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STATE OF ARIZONA

ENVIRONMENTAL SERVICES NEEDS STUDY

Gila County

Planning Division • Department of Economic Planning and Development

6862

STATE OF ARIZONA

GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

1970 - 1990

Prepared by

PLANNING DIVISION

DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT

ARIZONA WATER COMMISSION

June 1971

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Jeffrey K. Kracht

STUDY STAFF

Vicki Greenfield	- Planner
Judith Storms	- Economist
Harry Plumlee	- Economist
Ron R. Ross	- Planner
Eugene J. Johnson	- Indian Consultant
Abiano Moreno	- Draftsman
Margaret Wilcox	- Typist

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Boyd Sherman, Farmers Home Administration

FOREWORD

This study is the result of a financial assistance program administered by the Farmers Home Administration (FHA) to aid planning in small rural areas. The report was organized on a county basis with FHA regulations providing the framework for selections of study areas within the counties. The areas were not required to be incorporated municipalities, however some semblance of community organization was required and the population could not exceed 5,500 persons.

The report is primarily concerned with the identification and evaluation of existing water systems and sewage and solid waste disposal facilities, and the projection of future needs for these services in rural areas of Gila County. In addition, the completion of the study meets the following related objectives:

- The delineation of probable areas of community growth and their concomitant need for "environmental service systems" (see definition).
- An appraisal of existing land use patterns and environmental services problems which may result from various types of future use.
- The collection and interpretation of data projecting the future needs for environmental services on a county-wide and individual community basis.

Definitions

For the purposes of this report, the following definitions shall apply:

"ENVIRONMENT" - The aggregate of physical, social, and cultural conditions that influence the life of an individual or community.

"SERVICES" - (1) Contributions to the welfare of others; (2) Facilities supplying some public demand.

"COMMUNITY" - (1) A unified body of individuals; (2) People with common interests living in a particular area.

"WATER SUPPLY SYSTEM" - Wells, surface water collection reservoirs, storage reservoirs and tanks, water treatment equipment, distribution pipelines, water meters and all other appurtenances which serve to supply the public within a community or built-up area with a source of water suitable for drinking.

"SEWERAGE" - Pipelines and/or appurtenances which serve the public within a community or built-up area with a means of disposing sewage wastes from the properties on which they may reside. This term refers to the means by which sewage wastes are transported to some point removed from the community, or built-up area, for treatment.

"SEWAGE TREATMENT SYSTEMS" - Devices or equipment used for the expressed purpose of removing the organic and pathogenic constituents of sewage, and capable of producing an effluent safe for discharge to a water body, stream or disposal by seepage through soil to subterranean water tables.

"SOLID WASTES DISPOSAL METHODS" - Devices and/or means serving, or utilized by, the citizens of a community, or built-up area, for removal or disposal of garbage, trash, grass and brush clippings from places of residence.

"ENVIRONMENTAL SERVICES" - "Water Supply Systems," "Sewerage," "Sewage Treatment Systems" and "Solid Wastes Disposal Methods" utilized by the citizens of a community, or built-up area to serve public welfare and enhancement, enjoyment or maintenance of the environment in which they reside.

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SECTION I

CHAPTER I. SUMMARY AND RECOMMENDATIONS

A careful examination of existing conditions and coordinated planning for future needs is necessary in order to maintain adequate community water supplies and proper sewage and solid waste disposal facilities. Problems involving the health and general welfare of the communities within Gila County will occur if development of these necessary environmental services does not keep pace with the economic development and population growth of the county.

The following is a summary of the environmental services needs observed in Gila County. Included are general recommendations based on these needs, which may be considered in the preparation of related programs or in the implementation of future plans.

GENERAL

- Exploitation of the mineral and timber resources is forecasted to grow at a steady pace in the next twenty years. The utilization of these resources often results in disfiguration and the loss of aesthetic character in an area. Consideration of the natural environment and possible means of conservation and/or preservation prior to exploitation of these resources would benefit the county.

- Recreational development and activity is undergoing a period of marked growth in Gila County. This has complicated the problem of providing solid wastes disposal services and sewage disposal facilities. Facilities and services available on Forest Service lands appear inadequate for present demands. Planning schedules for needs have not been formulated by management agencies.

- The State of Arizona has no programs to aid in construction of waste treatment and disposal projects. Federal participation in such projects would be increased if there was a grant program on a state level.

- The urban areas of the county are anticipated to increase by 15 percent in the next twenty years. The bulk of this increase will be related to retirement living.

WATER SUPPLY SYSTEMS

- Water resources development in Gila County is of great concern. The promotion of water reuse for industrial or agricultural uses in areas where costs of domestic water is high should be undertaken. This would involve sewage collection, waste treatment and water reclamation systems. The Young and Payson regions of Gila County are in need of new domestic water resources if they are to continue present rate of development.

- The county has approximately 46 public water utilities. Forty-five of these systems are private investor owned with the remaining one being owned and operated by the municipality of Globe. About 75 percent of the systems serve scattered and isolated subdivisions and trailer parks.

- Water services provided by United Utilities Corporation have in recent months had operational deficiencies in the systems serving the Payson area which has resulted in delivery of domestic water having questionable quality.

SEWAGE DISPOSAL SYSTEMS

- A regional sewage collection and waste water treatment facility would be a valuable asset to the developed areas of Miami, Claypool, Central Heights, Globe and environs. Possibilities exist for utilizing the effluent from a treatment facility for industrial purposes provided a sophisticated treatment facility is used.

SOLID WASTES DISPOSAL METHODS

- Solid wastes disposal in the county is carried out through burning at thirteen dumpsites. These facilities are given infrequent inspections and maintenance and are deficient in pest control. There is also a lack of safety equipment for control of fires.

- A coordinated county-wide program for location and development of solid waste disposal sites with routine inspection and maintenance schedules would be a valuable benefit to the county. A survey of existing situations suggests that a plan for centrally located sanitary landfills serving all areas of the county would be highly advantageous in meeting future needs. The present thirteen sumpsites could be consolidated into five major sanitary landfills for the communities of Gila County. Three additional smaller scale sanitary landfills could be operated for the more remote recreational use areas.

CHAPTER II. COUNTY PROFILE

This chapter reviews the general physical and socio-economic aspects of Gila County. The physical structure of the county with respect to physiography and geology are discussed along with natural resources and land use patterns. Natural resources are considered with respect to their supply, quality and accessibility. A discussion of the economy is presented with particular emphasis placed on the relationships of economy to natural resources and development potentials within the county.

Population projections, based on past trends and county development potential, are then utilized in projections of water supplies, sewage and solid wastes management needs in Chapter III.

HISTORICAL BACKGROUND

Gila County was established from portions of Maricopa and Pinal Counties on February 8, 1881. Later, in 1889, the eastern boundaries were extended to the San Carlos River. The County was named after the Gila River which forms part of the southern boundary. Gila County contains approximately 3,040,000 acres with elevations ranging from 2,123 feet at Theodore Roosevelt Dam to 7,155 feet at Mt. Ord which overlooks the Tonto Basin.

The largest community in Gila County is Globe. Globe gained community status in 1875 after the discovery of silver ores in the region. These discoveries were soon depleted and the town might have become a ghost town if two, more extensive, deposits of silver ore had not been discovered in 1878. These deposits later became known as the Silver King Mine, located 20 miles southwest of Globe in Pinal County, and the Stonewall Jackson Mine, 20 miles northwest in the Castle Dome area. Globe and the surrounding area were in a strategic location to benefit from these mines because of a nearby operating smelter and a plentiful supply of water for ore processing. These deposits were finally depleted in 1890. During this period of time deposits of copper were discovered and Globe survived the closing of the silver mines.

PHYSICAL CHARACTERISTICS

Physiography and Geology

Gila County lies within the southeastern segment of the Physiographic Province known as the Transition Zone (FIGURE II-1).

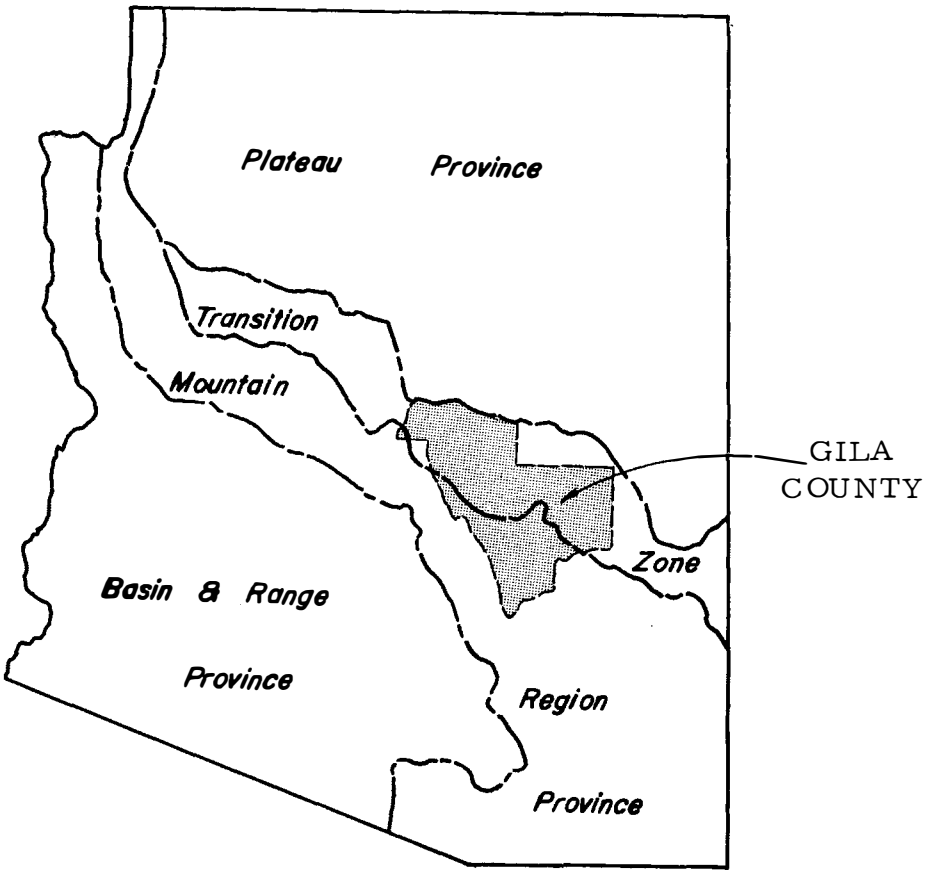


FIGURE II-1. PHYSIOGRAPHIC PROVINCES IN ARIZONA[1]

The land areas contained within Gila County's boundaries were given their character about 60,000,000 years ago. Faulting and erosion occurring at that time affected the region in many places and separated it physiographically from the Plateau and Basin Range Provinces. Headward erosion by the Gila and Salt Rivers and their tributaries has carved many deep canyons or valleys and steep-sided mountains. The mountains that are generally flat-topped or mesa-like are characterized by

sedimentary or volcanic rocks which prevail over most of the region. The more rugged looking mountains are characterized by metamorphic rocks and rolling terrains are generally related to the crystalline rock structures (PLATE 1).

Within the southeastern portion of the transition zone there are two great valleys--the Verde and Tonto which were formed as the result of relative downfaulting plus erosion. The Tonto Valley is primarily related to the Salt River watershed.

Soil characteristics are widely varied within Gila County (PLATE 1). The northwestern portion of the county around the community of Payson is predominantly basalt rock with surface soils containing Montmorillinite clays. These soils crack to the surface during the dry part of the year and expand during the wet season causing a slight uplifting of the land profile.

The soils found in the areas of the San Carlos Reservoir and Theodore Roosevelt Lake have been leached of carbonates in the upper few inches of the profiles with free carbonate usually present within 30 inches of the surface. These soils are found to occupy the narrower valleys and edges of the larger valleys. Most of the areas around the two water bodies mentioned above cannot be leveled satisfactorily for irrigation. The land is used for seasonal grazing, although grasses are severely limited by the lack of water. The remainder of the county consists of soil types formed through rapid geological surface erosion. These soils are further categorized in terms of the temperature regions under which they were generated. The parent materials are granite, schist, sandstone and basalt. The sandstone base soils are found in areas of steep slopes and have low water-holding capacities that hinder vegetative growth.

Vegetation

Vegetation consists of sparse seasonal stands of annual grasses, cacti and desert shrubs in the lower elevations.

PLATE 1 also illustrates the distribution of vegetative types found in Gila County. The forest regions are divided into three types: (1) the Douglas Fir-Ponderosa Pine which includes all species of fir, spruce and pine with the exception of pinon, (2) the pinon-juniper, and (3) the chaparral.[2]

The grasslands are also divided into three types: (1) the short grass (plains grassland), (2) desert grass (mesquite grass), and (3) the mountain meadow (alpine grasslands).

Climate

Climatic conditions in Gila County vary from subtropical in the steppe regions to microthermal snow forest in the highlands in the Rim Country. Rainfall varies from 15 inches per year in the southern portion of the county to as much as 25 inches per year in the Sierra Ancha Mountains (elevation of 5,100 feet). Monthly mean temperatures range from 72.6°F to 86.2°F in July. January monthly mean temperatures range from 36.0°F to 44.4°F. These temperatures are representative of both watershed sub-basins. The Tonto Basin portion of the Salt River sub-basin exhibits the highest estimated mean relative humidity within the county. Climatological data for the months of January and July are indicated in TABLE II-1 for various areas in Gila County.

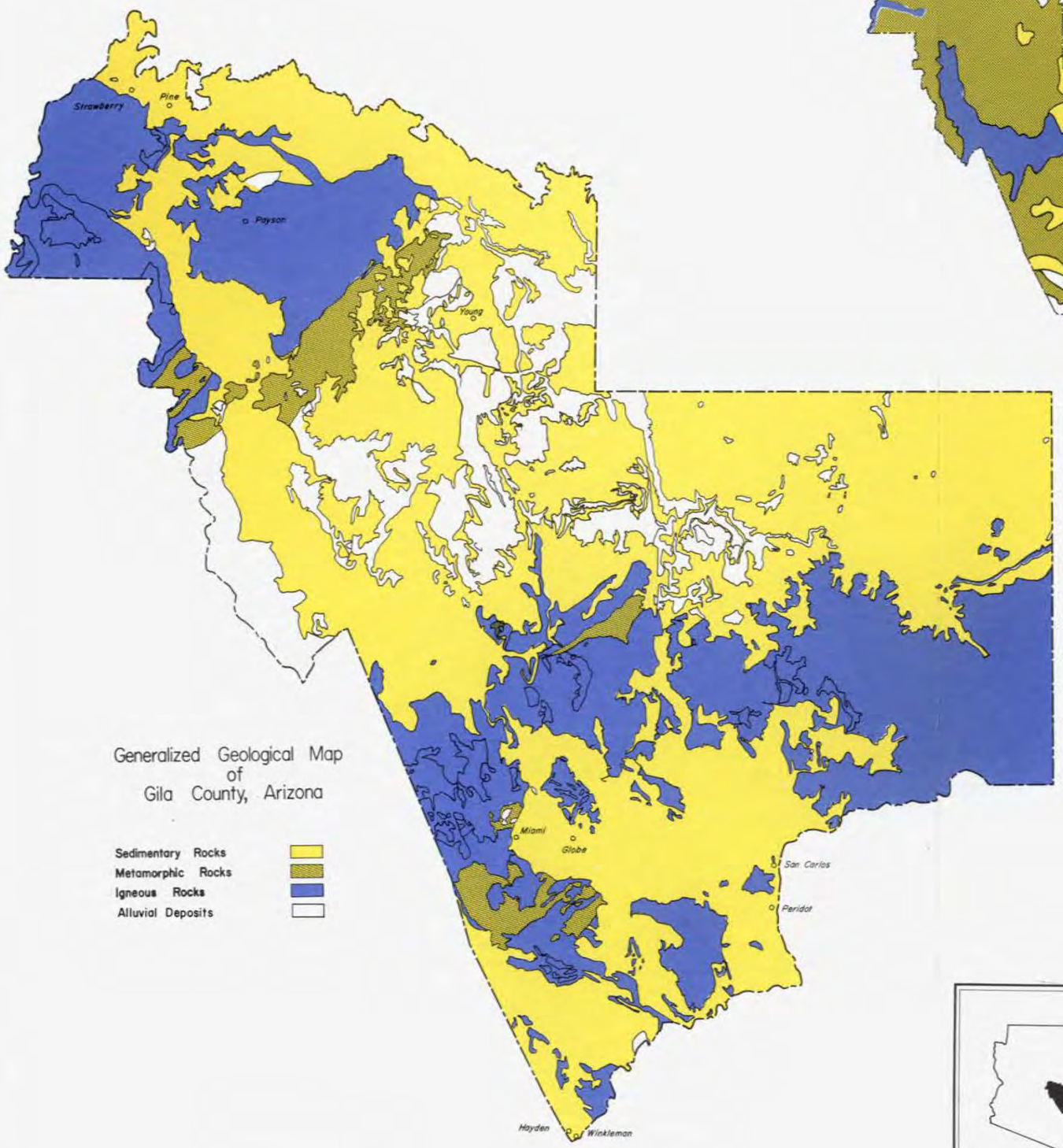
Approximately 48 percent of total percipitation falls in the transition zone during the months of May and October. The Mogollon Rim Country, forming the northern boundary of Gila County, receives an average snow fall of 23 inches during the winter months, accounting for about one-fourth of the winter precipitation for this portion of the Salt River Watershed.

Average annual lake evaporation rates in Gila County vary from 62-66 inches per year. The higher value can generally be applied to the Salt River sub-basin while the Upper Gila River sub-basin trends towards the lower value.

NATURAL RESOURCES

Minerals

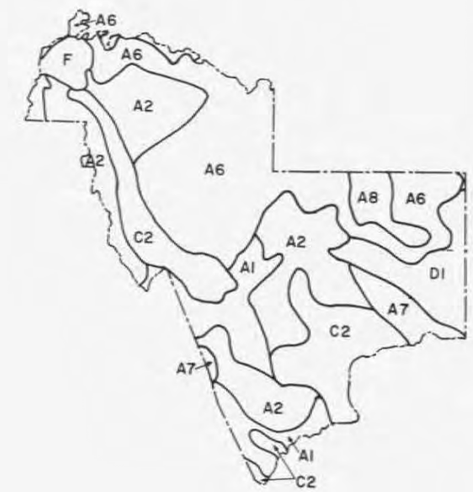
A large portion of the mineral related ores found in Gila County are present, at least in trace amounts, beneath every sort of terrain. Various kinds of mineral deposits can be expected in different geologic environments and this is strikingly displayed in Gila County. PLATE 2 depicts the areas of (1) known metallic mineral occurrences; (2) known non-ferrous base and precious metals mineral occurrences; and (3) known non-metallic mineral occurrences. In terms of presently exploitable minerals, Gila County and the watersheds it occupies are heavily mined regions of Arizona.



Generalized Geological Map
of
Gila County, Arizona

- Sedimentary Rocks
- Metamorphic Rocks
- Igneous Rocks
- Alluvial Deposits

Generalized Vegetation Map Of
Gila County, Arizona



Generalized Soils Map Of
Gila County, Arizona

A1: Shallow soils on granite and schist parent rock in the thermic region.
A2: Shallow soils on granite and schist parent rock in the mesic region.
A6: Soils on sandstone parent material in the mesic region.
A7: Shallow soils on basalt parent rock in the mesic region.
A8: Soils on Tertiary and Quaternary sands in the mesic region.
C2: Developed soils from acid igneous alluvium on gently rolling to hilly topography.
D1: Developed soils from basalt parent material.
F: Swelling and cracking clayey soils.

ENVIRONMENTAL SERVICES NEEDS STUDY

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GILA COUNTY, ARIZONA

GEOLOGIC, VEGETATION, AND SOIL TYPES

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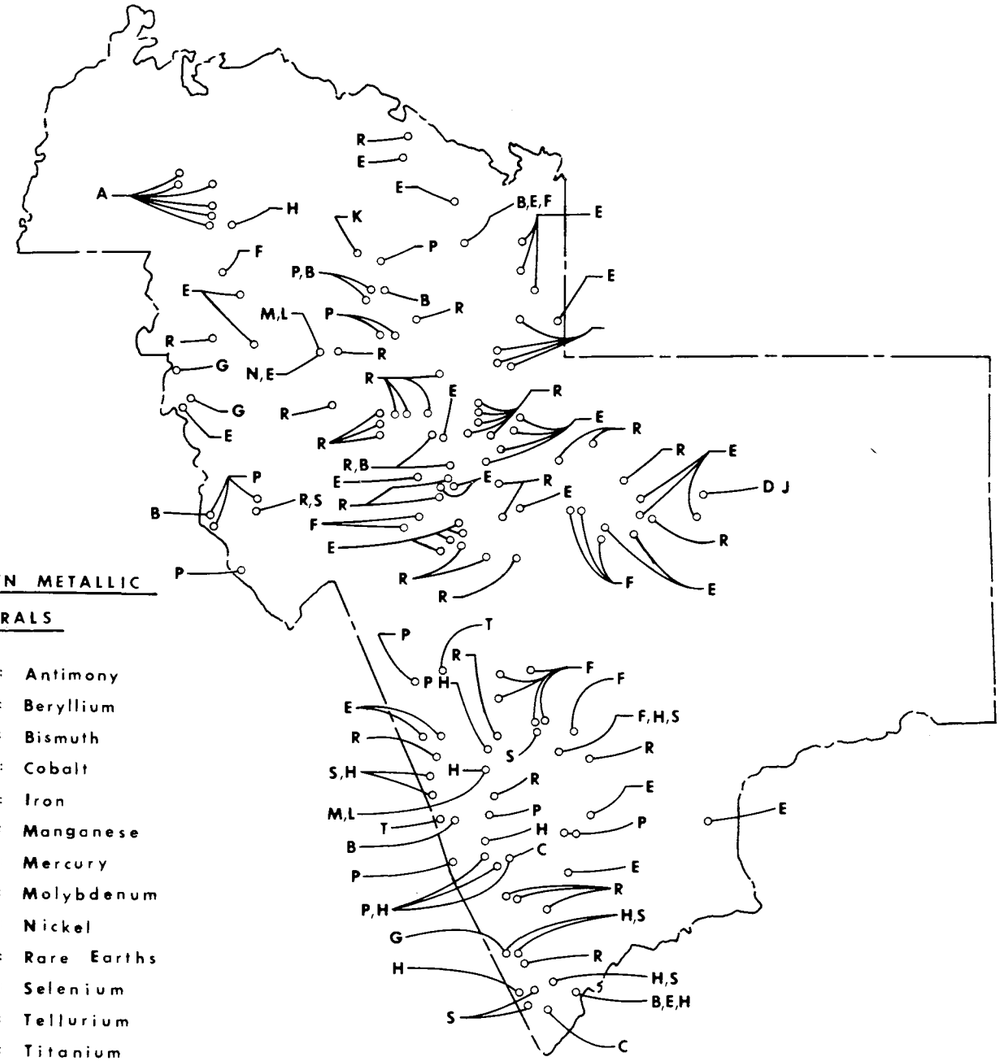
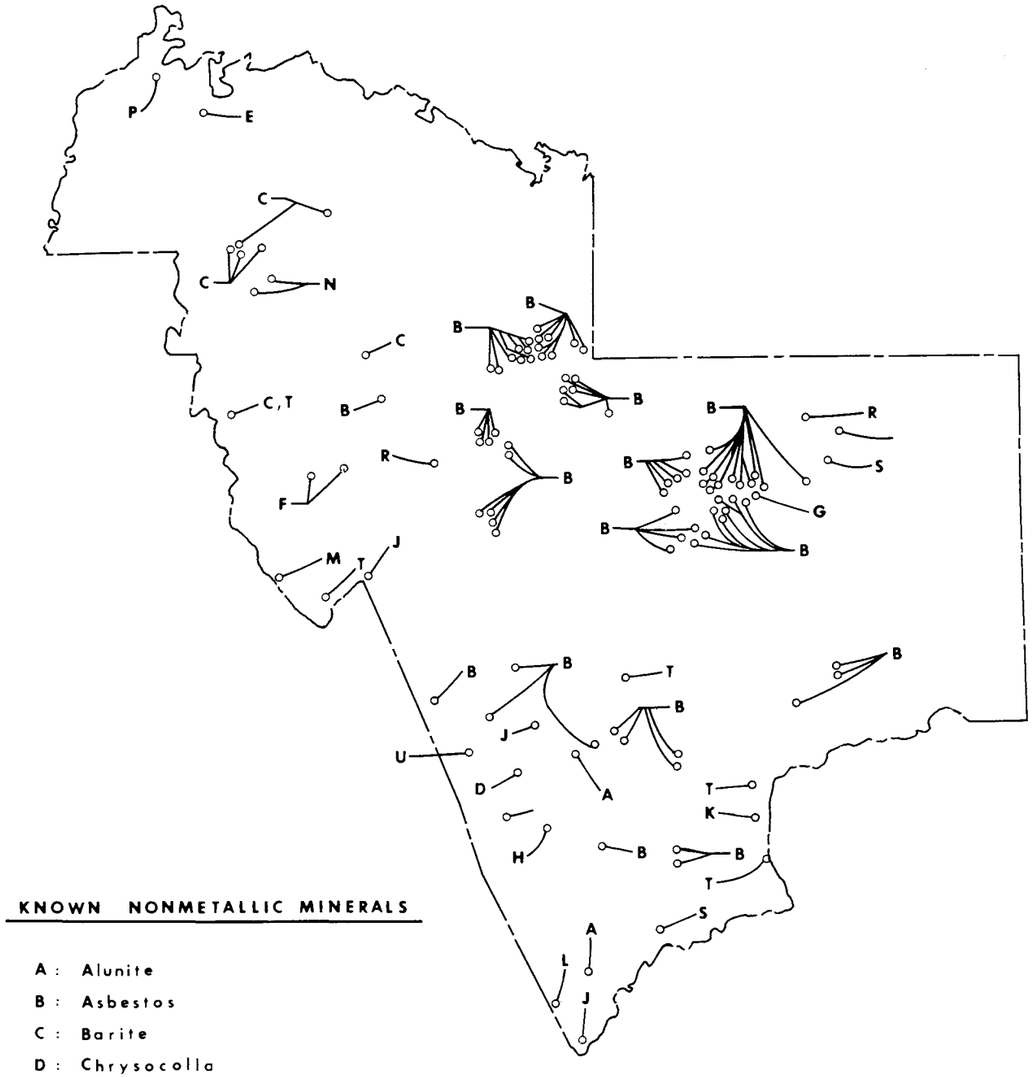
PLATE 1



