROOSEVELT IRRIGATION DISTRICT

IRRIGATION DISTRICTS

MAP 45

III. WASTEWATER TREATMENT

Existing Conditions

Community wastewater treatment facilities serve the unincorporated communities of Sun City West and Litchfield Park, Luke Air Force Base, and the incorporated limits of Goodyear and Avondale. Development in the remainder of the study area, including El Mirage and Surprise, depends on septic tanks. Small private treatment plants serve Phoenix-Litchfield Municipal Airport, the abandoned harness race track, and the Casitas Bonitas subdivision.

Sun City West, Litchfield Park, and Luke Air Force Base each have their own treatment facilities. Goodyear and Avondale share the Avondale municipal treatment plant. Information on each facility is summarized in Table 5-2.

AVONDALE TREATMENT PLANT

The Avondale treatment plant has been subject to flooding in the past. New holding and percolation ponds have been constructed as an interim solution to this problem. The population projections for Avondale suggest that additional treatment capacity will be needed in the 1980's (Maricopa Association of Governments, 1979).

LITCHFIELD PARK TREATMENT FACILITY

The existing aerated lagoon system is at capacity. The Litchfield Park Service Company is currently constructing a new package treatment plant on a 13 acre site located north of McDowell Road between Litchfield Road and Dysart Road. The estimated completion date is August, 1980. Upon completion, the existing facility will be abandoned (Crowell, 1980).

The design for the new plant is based on the future land use and residential densities indicated by the Litchfield Park Master Plan (see Part III.) It will have a capacity of 0.75 million gallons per day and accommodate that part of the development which can be served by gravity flow. This is roughly the area east of Reems Road. It should accommodate the wastewater needs of the existing development as well as that of planned Villages II and III; a total of approximately 15,000 people. Secondary treatment will allow the plants effluent to be reused for golf course irrigation (Bower, 1980).

LUKE AIR FORCE BASE TREATMENT PLANT

The Luke treatment plant has excess capacity. It has not been able to meet discharge requirements in the past (Maricopa Association of Governments, 1980).

TABLE 5-2

INVENTORY OF EXISTING SEWAGE TREATMENT FACILITIES
WHITE TANKS-AGUA FRIA AREA

	AVONDALE	LITCHFIELD PARK	SUN CITY WEST	LUKE AIR FORCE BASE
Owner/operator	City of Avondale	Litchfield Park Service Co.	Sun City West	U.S. Air Force
Location	¼ mile west of Dysart Road, south of Lower Buckeye Road in the floodplain of the Agua Fria River.	North of Thomas Road between Litchfield Road and Dysart Road.	South of Grand Ave. near the intersection of Union Hills and Bullard Road.	Northeast corner of the intersection of Glendale and El Mirage Roads.
Service Area	Incorporated limits Avondale/Goodyear	Exiting Development Village I	Existing Development Phase I	Luke Air Force Base (Includes Base Housing)
Type Facility	Aerated Lagoon	Aerated Lagoon	Aerated Lagoon	Trickling Filter
Year Built	1958	1966	1978	1942
Rated Capacity (Mgd)	1.0	0.4	N/A	1.5
Average Flow	0.68	N/A	N/A	0.57
Effluent Discharge Location	Agua Fria River	Land Application	Land Application	Agua Fria River
Effluent Reuse	None	Irrigation of Non-edible crops	Irrigation of Non-edible crops	None

Source: Maricopa Association of Governments, 1979.
Maricopa County Health Department, 1980.

SUN CITY WEST

Wastewater treatment for Sun City West is provided by aerated lagoons located south of Grand Avenue. These are capable of handling the waste load of approximately 6,000 dwelling units. Sun City West is currently constructing a new treatment plant east of the Agua Fria River north of Beardsley Road and east of 115th Avenue. It is expected to be operational by 1982. Upon completion, the existing aerated lagoons will be abandoned (Donaldson, 1980).

Future Plans for Wastewater Treatment

91ST AVENUE TREATMENT PLANT

The adopted plan calls for the 91st Avenue treatment plant in Phoenix to treat flows from El Mirage, Surprise, and Luke Air Force Base. Flows from these communities, as well as those from Glendale, Sun City, Youngtown, and west Phoenix, would be carried to the 91st Avenue plant via a major new interceptor along 99th Avenue.

The 91st Avenue treatment plant is an activated sludge, secondary treatment facility with a current design capacity of 90 mgd. It will be upgraded and expanded to 137.0 mgd by the year 2000. Effluent from the plant will be reused. Contracts for treated wastewater have already been made with the Arizona Nuclear Power Project to provide cooling water for the Palo Verde Nuclear Generating Station, the Buckeye Irrigation District, and the Arizona Game and Fish Department. Wastewater will be carried to the Palo Verde plant by an underground pipeline which crosses the study area.

Neither the town of El Mirage nor the Town of Surprise have the financial resources to participate in the expansion of the 91st Avenue treatment plant or the construction of the 99th Avenue interceptor at this time. Consequently, these communities do not have current plans for participating in these projects (Yingling, 1980 and Reese, 1980). Luke Air Force Base has indicated a desire to phase out its treatment plant as soon as alternatives become available (Frank, 1980).

REEMS ROAD TREATMENT PLANT

The Town of Goodyear plans to build a new treatment facility one half mile west of Reems Road just north of the Buckeye Canal. It will have a capacity of 5.4 million gallons per day and would be capable of handling flows from Avondale, Goodyear, and eventually Litchfield Park. Construction should begin before 1985 depending on when local financing becomes available (Kleinschmidt, 1980).

The Reems Road plant will use aerated lagoons with stabilization ponds and disinfection. It is proposed that effluent from the plant be reused for the irrigation of cotton or alfalfa on farmland west of the site (south of the Buckeye Canal and east of Sarival Avenue.) Between 500 and 1,400 acres would be needed for farmland. Disposal of effluent to the Buckeye Canal or the Gila River would not be permitted due to State and Federal regulation governing such discharge. Three months of storage capacity would be required if all of the effluent is used for farming. The possibility of contracting with the Arizona Nuclear Power Project for effluent reuse may also be viable (U.S. Environmental Protection Agency, 1979).

Avondale has decided to continue using its existing treatment plant for the immediate future. Consequently, the Town of Goodyear will build the Reems Road Treatment Plant alone unless conditions change.

The private wastewater treatment facility under construction in Litchfield Park will serve the needs of that community for the foreseeable future. Whether or not Litchfield Park will eventually use the Reems Road plant depends on a future decision by Litchfield Park officials. That portion of the proposed development west of Reems Road cannot be gravity fed into the plant currently under construction. Available options for this portion of the development include the construction of an additional plant to serve development west of Reems Road or a gravity fed interceptor to the Reems Road plant (Bower, 1980).

SUN CITY WEST TREATMENT PLANT

The treatment plant currently under construction for Sun City West will accommodate all wastewater flows from that community to the year 2000. This includes the development approved for Phase I as well as any development which takes place south of Grand Avenue in the proposed Phase II. Treatment will be secondary with disinfection. The treatment plant will be expanded as needed to meet the future service demands. Its ultimate capacity by the year 2000 is expected to be 2.6 mgd. Effluent from the plant will be reused for golf course irrigation (Maricopa Association of Governments, 1979).

IV. SOLID WASTE DISPOSAL

Existing Landfills

Disposal needs within the study area have been met by three public disposal sites: the El Mirage Industrial Landfill; the Glendale Municipal Landfill; and the Avondale Landfill. All of these sites are located within the 100 year floodplain of the Agua Fria River. Information on each site is summarized in Table 5-3.

EL MIRAGE INDUSTRIAL LANDFILL

The El Mirage Landfill is a privately owned and operated disposal site which serves El Mirage, Surprise, and Sun City West as well as other major communities east of the study area. According to the Arizona Department of Health Services (ADHS), the site is located in an area of high groundwater and is subject to washouts when flooding occurs along the Agua Fria River. It also constitutes an obstruction to the flow of the Agua Fria River which creates the risk of increased flooding both upstream and down. Enforcement actions are currently underway. This site is nearing its capacity. Any future expansions will require the approval of ADHS (Arizona Department of Health Services, 1980).

GLENDALE LANDFILL

The Glendale Landfill serves Luke Air Force Base as well as the communities of Glendale and Tolleson. It has approximately 10-15 years of disposal capacity remaining. ADHS does not consider this site to be a significant environmental concern at this time, although it is located within the floodplain of the Agua Fria River and is subject to surface drainage problems. Site modifications may be necessary in the future. This landfill is inaccessible whenever flooding occurs along the Agua Fria River. (Arizona Department of Health Services, 1980).

AVONDALE LANDFILL

The Avondale Landfill is operated by the Maricopa County Highway Department. It serves the southern half of the study area as well as areas east of the Agua Fria River. This site was opened as an emergency measure in 1978 after flooding required the closure of a former County landfill located at 123rd Avenue and the Gila river-bottom. It was never intended to be a permanent site.

This site is within the 100 year floodplain of the Agua Fria River and is subject to washouts and inundation. The site was never authorized by the Arizona Department of Health Services, and is in conflict with State law in that it is located within one mile of the Avondale City limits and a residential area, and is within one quarter mile of State Route 85 (Arizona Department of Health Services, 1980).

TABLE 5-3

PUBLIC LANDFILLS WITHIN THE
WHITE TANKS-AGUA FRIA AREA

	EL MIRAGE INDUSTRIAL LANDFILL	GLENDALE LANDFILL	AVONDALE LANDFILL
Location	.2 miles south of Grand Avenue on 115th Avenue in the floodplain of the Agua Fria River	115th Avenue and Glendale Avenue in the floodplain of the Agua Fria River	North of State Route 85, ¼ mile east of Dysart Road in the floodplain of the Agua Fria River.
Owner	El Mirage Landfill, Inc., John Knight	City of Glendale	Maricopa County
Operator	El Mirage Landfill, Inc., John Knight	City of Glendale	Maricopa County Highway Department
Length of Operation	Since 1973	Since 1974	Since 1978
Site Size	10 acres	40 acres	10 acres
Life Expectancy	Limited	10-15 years	None
Site Expansion Potential	Further expansion not possible without using the floodway district of the Agua Fria River.	Expansion Possible	To be closed October, 1980
Service Area	El Mirage, Surprise, Youngtown, Peoria, Sun City, Sun City West	Glendale, Tolleson Luke Air Force Base,	Avondale, Goodyear Litchfield Park Tolleson

Source: 1) Arizona Department of Health Services, 1980.
2) Maricopa Association of Governments, 1980.