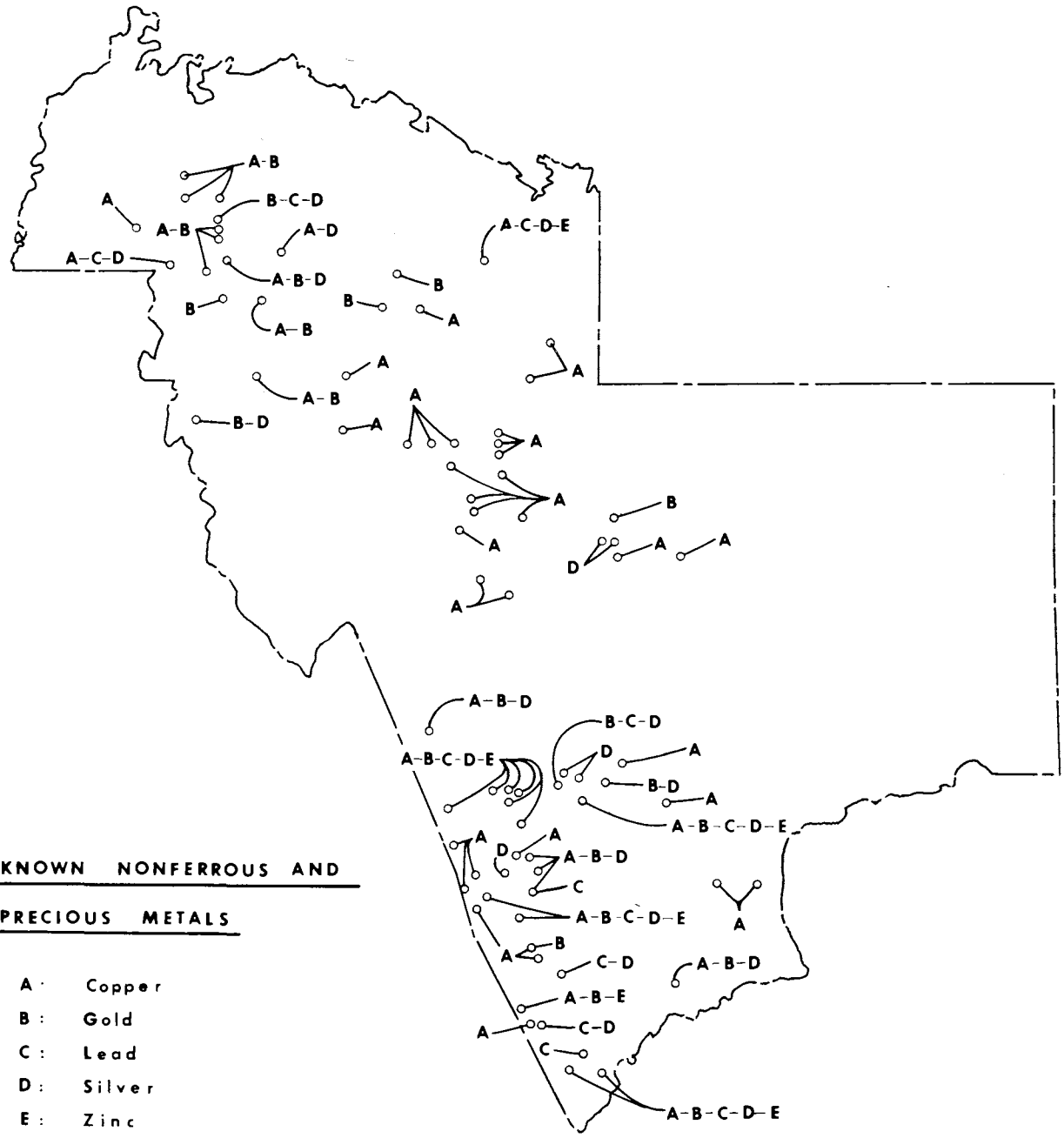
KNOWN METALLIC MINERALS

- A : Antimony
- B : Beryllium
- C : Bismuth
- D : Cobalt
- E : Iron
- F : Manganese
- G : Mercury
- H : Molybdenum
- J : Nickel
- K : Rare Earths
- L : Selenium
- M : Tellurium
- N : Titanium
- P : Tungsten
- R : Uranium
- S : Vanadium
- T : Zirconium



KNOWN NONMETALLIC MINERALS

- A : Alunite
- B : Asbestos
- C : Barite
- D : Chrysocolla
- E : Clays
- F : Fluorspar
- G : Halite
- H : Kyanite
  Andalusite
  Sillimanite
- J : Limestone
- K : Olivine
- L : Perlite
- M : Quartz
- N : Sand, Gravel, Crushed Rock
- P : Sandstone
- R : Slate
- S : Thermal Spring
- T : Tuff
- U : Turquoise



KNOWN NONFERROUS AND PRECIOUS METALS

A : Copper
B : Gold
C : Lead
D : Silver
E : Zinc

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GILA COUNTY, ARIZONA

MINERAL AND METAL RESOURCES

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PLATE 2

TABLE II-1

CLIMATOLOGICAL CHARACTERISTICS
OF GILA COUNTY*

Location	Elevation Above Sea Level (feet)	Yearly Mean Precipitation (inches)	Monthly Mean Temperature Jan/July (°F)	Estimated Mean Relative Humidity 0600 & 1800 MST Jan/July (percent)
Tonto Natural Bridge	4607	24.20	36.0/76.5	62-53/54-40
Payson	4848	21.48	36.0/72.6	69-52/60-39
Young	5050	21.53	38.4/79.2	67-43/61-30
Reno Ranger Station	2350	18.73	44.8/86.2	63-48/50-34
Sierra Ancha	5100	24.98	42.5/78.1	59-52/55-42
Globe	3540	15.75	43.9/82.5	61-50/59-42
Miami	3603	18.98	44.4/83.6	61-52/55-42

*Source: Arizona Climate, University of Arizona Press, 1964.

Copper mining and the related production of copper, silver, gold, zinc, and molybdenum has been the basic form of mineral resources utilization. Through the years there have been technological changes related to the processing of the copper ores. Many mines have been depleted of their high grade ore deposits and require the use of different mining techniques. One example is that of leaching of low-grade copper ore with acid which produces high grade (usually exceeding 65 percent) copper concentrates.

Exploitation of mineral resources influences (1) water use; (2) liquid waste production; (3) solid wastes production; (4) land use patterns; and (5) socio-economic aspects of local communities of the county.

Timber

Arizona has a total of 3,180,000 acres of commercial forest land, 69 percent of which is in federal ownership, principally National Forests.

The remaining 31 percent is made up of state, municipal, private and Indian lands. PLATE 3 shows the distribution of these commercial forest lands within Gila County and the Salt River sub-basin. These areas are primarily Ponderosa Pine with all commercial activity related to the production of sawmill lumber and pulpwood. Major lumber cutting occurs north of Payson and in the Pleasant Valley region of the county. In 1963 these areas yielded a record 18,500,000 board feet of saw timber and pulpwood. In 1969 saw timber and pulpwood harvested were 5,860,000 and 8,108,000 board feet respectively. 1970 yields of saw timber and pulpwood will be approximately 8,212,000 and 6,268,000 board feet respectively.

Future harvesting of timber reserves is virtually assured in these areas through selective cutting and the generation of evenage stands. A cutting rotation in the commercial lumbering districts is maintained over a twenty-year period. Mature and over-mature saw timber is cut prior to pulpwood sales and pre-commercial thinning resulting in the improvement of timber stands. This gradual cycle guarantees a sustained yield of product materials.

Water Resources

The availability of water in any particular region depends on climate, terrain and geology. These are factors that control the occurrence of water and the manner in which it enters, moves through and leaves an area. The occurrence of surface water primarily depends upon the terrain and geology of an area as characterized by the type, distribution and structure of rock and soils.

Gila County is located in the Central Highlands Province of Arizona's water regions. This province is essentially the same region as the transition region in FIGURE II-1. The Central Highlands Province consists principally of rugged mountain ranges which are considerably higher than the adjoining valleys of the lower province but generally lower than the high mesas in the northern province. The most outstanding feature of this region is the Mogollon Rim which approximates the groundwater and the surface water divide between the Little Colorado and Salt River drainage systems. At the base of the Rim within Gila County there are many springs issuing from the geologic formation called Coconino Sandstone.[3]

The Central Highlands Province receives the greatest amounts of precipitation. The regions of this province defined by the northern reaches of the Salt River sub-basin and the boundaries of Gila County,

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COMMERCIAL FOREST ZONES

GILA COUNTY

N

PLATE 3

receive an average annual precipitation of twenty-five inches. The Sierra Ancha Mountains, more centrally located in the County, receive the same average annual rainfall. That area of the county found within the Upper Gila River sub-basin receives an average annual precipitation of fifteen inches. Although most of this precipitation falls in late summer and mid-winter, perennial stream flow is maintained in many places. The Salt, East Verde, and San Carlos Rivers have flows derived primarily from this precipitation.

The areas of the Salt River sub-basin and Upper Gila sub-basin in Gila County are approximately 2,414,000 acres (3,769 square miles), and 626,000 acres (978 square miles) respectively. Assuming for the Salt River sub-basin an average annual precipitation of 24 inches and for the Upper Gila sub-basin an average annual precipitation of 15 inches, it is estimated that together these regions receive 5,606,500 acre-feet of precipitation each year. Looking at surface water run-off for these regions of the county, average yearly flow discharges are 550,500 acre-feet for the Salt River and 34,820 acre-feet for the Gila River. This indicates that an average of approximately 11 percent of the precipitation ends up as stream flow for the Salt River drainage basin of the county. For the Upper Gila region of the county approximately four and one-half percent results in surface water flow. The vast quantity of precipitation that does not find its way to water courses is made unavailable through evaporation, transpiration by vegetation or conductance to ground water reservoirs.

It is estimated that one percent of the total annual precipitation contributes to groundwater recharge. Using the above figures, approximately 48,240 acre-feet of water within Salt River drainage and 7,825 acre-feet of water in the Upper Gila drainage of Gila County enters groundwater reservoirs. These figures, along with drainage discharge figures for surface waters in the Salt and Upper Gila sub-basins, indicate that approximately 600,000 acre-feet and 43,000 acre-feet of water for these two regions may be available for use. The remaining quantity of precipitation, 87 percent in Salt River drainage region and 94 percent in Upper Gila drainage region of the county, is lost by evaporation and transpiration. FIGURE II-2 illustrates the generalized hydrologic movement of water in Gila County for the two sub-basin regions.

Gila County has two major storage reservoirs, Roosevelt Lake, with a maximum storage capacity of 1,382,000 acre-feet and surface area of 17,315 acres and San Carlos Reservoir with maximum storage capacity of 1,205,000 acre-feet and surface area of 18,845 acres. Along with these reservoirs there are numerous impoundments varying in size from 1 to 250 acres of surface area throughout the county. The majority

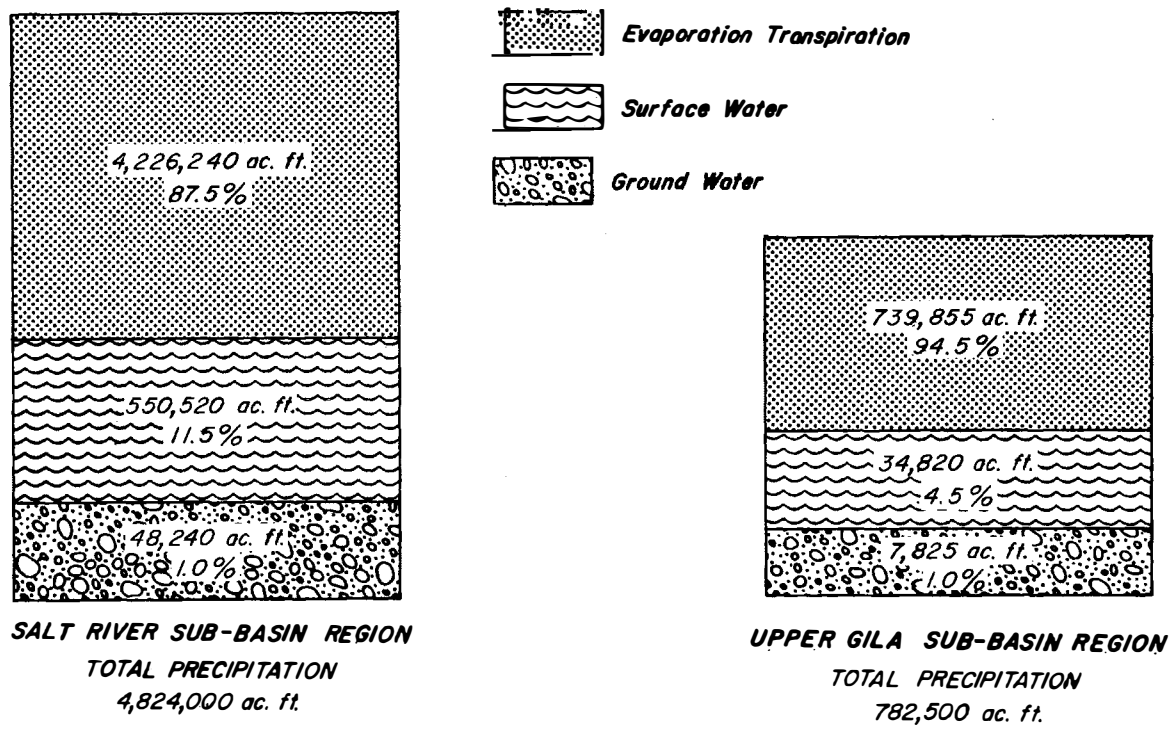


FIGURE II-2. GENERALIZED HYDROLOGIC MOVEMENT OF WATER IN THE SUB-BASINS FORMING GILA COUNTY

of these are on the San Carlos and Fort Apache Indian Reservations and involve approximately 526 surface acres of impoundments. Total maximum surface acreage for all impoundments in the county is approximately 36,690 acres with an average annual surface acreage of 10,850 acres. Considering evaporation as a major form of water loss and assuming an average annual lake evaporation rate of 60 inches, roughly 55,000 acre-feet of water is lost yearly from the reservoirs in Gila County. The major losses occur from the reservoirs of Roosevelt and San Carlos.

Groundwater is basically a transitory phase of the hydrologic cycle. The rates of percolation and quantity of water available in an underground reservoir are dependent upon the rock materials underlying a region. The subsurface reservoirs can be confined or unconfined depending on the geologic profiles. For the most part Gila County is comprised of consolidated rock formations with isolated alluvial deposits lying in the following areas: eastern side of Mazatal Mountains in the vicinity of Rye and Jakes Corner; Roosevelt Lake Basin; and the southern region of the county northwest of Hayden-Winkelman. The occurrence of groundwater is also related to the structural attitude of the geologic

formations, the configuration of the mountains and valleys and to the consolidation of deposits in the alluvial valleys. For Gila County, in general, the mountains and much of the area adjoining the Mogollon Rim consists of hard, dense igneous rocks and consolidated sedimentary rocks which contain little space for water storage. In places along the Rim, fractures provide open spaces for the accumulation of groundwater, and many springs issue from them. The valleys where alluvial deposits occur can hold large quantities of water, although topography is such that these waters are often discharged to the streams draining to the Salt and Gila Rivers. The groundwater that is stored in these deposits yields sufficient water to irrigation wells in terms of present-day demands.

Total quantity of water within the groundwater basin of Gila County is not directly available. The subsurface areas of the county have not been accurately delineated and therefore computation of the amount of groundwater available from storage is not feasible. The Verde Valley region northwest of Pine in Yavapai County is estimated to have 5.0 million acre-feet of stored water.[3]

Potential well production in 1969 for selected areas of Gila County can be found in TABLE II-2. Most of the county wells are capable of producing at least 10 gallons per minute.[4] Water quality records for selected wells used for domestic purposes in Gila County are summarized in TABLE II-3.

Primarily all water used within Gila County is domestic or industrially orientated with a very small quantity being used agriculturally. Domestic water demands will be discussed in another section for the respective communities that are a part of this study. Industrial users of water are principally those that are related to the copper mining and processing industries. The copper interests have extensive property holdings throughout the county. Along with these holdings go water rights that have been sufficient in the past to insure an adequate reserve of water for their activities. Recent explorations and trading of water in different basins removed from the areas of copper mining have been carried out to insure future supplies of water. Other future municipal and industrial water needs within the county will be met by developing authorized multi-purpose projects and groundwater reserves. Augmentation through sources outside of the county, desalination of brackish supplies and utilization of municipal waste treatment plant's effluents. Future livestock water needs will be met by groundwater and some sources of surface water.

TABLE II-2

POTENTIAL WELL PRODUCTION AND DEPTH TO WATER, 1969 FOR GILA COUNTY, ARIZONA

Location	Well Potential, gpm	Static Water Level, ft.
Hayden-Winkelman	50 → 2500* 1000 (CP)**	16 - 86
Globe	10 → 500 100 (CP)	7 - 10
Miami	50 → 2500 1000 (CP)	30
Payson	0 → 50 10 (CP)	--
Young	0 → 50 10(CP)	65
San Carlos	10 → 500 100(CP)	35
Roosevelt	10 → 500 100 (CP)	--

*Indicates well potential, i.e. 50 to 2500 gallons per minute or more.
**Most wells in area capable of producing indicated capacity.

Source: Annual Report on Ground Water in Arizona, U.S. Geological Survey, Spring 1968 to Spring 1969.

LAND OWNERSHIP AND LAND USE

The classification and inventorying of land uses and patterns of settlement will provide information defining the utilization of ground space as it reflects the spatial interrelationships of social and economic activities.

The land use described in this report will be in the broadest of terms in order not to impose a rigid framework upon local planners. The objective of this section is to provide a descriptive inventory of present and projected land uses within Gila County which then will be used in evaluating the water supply, sewage and solid waste disposal systems.

TABLE II-3

WATER QUALITY FOR SELECTED
DOMESTIC WELLS - GILA COUNTY

Location C TS RE Sec	Depth	Static level	Ca	Mg	Na	Cl	SO_4	HCO_3	CO_3	F
A (1-15)	155	28	193	9	55	30	474	125	0	.6
A (1-15) 20	152	27	201	41	32	55	452	161	0	.6
A (1-15)20caa	153	130	162	31	26	24	446	91	0	.4
A (1-15)22acr	588	315	30	14	43	16	18	230	0	.4
A (1-15)22dcd	400	235	33	15	42	20	10	236	0	.4
A (1-15)23cdd	800	610	41	11	35	16	14	226	0	.4
A (1-15)30acd	97	60	133	31	29	24	388	48	0	.6
A (1-15)30ccd	68	60	160	51	16	30	484	97	0	.8
A (1-15)31	140	50	47	12	26	24	26	200	0	.3
A (5-18)08			85	25	644	972	85	256	0	.6
A(6-22)20ccc	60		227	52	14	12	490	332	0	1.0
A(1-15)11cad	140	50	100	19	40	36	76	328	0	.4

Source: "The Quality of Arizona's Domestic Agricultural and Industrial Waters," Report 256, Agricultural Experiment Station, The University of Arizona, 1970.

LAND OWNERSHIP

Gila County has a total land area of 4,747 square miles (3,064,000 acres). The Tonto National Forest occupies 55 percent of this land area and various other federal agencies own another three percent. Indian reservations encompass 38 percent of the county. The State controls one percent leaving the remaining three percent (103,000 acres) available for private development (TABLE II-4).

Land ownership is of considerable importance in planning for future water systems, sewage and solid waste disposal needs, since most land use development takes place on privately owned land. This is emphasized by the fact that only three percent of Gila County's land is private. Privately owned land is concentrated within two areas (PLATE 4). The most populated is the rectangular tract in the center of the county. This area contains the towns of Maimi, Globe, and several unincorporated communities.

TABLE II-4

LAND OWNERSHIP IN GILA COUNTY - 1970

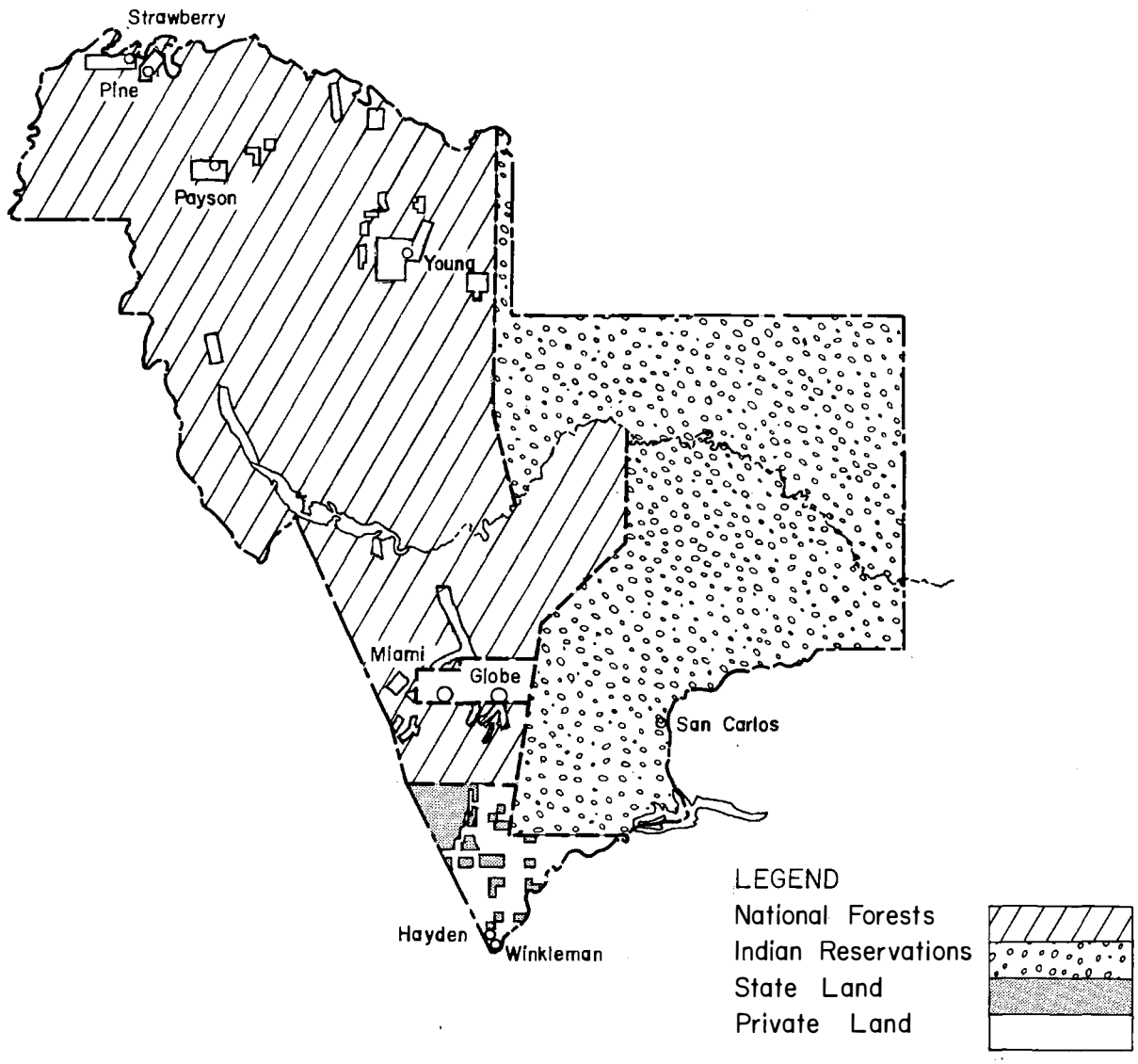
Gila County - Total		3,064,000[1] acres
Tonto National Forest (Net)		1,677,000 acres
Indian Reservations		1,164,000 acres
Other Federal Lands		89,000 acres
State of Arizona		30,000 acres
Privately Owned Lands		
Residential	2,250 acres	
Commercial	300 acres	
Industrial	200 acres	
Mining	4,400 acres	
Public & Quasi-Public	26,000 acres	
Ranch & Farm	50,000 acres	
Undeveloped Land	20,000 acres	
Total Private Land	103,150 acres	

[1]Totals will not add up due to rounding

Sources: Arizona County Statistics, Agriculture Extension Service
Arizona State Land Department
Preliminary Land Use Report Gila County, A.E. Ferguson and Associates, Inc.
Assessment Rolls, Arizona Department of Property Valuation.

The second concentration of private land is the triangle formed by the southern half of the county. The area is bounded on the north by the Tonto National Forest and the San Carlos Apache Indian Reservation and on the south by the county boundary. This area is the largest in size and contains the towns of Hayden and Winkelman.

The remaining private land is located in the areas of Payson, Pine, Strawberry and Young, with a large number of small individual parcels being scattered throughout the national forest lands.



ENVIRONMENTAL SERVICES NEEDS STUDY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

LAND OWNERSHIP

GILA COUNTY

N

PLATE 4

LAND USE

Present Land Use Patterns

Of the 3,064,000 acres within Gila County approximately 83,150 acres are developed (PLATE 4). The largest usage is farming and ranching (50,000 acres). There is very little crop farming with most of the land in this classification being used for livestock grazing. In addition there are large amounts of public land being leased for these activities which do not show in the above acreage figure (PLATE 5).

Mining makes up 5.3 percent of the developed private land. The mines, smelters and concentrators utilize a small amount of this land. The largest portion of the mining classified land is used for the dumping of tailings. In addition to the private land being used for this state land is also leased for the disposal of tailings and mine wastes.

Urban land uses are concentrated in the Payson-Pine-Strawberry-Miami-Globe and the Hayden-Winkelman areas. The communities in the southern portion of the county are mining oriented. The industrial and commercial land uses are either in direct or indirect support of the mining activities.

The communities in the northern portion of the county depend upon ranching and lumbering, but more recently recreation and tourism have become prominent sectors of their economies. This has encouraged many homestead farmers and small ranchers to subdivide their tracts for summer and retirement homesites.

Federal land is essentially undeveloped; its value as natural habitats and as recreation lands has been realized and is protected in some areas by strict land use administration. There have been many legal intrusions onto federal lands by mining and ranching interests which have endangered many of these natural areas.

Projected Land Use Patterns

The land use patterns of Gila County are influenced by two economic activities (PLATE 6). The future growth of the southern portion of the county is directly related to the mining industry. Recent developments on mineral bearing lands could result in extensive changes being made to the landscape, especially in the disposal of waste material (tailings and overburden).

The northeastern region of the county is beginning to actively develop its tourism and recreation potentials. Many of the original homesteads are being subdivided and sold as small summer home lots. Development in the Payson, Pine and Strawberry areas has occurred at a very rapid pace. This form of development is expected to continue for at least twenty years, with slower rates of growth occurring in those areas where access is limited.

In order to facilitate the orderly development of populated areas within National Forests, the U.S. Forest Service has engaged in a land exchange program whereby privately owned land in wilderness and natural habitat areas may be exchanged for federal land in urban developed areas. Land is exchanged on a dollar value rather than on an acreage basis. This program is being actively used in the Payson, Pine, Strawberry and Young areas.

Individual subdivision development in rural areas will increase as the demand for recreational living areas increases. The northern area of the county and the northwestern end of Roosevelt Lake are the major areas of this type of subdividing activity.

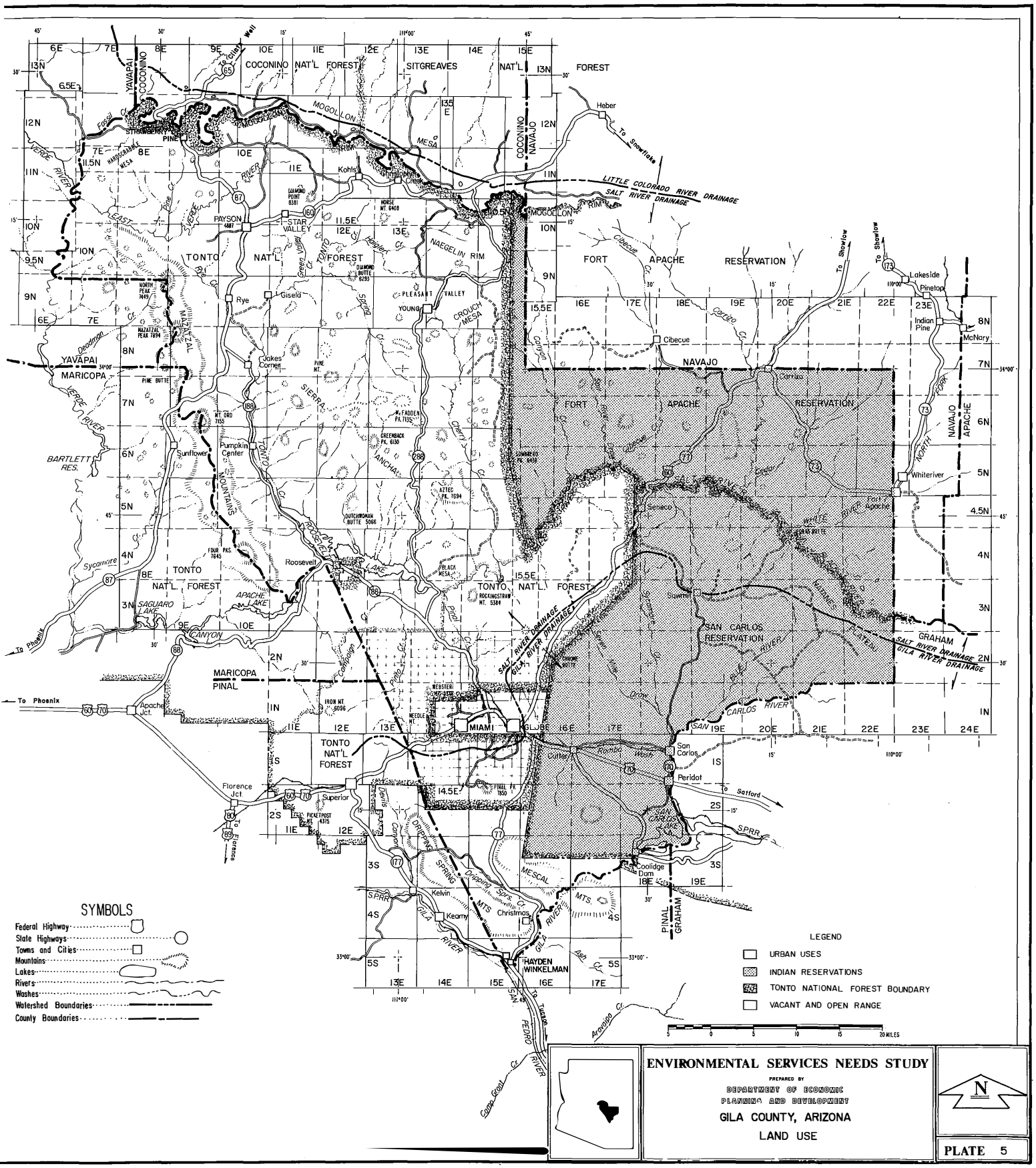
Indian Reservations within the county have in the last few years launched into various active programs of economic development. This development in Gila County has been associated with the recreational development of San Carlos and Seneca Lakes, and a small lumbering operation.

Recreation

The Arizona Outdoor Recreation Coordinating Commission has defined demand for outdoor recreation as "the desire of people to participate in various forms of outdoor recreation activity." It is related to social and physical factors such as climate and the mobility and size of the population. In addition it should be recognized that demand is usually limited and equal to the capacity of existing facilities.

With respect to the National Forests it is estimated that about 14 percent of the outdoor recreational experience of the state is derived in Gila County (TABLE II-5).

Tonto National Forest encompasses 55.2 percent of the total land area and most of the major outdoor recreation attractions located in the county (PLATE 7, TABLE II-6).



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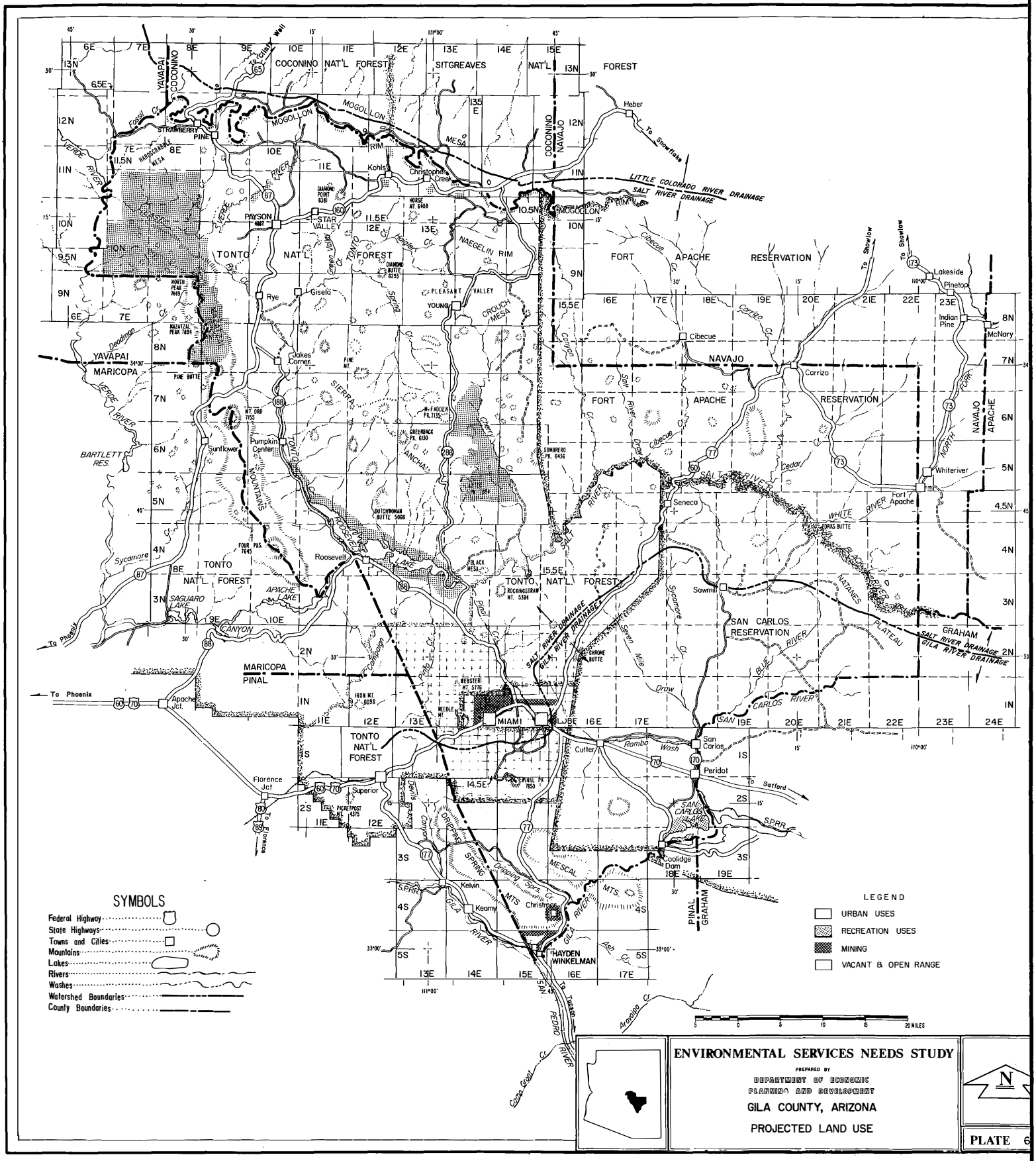
GILA COUNTY, ARIZONA

LAND USE

PLATE 5


COCONINO NAT'L FOREST
SITGREAVES NAT'L FOREST
TONTO NAT'L FOREST
FORT APACHE RESERVATION
SAN CARLOS RESERVATION
YAVAPAI
MARICOPA
PINAL
GRAHAM
NAVAJO
APACHE
LITTLE COLORADO RIVER DRAINAGE
SALT RIVER DRAINAGE
GILA RIVER DRAINAGE
MOGOLLON RIM
Heber
Kohls
Christopher Creek
PAYSON
STAR VALLEY
Rye
Gisela
PLEASANT VALLEY
YOUNG
Jakes Corner
Pumpkin Center
Sunflower
Roosevelt
APACHE LAKE
SAGUARO LAKE
BARTLETT RES.
Cibecue
Carrizo
Lakeside
Pinetop
Indian Pine
McNary
Whiteriver
Fort Apache
Seneca
Sawmill
San Carlos
Peridot
Coolidge Dam
SAN CARLOS LAKE
MIAMI
GLOBE
Cutter
Superior
Florence Jct
Apache Jct
Kelvin
Kearny
Christmas
HAYDEN
WINKELMAN
To Phoenix
To Snowflake
To Show Low
To Safford
SYMBOLS
Federal Highway
State Highways
Towns and Cities
Mountains
Lakes
Rivers
Washes
Watershed Boundaries
County Boundaries
LEGEND
URBAN USES
RECREATION USES
MINING
VACANT & OPEN RANGE
5 0 5 10 15 20 MILES
ENVIRONMENTAL SERVICES NEEDS STUDY
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GILA COUNTY, ARIZONA
PROJECTED LAND USE
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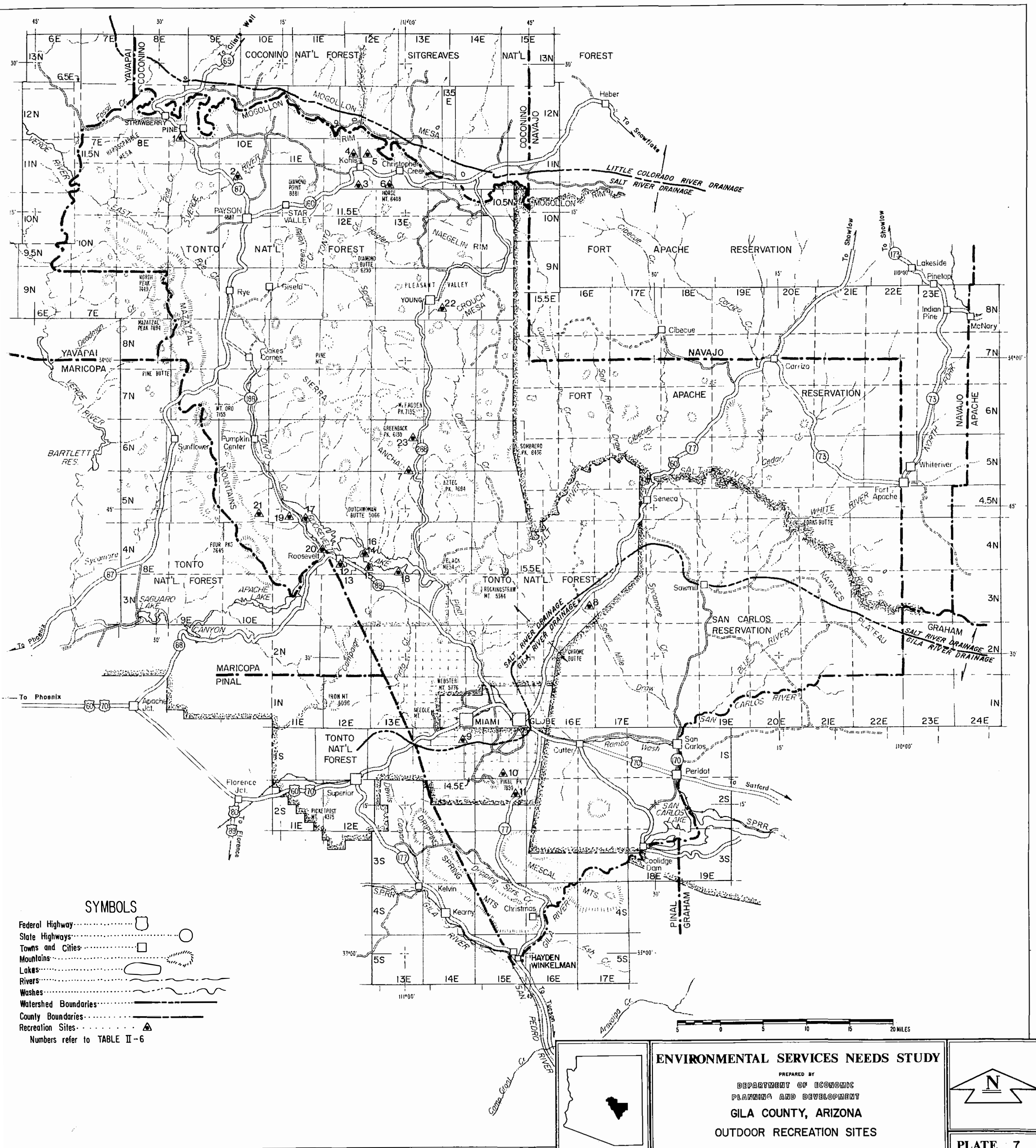
PLATE 6



ENVIRONMENTAL SERVICES NEEDS STUDY

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GILA COUNTY, ARIZONA

OUTDOOR RECREATION SITES

PLATE 7

TABLE II-5

COUNTY RECREATION COMPARISONS IN ARIZONA

County	Visitor-days* Total	Percent of Total
Apache	583.3	8.6
Cochise	229.1	3.3
Coconino	1,991.1	29.4
Gila	968.1	14.2
Graham	75.3	1.1
Greenlee	113.5	1.6
Maricopa	1,001.2	14.7
Mohave	1.8	.0
Navajo	186.5	2.7
Pima	616.5	9.1
Pinal	82.7	1.2
Santa Cruz	164.9	2.4
Yavapai	757.1	11.1
STATE TOTAL	6,771.1	99.9

*Visitor days is defined as one person participating in one activity for twelve hours or twelve people participating in the same activity for one hour.

Source: U.S. Forest Service, RIM Information.

Recreation demands on Forest Service lands within Gila County appear to be correlated with population growth in Maricopa County, and in particular to the Phoenix Metropolitan Area. Approximately three-fourths of the trips originating in other counties with destinations in Gila County were from Maricopa County.[18] The purpose of the trips were observed to be approximately eighty percent for recreation purposes during the summer months.

Highway travel data tied to recreation visitor day usage (VDU) made available by the Forest Service generates an equation which predicts VDU recreation demands related to the population of Maricopa County with a correlation factor of 0.977 (SD = 0.02). This equation is based on three years of data and is used to predict the demands on recreation areas, in terms of visitors days of use, for the county in years of 1975, 1980 and 1990. (FIGURE II-3).

TABLE II-6

RECREATION SITES IN TONTO NATIONAL FOREST
GILA COUNTY

Map No.	Site Name	Camping	Picnicking	Hunting	Fishing	Boating	Drink. Water	Devel. Units
1.	Pine	X	X	X	X		X	9
2.	Sycamore	X	X	X	X			8
3.	Ponderosa	X	X	X	X		X	16
4.	Tonto Creek	X	X	X	X		X	35
5.	Horton Creek	X	X	X	X		X	4
6.	Christopher Creek	X	X	X	X		X	44
7.	Rose Creek	X	X	X	X		X	5
8.	Jones Water	X	X	X				13
9.	Warnica Spring		X	X			X	8
10.	Pinal	X	X	X			X	22
11.	Pioneer Pass	X	X	X			X	27
12.	Roosevelt	X	X	X	X			4
13.	Roosevelt Marina (private)				X	X	X	
	The Following are Undeveloped Recreation Areas:							
14.	Porter Springs	X		X	X	X		
15.	Schoolhouse Point	X		X	X	X		
16.	Windy Hill	X		X	X	X		
17.	Carson's Landing				X	X		
18.	Grapevine	X	X	X	X			2
19.	Horse Pasture	X	X	X	X			
20.	Hotel Point	X	X	X	X			5
21.	Pigeon Springs	X	X	X				2
22.	Pleasant Valley	X	X	X				1
23.	Reynolds Creek	X	X	X	X			

Source: U.S. Forest Service Calendar Year 1969.

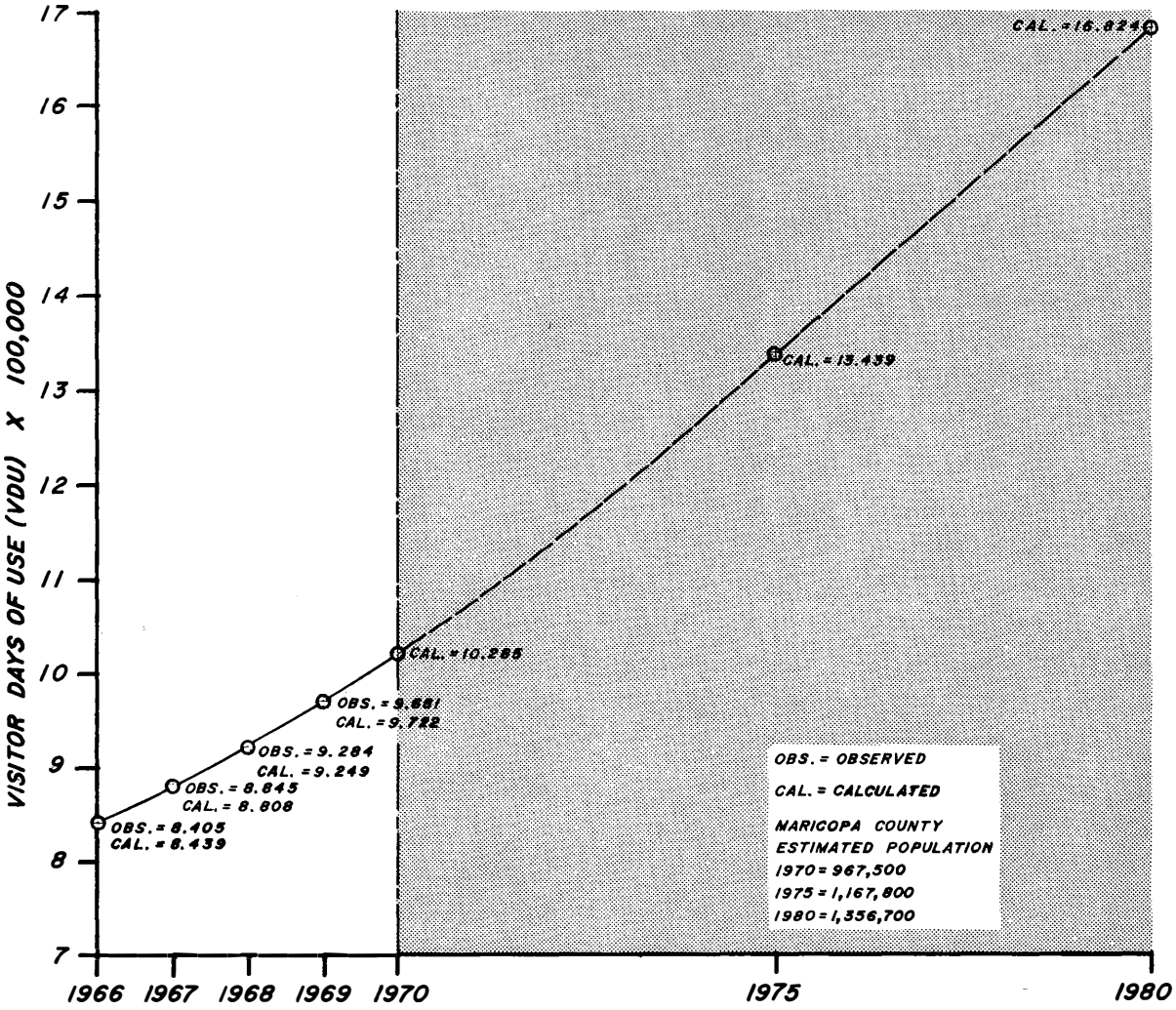


FIGURE II-3. OUTDOOR RECREATION PARTICIPATION (VDU) PROJECTION FOR TONTO NATIONAL FOREST (GILA COUNTY) BASED ON POPULATION OF MARICOPA COUNTY

Source: Tonto National Forest
Department of Economic Planning & Development
Arizona Employment Security Commission, UC Division
U.S. Bureau of the Census

Increasing levels of VDU will promote the development of new recreation sites and the modification of existing sites in Gila County. The predicted increases serve to point out the need for coordinated outdoor recreation planning on the county level of government. A uniform method of reporting use and projecting future outdoor recreation participation is needed. In addition, more work must be done in the areas concerning the types of activities which receive the heaviest participation and what impact each of these outdoor recreation activities have on the environment, before adequate environmental systems (water, sewer, solid waste) can be designed to preserve the landscape and corresponding ecological balances.

ECONOMY OF GILA COUNTY

In order to make projections of future water requirements and plans for sewage and solid waste management, it is essential to have growth and locational information on both the population and industry in the county.

It is the purpose of this section to present the pertinent socio-economic information available on Gila County. Each industry is examined individually including past trends in employment, labor earnings and unique factors which may affect development. Then the demographic characteristics of the county are presented and the population is projected through 1990.

Employment, Industry Analysis, Labor Earnings

Gila County had a civilian work force averaging 11,250 persons during 1970. Annual average employment was estimated to be 10,825. This results in a 3.7 percent unemployment rate, slightly lower than the state rate of 4.1 percent. TABLE II-7 which presents Gila County's labor force and employment by broad industry group for 1967 through 1970, shows mining, manufacturing, and government as the larges employers. A longer range indication of the importance of the various sectors of Gila's economy is given in TABLE II-8 which shows labor earnings by source. According to this table, mining has consistently been the largest sector in the economy since 1950, growing at an average growth rate of 2.3 percent. Government, while smaller than mining and manufacturing in terms of earnings, had the highest average growth rate (8.6 percent) of all the sectors. In the following section, past trends in each industry are examined individually as an aid in delineating growth potentials.

TABLE II-7

GILA COUNTY LABOR FORCE AND EMPLOYMENT
ANNUAL AVERAGE 1967-1970

	1967	1968	1969	1970
Civilian Work Force	8,100	8,950	10,450	11,250
Unemployment	424	375	325	425
Percent Unemployment	5.2	4.1	3.1	3.7
Total Employment	7,675	8,575	10,125	10,825
(a) Nonagricultural Wage and Salary	6,775	7,450	8,800	9,425
Manufacturing	1,475	1,575	1,850	1,950
Nonmanufacturing	5,300	5,875	6,950	7,475
Mining and Quarrying	1,650	1,950	2,400	2,750
Contract Construction	175	100	300	600
Trans., Comm., and Public Utilities	200	200	250	250
Trade	1,075	1,025	1,200	1,275
Finance, Insurance & Real Estate	100	125	125	125
Service	875	875	1,075	1,000
Government	1,225	1,600	1,600	1,475
(b) All Other Nonagricultural Employment	700	925	1,125	1,250
(c) Agriculture	200	200	200	150

Source: Employment Security Commission of Arizona, Unemployment Compensation Division.

TABLE II-8

GILA COUNTY LABOR EARNINGS BY SOURCE
(In Thousands Of Dollars)

	1950	1962	1966	1967	1968
Total Earnings	26,662	39,710	50,742	44,276	52,294
Farm Earnings	2,929	2,075	931	767	1,825
Non-Farm Earnings	23,733	37,635	49,811	43,509	50,469
Government Earnings	2,936	7,571	10,293	11,400	13,015
Total Federal	1,287	2,662	3,501	3,781	4,020
Federal Civilian	1,174	2,384	3,236	3,444	3,679
Military	113	278	265	337	341
State and Local	1,649	4,909	6,793	7,619	8,995
Private Non-Farm Earnings	20,797	30,064	39,518	32,109	37,454
Manufacturing	1,000	2,291	3,503	2,895	3,878
Mining	11,574	14,966	20,312	14,464	17,956
Contract Construction	810	1,652	2,532	1,804	1,804
Trans., Comm., and Public Utilities	854	1,324	1,457	1,484	1,784
Wholesale and Retail Trade	3,688	5,537	6,261	6,337	6,365
Finance, Insurance and Real Estate	361	685	913	946	1,001
Services	2,489	3,566	4,494	4,334	4,616
Other	21	43	46	45	50

Source: Office Of Business Economics

Agriculture. Agricultural activities in Gila County are almost entirely composed of cattle raising, with some poultry ranching. The main crop grown is alfalfa. There has been considerable fluctuation in earnings in agriculture in the past two decades. Earnings in 1968 were only 50 percent of their 1950 level. This, however, was more than double the 1967 figure. Such variation makes it difficult to predict what path earnings will follow in the future. Employment, after stabilizing at 200 for three years, dropped to 150 in 1970. Indications are that agriculture will offer little in the way of employment opportunities in the next twenty years.

Mining. Almost one-fourth of the county's labor force has been engaged in mining, primarily copper, during the past four years. The principal mining regions are the Hayden and the Miami areas. In 1967 there was a copper strike in the county which explains the decline in earnings between 1966 and 1967. Earnings increased again in 1968 and are expected to continue to grow in the future. The county is heavily dependent upon mining operations for income. Thirty-four percent of total earnings were directly earned in copper mining in 1968. Related manufacturing activities such as smelting, were a source of additional earnings.

Manufacturing. Manufacturing is not well developed in the county. While it is the second largest sector approximately 70 percent of the people employed in manufacturing work in copper smelting. Logging camps and sawmills account for another portion of manufacturing activity. There seems to be a good potential for development in the more refined processes related to the production of lumber and copper, and in the use of their by-products.

Contract Construction. Earnings in construction have increased since 1950, growing at an average annual rate of 4.5 percent. A considerable amount of construction has been highway and heavy construction. While this type of construction will not continue indefinitely, the building associated with the expansion of the Pine-Payson area as a summer home and recreation site should support construction employment for several years. Employment figures for the past four years indicate that while employment did drop off initially, it has since recovered and expanded to over three times what it was in 1967.

Trade. Wholesale and retail trade have employed at least eleven percent of the county's workers in the past four years. Most employment was found in food stores, eating and drinking places, and gasoline service stations. Purchases of durable goods are generally made outside the county. While the demand for these goods might seem to indicate a

potential area of development, it is doubtful that any such development will materialize as it would be difficult for any new stores to compete with the larger scale operations in Phoenix and Flagstaff. For this reason any growth in wholesale and retail trade in the next two decades will most probably be in the same type of retail stores which already exist.