The Avondale site is out of capacity and will be closed October 31, 1980. The County Highway Department has requested technical assistance from ADHS and the U.S. Environmental Protection Agency during its post closure operations.

The nearest alternative site to the Avondale Landfill is the Rainbow Valley Landfill which is located 5 miles south of the study area across the Gila River. The second nearest site is the Hassayampa Landfill which is located 13 miles west of the study area at Salome Highway and Ward Road. Another County landfill is located ten miles northwest of the study area near Morristown.

Future Disposal Plans

Maricopa County currently has plans to develop two new public landfills within the study area in the near future. Both would be located on properties now owned by the State of Arizona. The proposed southern site is 300 acres in size and is located in Section 7 of Township 1 North, Range 2 West (between Airport Road and Tuthill Road and Yuma Road and the Van Buren Street alignment). The proposed northern site is 160 acres in size and is located in Section 11 of Township 4 North, Range 1 West (one mile north of Deer Valley Drive between the Dysart Road and El Mirage Road alignments). Both sites are located outside of the 100 year floodplain.

Hazardous Waste Disposal

"Hazardous wastes" are those non-nuclear wastes which, because of their explosive, flammable, toxic, corrosive, infectious, or otherwise dangerous characteristics, could cause serious injury or death and require special handling and disposal practices. Hazardous wastes result primarily from industrial, agricultural, and mining activities. In Arizona, the majority of wastes are generated in the Phoenix and Tucson areas.

At this time, there are no facilities in Arizona that are entirely suitable for the disposal of hazardous wastes. The Hassayampa Landfill has been used for the disposal of certain types of hazardous wastes in Maricopa County on an interim basis. It will be closed to hazardous materials on October 28, 1980. The Arizona Department of Health Services is currently seeking authorization from the State Legislature to locate a hazardous waste disposal site within the State.

V. EMERGENCY SERVICES

Police Protection

The incorporated communities of Goodyear, Avondale, El Mirage, and Surprise provide police protection within their incorporated limits. Police protection for the unincorporated portion of the study area is provided by the Maricopa County Sheriff's Office. Military Police patrol Luke Air Force Base.

Two Sheriff's Office substations provide most of the services to the study area. The Glendale substation is located about seven miles east of the study area at 7115 North 57th Drive. The Avondale substation is located near Dysart Road and Van Buren Street in Avondale. The southwestern and northwestern portions of the study area are also served by substations in Buckeye and Wickenburg. (See Map 46.) An additional substation is currently planned at Grand Avenue and Dysart Road to improve future service within the area (Maricopa County Sheriff's Office, 1979).

The study area encompasses five full Sheriff's beats and three partial ones. The average response time for each beat ranges from 6 to 16 minutes. The overall average response time for the study area is 12 minutes. Average response time is based on both minor and emergency calls. Beats located closest to existing substations generally experience the shortest response time.

As might be expected, the majority of Sheriff's Office responses occur where significant population concentrations exist. This includes the Sun City West, El Mirage-Surprise, Goodyear-Avondale, Luke Air Force Base, and Litchfield Park areas (Maricopa County Sheriff's Office, 1979).

Fire Protection

The incorporated communities of Avondale, Goodyear, and El Mirage, each have their own volunteer fire department. Fire protection for the remainder of the study area is provided primarily by the Rural Metro Fire Department. A portion of the area south of the Roosevelt Irrigation District Canal and west of Cotton Lane is served by the Buckeye Valley Fire District. Luke Air Force Base provides its own fire fighting services.

Four of the five Rural Metro stations which serve the area are located east of the Agua Fria River. Three of these are located in Sun City, the other is located in Cashion. The only station located within the area is in Litchfield Park. The Sun City stations serve the Sun City West, Sun City, and Youngtown areas. Rural Metro service within the southern part of the study area is provided from the Litchfield Park station and the Cashion station. The one Buckeye Valley fire station is located at Jackrabbit Road and Baseline Road. An additional Rural Metro station is planned in Sun City West in the near future to improve service within the study area.

Rural Metro provides emergency services to both subscribers and non-subscribers. The majority of Rural Metro service is provided within a ten mile radius of each station. Although the Department does respond to areas outside of this zone, it is difficult to provide adequate fire protection in the more remote areas due to travel times and the lack of available water. Although tank trucks respond to fires when required, a local water supply system with adequate pressure to fight fires is needed for adequate fire protection in developed areas.

Fire insurance ratings are classifications which indicate risk translated into the cost associated with insuring property against fire damage. A low rating indicates less risk than a high rating. Among the rating factors are the following: the availability of service in a given area, whether or not the property owner subscribes to the service when applicable, the availability of an adequate permanent water supply, hydrant spacing, and nearness to a fire station.

In incorporated areas, a rating of 9 is given if the property is more than 1,000 feet from an adequate water supply, or more than 5 miles from the nearest fire station. In rural areas, a rating of 9 generally indicates that the property is more than 1,000 feet from a suitable water supply. The best rating possible in a franchised area is 7. A rating of 10 is given in rural areas when the property is more than 10 miles from the nearest station.

Fire insurance ratings for selected portions of the White Tanks-Agua Fria area are shown in Table 5-4. Generally speaking, much of the unincorporated area outside of Litchfield Park and Sun City West has a rating of 9 or 10. In comparison, the City of Glendale has ratings of 4 and 9 while the City of Phoenix has ratings of 2 and 9.

TABLE 5-4

GENERALIZED FIRE INSURANCE RATINGS
FOR SELECTED PORTIONS OF THE
WHITE TANKS-AGUA FRIA AREA

<u>COMMUNITY</u>	<u>RATING CLASS</u>
City of Avondale	6 and 9
City of El Mirage	8 and 9
City of Goodyear	6 and 9
City of Surprise	9
Sun City West	7
Litchfield Park	7
Buckeye Valley Fire District	9

Source: Insurance Services Office of Arizona, 1980.

Medical Facilities

Residents of the study area depend on the numerous health care facilities located within the Phoenix metropolitan area. Four medical facilities are located in or near the study area. They are: 1) the new West Valley Emergency Center located on Litchfield Road just south of Interstate-10; 2) Boswell Memorial Hospital in Sun City; 3) Valley View Community Hospital in Youngtown; and 4) the Luke Air Force Base Hospital located just east of the Base on Litchfield Road.

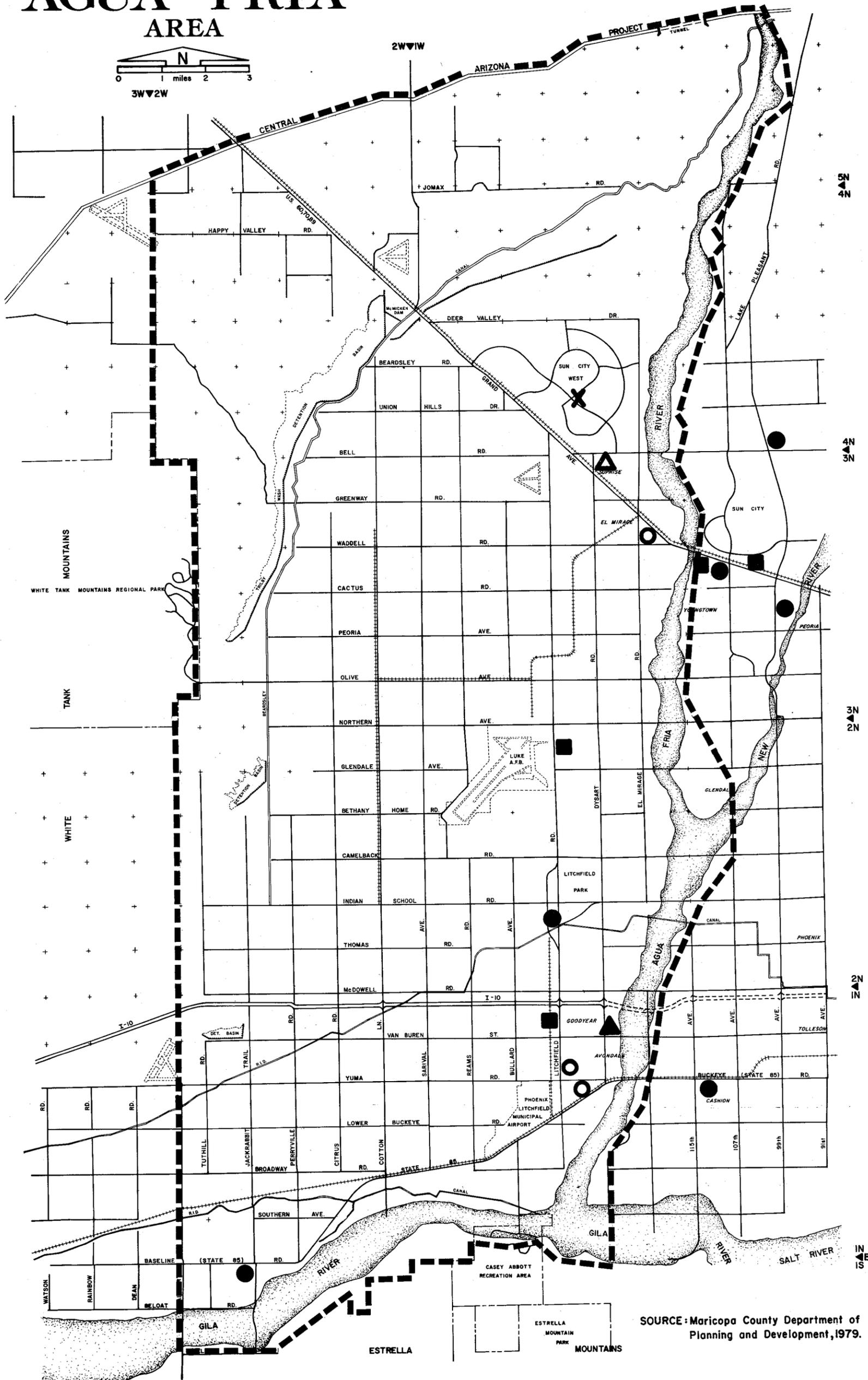
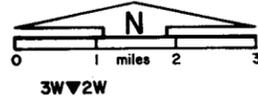
The West Valley Emergency Center provides immediate emergency and diagnostic services to the area. The center is open 24 hours a day, has a doctor and nurse on duty around the clock, and provides both vehicle and helicopter ambulance service. The center will provide all the supporting services to handle major trauma and medical emergency patients until they can be transferred to another facility. The center will also extend comprehensive X-ray, laboratory, and other diagnostic services to the private physicians in the service area.