Transportation, Communication and Public Utilities. Labor earnings in this sector doubled in the period 1950-1968. Even with this growth in earnings, less than four percent of total earnings came from transportation, communication or public utilities in 1968. The small role indicated by these figures is further reflected in the employment data presented for 1967-1970. Only 2.3 percent of total employment in the county was in transportation, communication or public utilities. There is no indication that any major developments will occur in any of these industries in the next two decades. Therefore, moderate growth in earnings should be expected with a minor increase in employment as a growing population causes increased demand upon existing facilities.

Services. Labor earnings in this sector have grown at an annual average rate of 3.5 percent since 1950. The sector appears to have a good potential for development in the next two decades. It has accounted for less than fifteen percent of total employment in the past three years. The composition of services available indicates a shortage of supply in several areas of consumption. There appears to be a market for personal services, automobile repairs, entertainment and recreation, medical services and legal services, that is not being met within the county. The development of summer homes and recreation facilities that is taking place within the county should stimulate additional demand for services.

Finance, Insurance and Real Estate. Employment in this sector has averaged less than one percent of total employment in Gila County in the past four years. There is, however, a potential for growth. The developing vacation and recreation sites should stimulate real estate activity and also create a need for additional finance and insurance companies. If this occurs, earnings which have grown at an average annual rate of 5.8 percent since 1950 should continue to expand in the next two decades.

Government. Government has consistently been the third largest employer in the county. Approximately 69 percent of labor earnings are from state and local government. According to the data available on labor earnings since 1950, state and local government earnings in Gila County are not only larger than federal government earnings, but in

addition have grown at a much higher annual rate (9.9 percent) than federal government earnings (6.5 percent per annum). It is expected that government employment will grow at a moderate rate in the coming decades as county and state offices expand to provide additional services to the growing population of the county, and federal employment grows as recreation use of forest areas increases.

Population and Growth Projections

Gila County is one of Arizona's least populous counties. Its 1970 population of 28,414 and its land area of 4,747 square miles result in an average population density of six persons per square mile compared to an average of 15.4 persons per square mile for the state as a whole. Although the population density of Gila County is low, it is not uniform throughout the county. Only 3.1 percent of the land within the county is privately owned; and, with the exception of the San Carlos Reservation, most of the county's population is found on this small portion of the county's total area.

The largest concentration of population in Gila County is in the Globe-Miami area. According to the 1970 United States Census of Population, 6,583 persons reside in Globe and another 3,302 are found in Miami. These data cover only the city limits of each town and given the population of the outlying areas it is likely that approximately half of the county's 1970 population of 28,412 reside in the greater Globe-Miami area. Other centers of population density are the Hayden-Winkelman, Payson, and Pine-Strawberry areas. The San Carlos Indian Reservation has an estimated population of 4,400 most of which is in Gila County. This reservation has a land area of approximately 2,900 square miles giving a population density of less than two persons per square mile. The community of San Carlos, located in Gila County, is the location of the tribal headquarters and the largest population center on the reservation. Approximately 1.6 percent of the state's population is found in Gila County. Since 1950, the county's population has increased by only slightly more than 4,000. As seen in FIGURE II-4 Gila County's population is projected to increase to a median of 44,400 by 1990 with projected interim populations of 34,200 in 1980 and 31,200 in 1975. These projections assume that the county's proportion of Arizona's population will follow the trend seen in the period 1950-1970. (See SECTION III.)

The industrial support for the population growth will most probably come in part from continued mining activity. In addition, manufacturing and services appear to offer some development potential. The most likely areas for development are in the Globe-Miami area where there is an existing labor market.

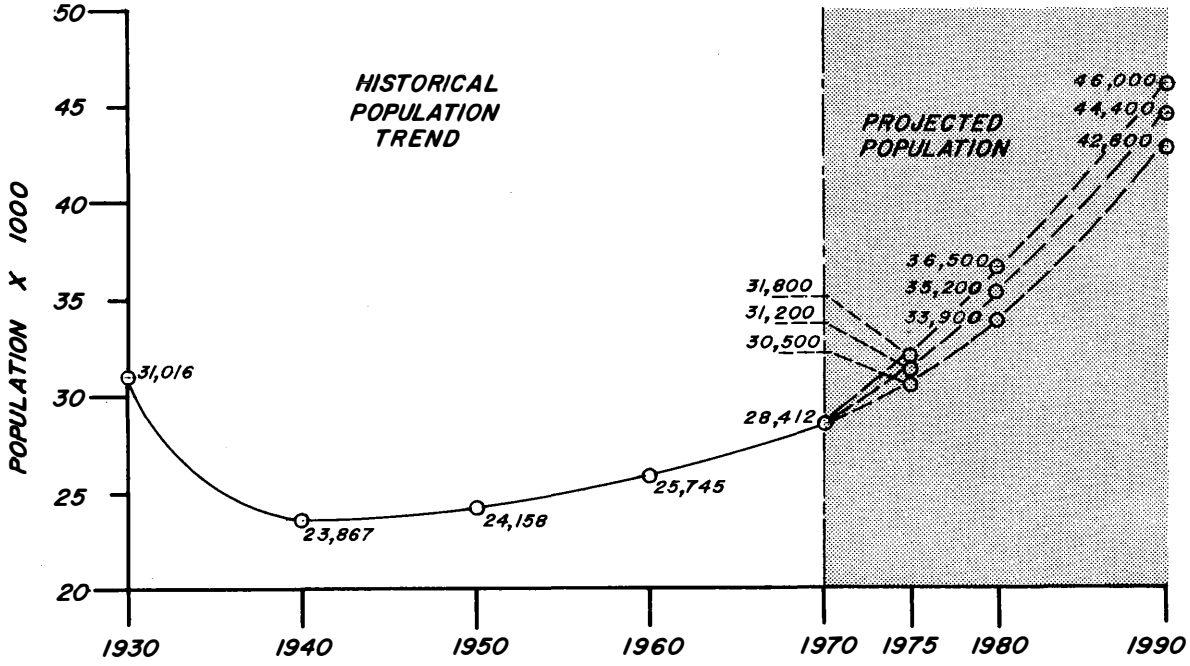


FIGURE II-4. POPULATION OF GILA COUNTY AND PROJECTIONS TO 1990.

CHAPTER III. COMMUNITY PROFILES

Socio-economic activity is related in part to various regional factors such as physiography and natural resources. These factors establish many of the conditions under which initial community development and future growth is possible.

This Chapter consists of community sections, each of which discuss the economic segments of the community and the related development needs for water supply and distribution systems, waste water treatment facilities and solid wastes management. Growth projections are derived from information on the community's economy and development potential and are utilized in forecasting the needs for future environmental services.

A summary and discussion of projected environmental services needs on a countywide basis is presented at the end of the chapter. It is believed that this general picture will provide county and local government and service agencies with necessary information regarding those areas in need of coordinated development planning.

COMMUNITY OF PAYSON

HISTORICAL PROFILE

The northern regions of Gila County were settled around 1882. The earliest community in the area was Payson which lies at the base of the Mogollon Rim. The town was founded as a gold mining camp but soon became associated with the cattle and lumber industries. In 1884, the Post Office was established.

Today Payson is the largest retail trade center in northwest Gila County. Part of this growth has resulted from retirement living and the summer recreation potential of the region. This growth is presently undergoing a marked increase and has generated a number of problems related to environmental services needs.

The failure of septic tank sewage disposal systems in the community prompted the study and preparation of a report on soil conditions in the area.[5] This study involved the delineation of areas of the

community where soil conditions were not compatible with the use of septic tanks. Following this was the preparation of an engineering study which would provide the community with centralized sewage collection and waste water treatment facilities.

PHYSIOGRAPHY-GEOLOGY

Topographically the surrounding area ranges in elevation from 4,900 to 5,200 feet. Snowstorm Mountain to the west of the community and Yerba Sente Butte to the east have elevations of 5,161 and 5,162 respectively. The general topography of the community is illustrated in PLATE 8.

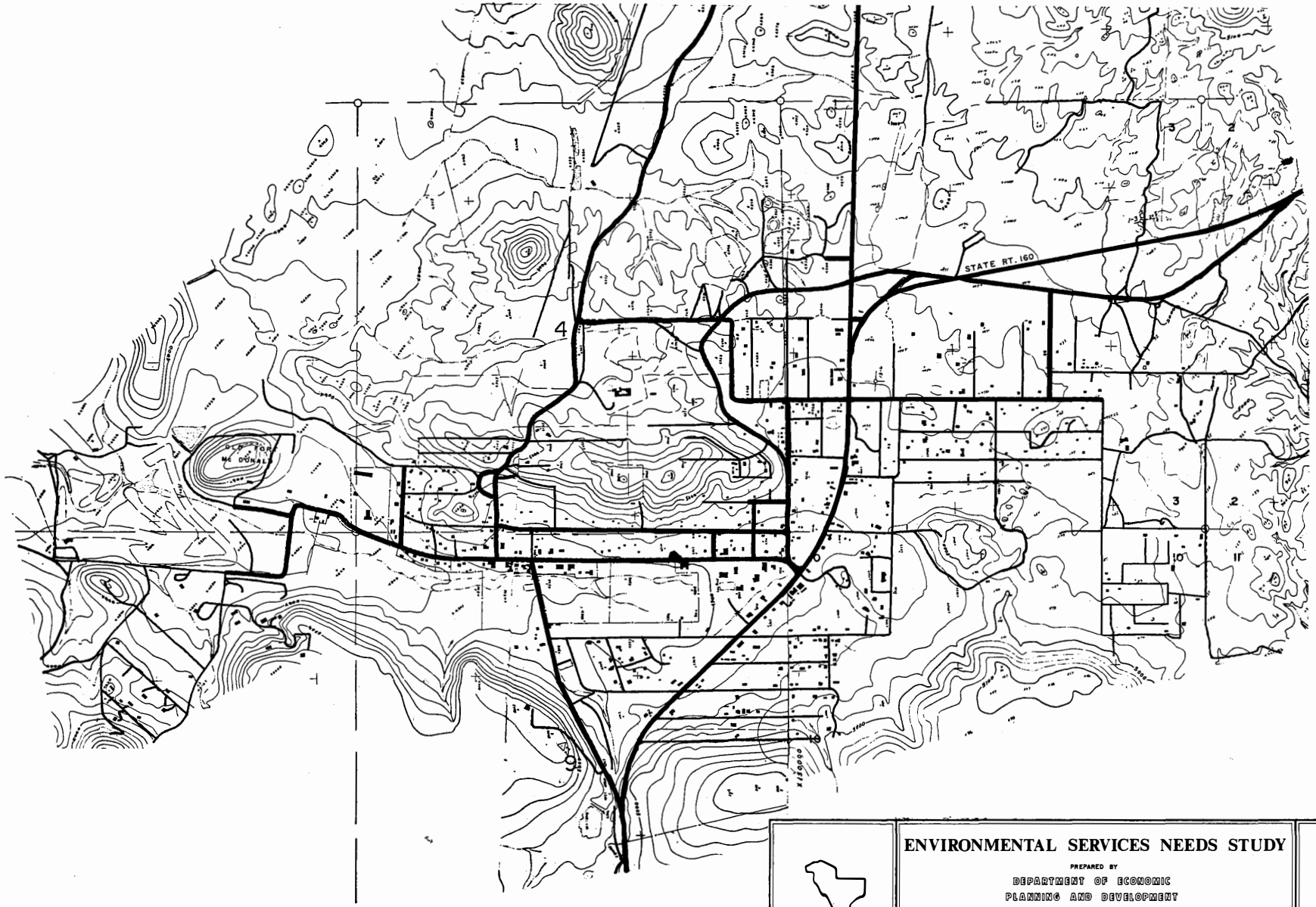
Payson lies on the drainage divide between the Tonto Creek and East Verde River Watersheds of the Salt River sub-basin. The western 80 percent of the developed area drains northwesterly through the American Gulch to the East Verde River. The remaining area drains to the southeast towards Houston Creek which is tributary to Tonto Creek. The central area of development within the community along Highway 87 and Main Street lies in a low lying plain that drains east to west in a shallow drainage channel just south of Main Street. In the area of the Payson Country Club the drainage enters a well defined intermittent stream bed.

The low-lying plain is principally made up of alluvial materials originating in the surrounding hillside soils. The area south of Main Street is of a clay loam nature with poor drainage characteristics. Moving out from this central area the slopes of the terrain increase by three to eight percent and soil characteristics change to a gravelly loam material with fairly good drainage properties. Throughout the area granite bedrock is found at depths ranging from a few inches to about 12 feet with rock outcroppings occurring frequently.

Static water levels in the clay loam (central east-west corridor) occur at depths ranging from zero to eight feet depending on the season of the year with soil pH ranging from moderately alkaline to neutral. Moving away from this corridor the water table drops as soil pH becomes moderately acidic.

SOCIO-ECONOMIC PROFILE

Because Payson is a small unincorporated community, no census data for Payson have ever appeared. In 1960 the Tonto County Census



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT

PAYSON, ARIZONA

TOPOGRAPHIC FEATURES

ELEVATION: 4390 feet

POPULATION: 2000

N

PLATE 8

Division, including all of northern Gila County, was reported to contain 1,789 inhabitants. This includes those persons residing in Payson, Pine, Strawberry, Young, Rye, Gisela and Roosevelt, as well as those at several scattered ranches.

The economy of Payson is based upon ranching and manufacturing. The bulk of manufacturing employment is related to a local lumber operation, and retail trade and services have become increasingly important since the latter 1950's. With the paving of the Beeline Highway between Mesa and Payson, the area has enjoyed increased economic activity due to the growing demand for the recreational aspects of the areas.

At this time, with no current census data and no historical trend, it is extremely difficult to foresee what Payson's population might be at some point in the future. The estimated 1970 population of the community is 2,350. In light of this paucity of data, and in conjunction with the apparent growth in summer and retirement homes, it is reasonable to assume a high rate of growth for the community of 4.4 percent per year, a medial of 3.5 percent and a low of 2.8 percent. The population estimate for 1970 and projections to 1990 are seen in FIGURE III-1.

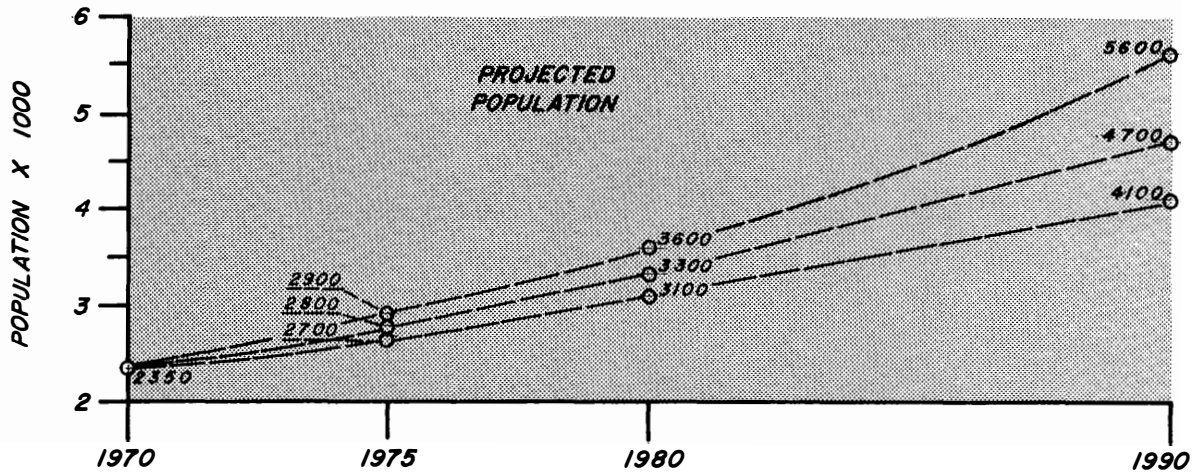


FIGURE III-1. POPULATION OF PAYSON AND PROJECTIONS TO 1990.

Present Land Use Patterns

Payson, as stated previously, is located along Arizona Route 87 and the major retail establishments are along this thoroughfare (PLATE 9). Businesses are tourist and recreation oriented, with a large number of service stations and specialty shops.

The original commercial district is in the downtown area west of the highway. The businesses in this district are primarily community oriented, i.e., bowling alley, hardware store and government offices. The government buildings are along Main Street which serve as the center of government functions in northern Gila County.

Large amounts of industrial land usage are shown on the existing land use map. The sawmill on Main Street is the primary occupant with the remaining industrial land shown composed of open storage yards, mostly used for building materials.

Conventional housing in Payson is mixed, with the majority being summer residences and the remaining year-round housing. There are several new subdivisions in the Payson area. The country club is one of the newest subdivisions and probably the most expensive.

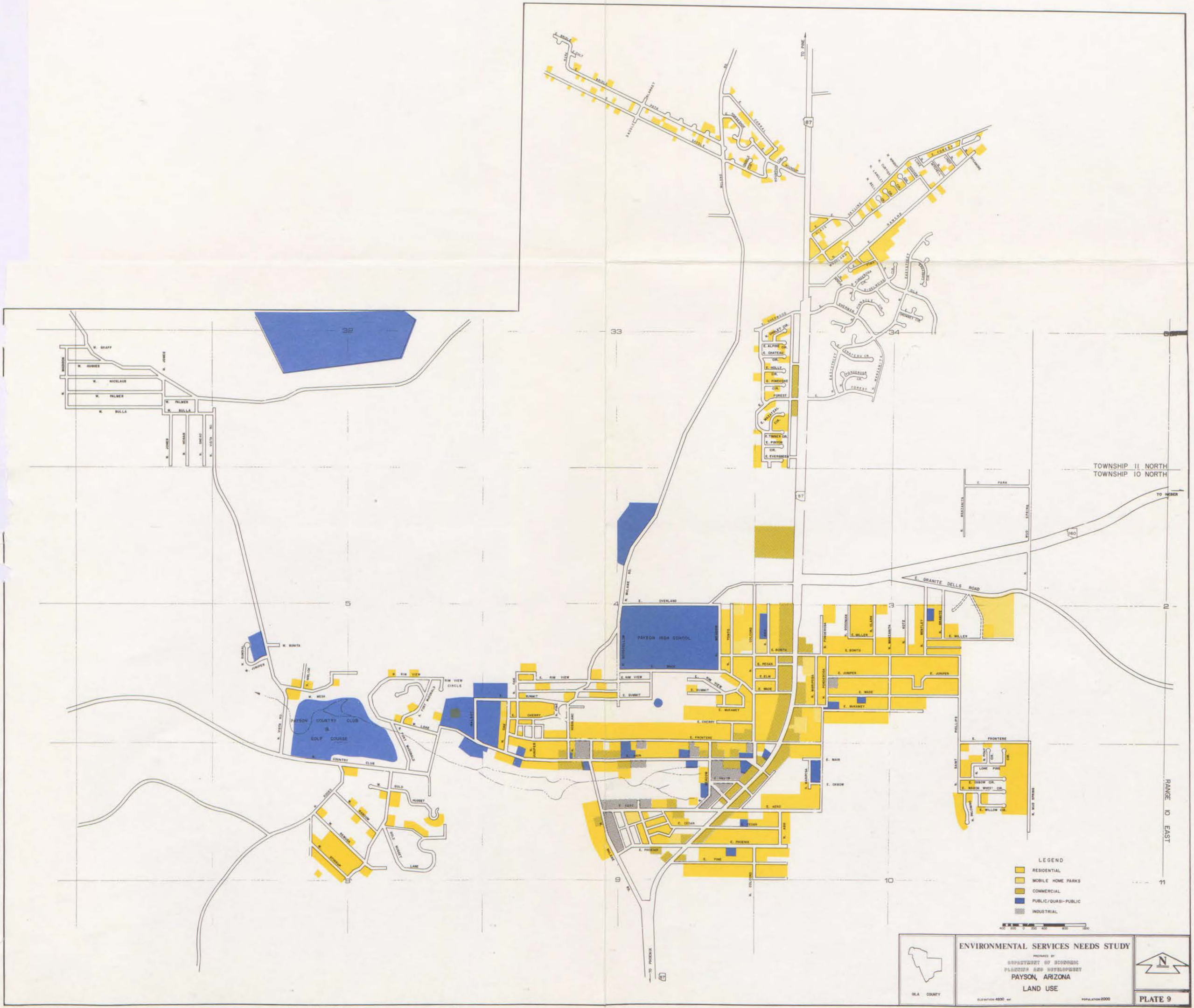
The older residential areas of Payson north of Main Street and west of the highway are characterized by mixed land use patterns. Commercial and residential uses are combined, making the area less desirable for new housing than the more open and undeveloped areas north of the community.

The housing east of the highway consists of conventional housing and mobile homes. The conventional housing is relatively new and is priced in the $20,000 to $30,000 range. A large proportion of the units are used for summer occupancy only.

Projected Land Use Patterns

Recreational activity and retirement living has shown a marked increase in past years, particularly for areas in proximity to Payson. Probable future changes in existing land use patterns are delineated in PLATE 10 for Payson and the surrounding areas.

Residential areas will develop north of the community adjacent to the highway. Presently there are active promotional efforts on the part of land developers in this area. Residential development will


TOWNSHIP 11 NORTH
TOWNSHIP 10 NORTH
RANGE 10 EAST
PAYSON HIGH SCHOOL
PAYSON COUNTRY CLUB & GOLF COURSE
E. GRANITE DELLS ROAD
TO PHOENIX
TO HEBER
LEGEND
RESIDENTIAL
MOBILE HOME PARKS
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
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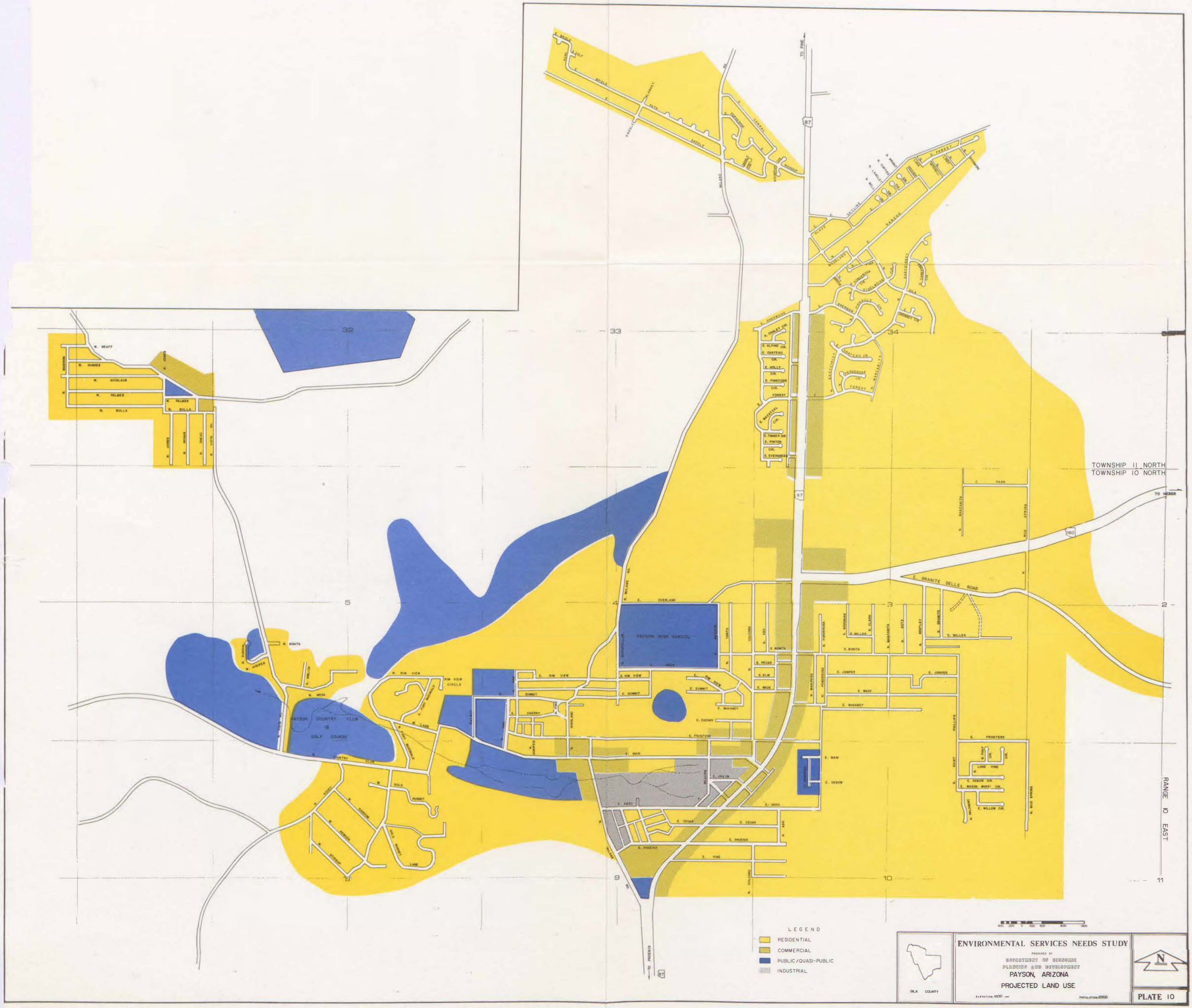
PLANNING AND DEVELOPMENT
PAYSON, ARIZONA
LAND USE
ELEVATION: 4920 MSL
POPULATION: 2000
N
PLATE 9


TOWNSHIP 11 NORTH
TOWNSHIP 10 NORTH
RANGE 10 EAST
TO PINE
TO HEBER
TO PHOENIX
E. GRANITE DELLS ROAD
PAYSON COUNTRY CLUB
GOLF COURSE
PAYSON HIGH SCHOOL
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
PAYSON, ARIZONA
PROJECTED LAND USE
ELEVATION: 4930 ±
POPULATION: 2900
PLATE 10

generate a demand for improved water supply systems and eventually the development of sewage collection and treatment facilities.

Commercial land use patterns will absorb most of the residential areas along Main Street. Commercial density along the highway will also increase. The light industrially classified areas presently utilized as storage yards will gradually take on actual industrial activities as the community grows and can support light industry.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

Existing Facilities

The Payson water supply and distribution system is owned and operated by United Utilities Corporation. The distribution system illustrated in PLATE 11 serves the developed area of the community. The system was initially several separate systems which were incorporated into one as the United Utilities Corporation acquired the rights to the individual systems.

The system derives water from existing groundwater resources with the use of four wells, three of which feed the system directly with one well being used in an emergency standby capacity. The well locations and pertinent data for the system equipment and water quality can be found in TABLE III-1. The water storage system is comprised of gravity and pressure tanks with a capacity of 895,000 gallons. The largest storage reservoir is a recently completed 500,000 gallon gravity tank on a hilltop in North Payson.

The well system for the community is capable of producing 1,080,000 gallons per day (1,209.6 acre-feet per year). This satisfies present demand requirements that are in the range of 85,000 gallons per day for 305 metered customers and 75,000 gallons per day for 257 unmetered customers in the outlying subdivisions.