Boswell Memorial Hospital offers extended care and 24 hour emergency care services to surrounding residents. Valley View Community Hospital also provides 24 hour facilities to area residents. Luke Air Force Base has its own hospital and related medical facilities to serve its personnel. This Hospital does provide 24 hour emergency service facilities which will serve the general public for major trauma cases.

Maricopa County operates a Primary Care Center in Avondale with services available to low income persons.

WHITE TANKS AGUA FRIA AREA

HIROGLYPHIC MOUNTAINS



LEGEND

- MUNICIPAL FIRE STATION
- X PROPOSED FIRE STATION
- ▲ SHERIFF'S SUBSTATION
- OTHER FIRE STATION
- HOSPITAL/MEDICAL FACILITY
- △ PROPOSED SHERIFF'S SUBSTATION

SOURCE: Maricopa County Department of Planning and Development, 1979.

CHAPTER VI. PUBLIC SCHOOLS

School Districts

School districts are autonomous bodies that are governed by a local school board elected by the residents of the district. These districts receive financial support from a number of sources including state property taxes and local school district property taxes. The three types of school districts in Maricopa County area as follows:

Elementary Districts - these include elementary schools only;

Union Districts - These include only high schools but encompass one or more elementary districts; and

Unified Districts - These have both high schools and elementary schools.

Areas that are not included within a school district are called "unorganized". Property owners in these areas do not pay local school district taxes.

The White Tanks-Agua Fria area overlaps the boundaries of several school districts. (See Map 47). Of these, Nadaburg Elementary, Avondale Elementary, Buckeye Union, and the Peoria Unified District have had increasing enrollments in recent years. Litchfield Elementary, Liberty Elementary, and the Agua Fria Union district have shown slight declines. Significant declines in enrollment have occurred within the Dysart Unified District (Simon, 1980).

A portion of the study area north of Jomax Road is unorganized. Students living there are served primarily by the Dysart Unified District.

Schools Within The Study Area

Thirteen public schools are located within the study area (See Map 47 and Table 5-5). Three of these are high schools, the rest accommodate various mixtures of grade levels from kindergarten through eighth grade. All are located on separate campuses with the exception of the Dysart High School and the Dysart Elementary/Junior High which share a common campus.

Liberty elementary is the only school which serves a significant number of students living outside of the study area. A significant percentage of its student body comes from Rainbow Valley, an unincorporated agricultural community located about 10 miles south of the Gila River. Access to the school from Rainbow Valley has been a problem in the past when floods occurred along the Gila River.

TABLE 5-5

PUBLIC SCHOOLS SERVING THE
WHITE TANKS-AGUA FRIA AREA

DISTRICT	ELEMENTARY SCHOOLS	HIGH SCHOOLS
Dysart Unified	1. Surprise Elementary 2. El Mirage Elementary 3. Dysart Elementary 4. Luke Elementary	A. Dysart High School
Litchfield Elementary	5. Litchfield Elementary 6. Scott Libby Elementary	
Avondale Elementary	7. Lottie Coor Elementary 8. Avondale Junior High 9. Avondale #1 Elementary	
Liberty Elementary	10. Liberty Elementary	
Nadaburg Elementary	11. Nadaburg Elementary	
Agua Fria Union		B. Agua Fria Union High School South Campus C. Agua Fria Union High School North Campus
Buckeye Union		D. Buckeye Union High School

Overcrowding is not currently a problem at schools within the study area (See Table 5-6). During the 1978-1979 school year enrollment exceed the estimated design capacity at only one school, Agua Fria Union High School. This condition has since been corrected by the opening of a new north campus.

The north campus of Agua Fria Union High School was opened to freshmen students in the fall of 1979. During the 1979-1980 school year, the school had 345 students enrolled with an average daily attendance of 320. The schools current design capacity is 400 students. It is located on a 39 acre site of which approximately eight acres are available for future expansion. Industrial arts shops and additional classrooms will be added within the next two years. Within two years, this school will accommodate both freshmen and sophomores from the district. The original south campus will serve juniors and seniors. The master plan for the north campus calls for a potential maximum student body of 1,400.

Anticipated onsite expansions at existing schools within the study area are described in Table 5-6. At this time, no additional classrooms are planned except at the north campus of Agua Fria Union High School.

Schools Outside Of The Study Area

Elementary students in the Nadaburg Elementary District must travel to Nadaburg Elementary School, which is located about four miles north-west of the study area in Wittman. High School students from this area attend either Dysart High School, or Wickenburg High School, which is located 20 miles away in the Town of Wickenburg.

High School students in the Liberty Elementary District attend Buckeye Union High School, which is located four miles west of the study area in Buckeye. This high school serves an area of over 3,000 square miles.

The northeastern part of the study area, which includes the small communities of Hound Dog Acres and Rose Garden Lane, is within the Peoria Unified School District. Students from this area must travel over ten miles to attend either Peoria High School or any one of a number of elementary schools in Peoria.

Overcrowding is not currently a problem at Nadaburg Elementary or Buckeye Union High School. No expansion is planned at Nadaburg in the near future. Up to twelve portable classrooms will be added at Buckeye High School within three years. Information was not collected for schools within the Peoria Unified District during the survey of schools conducted in 1979.

TABLE 5-6

INVENTORY OF SCHOOLS SERVING THE WHITE TANKS-AGUA FRIA AREA**
1978-79 SCHOOL YEAR

HIGH SCHOOLS	GRADES	DESIGN CAPACITY	TOTAL ENROLLMENT	AVERAGE DAILY ATTENDANCE	NUMBER CLASSROOMS	AVERAGE CLASS SIZE	TOTAL SITE SIZE	AREA AVAILABLE FOR ON-SITE EXPANSION	EXPANSION ANTICIPATED IN THE FUTURE
Dysart High School	9-12	900	829	779	No Response	16	42 acres*	11 acres	Agriculture land Lab (no time frame)
Agua Fria Union High School South	9-12	1,300	1,441	1,337	65	16	58 acres	Limited	Vocational Education Facilities 4-8 years
Agua Fria Union High School North	-----NOT OPEN DURING 1978-1979 SCHOOL YEAR-----								
Buckeye Union High School	9-12	1,000	840	780	No Response	20-25	60 acres	10 acres	Portable classrooms (up to 12 in the near future)
<u>ELEMENTARY-JR. HIGH</u>									
Dysart Elementary/Jr. High	K-8	1,100	993	919	No Response	24	42 acres*	No Response	Jr. High Physical Education Building (Completed 3-80)
Luke Elementary	K-6	700	558	547	No Response	26	19 acres	No Response	None
El Mirage	K-6	800	665	627	42	21	20 acres	No Response	None
Surprise	K-6	350	254	244	17	21	20 acres	No Response	No Response
Scott Libby	K-5	450	376	339	16	21	20 acres	120 acres	Indefinite
Litchfield	K-8	1,300	955	862	54	21	16 acres	4 acres	None (replacement of older facilities in 3-4 years)
Avondale Jr. High	7-8	450	400	375	27	26	15 acres	None	None
Lattie Coor	4-6	625	600	565	32	27	20 acres	None	None
Avondale #1	K-3	950	900	850	42	25	30 acres	3 acres	Undertermined
Liberty	K-8	700	628	590	28	25	23 acres	Unlimited	None
Nadaburg	K-8	No Response	300	250	13	30	10 acres	No Response	None

*Common Campus

**Does not include schools in the Peoria Unified School District.

Source: White Tanks-Agua Fria Citizen Committee, 1979.

Future Conditions

It is beyond the scope of this report to evaluate future enrollment trends or school site acquisition needs within the study area. These will vary by district according to the type, timing, and location of future growth. Certainly, the age structure, household size, and residential densities within each school district will change due to immigration to the study area. At this time, none of the school districts within the area have plans to construct additional school facilities at new sites within the study area.

A substantial amount of growth is projected within the Dysart Unified District. However, the majority of this growth will result from retirement immigration to Sun City West and cause little increase in the school age population. The Dysart School District may be affected in another way by this new community, however. Voters in the District must approve future bond issues for school facilities. The bonding capacity of this District is already a controversial issue with the residents of Sun City West. In the past, similar disputes between the residents of Sun City and the Peoria Unified School District resulted in Sun City requesting and receiving special State Legislation which allowed it to become an unorganized area.

The Maricopa Community College District has expressed interest in acquiring a site for a community college in the Litchfield Park area. The most recent discussions have involved a site at the northwest corner of Dysart and Thomas Roads. A new campus would not be constructed prior to 1990.

VII. RECREATION

A number of public and private facilities currently provide opportunities for both active and passive outdoor recreation within the study area. In addition, two regional parks and the Casey Abbott Recreation Area are located just outside of the area.

Municipal Parks

The incorporated communities within the study area provide urban parks for use by their residents. These vary, however, in terms of their stage of development and general quality. Each facility is briefly described in Table 5-7.

TABLE 5-7

MUNICIPAL PARKS WITHIN THE
WHITE TANKS-AGUA FRIA AREA

<u>COMMUNITY</u>	<u>NAME OF FACILITY</u>	<u>SITE SIZE</u>	<u>GENERAL IMPROVEMENTS</u>
Avondale	Desi Lorenz Park	3 acres	Playground equipment Lighted ballfield, tennis courts, basket- ball courts, picnic tables and ramadas
	Mountain View Park	4.5 acres	
	Unnamed Roadside Park	4 acres	
	Unnamed Roadside Park	2 acres	
El Mirage	El Mirage Park	1 acre	Benches and Tables Ball field
	Ludden Park	4 acres	
Goodyear	Loma Linda Park	7.8 acres	Tennis courts, swimming pool, playground, com- munity building Basketball court, play- ground Benches and Tables
	Parque de Pas	4.8 acres	
	LaCrescenta Park	.6 acres	
Surprise	Surprise Park	5.5 acres	Ball field and Soccer facilities (under con- struction)

Source: Respective City or Town, 1980.

Other Facilities Within the Study Area

Community recreation facilities are generally not provided in the unincorporated portion of the study area, except at Litchfield Park and Sun City West. Litchfield Park provides three 18 hole golf courses, neighborhood parks, a recreation center with tennis courts and swimming pool, and a lake which offers small boating opportunities. These facilities are available for the use of residents of Litchfield Park. In addition, the Litchfield Park Country Club offers tennis facilities.

Recreation facilities available for the use of Sun City West residents include an 18 hole golf course and a recreation center with facilities for swimming, billiards, bowling, shuffleboard, and other activities. Additional recreational facilities are planned in the future.

In addition to the recreational facilities already mentioned, a number of semi-public recreation facilities are present within the area. These include: 1) the Phoenix Trap and Skeet Club, 2) the Peoria Rod and Gun Club and 3) the Magma Hunting Preserve. Quail and dove hunting are also popular in the undeveloped portions of the study area.

County Parks

Three County parks operated by the Maricopa County Parks and Recreation Department are located just outside of the study area. They provide recreational opportunities to residents of the study area, as well as to other people living in the western metropolitan area. Each takes advantage of the on-site natural features to provide a distinct outdoor environment. The number of visitors to these parks since 1976 is shown in Table 5-8. Attendance is generally highest during the winter months.

Estrella Mountain Regional Park

Estrella Mountain Park is located south of the Casey Abbott Recreation Area. It contains approximately 16,476 acres, most of which is undeveloped. Access to the park is gained via an unsurfaced road from the west.

Improvements at the park are limited to a few campsites and picnic tables. The numerous hiking and riding trails offer significant opportunities for "back country" recreation. Future plans call for limited development which emphasizes a historic theme and maintains the wilderness atmosphere of the park (Maricopa County Parks and Recreation Department, 1980).

TABLE 5-8

VISITORS AT NEARBY REGIONAL PARKS
1976-1980

PERIOD	NUMBER OF USERS		
	Estrella Mountain Regional Park	Casey Abbott Recreation Area	White Tank Mountain Regional Park
July 1976-June 1977	256,853	45,635	72,591
July 1977-June 1978	226,350	35,299	64,180
July 1978-June 1979	122,794**	23,054**	88,479
July 1979-Jan. 1980*	92,269	18,973	35,469

*Partial Fiscal Year.

**Park closed for extended period due to flooding.

Source: Maricopa County Parks and Recreation Department, 1980.

White Tank Mountain Regional Park

White Tank Mountain Regional Park covers approximately 28,195 acres (over 44 square miles) and is the largest park in the County system. 70 percent of the White Tank Mountains is contained within the parks boundary. Elevations range from 1,370 feet to over 4,000 feet above sea level. The park contains a variety of desert vegetation and wild-life. Numerous archaeological sites and petroglyphs are found within the park's boundaries, more than in any other County park.

The only entrance to the park is through the study area via Olive Avenue. About 7 to 8 miles of the park's total area is developed at this time. Improvements consist of a paved access road and parking areas, 12 distinct picnic areas most of which have shaded areas or ramadas, pit toilets, a family campground, and a special group camp-site. Numerous hiking and riding trails cover the park.

Future plans call for further expansion of the campground and picnic areas. The majority of the park, however, will be maintained as a primitive desert wilderness area. Olive Avenue will remain the only entrance to the park (Maricopa County Parks and Recreation Department, 1980).

Casey Abbott Recreation Area

The Casey Abbott Recreation Area is a semi-regional park located just south of the Gila River. The park contains over 2,100 acres of land of which about 600 are developed for urban type recreation. Facilities include an 18 hole golf course and clubhouse, picnic tables, grills, and ramadas, a playground area, restroom facilities, an outdoor amphitheatre, archery range, campsite, and paved roads and parking areas. Numerous hiking and riding trails are also located within the park. Additional improvements are planned for the future which will maintain the mixture of semi-wilderness and urban recreation opportunities.

The main entrance to the park is through the study area via Bullard Road across the Gila River. The park is closed for extended periods of time when flooding occurs. Much of the park itself is also located in the 100 year floodplain. Inundation does occur, but damage is usually minimal and requires primarily clean up efforts (Maricopa County Parks and Recreation Department, 1980).

Proposed Hiking and Riding Trails

At this time, there are no established hiking and riding trails within the study area. A County-wide system of trails has been proposed by the Maricopa County Hiking and Riding Trails Committee. This group serves as an advisory body to the Maricopa County Parks and Recreation Commission. The primary component of this system is the Sun Circle Trail which, when completed, will surround the Phoenix metropolitan area. A large segment of this system has already been established. It currently ends at Phoenix South Mountain Park and at New River where it intersects the Arizona Canal.

A primary section of the remainder of the Sun Circle Trail lies within the White Tanks-Agua Fria area. From the existing trail in Phoenix South Mountain Park, the proposed trail would follow the Gila River west to the Casey Abbott Recreation Area, then turn northward along the Agua Fria River channel to its confluence with New River. From there the trail would leave the study area and follow New River to its intersection with the Arizona Canal near 83rd Avenue. This trail is planned to tie in with the Phoenix and New River Streams Flood Control Project (See Part I, Chapter V). Rest areas and picnic sites are proposed along the trail at 5 mile intervals.

A secondary trail has been proposed to connect White Tank Mountain Park with the Sun Circle primary trail. As proposed, this trail alignment would be located north of Peoria Avenue from the Park to Dysart Road, then south to Olive Avenue, and then east to the Sun Circle Trail (Maricopa County Parks and Recreation Department, 1979).

The development of these trails is dependant upon the future acquisition of rights-of-way and easements. Since much of the primary trail is located in the floodplain of the Agua Fria River, future development and flood control measures will affect it.

SELECTED REFERENCES

- Arizona Public Service Company, 1979. Personal communication.
- Arizona Corporation Commission, 1979. Maps showing utility franchise areas, Utilities Division, August, 1979.
- Arizona Department of Health Services, 1980. Personal communication, Stu Baker, Bureau of Sanitation, February, 1980.
- Arizona Department of Water Resources, 1980. Personal communication, Ed Nemecek, September, 1980.
- Arizona Water Commission, 1978. Projected Water Uses, Supplies, and Groundwater Conditions In Selected Basins In Arizona, draft report, April, 1978.
- Bower, 1980. Personal communications, Jeff Bower, Goodyear Farms, April, 1980.
- Crowell, 1980. Personal communication, Dick Crowell, Litchfield Park Properties, April, 1980.
- Donaldson, 1980. Personal communication, George Donaldson, Del E. Webb Development Company, April, 1980.
- Frank, 1980 Personal communications, Mark Frank, 208 Program Manager, April, 1980.
- Insurance Services Office of Arizona, 1980. Personal communication, April, 1980.
- Kleinschmidt, 1980. Personal communications, Ernie Kleinschmidt, Manager, Town of Goodyear, April, 1980.
- Maricopa Association of Government, 1979. Final Plan MAG 208 Water Quality Management Program, 208 Program, July, 1979.
- _____, 1980. Regional Solid Waste Needs Assessment, MAG 208 Water Quality Management Program, August, 1980.
- Maricopa County Health Department, 1980, Personal communications, Herb Jennings, 1980.
- Maricopa County Planning and Zoning Department, 1976. Public Schools Districts, Maricopa County, Arizona, published map, 1976.
- Maricopa County Parks and Recreation Department, 1979. "Maricopa County Hiking and Riding Trails" map, 1979.
- _____, 1980. Personal communication, Joe Sharp, 1980.

Maricopa County Sheriff's Office, 1979. Personal communication, Planning and Research Division, 1979.

Reese, 1980. Personal communication, Margarita Reese, Manager, Town of El Mirage, April, 1980.

The Salt River Project, 1979. Personal communication.

Simon, 1980. Personal communication, Mildred Simon, Office of the Superintendent of Schools, Maricopa County, Arizona, May, 1980.

Thomas, 1979. Personal communication, Mr. Thomas, Forecasting Division, Mountain Bell, June, 1979.

University of Arizona, 1978. Water Service Organizations In Arizona, A Report to the Arizona Water Commission and the Central Arizona Water Conservation District, submitted by Water Resources Research Center, College of Earth Sciences, August, 1978.

U.S. Department of Energy, 1979. Personal communication.

U.S. Environmental Protection Agency, 1979. Final Environmental Impact Statement Maricopa Association of Governments Point Source Metro Phoenix 208 Wastewater Management Plan, July, 1979.

White Tanks-Agua Fria Citizen Committee, 1979. Survey of Schools Serving the White Tanks-Agua Fria Area, October, 1979.

Winn, 1980. Personal communication, Greg Winn, Forecasting Division, Mountain Bell, April, 1980.