Over the years the system has had several minor deficiencies resulting from the addition of isolated water systems as they were acquired and joined to the main system. These deficiencies have been corrected and no other major shortcomings are apparent. Representative water quality data for wells on the Payson System are illustrated in TABLE III-2.

TABLE III-1

WELL LOCATIONS AND WELL DATA FOR PAYSON, ARIZONA

A (10-10) 3-1	300 gpm, 40.0 hp, 3 phase 400 volt, Reda submersible pump, 400 ft. deep in rock, 37 ft. static water depth, 325 ft. bowl setting - 100 linear feet of eight (8) inch casing - good producer with additional capacity available.
A (10-10) 10-2	70 gpm, 3.6 hp, Serno-7 stage submersible pump, 110 ft. deep in granite, 84 ft. bowl setting, eight (8) inch casing.
A (10-10) 8-3	75 gpm, 7.5 hp., Serno-9 stage submersible pump.
A (10-10) 3-13 (standby)	45 gpm, 3.0 hp, Jacuzzi submersible, 90 ft. of casing, 75 ft. to static water level

*All well locations designations used in this report are given according to the U.S. Geological Survey System.

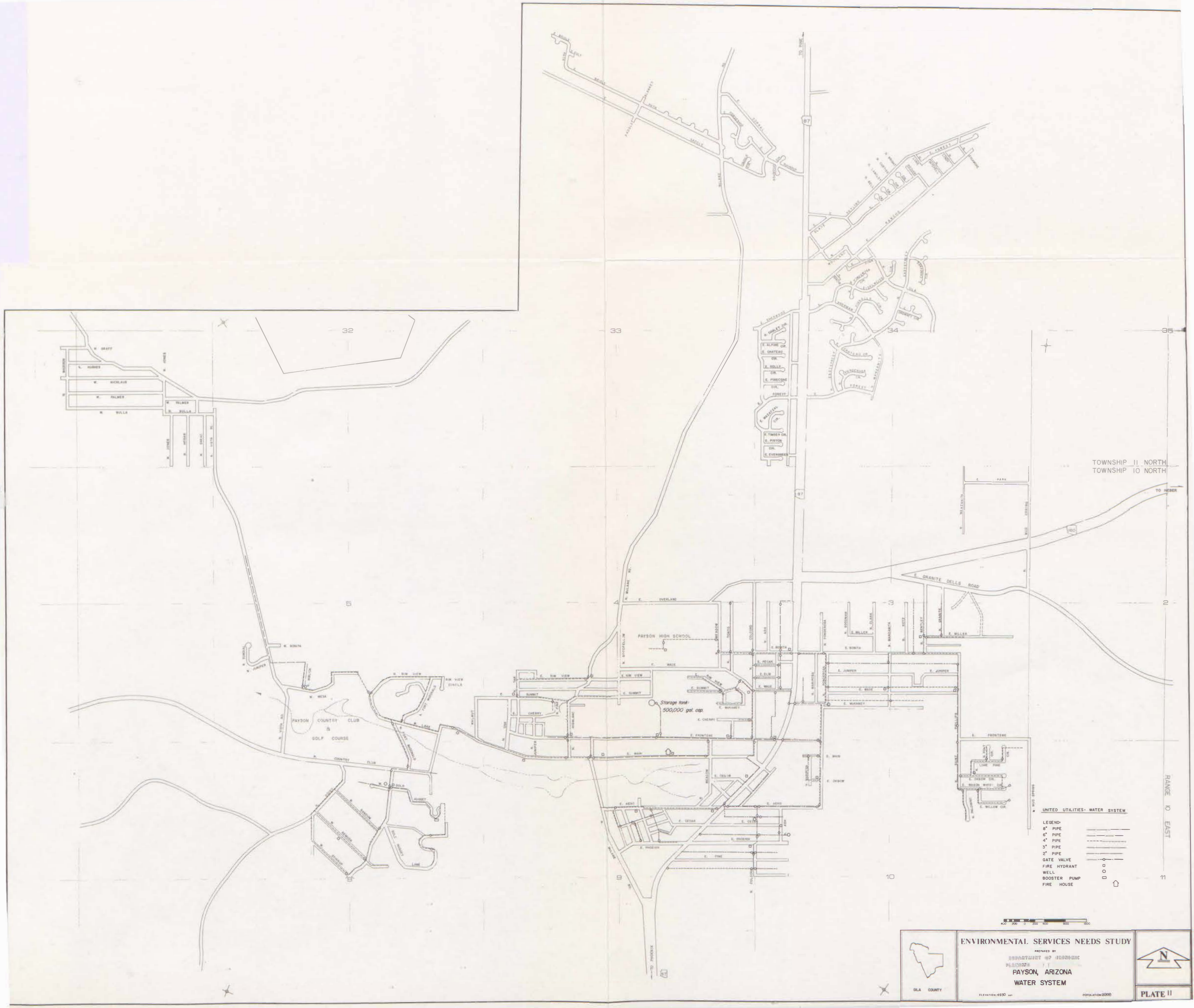
Source: United Utilities Corporation.

TABLE III-2

REPRESENTATIVE WATER QUALITY DATA
FOR PAYSON WATER SYSTEM

Parameter	Concentration milligrams per liter*
Hardness (as Calcium Carbonate)	104.0
Calcium	23.0
Magnesium	11.0
Sodium	17.0
Chloride	8.0
Sulfate	9.0
Total Dissolved Solids (TDS)	184.0
Fluorides	0.6
Nitrates	6.0

Source: Arizona State Dept. of Health (ASDH), Water Supply Div.


PAYSON HIGH SCHOOL
PAYSON COUNTRY CLUB & GOLF COURSE
Storage tank 500,000 gal. cap.
TO PINE
TO HEBER
E. GRANITE DELLS ROAD
TOWNSHIP 11 NORTH
TOWNSHIP 10 NORTH
RANGE 10 EAST
UNITED UTILITIES WATER SYSTEM
LEGEND
8" PIPE
6" PIPE
4" PIPE
3" PIPE
2" PIPE
GATE VALVE
FIRE HYDRANT
WELL
BOOSTER PUMP
FIRE HOUSE
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
PAYSON, ARIZONA
WATER SYSTEM
ELEVATION: 4930
POPULATION: 2000
N
PLATE II

Although the United Utilities system is the largest combined system in the area, there are 13 other individual water systems serving isolated subdivisions and trailer parks within a 12-mile radius of Payson.[6] Most of these outlying systems are operated by the United Utilities Corporation. Difficulties result from the complexity of maintaining such scattered systems in good operational condition. Within a six mile radius of Payson there are eight water systems, seven of which are operated by United Utilities and one by the Beaver Valley Water Company.

Future Needs

The rates of population growth and increasing economic activity in Payson and the surrounding area will necessitate modifications and improvements in the distribution system, particularly in residential areas east of the highway. Also the need for a regional water distribution system should be given consideration. The eventual inability to satisfy future area water demands by small systems such as those existing presently is apparent. The coordinated development of a water system serving all developed areas would be an asset to the region.

Water supply needs for the Payson area are outlined in TABLE III-3.

The well delivery capacity for the distribution system appears adequate to meet the needs expected for the high alternative forecast in 1990. Present well delivery capacity is rated at 1,080,000 gallons per day as compared to the 761,000 gallons per day expected needs.

SEWERAGE AND WASTE WATER TREATMENT

Existing Facilities

A special study of soil types in the Payson area by the Soil Conservation Service indicated that for the most part the septic tank-leach field system of sewage disposal could not be expected to work efficiently. The study was prompted by the continued failure of septic tank systems in the community. This situation caused several health problems in past years with water supply systems. At times there were septic tank effluents in the intermittent stream bed passing through the community.

This situation prompted citizens to support the formation of improvement and sanitary districts in the community. Subsequent to

TABLE III-3

PROJECTED AVERAGE DAILY AND YEARLY
WATER DEMANDS FOR PAYSON
IN 1975, 1980 AND 1990*

Projection Level	YEAR 1975	1980	1990	Acre feet per year
Time of Year	Gallons/day	Gallons/day	Gallons/day	
Summer	307,400	417,600	761,600	
High	267	362	705	
Winter	171,100	248,400	498,400	
Summer	296,800	382,800	639,200	
Median	258	342	592	
Winter	163,300	227,700	418,300	
Summer	286,200	359,600	557,600	
Low	248	321	516	
Winter	157,400	213,900	364,900	

*Project staff estimates

formation of the districts, engineering plans were prepared for the waste treatment facility and sewage collection system (PLATE 12).

The waste treatment facility is based on a relatively new process called contact stabilization which has been designed to handle up to 350,000 gallons of sewage per day. Effluents from this facility are intended for irrigation use on the golf course belonging to the Payson Country Club.

Future Needs

The waste water treatment facility was designed to handle 350,000 gallons of sewage per day. Considering the rate of growth in the community it appears that the plant capacity may be exceeded shortly after the 1980 population estimates are teached (TABLE III-4). It would be advantageous for the Board of Directors of the Payson Sanitary District to plan for modification or expansion a few years prior to the possibility of reaching design flows. This situation may occur sooner if

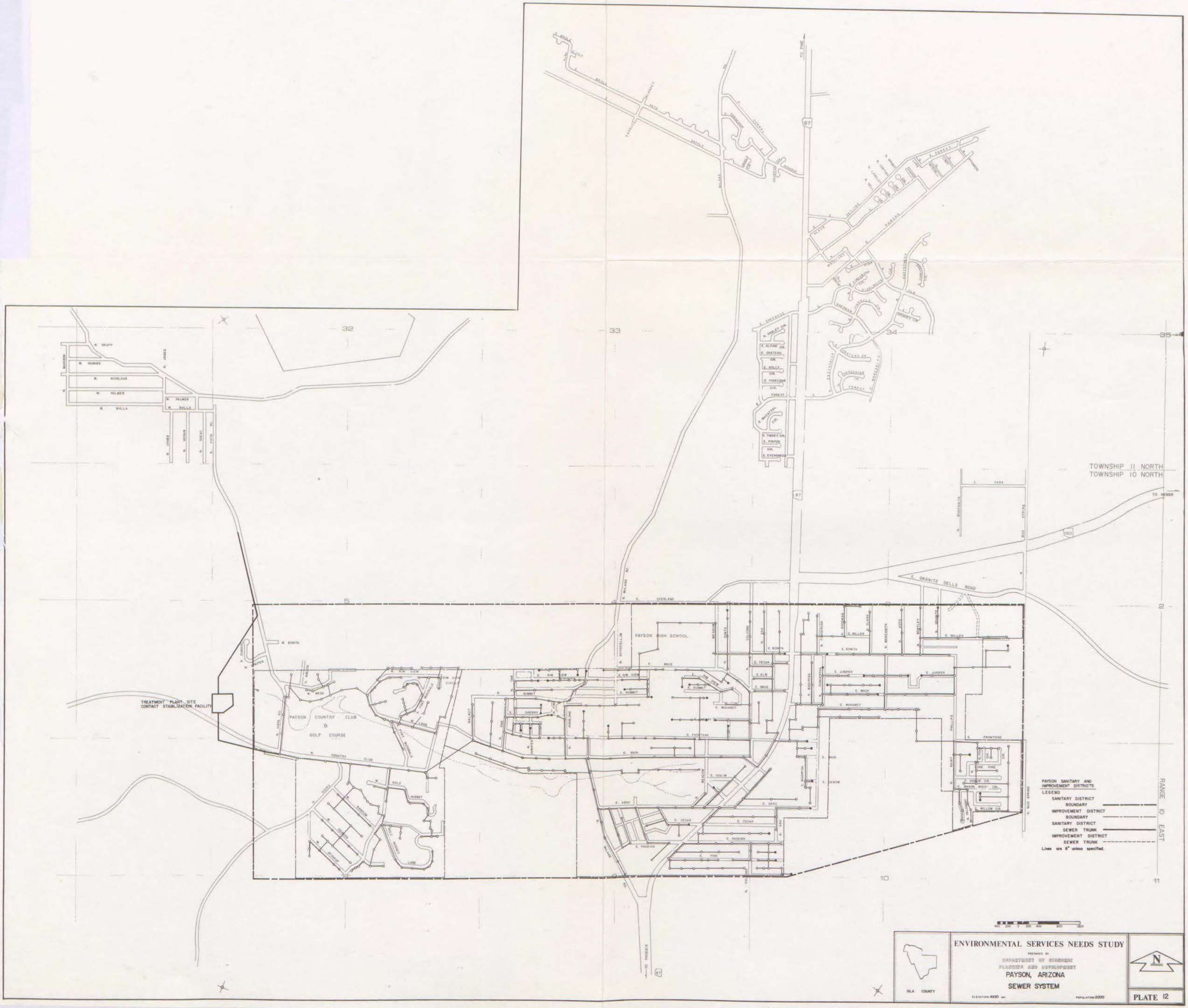

TOWNSHIP 11 NORTH
TOWNSHIP 10 NORTH
RANGE 10 EAST
TO PINE
TO HEBER
TO PHOENIX
PAYSON HIGH SCHOOL
PAYSON COUNTRY CLUB & GOLF COURSE
TREATMENT PLANT SITE CONTACT STABILIZATION FACILITY
E. GRANITE DELLS ROAD
PAYSON SANITARY AND IMPROVEMENT DISTRICTS
LEGEND
SANITARY DISTRICT BOUNDARY
IMPROVEMENT DISTRICT BOUNDARY
SANITARY DISTRICT SEWER TRUNK
IMPROVEMENT DISTRICT SEWER TRUNK
Lines are 6" unless specified.
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT
PAYSON, ARIZONA
SEWER SYSTEM
ELEVATION: 4930 ±
POPULATION: 2000
N
PLATE 12

TABLE III-4

PROJECTED AVERAGE DAILY AND YEARLY
SEWAGE FLOWS FOR PAYSON*
IN 1975, 1980 AND 1990

Projection Level	YEAR 1975	YEAR 1980	YEAR 1990	Acre feet per year
Time of Year	Gallons/day	Gallons/day	Gallons/day	
High Summer	200,000	271,400	495,000	
	184	256	486	
High Winter	128,300	186,300	373,800	
Median Summer	193,000	248,800	415,000	
	177	235	408	
Median Winter	122,500	171,000	314,000	
Low Summer	186,000	234,000	362,400	
	171	221	356	
Low Winter	118,000	160,400	274,000	

*Project Staff estimates

subdivision development in the surrounding areas of Payson continues at the present pace. The benefits to be realized by land developers are apparent as soil characteristics have been found unsatisfactory for effluent use of septic tank facilities.

Further benefits could be realized by the community if a periodic updating of the sewerage needs study, completed in 1968, is undertaken by the Board of Directors of the Payson Sanitary District in coordination with the Gila County Planning and Zoning Commission.

SOLID WASTES DISPOSAL PRACTICES AND TECHNIQUES

Existing Facilities

At present Payson is without a public garbage collection service. A private contract pickup service, subscribed to primarily by the

commercial sector, is available in the community. The residential areas are basically an individual responsibility with collected wastes usually hauled to dumpsites to the west and south of the community.

The dumpsites are maintained by county and Forest Service personnel on a non-scheduled periodic basis. Basic means of volume control is through burning, however, provisions have not been made for pest or fire control at the sites. The dumpsites are inadequate for the community both in terms of capacity and supply of topsoil for the burial of residues.

Future Needs

As population grows and population densities become greater in the community, a public or reasonably expanded contract garbage collection service will be a necessity. Along with this service will be a need for a more sophisticated means of waste disposal. The development of an efficiently operated sanitary landfill and salvaging operation in the area would be a tangible asset to the community. The quantities of solid waste materials produced will increase substantially in the next twenty years (TABLE III-5).

The tonnages indicated could be efficiently disposed of in a well designed, maintained and operated sanitary landfill facility.

TABLE III-5

PROJECTED AVERAGE SOLID WASTES
PRODUCTION LEVELS FOR PAYSON*
IN 1975, 1980 AND 1990
(tons per year)

Population Projection YEAR	PRODUCTION LEVELS POPULATION PROJECTION LEVELS LOW	MEDIAN	HIGH
1975	1,400	1,460	1,510
1980	1,950	2,080	2,270
1990	3,410	3,950	4,700

*Project staff estimates

COMMUNITIES OF HAYDEN AND WINKELMAN

These two communities exist in close proximity to each other and, not surprisingly, exhibit many characteristics and relationships in common. They exist as one broad economic area linked through community patterns, retail trade and services. Beyond the economic traits are numerous similarities in social institutions and recreational areas. For these reasons the two communities are treated in a single section of this report, although mention must be made of the fact that those characteristics unique to each community are given equal and individual attention.

HISTORICAL BACKGROUND

The community of Hayden was founded in 1909 as a milling and smelter camp for mines located in the southern portion of the county. In 1911, the Ray Consolidated Copper Company (now Kennecott Copper Corporation) built a 10,000 ton copper ore processing mill and established the town of Hayden for its employees. The following year American Smelting and Refining Company built a smelter adjacent to the mill.

Hayden grew sporadically and lingered on through the Great Depression. Kennecott started construction of a new smelter in 1955 with the discovery that copper ore deposits in the area were much more extensive than originally predicted. In December of 1956 the community officially incorporated as a municipality.

One of the first public projects undertaken by the newly formed government was the formulation of a water supply and sewage collection services needs reports. Yost and Gardner Engineers published a report in July of 1958 which outlined the existing services and needs for improvement and modifications in the water and sewer systems. It was pointed out in this study that the lack of adequate sewage disposal facilities was the most outstanding deficiency of the sewage collection and disposal system. At that time raw sewage was dumped into washes in the inhabited areas of the community. As a result of this particular study, water system improvements were carried out in January of 1959.

In December of 1961 a planning needs study was published for the combined areas of Hayden and Winkelman.[7] This study was basically a general plan for both areas which made recommendations for land use, neighborhood rehabilitation, parks, playgrounds, streets, public buildings and grounds, sewage collection and waste disposal, flood control and the financing of capital improvements. This plan further outlined the eventual

need for sewage collection and waste water disposal services in the communities.

The history of the development of the Winkelman area dates from the 1870's when the first ranchers moved into this area. Pete Winkelman settled the area in 1871, and by 1903, with the coming of the Phoenix Eastern Railroad that extended to Christmas, the Winkelman area had developed into a good-sized settlement.

High grade ores were discovered in the Christmas area in 1878, but after the claims had been staked it was found that the area was on the San Carlos Indian Reservation. An Act of Congress in 1902 changed the reservation line so that the area could be opened for mining. With the continued ranching activity and new mining activity, the town grew rapidly and the site was recorded May 7, 1912, and given the name Winkelman after Pete Winkelman. The community was incorporated in 1914.

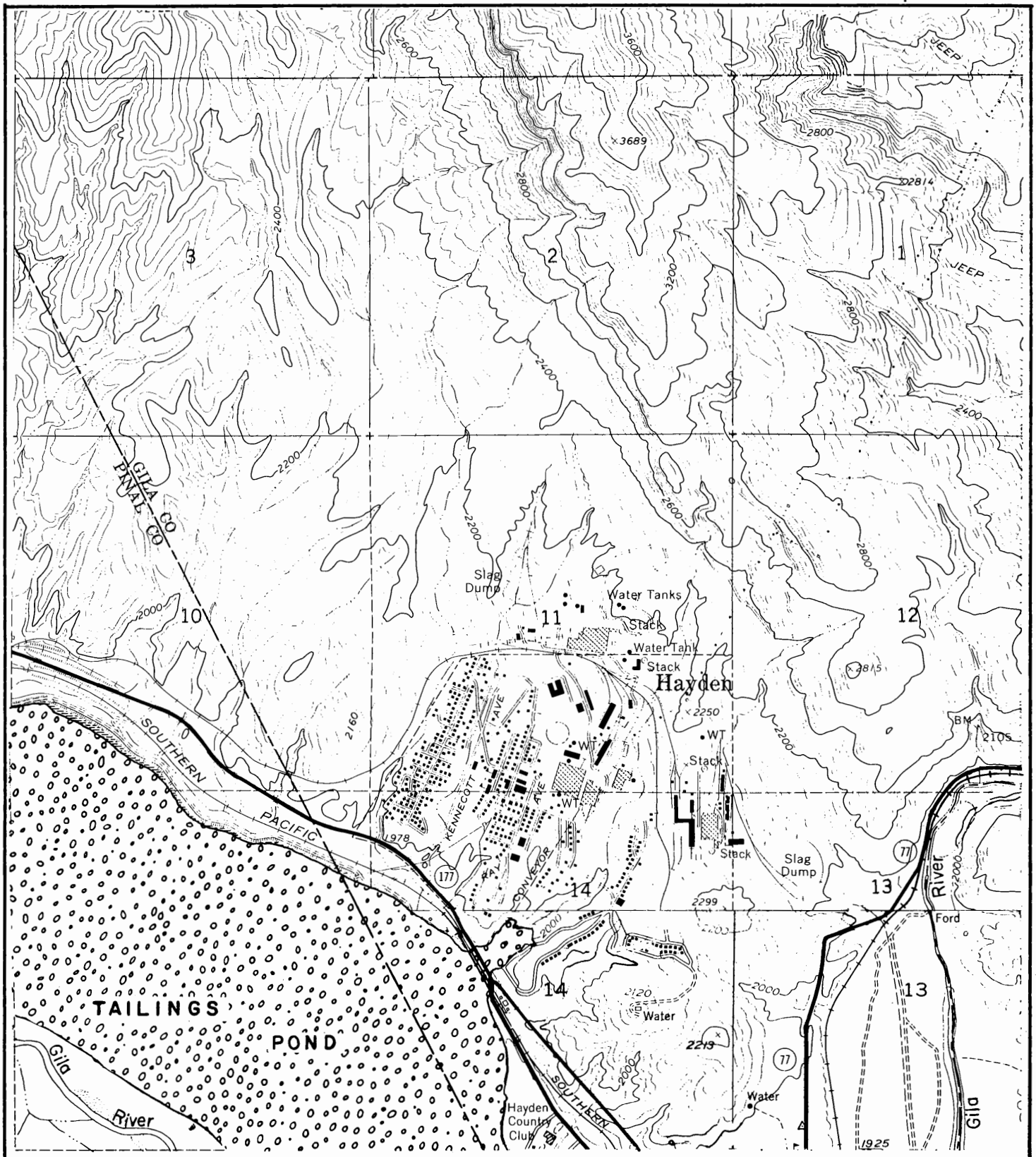
Prior to 1961 no studies or reports had been prepared for community guidance in planning for public works needs. In 1961, however, Winkelman completed its first report on planning for community needs in the above area.

An engineering study was prepared in 1967 outlining the design and construction details for a sewage collection and disposal system for the community.

PHYSIOGRAPHY AND GEOLOGY

Hayden is located approximately one mile north of Winkelman in the southernmost part of Gila County. The community is situated adjacent to Highway 177 in generally rugged terrain and is approximately 2,100 feet above sea level (PLATE 13). Elevations rise to 4,483 feet two miles north of Hayden in the Dripping Springs Mountains at Toronado Peak. Surface water drainage moves southwest to the Gila River from Hayden. The area is covered with gravel, sand and silt deposits with the mountains to the north composed of limestone, shale and sandstone. Deposits of conglomerates are also exhibited in Hayden.

Winkelman is approximately 1,950 feet above sea level (PLATE 14) and is located at the junction of the San Pedro and Gila Rivers approximately 100 miles southeast of Phoenix and 70 miles north of Tucson. At Winkelman, the Gila River drains 13,268 square miles, of which only 382 square miles are below Coolidge Dam, north and east of the community. The dam allows for a continual flow in the Gila. The United



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

HAYDEN, ARIZONA

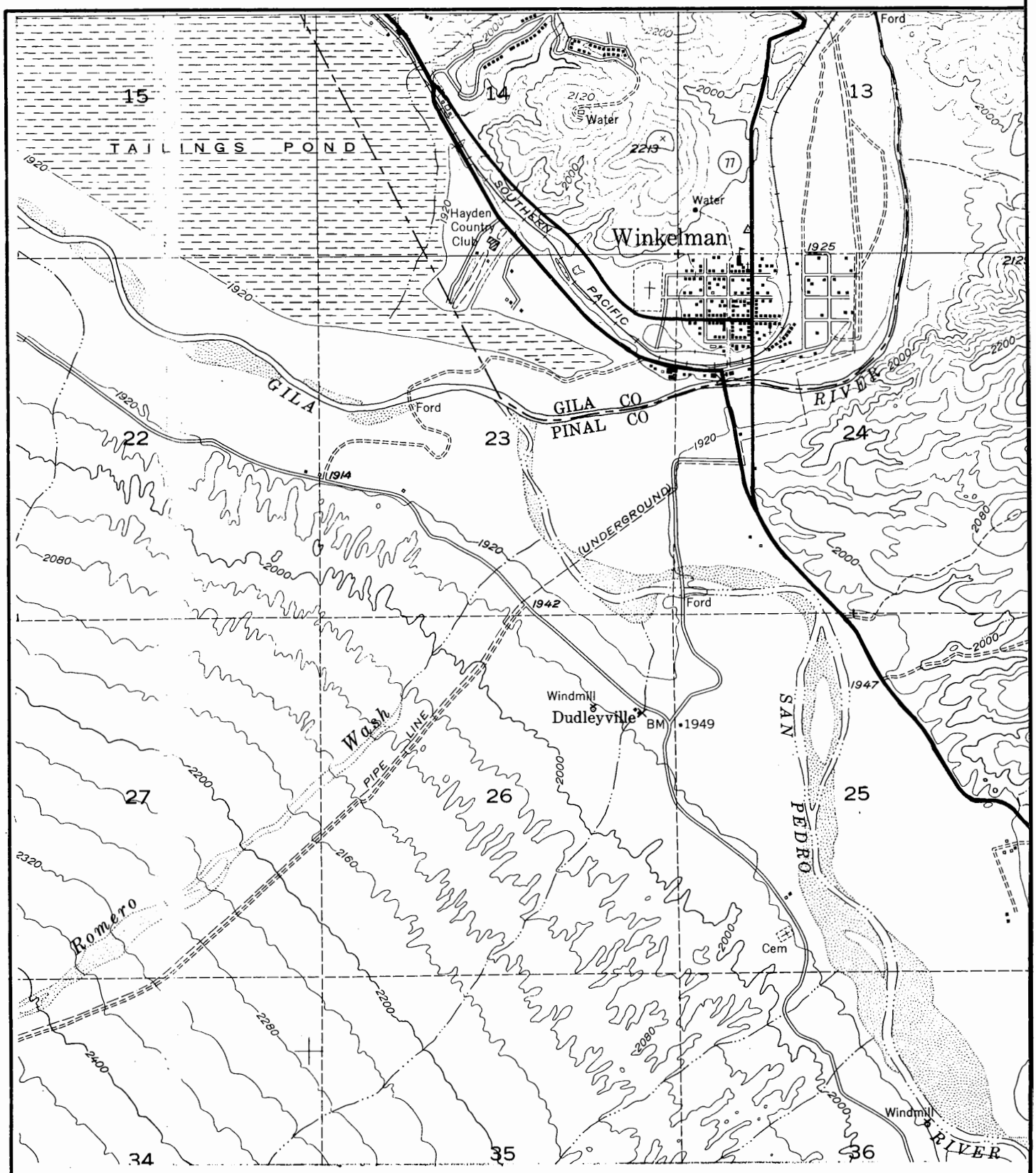
TOPOGRAPHIC FEATURES

ELEVATION: 2100 Feet

POPULATION: 1276

N

PLATE 13



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

WINKELMAN, ARIZONA

TOPOGRAPHIC FEATURES

ELEVATION: 1950 Feet

POPULATION: 977

N

PLATE 14

States Geological Survey reports an average daily flow of 196 cubic feet per second (cfs) and lows of 12 cfs as it flows past Winkelman. The San Pedro River drains an area 4,449 square miles of which 696 miles are in Mexico. Level flood plains exist along the Gila River Watercourse.

Generally the area is covered with gravel, sand and silt deposits with surface water drainage moving south to the Gila River from the community. The alluvial soils found adjacent to the Gila River generally contain free carbonates within 30 inches of the ground surface which may have an influence on water quality in the area.[4] The potential well production capacities in these deposits are rated in the range of 50 to more than 2,500 gallons per minute with most wells in the area capable of producing 1,000 gallons per minute. Static groundwater levels are approximately 20 feet.

SOCIO-ECONOMIC PROFILE

With the exception of ranching, which now is relatively insignificant to the economy of Hayden and Winkelman, the existence of the two communities is almost wholly dependent upon the mining and processing of copper ore. Two smelters are located in Hayden and two large copper mines are found within a twelve-mile radius of Hayden-Winkelman. With the exception of a small retail base in Hayden, the smelters and mines are the primary source of employment for the populace. The smelters in Hayden alone account for nearly 1,400 jobs.

The town of Winkelman is primarily a service center and residential area for the families of employees associated with mining and smelting in the area. According to preliminary census figures, Winkelman has a 1970 population of 974 as compared to 1,123 in 1960.

Hayden also has a small retail trade and service sector, but the primary employers are the two smelters within the city limits. Hayden had a population of 1,760 in 1960 which has declined to 1,276 in 1970.

The declines in the population of Hayden and Winkelman in the last decade are attributed to a moderate demolition of housing in the area with little replacement. In conjunction with this, the new town of Kearny has experienced a large-scale construction of homes since 1960 that has resulted in a tripling of Kearny's population in the last decade. Kearny, approximately eleven miles west of Winkelman, is in Pinal County and is not covered in this report.

FIGURE III-2 shows the past population trends in Hayden and Winkelman and projections to 1990. The low projection assumes that the population of both towns will continue the moderate decline seen in the past decade. This decline would be a function of continued housing demolitions and a continued population shift to Kearny or other areas. The low 1990 projections for Hayden are 1,050 and the low for Winkelman is 800. The high 1990 projections for Hayden and Winkelman are 1,900 and 1,450 respectively. It is unlikely that this projection will be exceeded because there is a limited amount of developable land near the communities. The median projection assumes that the population of Hayden and Winkelman will remain stabilized at or near the current 1970 levels.

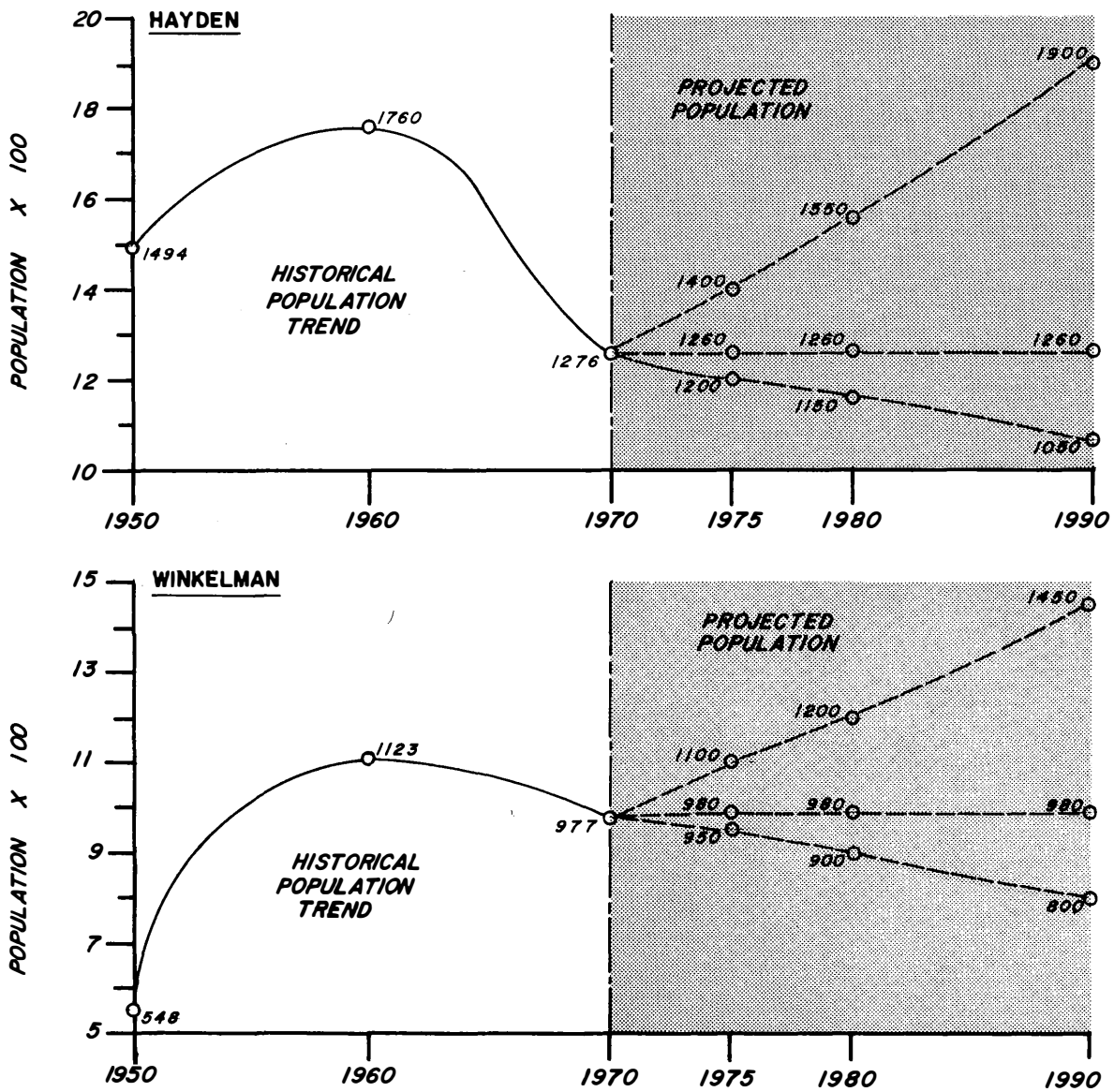


FIGURE III-2, POPULATION OF HAYDEN AND WINKELMAN AND PROJECTIONS TO 1990

LAND USE

Present Land Use Patterns-Hayden

Commercial land uses in Hayden are concentrated at the center of the community (PLATE 15).

Adjacent to this commercial center are the public and quasi-public uses. These uses are of a general welfare nature; usually parks, schools, religious institutions, etc. The location of these public land use areas and the adjacent commercial district form a focal point of community activity.

Surrounding this center of commercial and public uses are the residential areas. Hayden's residential areas have very high densities. San Pedro Ridge has the highest with 10.3 single family dwellings per acre. The entire 227 housing units along this ridge have been placed on 22 acres. The densities of this single family residential area is equal to that recommended for two or multi-family housing.

The copper mills and smelters are located north and northeast of the central core and residential areas.

Projected Land Use Patterns-Hayden

The future growth of Hayden will be restricted to the existing townsite area. The land surrounding the community is owned by the copper companies who are not releasing it for development.

Much of this copper company land is being used for either copper processing facilities or waste dumping. The vacant land is being held as potential areas for future processing facilities or related activities. The expansion of the Ray, Christmas and Morenci mines should have an impact upon the expansion activities of these facilities in Hayden.

Future residential development is projected to take two forms. The first will be to utilize the vacant lots within the community to construct new housing units. The second form future residential development is likely to take is the removal or renovation of existing residential and commercial structures and their conversion to apartment units.

The commercial district in the center of the community will undergo little change due to the lack of potential for population growth.

Present Land Use Patterns-Winkelman

Winkelman was originally laid out in a grid pattern. The residential structures are mixed with one-fourth of the housing units being mobile homes (PLATE 16).

Commercial uses have located along Prewitt Avenue and Arizona Route 177. The uses along Prewitt utilize small buildings which house such activities as specialty shops, professional offices and appliance stores. The commercial uses which have located along Arizona 177 and the Old Arizona 177 require large parking or storage areas. Many of these could be classed as light industrial in character.

There are no basic industrial uses in Winkelman. The major employers are the copper smelters in Hayden. Those industrial uses shown on PLATE 16 are service types, i.e., cement plant, petroleum wholesaler, etc.

Projected Land Use Patterns-Winkelman

Like Hayden the land surrounding Winkelman is owned by the copper companies. This has restricted the direction and rate of growth of the community (PLATE 17).

Future residential development has been proposed for the area north of Fifth Street along Arizona 77. The terrain is rough, limiting the density to three or four units per acre. This could lead to an increasing use of mobile homes for housing. Other areas which could be developed for residential purposes are owned by the copper companies and are not available for development at the present time.

An area which has been proposed for multi-family development is located directly north of the golf course. At the present time there are no plans for developing this area.

The commercial area will probably continue to develop along Arizona 177 and the "Old Highway." Businesses requiring large parking areas or storage yards should be encouraged to locate along these access routes. Light industrial uses will also tend to locate in this same area due to their space and nuisance factors.

The commercial uses along Prewitt Avenue will remain small and be composed of specialty stores and professional offices.

GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

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DEPARTMENT OF ECONOMIC
DEVELOPMENT AND DEVELOPMENT

HAYDEN, ARIZONA

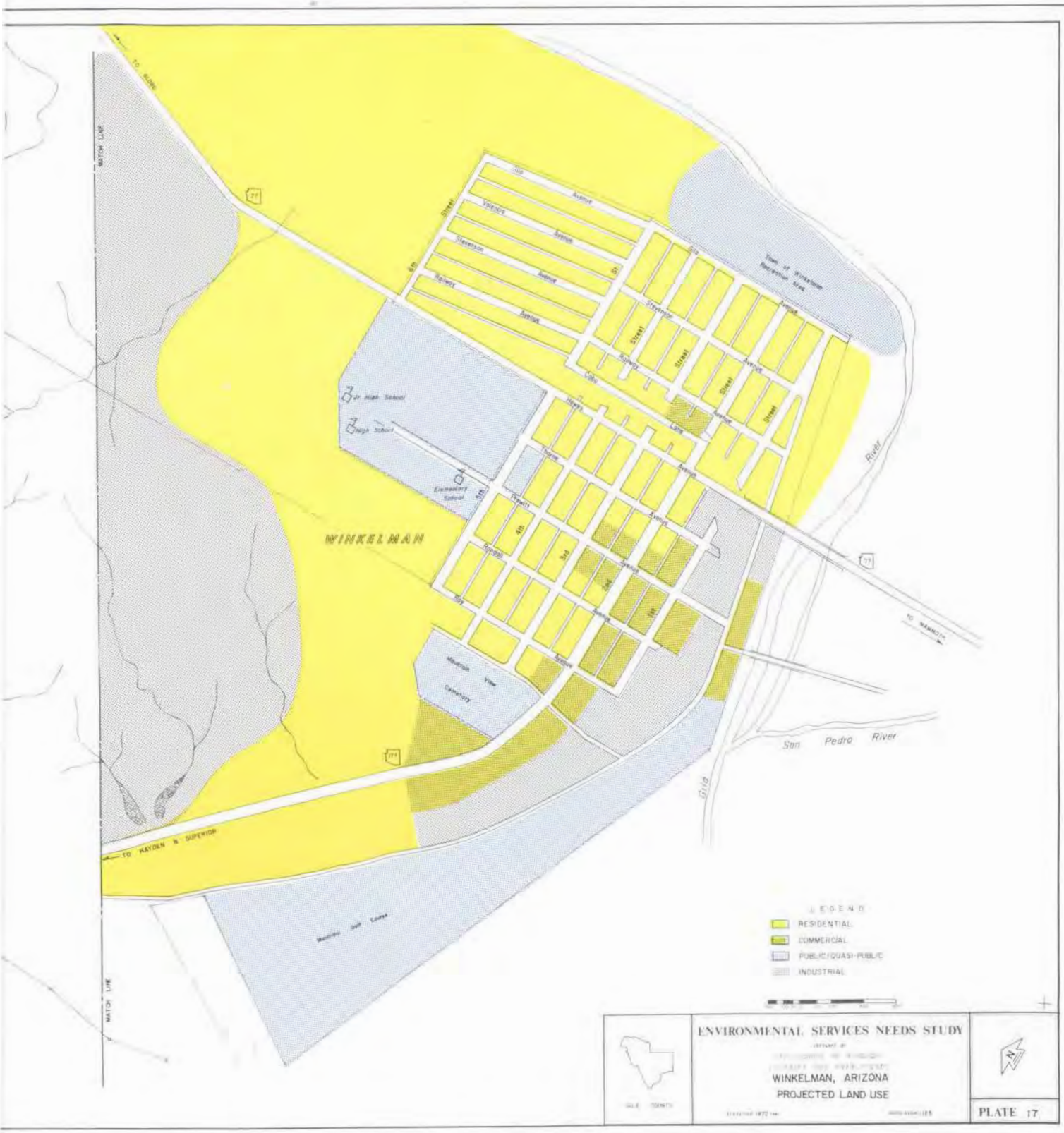
LAND USE

ELEVATION 3572 Feet

POPULATION 1276

PLATE 15

TO GLOBE
MATCH LINE
77
6th Street
Gila Avenue
Valencia Avenue
Stevenson Avenue
Railway Avenue
5th
Town of Winkelman Recreation Area
Stevenson Street
Railway Street
Coop Lane
Jr High School
High School
Elementary School
Hayes Avenue
Perry Avenue
Powell Avenue
Rondon Avenue
4th
3rd
2nd
1st
Mountain View Cemetery
WINKELMAN
River
TO MAMMOTH
San Pedro River
Gila
TO HAYDEN & SUPERIOR
Walnut Gulch Creek
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
WINKELMAN, ARIZONA
LAND USE
POPULATION 1123
PLATE 16



ENVIRONMENTAL SERVICES NEEDS STUDY

WINKELMAN, ARIZONA

PROJECTED LAND USE

PLATE 17

The area around the junction of Arizona 77 and 177 is being reserved for tourist types of commercial uses, i.e., motels, service stations and restaurants.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

Existing Facilities-Hayden

The water distribution and supply system for Hayden was initially owned by Kennecott Copper Corporation. In 1956 the distribution system was turned over to the newly incorporated municipality with Kennecott providing a metered source of water in three locations (PLATE 18). Recent water quality data shown in TABLE III-6 indicates that the area's domestic water supply exceeds 1962 USPHS recommended limits for soluble solids and sulfates.[8] Review of the problem by the Arizona State Department of Health has resulted in the recommendation that the community seek another water source.

TABLE III-6

REPRESENTATIVE WATER QUALITY DATA FOR HAYDEN

Parameter	Concentration mg/liter
Hardness (as Calcium Carbonate)	563.0
Calcium	158.0
Magnesium	41.0
Sodium	171.0
Chloride	148.0
Sulfate	550.0
Total Dissolved Solids (TDS)	1,040.0
Fluoride	0.70
Nitrate	4.0
pH	*7.4

*Standard units

Source: Arizona State Department of Health, Water Supply Division

The water quality data cited pertains to a composite water sample from five wells Kennecott operates in the area. The largest part of this water is used for industrial purposes and is not particularly suited for domestic purposes.

These five wells serve the distribution network with a 300,000 gallon storage reservoir. The reservoir is outmoded and improvements should be considered if the facility is to remain a part of the domestic supply system. Other storage reservoirs in the area total 1,500,000 gallons capacity, and are used for the industrial complex as operated by Kennecott and ASARCO. An additional 15 wells can be fed into this system which collectively have a rated output of 33,400,000 gallons per day with average daily demand of 14,400,000 gallons. The annual supply of 16,123 acre-feet per year, based on the average daily demand, has been limited by water rights established in the Sames' Decree of June 29, 1935.

The domestic system experienced problems with bacteriological contamination in February and August of 1969. The exact source of contamination was not found, however, the situation was resolved by increasing chlorination dosages. This problem has been related to the fact that portions of the distribution system are over sixty years old. From the reservoir, the system consists of 500 feet of ten-inch asbestos cement pipe, 2,000 feet of ten-inch castiron pipe and about 20,000 feet of standard steel pipe in sizes 2.5 inch through ten inch. The service pipe and other lines under 2.5 inches are standard galvanized steel pipe.

Chemical analysis of soils in the area indicates a high corrosivity potential with respect to steel pipe. This is evidenced by the replacement in recent years of many service lines.

Future Needs-Hayden

Water supply needs in Hayden are outlined in TABLE III-7. As noted, the Kennecott Corporation provides the community with a metered source out of a well delivery system capable of producing 14,400,000 gallons per day.

The distribution system however will conceivably need line replacements in future years basically as a result of corrosion. Increased delivery capacities may be required for those areas where multi-family housing is projected to develop.

ASARCO HOLDINGS
K.C.C. 24" Line to old Reservoir Capacity 1,000,000 Gallons
Reservoir
Pump
K.C.C. 5 m GPM 200 PSI Electric
Water
KCC HOLDINGS
6" Loop
Reservoir 24 m Metered
Water
Water
ASARCO
K.C.C.-10" Line to Reservoir
Hayden
KCC HOLDINGS
ASARCO HOLDINGS
TO MINKELMAN
MATCH LINE
MATCH LINE
TO SUPERIOR
WATER SYSTEM
LINE SIZES
3/4"-2 1/2"
3"
4"
6"
8"
GATE VALVE
WELL
HYDRANT
FIRE STATION
BOOSTER PUMP
ASARCO HOLDINGS
K.C.C. HOLDINGS
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
HAYDEN, ARIZONA
WATER SYSTEM
ELEVATION 1872 Feet
POPULATION 1276
PLATE 18

TABLE III-7

PROJECTED AVERAGE DAILY AND YEARLY WATER DEMANDS FOR HAYDEN IN 1975, 1980 AND 1990

Projection Level	1975 Gallons/day	1980 Gallons/day	1990 Gallons/day	Acre feet per year
Summer	191,800	227,850	317,300	
High		167	202	290
Winter	106,400	133,300	201,400	
Summer	173,000	185,000	210,000	
Median		151	164	193
Winter	96,000	108,000	134,000	
Summer	164,000	169,000	175,000	
Low		143	150	160
Winter	91,200	98,900	111,300	

Source: Project Staff estimates.

Existing Facilities - Winkelman

Water services in Winkelman are supplied by the investor-owned Arizona Water Company. The water system in the community (PLATE 19) delivers water originating in two wells located in the Gila River Flood Plain near the western city limits of the community. These wells have a maximum depth of about 300 feet and static water levels of 30 feet. The quality of Winkelman's water supply is presented in TABLE III-8.

Water from the wells is pumped to a 200,000 gallon storage tank which floats on the distribution system. The well system has the estimated capability to deliver 115,000 gallons per day. At present, peak demands reach 100,000 gallons per day for 264 metered customers. Customer service includes 227 residential; 35 commercial; and 2 industrial users.

TABLE III-8

REPRESENTATIVE WATER QUALITY DATA FOR WINKELMAN WATER SYSTEM OPERATED BY ARIZONA WATER COMPANY

Parameter		Concentration mg/liter
Hardness (as Calcium Carbonate)		305.0
Calcium		80.0
Magnesium		25.0
Sodium		86.0
Chloride		230.0
Sulfate		160.0
Total Dissolved Solids (TDS)		828.0
Fluorides		1.1
Nitrates	(less than)	1.0

Source: Arizona State Department of Health, Water Supply Division

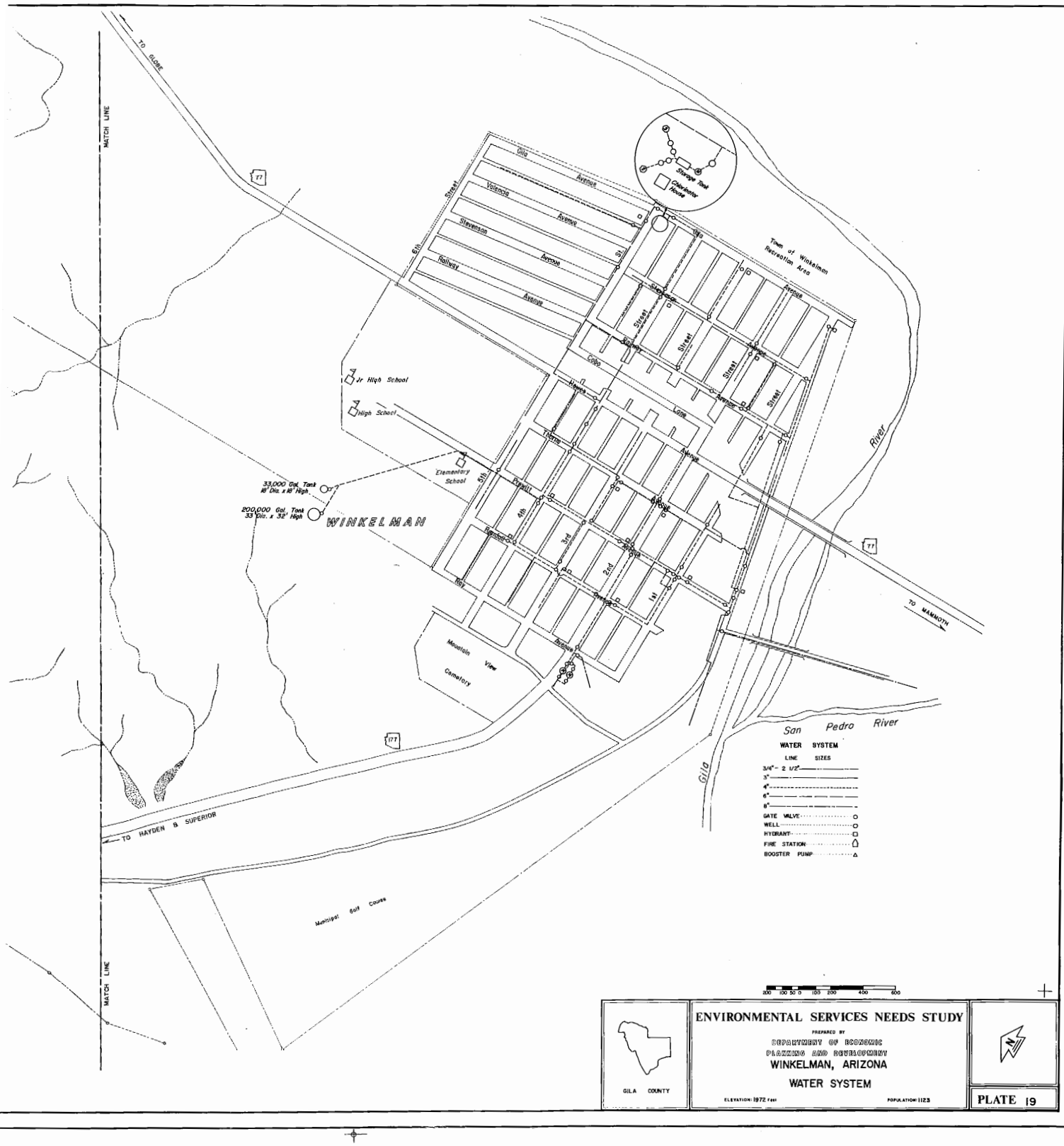
Future Needs-Winkelman

There will be a need for additions to the distribution system in the vacant areas of the community which will eventually come under residential use. Water supply demand estimates are outlined in TABLE III-9.

SEWERAGE AND WASTE WATER TREATMENT

Existing Facilities-Hayden

Sewage collection lines have been installed to serve about 95 percent of the community (PLATE 20). All lines are vitrified clay pipe with cement joints. The sewers in the San Pedro district of the community were constructed in 1951 with manholes at all intersections. The sewers in the Hayden and ASARCO districts were constructed prior to 1951, and apparently were not installed with manholes or cleanouts. Consequently, visual inspection of these sewers is not possible.