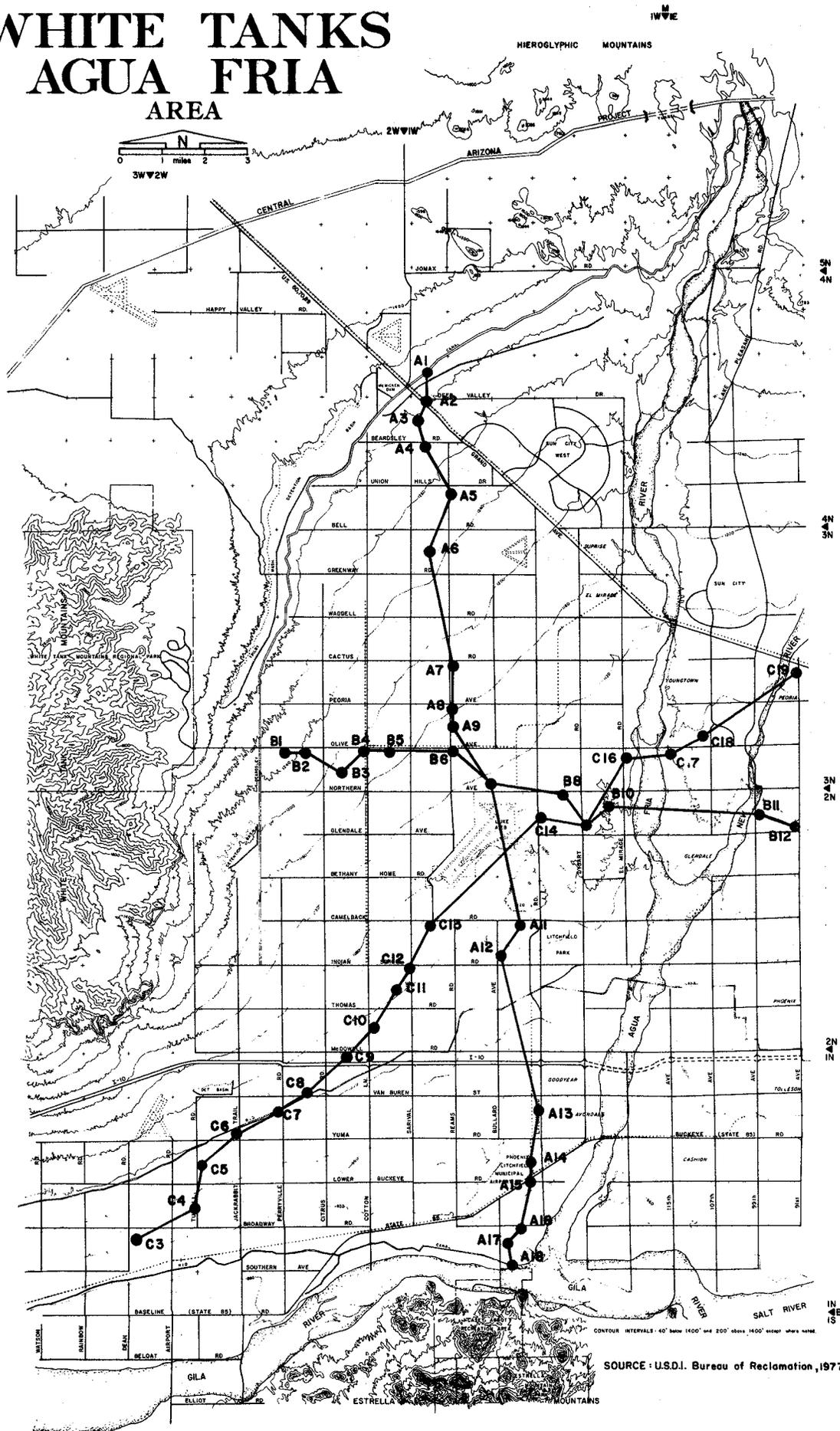
Yingling, 1980. Personal communication, Harold Yingling, Manager, Town of Surprise, April, 1980.

**A
P
P
E
N
D
I
C
E
S**

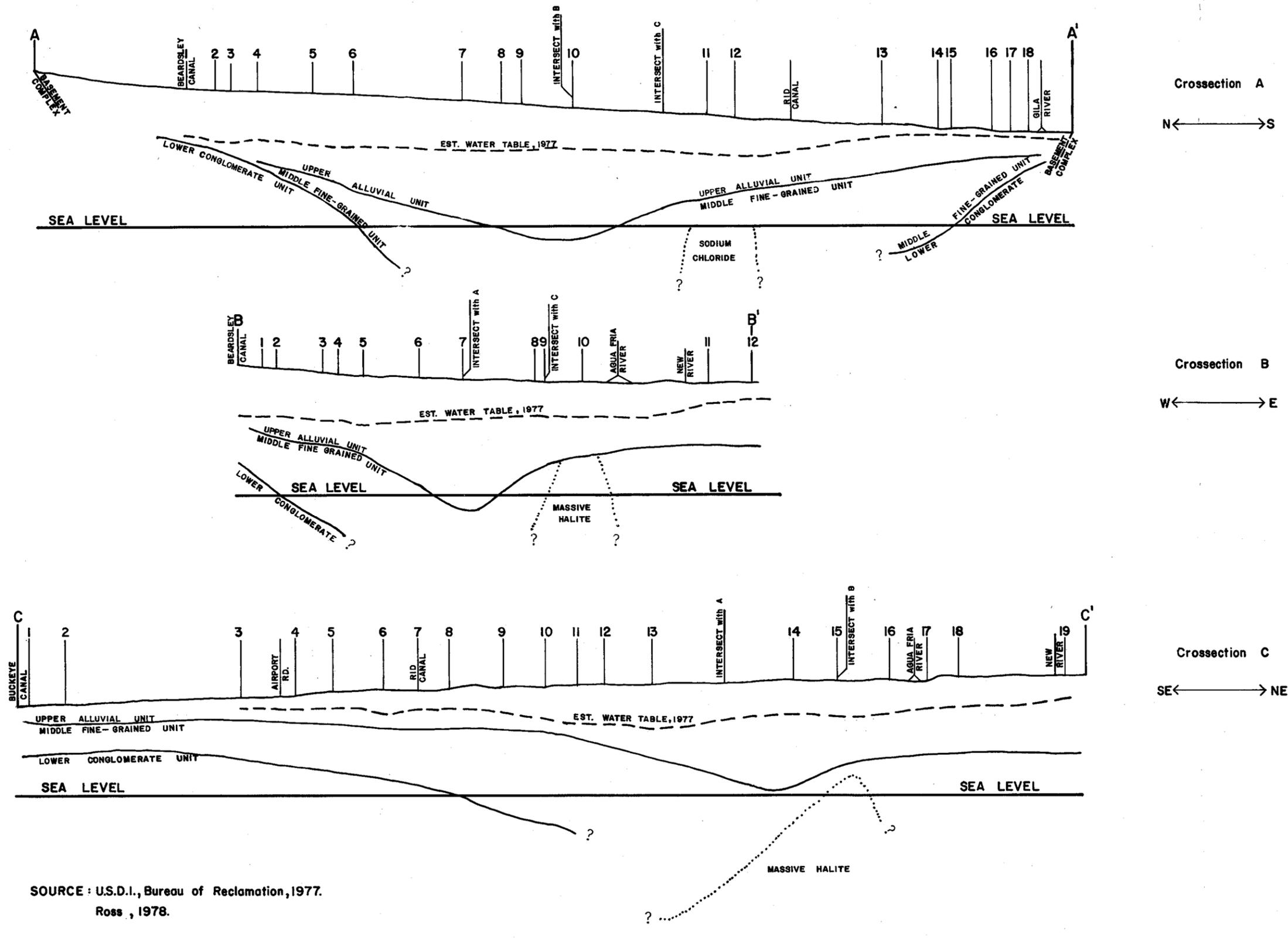
APPENDIX A

Subsurface Cross Sections

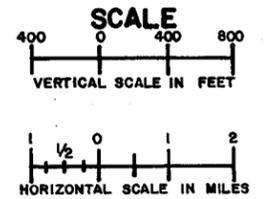
WHITE TANKS AGUA FRIA AREA



INDEX MAP TO SUBSURFACE CROSS SECTIONS MAP A-1



SOURCE: U.S.D.I., Bureau of Reclamation, 1977.
 Ross, 1978.



SUBSURFACE CROSS SECTIONS

FIGURE A-1

APPENDIX B

Estimated Distribution of Recoverable Groundwater

TABLE A - 1
 Estimated Amount of Recoverable Groundwater
 Within the White Tanks-Agua Fria Area

Subarea		Water In Acre Feet**				
Number*	Portion In Study Area (Square Miles)	Water between land surface and 300' below land surface	Water between 300' and 700' below land surface	Water between 700' and 1200' below land surface	Total	Average per Square Mile
6	9.2	0	129,000	233,000	362,000	39,000
13	3.2	10,000	61,000	53,000	124,000	39,000
10	34.4	0	530,000	720,000	1,250,000	36,000
11	38.8	0	905,000	865,000	1,770,000	46,000
12	4.7	0	56,000	119,000	175,000	37,000
28	28.5	0	403,000	572,000	975,000	34,000
29	35.0	10,000	1,197,000	1,496,000	2,703,000	77,000
30	0.5	2,000	20,000	18,000	40,000	80,000
38	30.0	0	417,000	666,000	1,083,000	36,100
39	35.1	185,000	674,000	966,000	1,825,000	52,000
40	3.0	37,000	51,000	56,000	144,000	48,000
49	32.5	480,000	630,000	960,000	2,070,000	64,000
50	25.4	427,000	561,000	478,000	1,466,000	58,000
63	6.3	135,000	133,000	105,000	373,000	59,000
Total	286.6***	1,286,000	5,767,000	7,307,000	14,360,000	50,000
% of Total	NA	8.9	40.2	50.9	100.0	NA

* Subarea Numbers correspond with USGS Map I-845-K.