TO GLOBE
MATCH LINE
77
Gila Avenue
Valencia Avenue
Stevenson Avenue
Railway Avenue
6th Street
5th Street
Storage Tank
Chlorinator House
Town of Winkelman Recreation Area
Jr High School
High School
Elementary School
33,000 Gal. Tank 18' Dia. x 18' High
200,000 Gal. Tank 33' Dia. x 32' High
WINKELMAN
Cobb Lane
Hayes Avenue
Ryan Street
4th Street
3rd Street
2nd Street
1st Street
Mountain View Cemetery
San Pedro River
Gila River
TO MAMMOTH
TO HAYDEN & SUPERIOR
Municipal Golf Course
WATER SYSTEM
LINE SIZES
3/4" - 2 1/2"
3"
4"
6"
8"
GATE VALVE
WELL
HYDRANT
FIRE STATION
BOOSTER PUMP
200 100 50 0 100 200 400 600
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
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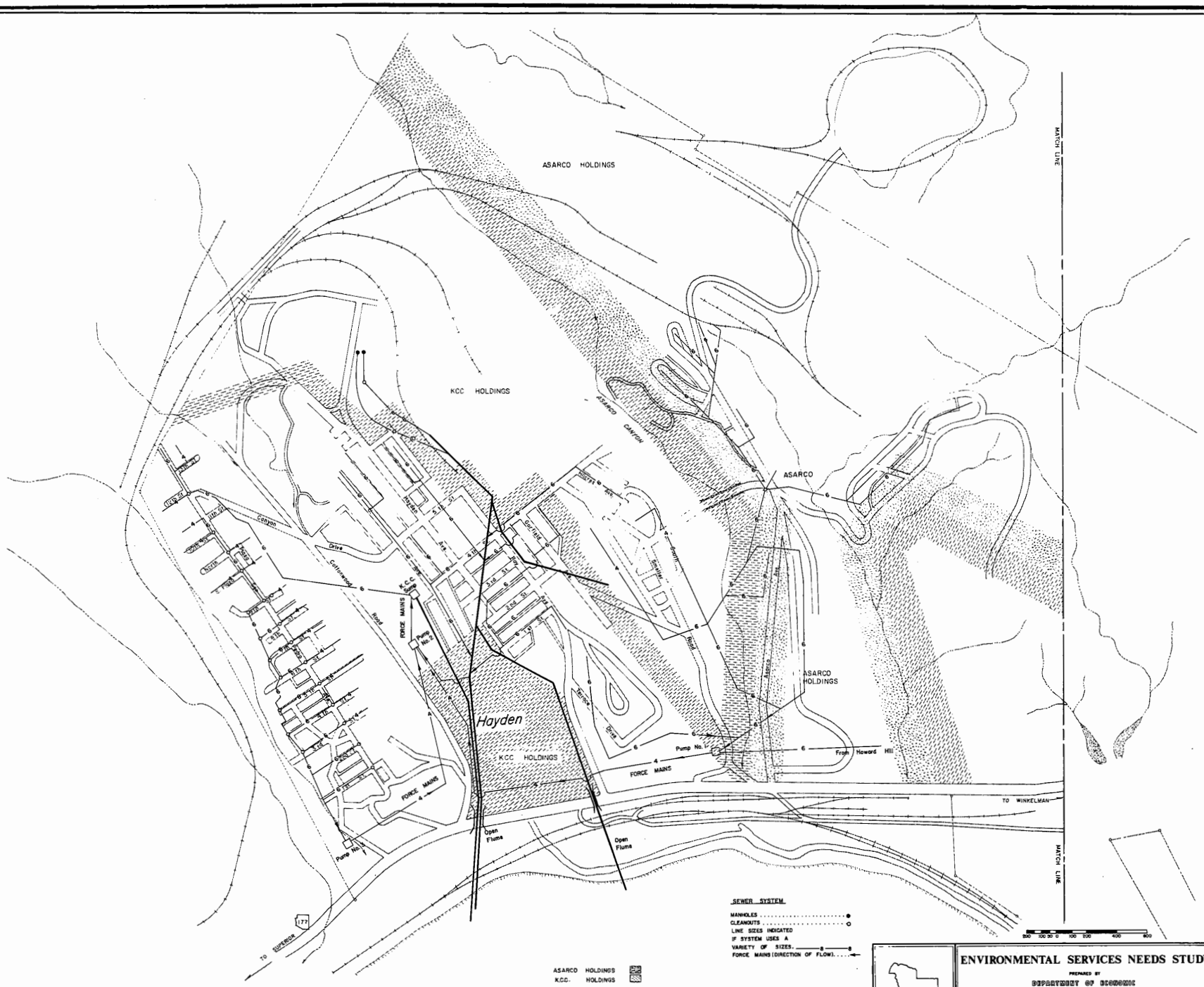
PLANNING AND DEVELOPMENT
WINKELMAN, ARIZONA
WATER SYSTEM
ELEVATION: 1972 Feet
POPULATION: 1123
PLATE 19


ASARCO HOLDINGS
KCC HOLDINGS
ASARCO CANYON
ASARCO
ASARCO HOLDINGS
Hayden
KCC HOLDINGS
FORCE MAINS
Pump No. 1
From Howard Hill
TO WINKELMAN
Open Flume
Open Flume
Pump No. 2
K.C.C. Office
Pump No. 3
Cottonwood Road
Canyon Drive
Hayden Ave
Gila Ave
Ash Ave
Cedar Ave
Elm Ave
Pine Ave
Oak Ave
Maple Ave
Sycamore Ave
Walnut Ave
Hill Ave
Ash Ave
Cedar Ave
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Pine Ave
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MATCH LINE
SEWER SYSTEM
MANHOLES
CLEANOUTS
LINE SIZES INDICATED
IF SYSTEM USES A
VARIETY OF SIZES.
FORCE MAINS (DIRECTION OF FLOW).
ASARCO HOLDINGS
K.C.C. HOLDINGS
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
HAYDEN, ARIZONA
SEWER SYSTEM
ELEVATION: 1972 Feet
POPULATION: 1276
PLATE 20

TABLE III-9

PROJECTED AVERAGE DAILY AND YEARLY WATER SUPPLY NEEDS FOR WINKELMAN IN 1975, 1980 AND 1990

Projections Level	YEAR 1975	1980	1990	
Time of Year	Gallons/day	Gallons/day	Gallons/day	
Summer	110,000	132,000	188,500	
High	111	134	195	Acre feet per year
Winter	88,000	108,000	159,500	
Summer	98,000	107,800	127,400	
Median	99	110	132	
Winter	78,400	88,200	107,800	
Summer	95,000	99,000	104,000	
Low	96	101	108	
Winter	76,000	81,000	88,000	

Project staff estimates

At one time the community used two Imhoff tanks as a means of effecting primary treatment of sewage. The effluent from these facilities were discharged partly to the tailing ponds and sometimes into a wash adjacent to the smelter access road. This form of treatment was abandoned in 1956 with all collected sewage now disposed of on the tailings dumps west of the community.

At present collected sewage is transferred to tailings sluceways by use of three lift stations. The lift stations are operated and maintained by the Kennecott Copper Corporation through an agreement with the city. No problems have occurred within the collection system, however, power outages have caused temporary problems with the lift stations.

Estimated sewage flows range from 75,000 to 135,000 gallons per day with the higher value indicative of flows produced in the summer.

Future Needs-Hayden

Apparent needs for new sewage collection lines are minimal. The only situation which may necessitate additional collection lines is the construction of multi-family housing and apartments of such density that existing collection lines may be overloaded. This type of situation may result in lift stations becoming inadequate with respect to pumping capacities.

Waste treatment needs are also minimal, provided Kennecott, through their agreement with the city, continues to transport collected sewage to the tailing ponds. This agreement, however, does not imply that Kennecott will always take the responsibility of disposing of wastes generated. Kennecott may decide that the utilization of untreated raw sewage wastes on the tailings piles is not to their best advantage. Hayden can best prepare for this possibility by initiating plans for the eventual construction of a community waste water treatment facility.

Anticipated sewage flows for the community are presented in TABLE III-10.

TABLE III-10

PROJECTED AVERAGE DAILY AND YEARLY SEWAGE FLOWS FOR HAYDEN IN 1975, 1980 AND 1990

Projection Level	YEAR						
	1975		1980		1990		
Time of Year	Gallons/day		Gallons/day		Gallons/day		
Summer	124,670		148,100		206,300		
High		98		116		162	Acre feet per year
Winter	80,000		100,000		151,000		
Summer	112,000		120,000		137,000		
Median		88		94		107	
Winter	72,000		81,000		101,000		
Summer	107,000		110,000		114,000		
Low		84		86		89	
Winter	68,400		74,000		83,000		

Project staff estimates

Existing Facilities-Winkelman

At present, sewage wastes generated in the community are disposed of through the use of septic tanks and associated leach fields or seepage pits. Continuing problems with septic tanks system prompted the formation of a Sanitary District in Winkelman subsequent to the design of the proposed collection system illustrated in PLATE 21.[9]

Collected wastes are to be treated in an extended aeration type facility which will handle a design flow of 60,000 gallons per day. The sewage treatment plant site was obtained from Kennecott Copper Corporation for no cost. This was contingent upon the municipality giving Kennecott all rights to the treated effluent from the facility. Kennecott anticipates an eventual need for this reclaimed water for industrial uses.

Effluent from the treatment facility will be discharged after chlorination to the Gila River until such time when Kennecott exercises the rights to the water.

Future Needs-Winkelman

Present needs for sewage collection and disposal are on the verge of being met. In a short time, however, additional needs will no doubt arise. These needs will involve expansion of the collection system to the vacant areas of the community where new housing will develop. The design capacity of the waste treatment facility may be exceeded and expansion needed. TABLE III-11 presents future expected average daily sewage flows in the community. By 1975, it appears the need to expand the treatment unit may be a reality. The development of new housing in the northeast section of the community in future years is included as contributing to the sewage flows projected in TABLE III-11.

SOLID WASTE DISPOSAL PRACTICES AND TECHNIQUES

Existing Facilities-Hayden and Winkelman

Both municipalities have a bi-weekly collection service for residential areas and daily service in the commercial districts.

Collected wastes for both communities are disposed of in a joint dumpsite located on the flood plain of the Gila River west of State Highway

TABLE III-11

PROJECTED AVERAGE DAILY AND YEARLY SEWAGE FLOW FOR WINKELMAN IN 1975, 1980 AND 1990

Projection Level	YEAR 1975		YEAR 1980		YEAR 1990	
Time of Year	Gallons/day		Gallons/day		Gallons/day	
Summer	85,800		105,600		156,600	
High		82		102		155
Winter	59,400		76,800		121,800	
Summer	76,400		86,200		106,000	
Median		72		83		105
Winter	53,900		63,000		82,300	
Summer	74,100		83,600		102,600	
Low		70		81		102
Winter	51,300		61,000		79,800	

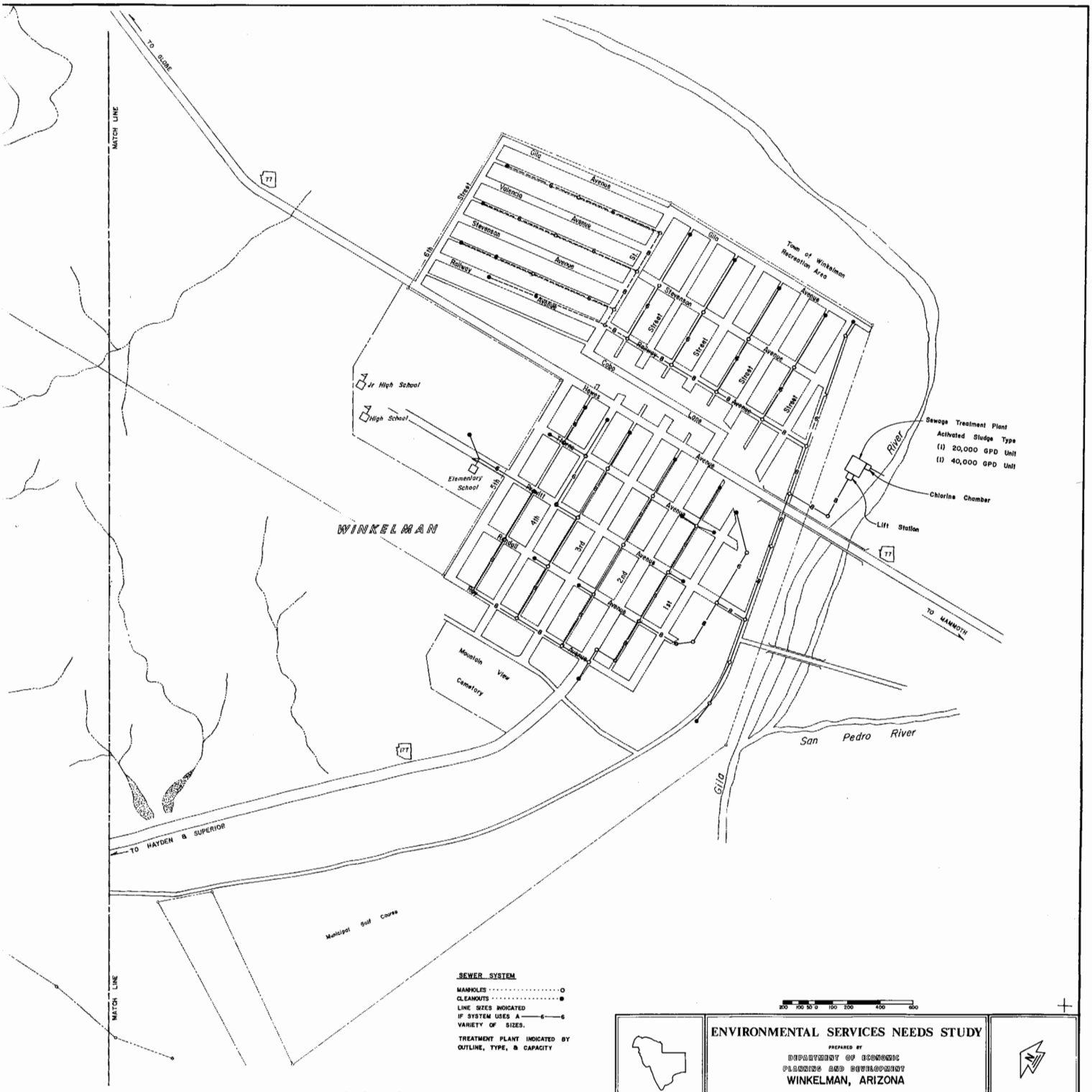
Acre feet per year

Project staff estimates

171 adjacent to the Hayden municipal golf course. The trench and fill technique is utilized at the dumpsite, however, burning is practiced in the trenches due to the limited size of the site. City crews periodically maintain the dumpsite by covering filled trenches and constructing new ones.

Future Needs-Hayden and Winkelman

The location of Hayden and Winkelman's solid waste dumpsite makes it susceptible to flooding during periods of high flow in the Gila River. The site is also too small to adequately serve the community. The development of a sanitary landfill in a location of sufficient area should be considered by the community. Solid waste production levels for Hayden and Winkelman are presented in TABLE III-12.



AT DATE OF PUBLICATION, THE WINKELMAN SEWERAGE COLLECTION AND DISPOSAL SYSTEM IS BEING SUBMITTED TO CONTRACTORS FOR BIDS ON CONSTRUCTION OF INDICATED FACILITIES.

TABLE III-12

PROJECTED AVERAGE YEARLY
SOLID WASTE PRODUCTION FOR HAYDEN AND WINKELMAN
IN 1975, 1980 AND 1990
(tons per year)

HAYDEN

Population Projection YEAR	PRODUCTION LEVELS POPULATION PROJECTION LEVELS LOW	MEDIAN	HIGH
1975	625	655	750
1980	725	790	980
1990	880	1,060	1,600

WINKELMAN

Population Projection YEAR	PRODUCTION LEVELS POPULATION PROJECTION LEVELS LOW	MEDIAN	HIGH
1975	495	510	570
1980	570	615	760
1990	670	820	1,220

Source: Project Staff Estimates.

COMMUNITY OF MIAMI
(Claypool-Midland City-Central Heights)

HISTORICAL BACKGROUND

The community of Miami was established in 1907 as a result of expanded copper mining and smelter activities in Globe. The community was nicknamed "Concentrator City" in 1909 when the Superstition Mine Company constructed a huge reduction plant. Miami was incorporated in 1918 and today encompasses an area of approximately five square miles.

PHYSIOGRAPHY-GEOLOGY

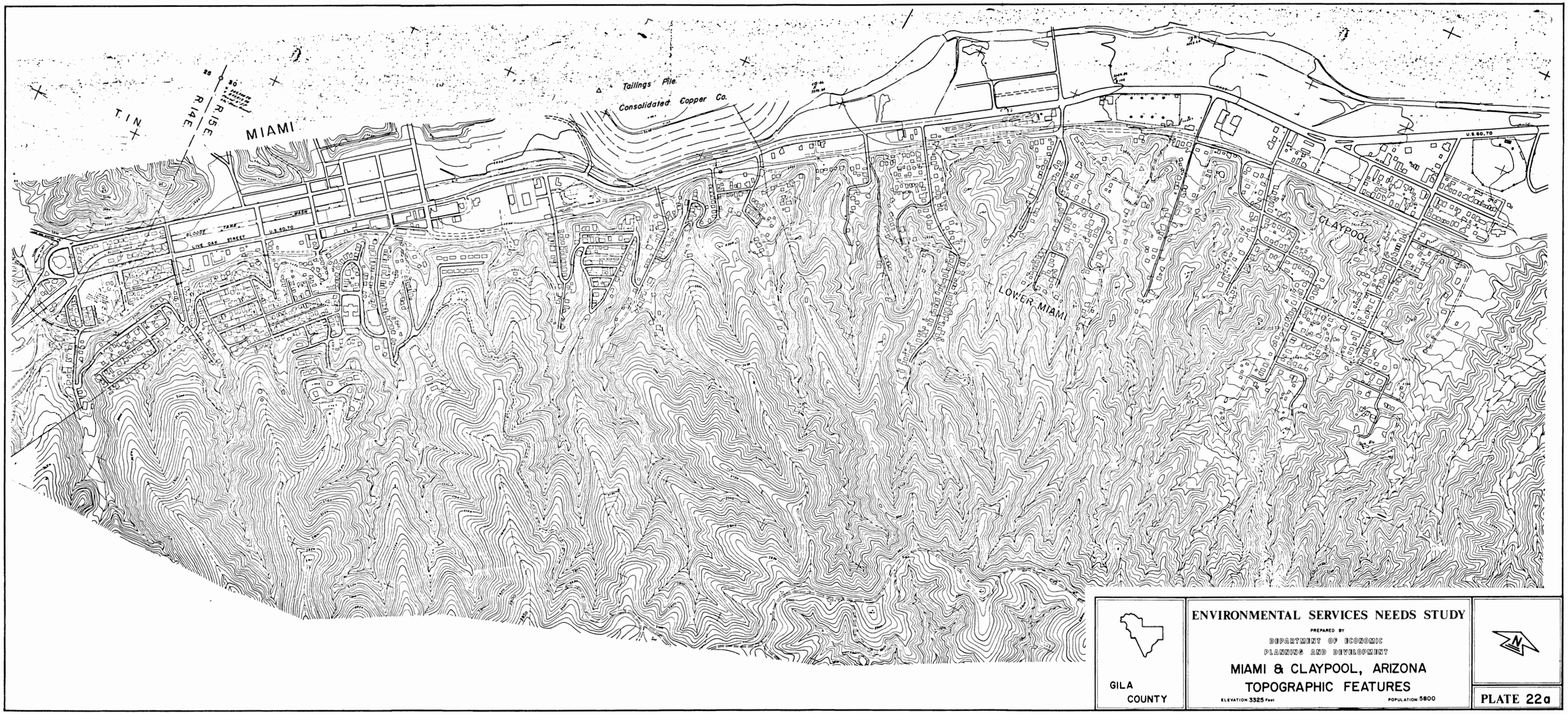
Miami lies at the western end of a narrow valley bounded by rugged mountains with elevations to 3,700 feet (PLATE 22). The mountainous character forms the major intermittent stream beds that carry surface drainage from the region. Pinal Creek which is tributary to the Salt River approximately six miles upstream from Theodore Roosevelt Lake, carries surface drainage originating in Bloody Tanks Wash and Miami Wash.

The soils found in this region are generally shallow in depth lying on granite and schist rock formations. The Miami area exhibits rugged terrain of a conglomerate nature. East of Miami in the area of Claypool and Central Heights extensive alluvial soil deposits are exhibited with high permeability constants.

SOCIO-ECONOMIC PROFILE

The economy of Miami is heavily dependent upon the mining and smelting of copper ore. About three-fourths of the mining in the county is in the Miami area which gives the community a significant role in the county's economy, as mining is Gila County's largest sector of employment and source of labor earnings. Recently, manufacturing has also become important to the community with the establishment of a copper wire rod plant. Significant additional employment in Miami is found in wholesale and retail trade and services.

The population of Miami reached a peak of 7,693 in 1930 and has declined with every decennial census since that time. FIGURE III-3 shows the trend in Miami population since 1920 with high, median and low projections to 1990. The median projection assumes that Miami's population has stabilized at the 1970 figure of approximately 3,300. The high projection for 1990 is 4,030. At this time housing in Miami is in short supply but additional building within the city limits could permit a population increase resulting in the high projection being met. Annexation could also significantly increase the town's population. Three different parcels were annexed during the preceding decade and it seems probable that portions of Claypool might be annexed in the next twenty years, especially since Claypool is already served by some of Miami's municipal services. The low projection for 1990 is 2,700. This lower population figure is a definite possibility if the town continues to experience the population trend seen in the last forty years.



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

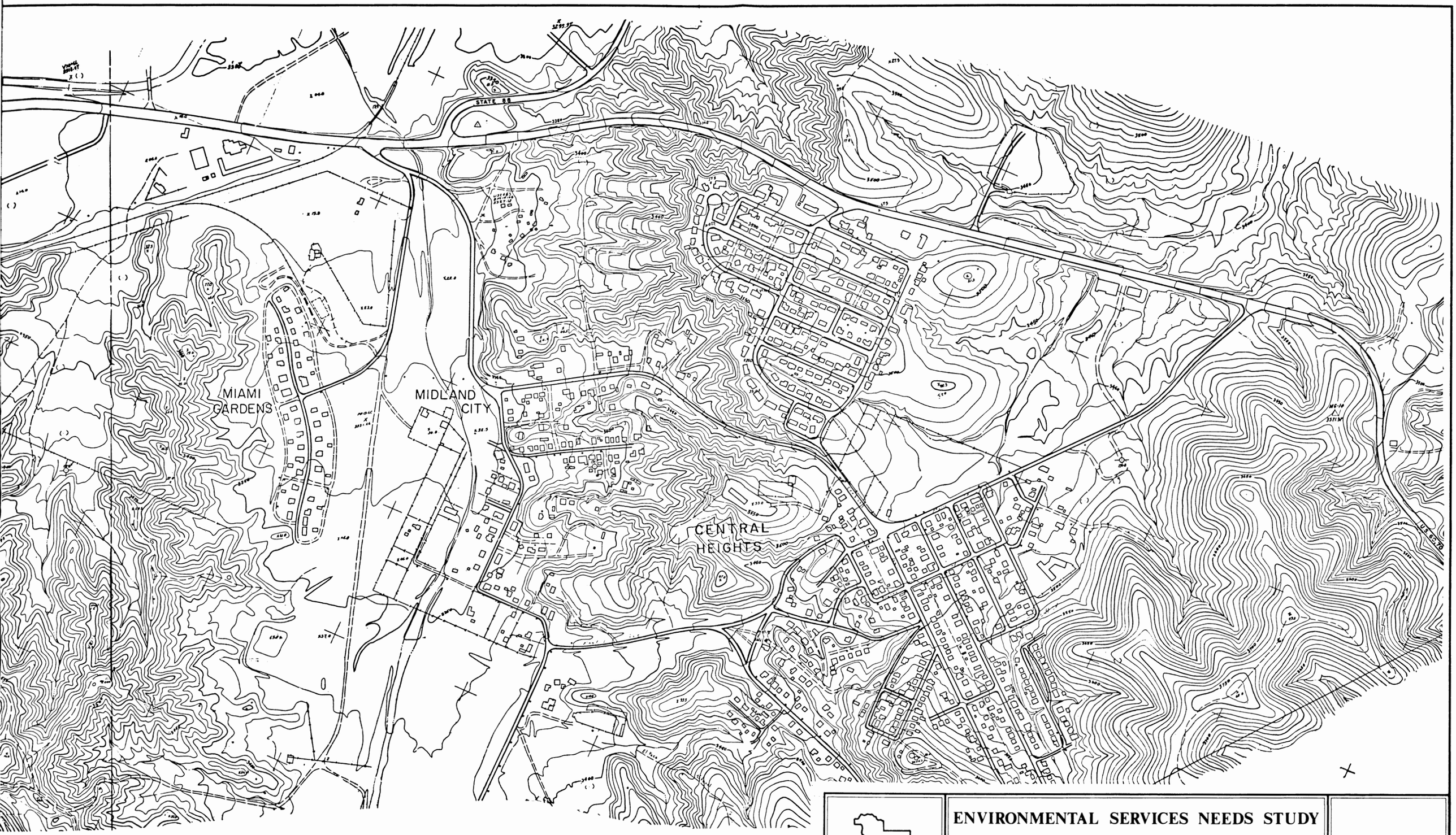
MIAMI & CLAYPOOL, ARIZONA

TOPOGRAPHIC FEATURES

ELEVATION 3325 Feet

POPULATION 5800

PLATE 22a



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

CENTRAL HEIGHTS, ARIZONA

TOPOGRAPHIC FEATURES

ELEVATION: 3400 Feet

POPULATION: 2500

N

PLATE 22b

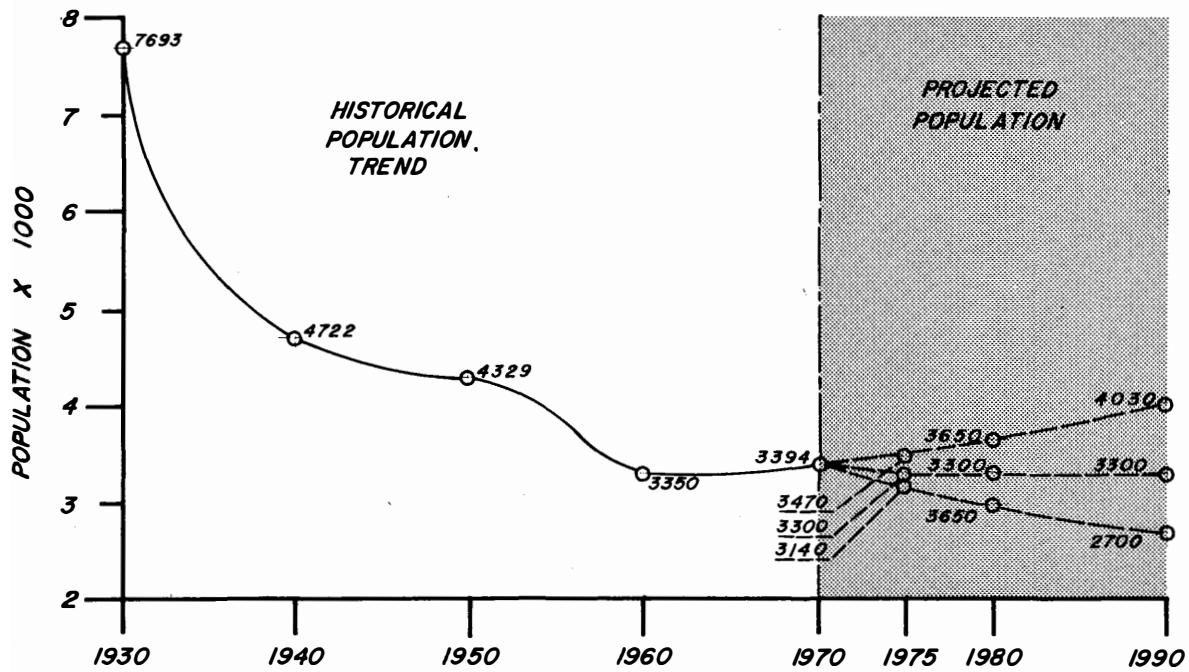


FIGURE III-3. POPULATION OF MIAMI AND PROJECTIONS TO 1990

There is a possibility that Miami may experience a boom in underground mining operations in the near future. The majority of deeded property within the city limits has mineral rights only to a depth of 40 feet. Under this level mining operations can legally occur which could possibly result in surface structural damage for which the property owner would have no source of compensation. The effect of this, if it should occur, upon the town's population or upon the future site of the town is difficult to assess. At this time extensive test drilling is occurring within the city limits.

Although the official population of Miami has consistently declined since 1930, the trend is somewhat misleading. The two nearby

unincorporated areas of Central Heights and Claypool are essentially residential communities for persons whose source of employment is in and around Miami and Globe. Together, Claypool and Central Heights contain approximately 5,000 persons, nearly equally divided between each community. This population gives the Miami-Claypool-Central Heights area approximetely 8,300 inhabitants in 1970, about the same as the 1930 population of Miami. Figure III-4 shows the population projection for the Miami-Claypool-Central Heights area to the year 1990.