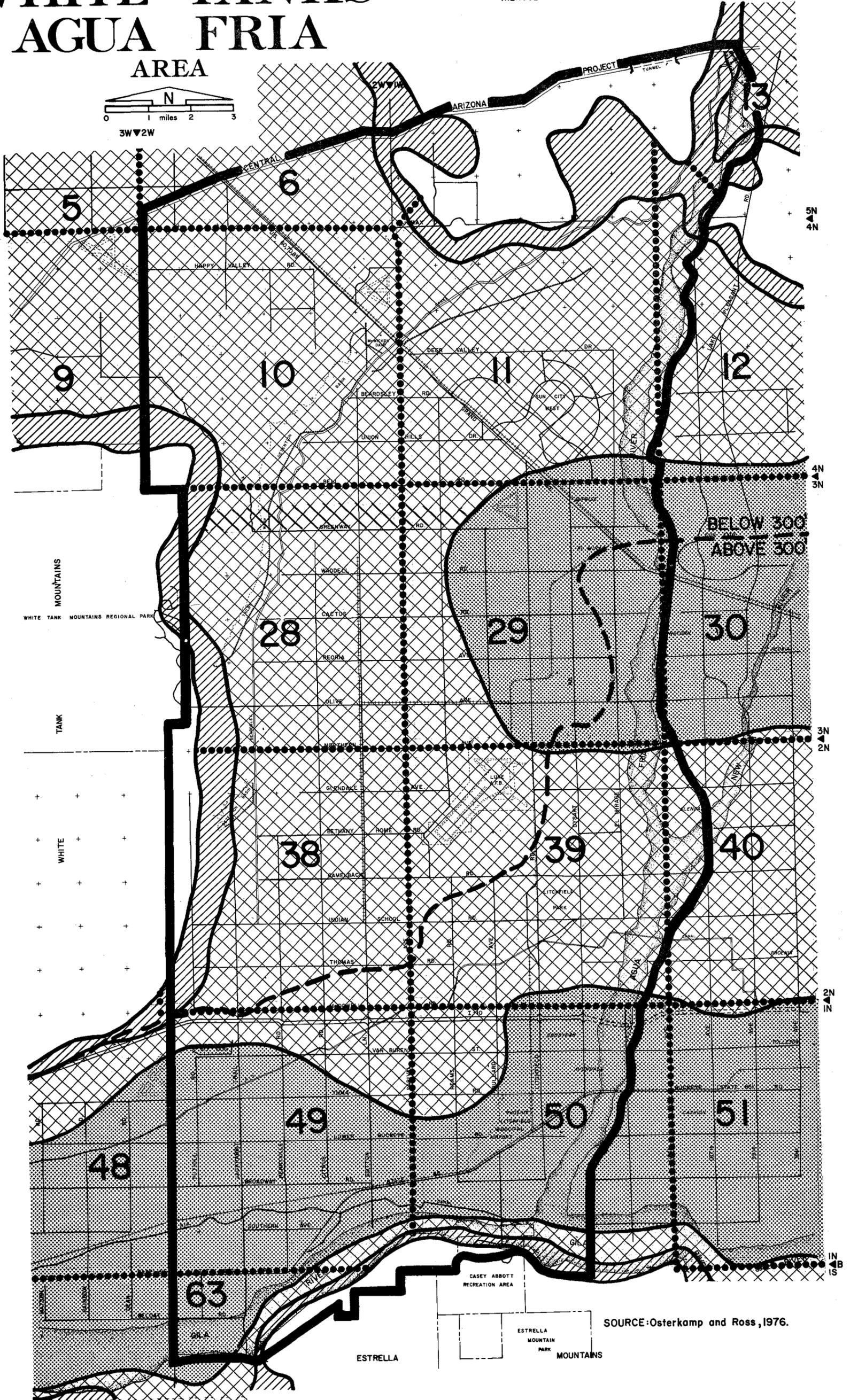
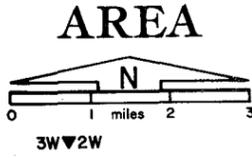
** Rounded to nearest 1,000 acre feet.

*** Less than total study area due to the presence of non water bearing rocks.

Source: Adapted from Osterkamp, 1972 and Osterkamp and Ross, 1976.

WHITE TANKS AGUA FRIA AREA

HIEROGLYPHIC MOUNTAINS



BELOW 300'
ABOVE 300'

SOURCE: Osterkamp and Ross, 1976.

- | | | | | | | | | |
|--------|--|-----------------------------|--|------------------|--|----------------------------|--|----------------------------|
| LEGEND | | 300' GROUNDWATER LEVEL 1972 | | SUBAREA BOUNDARY | | CONSOLIDATED ROCKS | | 30,000-60,000 ACRE FEET |
| | | STUDY AREA BOUNDARY | | 38 INDEX NUMBER | | LESS THAN 30,000 ACRE FEET | | MORE THAN 60,000 ACRE FEET |

DISTRIBUTION OF RECOVERABLE GROUNDWATER

APPENDIX C

History of Rezoning 1970-1979

TABLE A-2

HISTORY OF REZONING WITHIN THE
WHITE TANKS-AGUA FRIA AREA
1970-1979*

YEAR OF APPLICATION	ZONING CASE	ZONING MAP	ZONE CHANGE		ACREAGE		YEAR OF APPLICATION	ZONING CASE	ZONING MAP	ZONE CHANGE		ACREAGE		
			FROM	TO	INSIDE AREA	OUTSIDE AREA				FROM	TO	INSIDE AREA	OUTSIDE AREA	
1970	Z 70-30	C-21	Rural 43	R1-10	30.0		1977 (Continued)	Z 77-68	A-22	Rural 43	R1-8	70.5	30.21	
	Z 70-37	C-22	Rural 43	C-2	2.6			Rural 43	R1-18	2.1	90.0			
			Rural 43	C-3	5.6			Rural 43	R-3	0.0	13.8			
	Z 70-58	C-21	Rural 43	SU Rural 43 Earth Extraction	60.0			Rural 43	C-5	0.0	8.2			
								Rural 43	C-0	0.0	3.6			
	Z 70-67	C-22	Rural 43	SU Rural 43 Dog Kennel	6.7			Z 77-103	C-22	Rural 43	SU Rural 43 Mini-Warehouses	3.4		
	Z 70-77	C-1	Rural 43	R1-6	10.0	30		Z 77-106	D-3	Rural 43	SU Rural 43 Sand & Gravel	154.8		
	Z 70-104	C-21	Rural 43	SU Rural 43 Earth Extraction	40.0			1978	Z 78-16	C-24	Rural 43	SU Rural 43 Sports Arena	4.8	
	Z 70-106	C-22	Rural 43	R-5	285.5				Z 78-29	C-24	Rural 43	SU Rural 43 Custom Meat Processing	2.4	
			Rural 43/R-4	C-2	94.8				Z 78-42	C-3	Rural 43	IND-2	5.7	
		Rural 43	C-3	77.6		Z 78-57	C-22		C-2	R-4	0.7			
		Rural 43/R-4	C-3	44.9		Z 78-105	C-22		R-4	RUP R-4	6.6			
1971	Z 71-29	C-4	Rural 43	C-2	0.7		Z 78-139	C-21	Rural 43	R1-10	15.1			
	Z 71-33	C-1	Rural 43	IND-3	20.0			C-22	R1-18	RUP R1-18	13.4			
	Z 71-45	C-24	Rural 43	SU Rural 43 Private Airport	128.3			IND-2/C-3	AD-I, AD-II, AD-III	1,945.7				
	Z 71-46	C-21	Rural 43	R1-10	44.4									
	Z 71-124	C-42	Rural 43	R1-18	3.3		Z 78-159	C-42	Rural 43	R1-10	16.3			
			Rural 43	SU Rural 43 Sand & Gravel	33.4			C-22	Rural 43	R1-18	0.7			
1972	Z 72-14	A-82	Rural 43	SU Rural 43 Gun Club	45.0	35	1979	Z 79-25	C-4	Rural 43	C-3	0.7		
	Z 72-40	D-3	Rural 43	SU Rural 43 Sand & Gravel	35.5			Z 79-41	C-21	Rural 43	IND-2	33.8		
	Z 72-106	C-21	Rural 43	R1-6	11.8			Z 79-123	C-41	Rural 43	IND-2	5.0		
	Z 72-130	C-22	Rural 43	SU Rural 43 Golf Driving Range	51.9									
	Z 72-158	C-22	Rural 43	SU Rural 43 Sand & Gravel	20.6									
1973	Z 73-49	C-24	Rural 43	SU Rural 43 Dog Kennel	5.0									
	Z 73-63	C-22	Rural 43	SU Rural 43 Sand & Gravel	158.0									
1974	Z 74-53	C-22	Rural 43	SU Rural 43 Sand & Gravel	158.0									
	Z 74-58	C-3	Rural 43	SU Rural 43 Mobile Home Sub	76.4									
	Z 74-87	C-22	R-4	RUP R-4	11.8									
1975	-----None-----													
1976	Z 76-15	C-3	Rural 43	IND-2	4.2									
	Z 76-74	C-21	Rural 43	R1-8	33.7									
			Rural 43	R1-10	7.4									
	Z 76-80	C-42	Rural 43	SU Rural 43 Liquid Gas	7.3									
	Z 76-86	C-21	Rural 43	RUP R1-8	28.8									
1977	Z 77-8	C-23	Rural 43	SU Rural 43 Experimental Proving Grounds	1,920.0	6,705								
	Z 77-29	C-21	Rural 43	IND-3	14.7									
	Z 77-55	C-3	Rural 43	SU R1-6 Mobile Home Sub	27.3									
											Subtotal Not Including Sun City West		4,722.8	
											SUN CITY WEST			
							1977	Z 77-112	C-62	Rural 43	R1-7	298.4		
								Z 77-113		Rural 43	C-2	67.0		
										Rural 43	RUP R-3	318.3		
							1978	Z 78-14		Rural 43	R1-7	831.3		
										Rural 43	C-2	161.5		
										Rural 43	IND-2	165.7		
										Rural 43	IND-3	6.4		
								Z 78-15		Rural 43	RUP R-3	178.8		
								Z 78-91		Rural 43	SU Rural 43 Tennis Courts	6.9		
								Z 78-96		Rural 43	RUP R-3	112.9		
								Z 78-97		Rural 43	R1-7	629.6		
										Rural 43	C-2	2.0		
							1979	Z 79-78		Rural 43	C-2	2.5		
								Z 79-122		Rural 43	C-2	11.9		
											Subtotal Sun City West		2,793.2	
											TOTAL ACREAGE REZONED**		8,579.1	

*Unincorporated area only

**Some parcels rezoned more than once

Source: Maricopa County Department of Planning and Development, 1980.

APPENDIX D

Existing Subdivisions

April, 1980

TABLE A-3

 EXISTING SUBDIVISIONS
 WHITE TANKS-AGUA FRIA AREA
 1979

MAP REFERENCE	NAME	LOCATION (T,R,S)	RECORDED (BOOK, MAP)	DATE RECORDED	TOTAL ACREAGE	# LOTS	AVERAGE LOT SIZE (Square Feet)	# LOTS DEVELOPED	PERCENT COMPLETE	REMARKS
1	Chaparral Rancheros #1	5N-2W-31	143-17	11-04-71	139.3	100	43,560	52	52	
2	Chaparral Rancheros #2	5N-2W-31	159-33	3-07-73	500.7	343	43,560	39	11	
3	Churchill South	5N-2W-33	76-22	9-20-59	225.0	43	34,848	0	0	
4	Beardsley Ranchitos #1	4N-2W-10	124-46	7-23-69	66.9	25	100,188 174,240	21	84	23- 2.3 Acre Lots, 2 - 4 Acre Lots
5	Martin Acres	4N-2W-11	65-47	12-13-55	79.8	66	43,560	3	4	
6	Frank E. Bellamy	4N-2W-15	11-19	8-30-23	160.0	32	209,088	3	9	
7	Tract "0" Beardsley	4N-1W-29	28-16	2-02-42	1.6	6	8,276 17,424	1	17	4- .19 Acre Lots 2- .4 Acre Lots
8	Beardsley	4N-1W-29	28-06	9-16-41	39.8	34	26,136	3	9	
9	Waddell Haciendas	3N-2W-10	145-11	1-10-72	96.0	86	43,560	32	37	
10	Waddell Haciendas Unit 2	3N-2W-10	158-38	2-05-73	122.0	98	43,560	18	18	
11	Ramola of Arizona #22	3N-2W-15	21-09	4-22-29	628.0	611	43,560	1	0.2	
12	Waddell	3N-2W-12	24-12	8-05-35	37.0	88	6,250	0	0	
13	Ramola of Arizona #29	3N-2W-24	19-19	7-16-28	640.0	621	43,560	8	1	
14	Sun Park	3N-2W-27	99-25	6-11-62	20.0	25	37,026	0	0	
15	Ramola of Arizona #38	3N-2W-35	18-38	3-03-28	640.0	621	43,560	3	0.5	
16	Ramola of Arizona #42	2N-2W-3	18-40	4-01-28	640.0	620	43,560	0	0	
17	Ramola of Arizona #43	2N-2W-2	18-41	5-03-28	628.0	616	43,560	1	0.2	
18	Los Lagos Oeste	3N-1W-14	162-08	5-10-73	76.0	447	6,600	0	0	Incorporated
19	Dysart Ranchettes	3N-1W-23	144-13	12-06-71	318.0	103	135,036	33	32	
20	Ranchos de Loma 1	2N-1W-10	106-39	10-06-64	32.0	36	34,848	18	50	
21	Casitas Bonitas	2N-1W-10	151-48	7-14-72	47.0	137	11,119	42	31	
22	Luke Field Homes	2N-1W-10	60-13	7-28-54	60.6	244	6,600	138	56	3 duplex, Mobile Homes
23	Litchfield Heights N.	2N-1W-11	142-09	10-05-71	19.6	14	43,560	10	71	
24	Tierra Buena	2N-1W-14	121-50	8-08-68	25.3	57	14,850	21	37	
25	Indian School 125th Ave	2N-1W-26	501-82	12-05-60	5.9	23	7,000	3	13	
26	Beautiful Arizona Estates	2N-2W-17	99-38	7-03-62	318.0	293	36,874	2	0.7	
27	Spencer's Mountain Vista	2N-2W-28	80-25	12-02-58	10.0	18	18,500	14	78	
28	Valencia Heights	2N-2W-32	21-31	6-11-29	480.0	24	871,200	1	4	
29	Valencia Village Annex	2N-2W-32	172-30	5-07-74	65.0	34	69,696	32	94	
30	Valencia Village	2N-2W-32	139-23	7-06-71	80.0	68	43,560	64	94	

TABLE A - 3 (Continued)

MAP REFERENCE	NAME	LOCATION (T,R,S)	RECORDED (BOOK, MAP)	DATE RECORDED	TOTAL ACREAGE	# LOTS	AVERAGE LOT SIZE (Square Feet)	# LOTS DEVELOPED	PERCENT COMPLETE	REMARKS
31	Valencia Village Unit 2	2N-2W-32	178-42	5-13-75	14.5	2	43,560	12	100	
32	Harness Mobile Home Sub.	2N-2W-32	114-21	5-15-67	23.0	67	6,100	0	0	
33	Orangewood Farms	1N-2W-4	140-36	8-17-71	80.0	48	60,984	11	23	1 Mobile Home
34	White Tank Homes	1N-2W-4	70-06	12-21-56	80.0	64	52,272	56	87	
35	Hills Desert Estates	1N-2W-4	93-44	3-03-61	20.0	48	13,208	38	79	
36	Quintana Estates	1N-2W-3	144-01	11-30-71	159.0	112	52,272	0	0	
37	Marwest Estates	1N-2W-3	151-26	7-03-72	76.0	33	87,120	28	85	Mobile Homes
38	White Tank Citrus Tract B	1N-2W-10	21-28	6-04-29	111.4	24	196,020	0	0	
39	White Tank Citrus Tract A	1N-2W-18	21-27	6-04-29	141.0	24	261,360	9	37	Workout Track on 4 lots
40	Los Ranchitos de Los Conejos	1N-2W-17	159-20	2-26-73	135.0	28	196,020	19	70	
41	Sweetwater Estates 2	1N-2W-14	139-03	6-15-71	115.0	75	47,916	52	69	
42	Salt River Acres	1N-2W-22/23	23-19	12-31-30	280.0	28	435,600	1	4	
43	Sarival Gardens	1N-2W-13	147-19	3-15-72	320.0	241	43,560	36	15	
44	Morocco Townsite Properties B	1N-2W-25	22-41	4-10-30	40.6	208	Varies	2	1	
45	Morocco Townsite Properties A	1N-2W-25	22-37	3-13-30	30.0	26	43,560	0	0	
46	Rio Vista West	1N-1W-14	137-21	4-13-71	39.5	136	7,700	127	93	
47	Romola of Arizona #47	2N-2W-11	19-08	6-21-28	640.0	618	43,560	5	0.8	
	LITCHFIELD PARK									
	Litchfield Park Sub #4	2N-1W-27	51-08	7-19-51	5.6	24	9,100	24	100	
	Litchfield Park Sub #5	2N-1W-27	66-01	12-28-55	8.7	32	10,179	32	100	
	Litchfield Park Sub #6	2N-1W-22	66-02	12-28-55	15.4	34	12,500	34	100	
	Litchfield Park Sub #7	2N-1W-22	99-42	7-17-62	35.0	76	14,300	76	100	
	Litchfield Park Sub #9	2N-1W-22	101-21	1-29-63	18.8	23	38,850	22	96	
	Litchfield Park Sub #10	2N-1W-21	109-02	8-03-65	12.7	24	15,000	24	100	
	Litchfield Park Sub #11 Unit 1	2N-1W-22	112-49	11-10-66	34.3	50	20,127	50	100	
	Litchfield Park Sub #11 Unit 2	2N-1W-22	159-01	2-13-73	68.5	92	25,160	84	91	
	Litchfield Park Sub #12	2N-1W-22	111-05	4-05-66	47.1	86	16,500	86	100	
	Litchfield Park Sub #14	2N-1W-22	121-22	12-18-68	9.0	36	7,000	34	94	
	Litchfield Park Sub #14A Unit 1	2N-1W-22	145-12	1-10-72	5.1	17	12,000	17	100	
	Litchfield Park Sub #14A Unit 2	2N-1W-22	145-08	1-10-72	4.6	8	19,000	8	100	

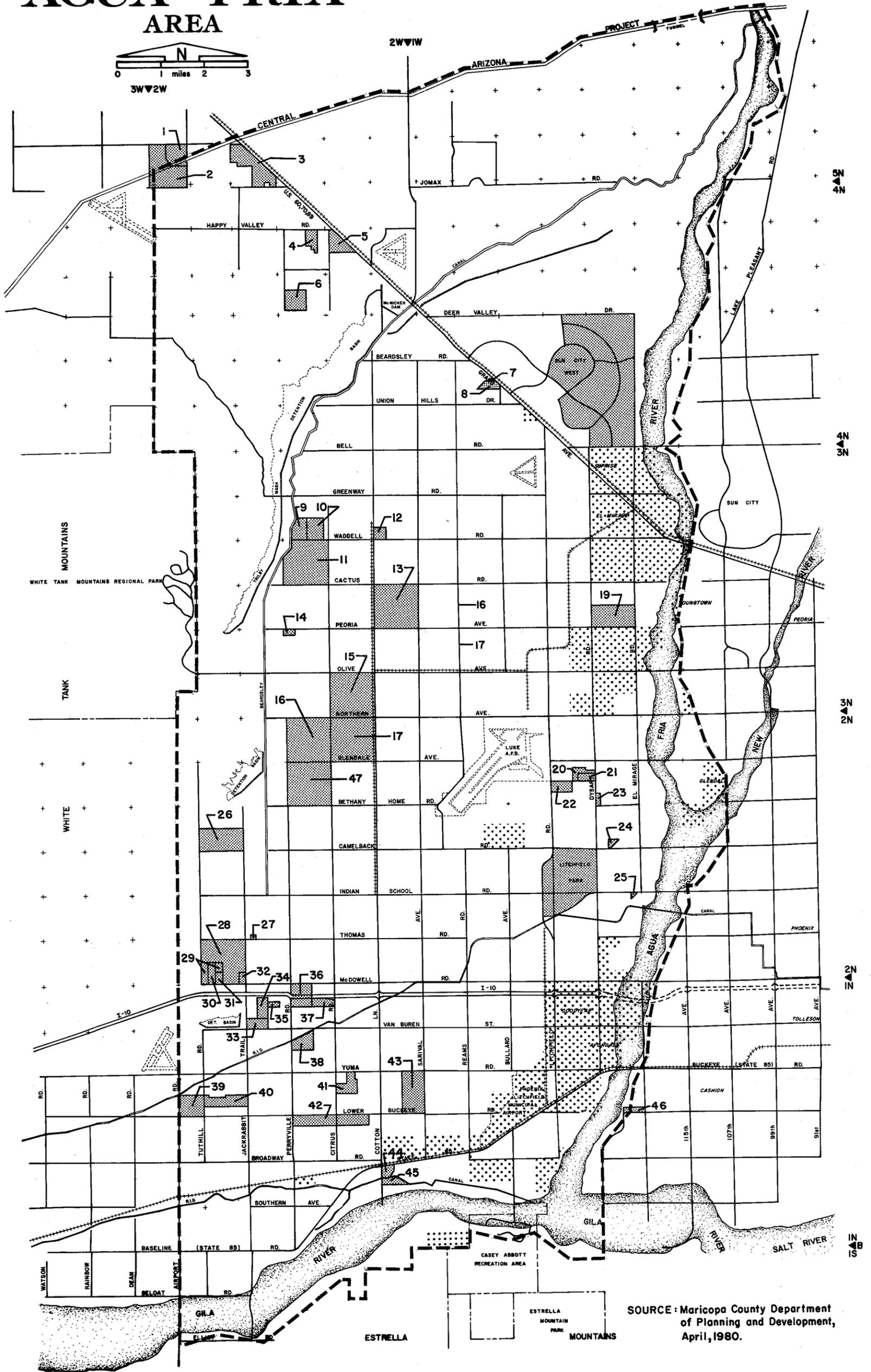
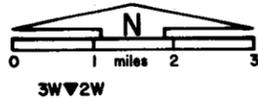
TABLE A - 3 (Continued)

MAP REFERENCE	NAME	LOCATION (T,R,S)	RECORDED (BOOK, MAP)	DATE RECORDED	TOTAL ACREAGE	# LOTS	AVERAGE LOT SIZE (Square Feet)	# LOTS DEVELOPED	PERCENT COMPLETE	REMARKS
	Litchfield Park Sub #15A	2N-1W-21	114-38	6-12-67	42.6	131	9,000	126	96	
	Litchfield Park Sub #15B	2N-1W-27	115-01	7-03-67	5.6	90	2,800	90	100	Townhouses
	Unit 1									
	Litchfield Park Sub #15B	2N-1W-27	119-30	8-12-68	15.6	182	2,800	182	100	Townhouses
	Unit 2									
	Litchfield Park Sub #15B	2N-1W-27	122-17	2-24-69	6.7	87	2,675	87	100	
	Unit 3									
	Litchfield Park Sub #16	2N-1W-28	153-15	8-14-72	42.9	105	9,000	105	100	
	Litchfield Park Sub #17	2N-1W-21	123-08	4-07-69	14.0	30	15,250	30	100	
	Litchfield Park Sub #17	2N-1W-22		5-79-32	15.8	38	21,458	2	5	
	Unit 2									
	Litchfield Park Sub #18	2N-1W-22	186-48	12-14-76	22.8	41	18,500	33	80	
	Litchfield Park Sub #19	2N-1W-22	211-44	5-23-79	12.5	27	20,102	0	0	
					4.4	51	3,720			
	Laguna Royale	2N-1W-27	133-39	11-2-70	1.9	20	3,484	16	80	Townhouses
	LaCasa Linda 1	2N-1W-28	178-01	3-04-75	6.1	78	1,600	78	100	Townhouses
	LaCasa Linda 2	2N-1W-28	203-48	9-19-78	4.3	39	4,320	8	20	Townhouses
	Arizona Project 1	2N-1W-28	157-08	12-19-72	1.4	14	1,200	14	100	Condominiums
	Tierra Verde	2N-1W-28			3.1	40	1,295	40	100	Condominiums
	Condominiums 1 & 2									
	Tierra Verde Townhouses #1	2N-1W-22	14-49	7-03-67	6.8	37	8,208	37	100	Townhouses
	<u>SUN CITY WEST</u>									
	Sun City West Unit 1	4N-1W-22/23/ 26/27	200-01	5-24-78	7.9	30	11,325	11	36	Single Family Model Homes
					21.0	238	1,820	238	100	8 model condos
					1.1	6	3,750	6	100	Model duplex
	Sun City West Unit 2	4N-1W-27	215-26	8-24-79	5.9	96	2,482	96	100	Duplex (96 units)
	Sun City West Unit 3	4N-1W-26/27 34/35	199-17	5-10-78	165.5	728	9,903	728	100	
	Sun City West Unit 4	4N-1W-27/34	199-18	5-10-78	37.6	302	2,520	302	100	Condominiums
	Sun City West Unit 5	4N-1W-26/ 34/35	199-19	5-10-78	52.9	312	3,750	312	100	Duplex
	Sun City West Unit 6	4N-1W-26	199-20	5-10-78	62.7	280	9,583	280	100	
	Sun City West Unit 7	4N-1W-27/34	203-35	9-12-78	62.2	499	2,592	0	0	Condominiums
	Sun City West Unit 8	4N-1W-34/35	203-36	9-12-78	118.0	477	10,777	477	100	
	Sun City West Unit 9	4N-1W-35	203-37	9-12-78	114.5	450	11,080	450	100	
	Sun City West Unit 10	4N-1W-35	204-42	10-17-78	173.6	551	13,700	0	0	
	Sun City West Unit 11	4N-1W-26/35	205-50	11-14-78	73.9	444	16,500	0	0	Duplex
	Sun City West Unit 12	4N-1W-23/ 26/35	205-40	11-07-78	140.8	532	11,526	0	0	
	Sun City West Unit 14	4N-1W-27/34	212-41	6-26-79	38.5	314	2,592	0	0	Condominiums
	Sun City West Unit 15	4N-1W-23	210-04	3-26-79	47.0	272	3,750	0	0	Duplex
	Sun City West Unit 16	4N-1W-23/26	209-40	3-16-79	64.2	277	10,097	0	0	
	Sun City West Unit 17	4N-1W-22/ 23/26	210-05	3-26-79	151.4	650	10,144	0	0	
	Sun City West Unit 18	4N-1W-22/ 23/26	210-09	3-25-79	50.9	233	9,509	0	0	
	Sun City West Unit 19	4N-1W-23	212-42	6-26-79	100.7	419	10,465	0	0	
	Sun City West Unit 20	4N-1W-22/23	210-10	3-26-79	98.9	401	10,738	0	0	

*Unincorporated Area Only

WHITE TANKS AGUA FRIA AREA

MEROGLYPHIC MOUNTAINS



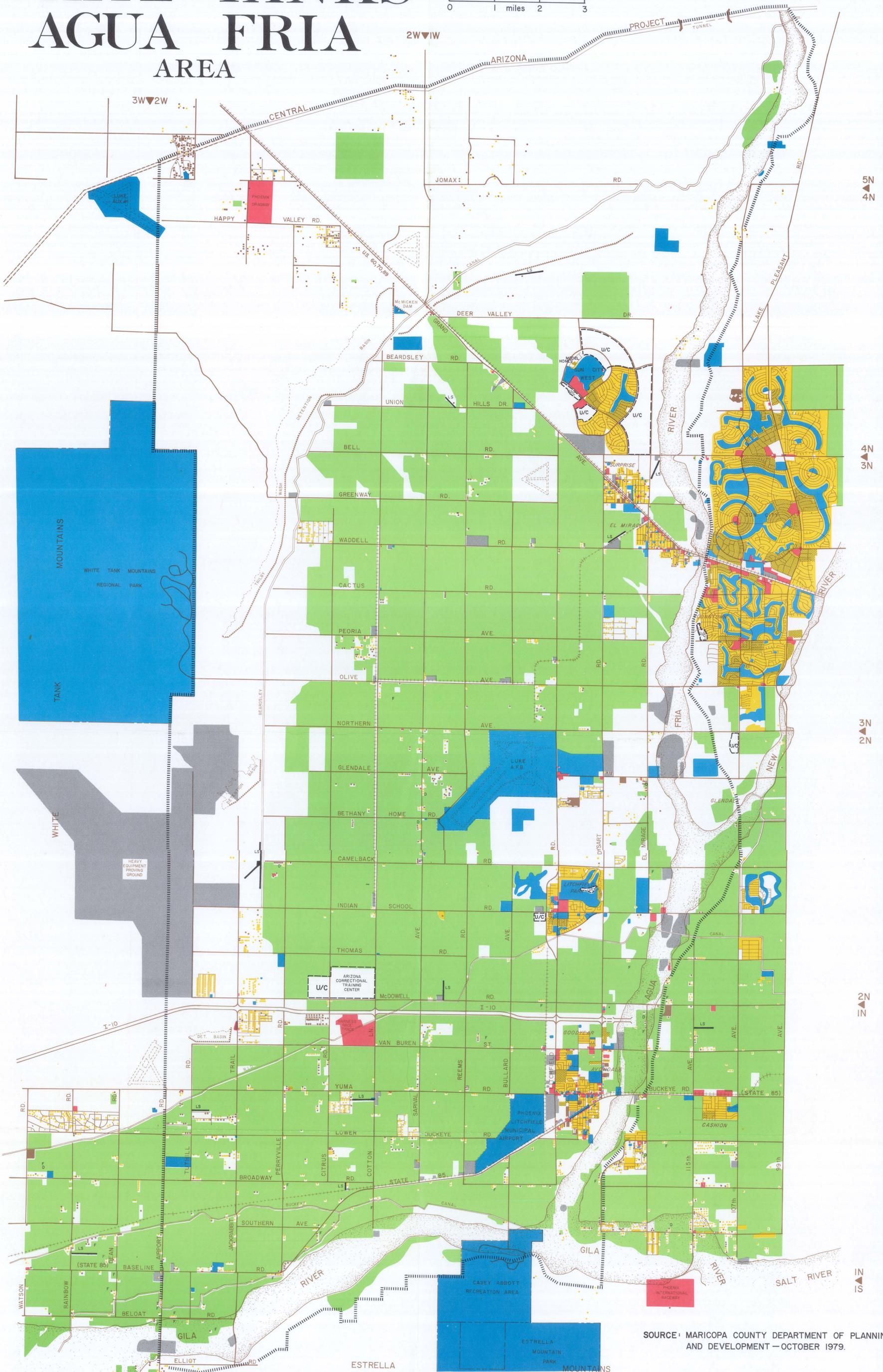
SOURCE: Maricopa County Department of Planning and Development, April, 1980.

● INCORPORATED AREA --- STUDY AREA BOUNDARY

EXISTING SUBDIVISIONS

MAP A-4

WHITE TANKS AGUA FRIA AREA



SOURCE: MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT - OCTOBER 1979.

GENERALIZED EXISTING LAND USE

LEGEND

- | | | | |
|-----------------|--------------|----------------------------------|--------------------|
| SINGLE FAMILY | COMMERCIAL | PUBLIC OR SEMI-PUBLIC | FLOODWAY DISTRICT |
| MOBILE HOME | INDUSTRIAL | TRANSITIONAL- UNDER CONSTRUCTION | LS - LANDING STRIP |
| MULTIPLE FAMILY | AGRICULTURAL | VACANT OR NATURAL DESERT | F - FEEDLOT |
| | | | D - DAIRY |
| | | | STUDY AREA |