The growth potential of the entire area is heavily dependent upon future mining activity and the mining base of the community seems sufficiently secure for many years.

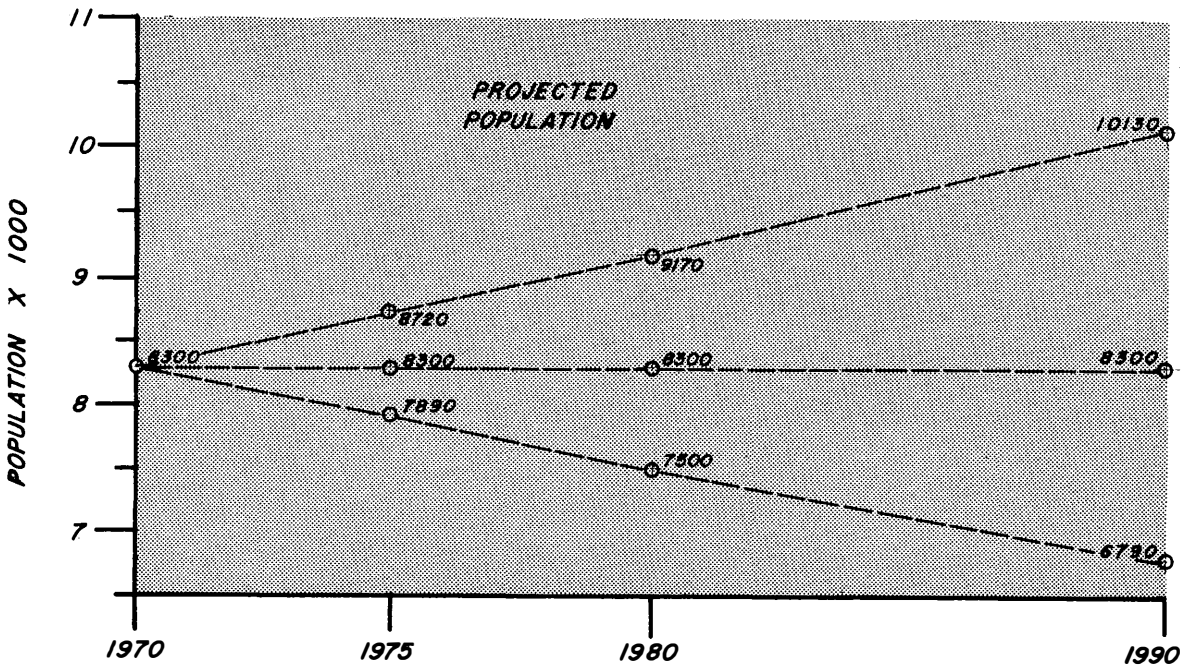


FIGURE III-4. POPULATION PROJECTIONS OF MIAMI-CLAYPOOL-CENTRAL HEIGHTS AREA 1975, 1980, AND 1990

LAND USE

Present Land Use Patterns

The community of Miami and the developed unincorporated areas of Lower Miami, Claypool, Midland City and Central Heights are basically a form of strip development along U.S. Highway 60-70. Physically the strip development follows the Canyon floor indicated in PLATE 23.

Residential development has occurred along the sides of the canyon leaving the floor for commercial and industrial usage. Much of the housing in Miami and Claypool is old and deteriorating.

With the exception of the Town of Miami there is little multi-family development. The multi-family structures found in Miami are converted, large, single family homes north of town.

Presently there are over 300 mobile home units in the planning area. The greatest concentrations are in Central Heights and Claypool.

Commercial land uses occur along the center of the canyon floor. The major districts are the Miami Central Business District and strip development adjacent to U.S. 60-70. There has been additional commercial development in Central Heights and Claypool but not as concentrated as Miami and along the highway. A large number of the commercial structures in the Miami Central Business District are vacant and many of these are owned or held under option by the mining corporations.

Leapfrogging has occurred along U.S. 60-70 in and around Miami. Much of the commercial land use areas are surrounded by large tracts of land being used for residential or public purposes. Many of the buildings on the strip development from Miami through Central Heights are vacant or deteriorating.

With the exception of mining operations, industrial development has been confined to a few small enterprises which are indirectly supportive to the mining operations. On the land use map are open storage yards, maintenance yards and other basic facilities.

The mining operations make up the industrial base for the Miami Planning Area. The mining companies own most of the land and all of the mineral rights within the area, leaving very few tracts available for other types of industrial development.

It is conceivable that within the near future mining activity will extend into the Town of Miami. The extent of the area which may be involved is not known at this time but it is thought to include the downtown area and as far south as Bloody Tanks Wash. The mining interests have extended options for all the land within downtown Miami.

Projected Land Use Patterns

Changes in land use patterns for the Miami area are at this time difficult to predict. Miami is situated above a large deposit of copper ore and the area has received considerable attention from the mining interests who have extended numerous options for purchase to the property owners. In addition to resolving problems of mineral rights, it will be necessary to establish the extent to which the mining companies may be liable for disruption of surface activities in the event a decision is made on the economic feasibility of exploiting the ore body.

The vacant tracts of land between established commercial areas moving eastward along the highway will most probably be utilized for commercial purposes. Spreading residential patterns and increasing population density adjacent to vacant commercial areas will stimulate development and as these areas come under development additional water service capabilities will arise. (PLATE 24).

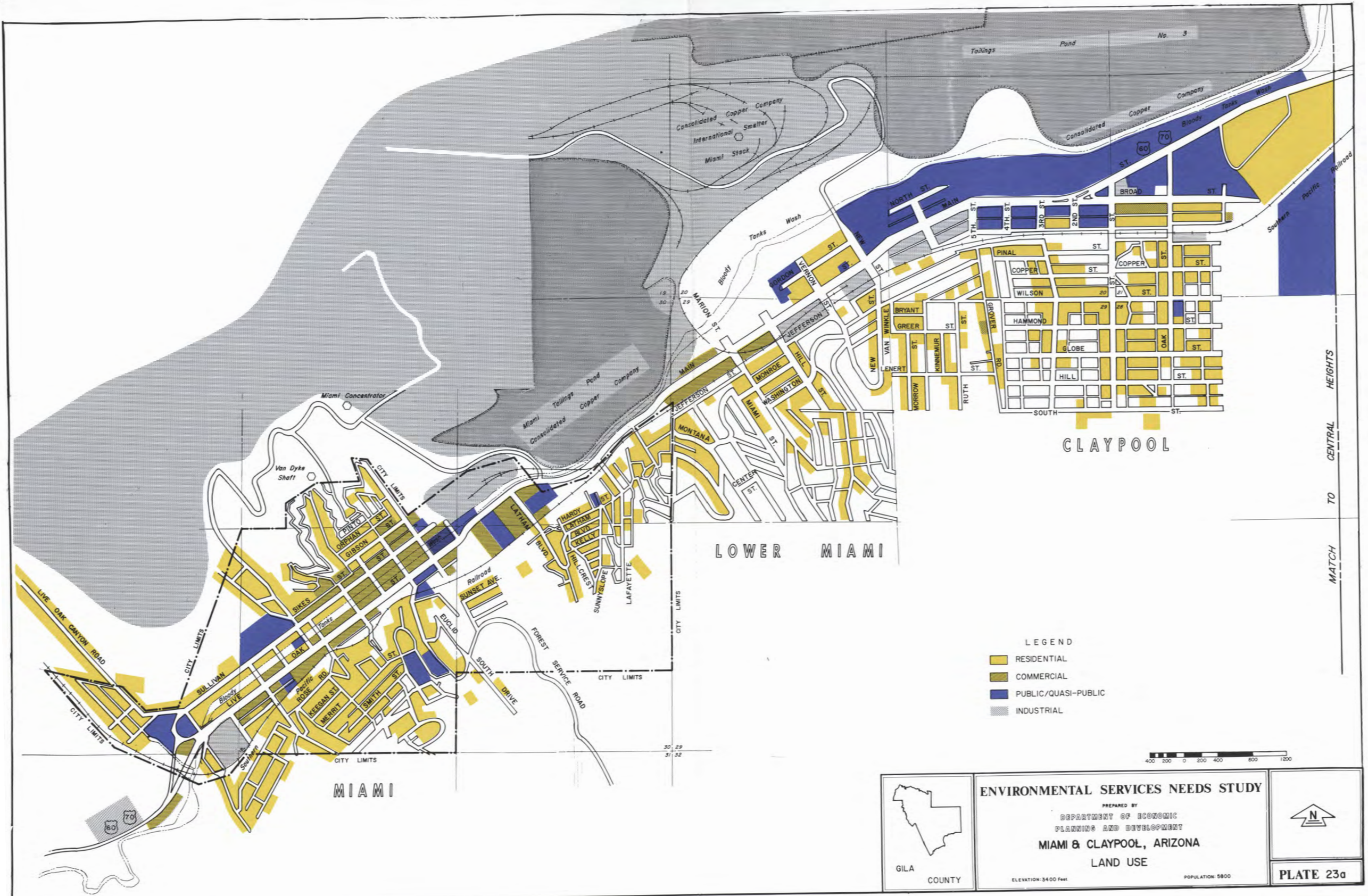
Residential land use will spread and become more densely settled in the areas of Midland City and Central Heights. The topography is not as rugged as in the Miami area and subsequently does not present major development difficulties. Soil characteristics are not of a nature to make construction of water or sewer collection lines particularly difficult.

The area along Arizona Route 88 and the Cobre Valley Country Club is flat and desirable for future residential development.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

Existing Facilities

The community of Miami and adjacent areas of Lower Miami, Midland City, Claypool, Miami Gardens and Central Heights are served by a combined water distribution network operated by the Arizona Water Company (PLATE 25a and 25b).


Tailings Pond No. 3
Consolidated Copper Company
International Smelter
Miami Stack
Tanks Wash
Bloody
Miami Concentrator
Van Dyke Shaft
Miami Tailings Pond
Consolidated Copper Company
CLAYPOOL
LOWER MIAMI
MIAMI
CENTRAL HEIGHTS
MATCH TO
CITY LIMITS
LIVE OAK CANYON ROAD
SULLIVAN
LIVE
OAK
SIKES
PINTO
ORPHAN
GIBSON
ROSE
KEEGAN ST
MERRIT
SMITH
EUCLID
SUNSET AVE.
Railroad
SOUTH DRIVE
FOREST SERVICE ROAD
LATHAM BLVD.
HARDY
LATHAM
KELLY
HILLCREST
SUNNYSLOPE
LAFAYETTE
MONTANA
CENTER ST.
JEFFERSON
MONROE
WASHINGTON
HILL
MIAMI
MARION ST.
GORDON
VERNON
NEW
NORTH ST.
MAIN
BROAD
PINAL
COPPER
WILSON
HAMMOND
GLOBE
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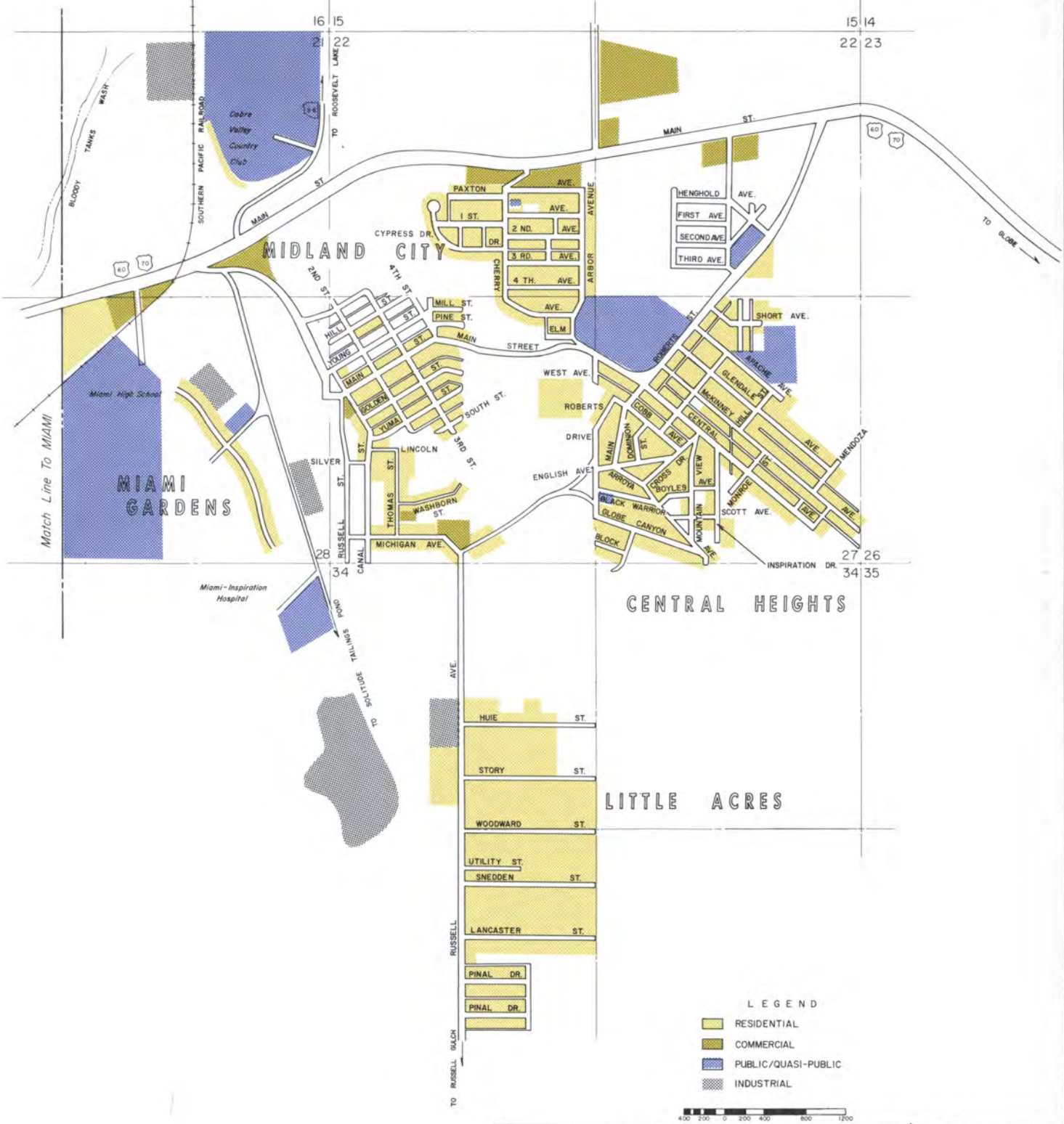
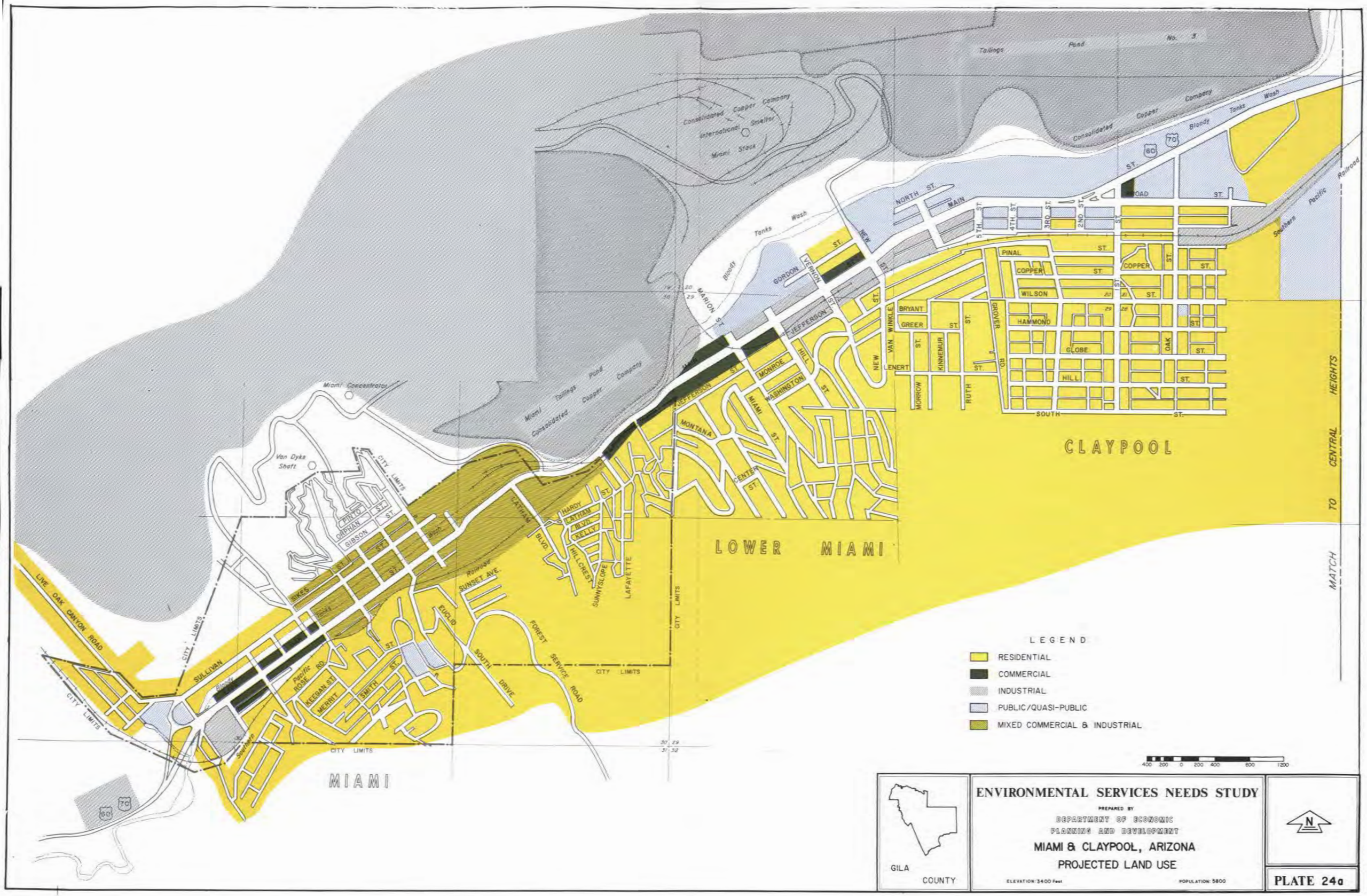
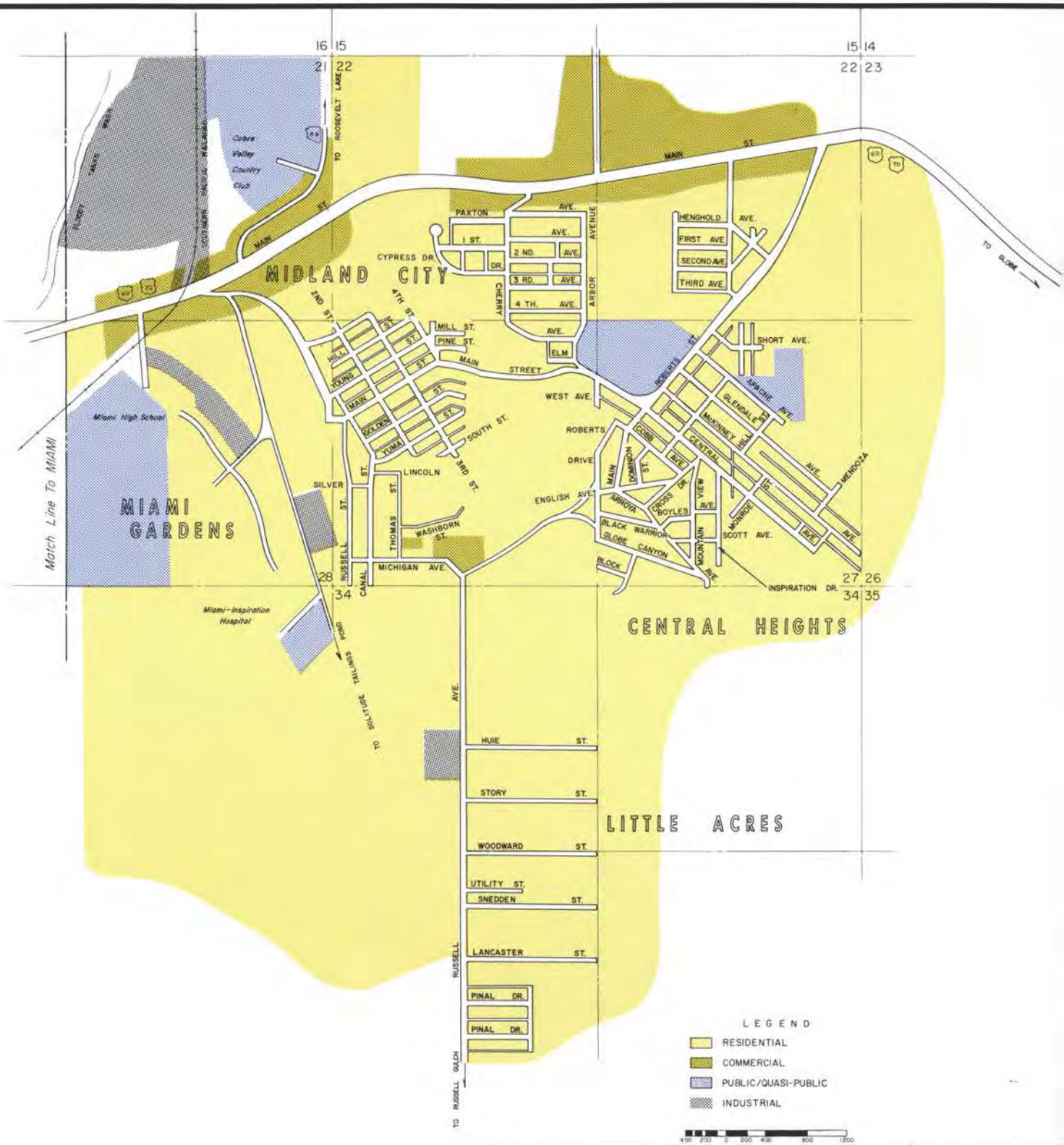
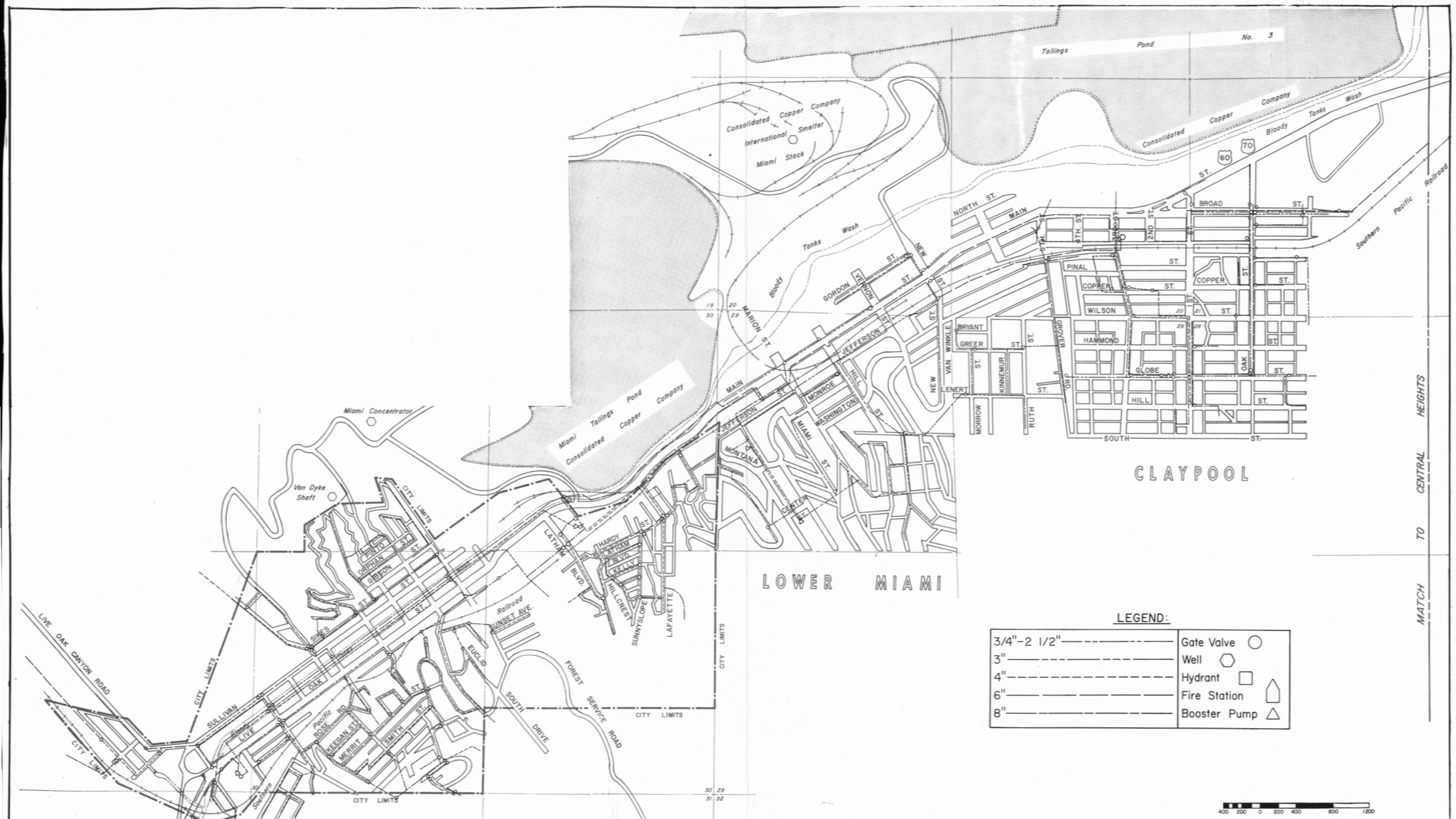
BRYANT
GREER
KINNEMUR
MORROW
RUTH
VAN WINKLE
LENERT
GROVER
OAK
1ST. ST.
2ND ST.
3RD. ST.
4TH. ST.
5TH. ST.
Southern Pacific Railroad
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT
MIAMI & CLAYPOOL, ARIZONA
LAND USE
ELEVATION: 3400 Feet
POPULATION: 5800
N
PLATE 23a


MIDLAND CITY
MIAMI GARDENS
CENTRAL HEIGHTS
LITTLE ACRES
Match Line To MIAMI
Miami High School
Miami-Inspiration Hospital
Cobre Valley Country Club
BLOODY TANKS WASH
SOUTHERN PACIFIC RAILROAD
TO ROOSEVELT LAKE
MAIN ST.
TO GLOBE
PAXTON AVE.
1 ST. AVE.
2 ND. AVE.
3 RD. AVE.
4 TH. AVE.
ELM AVE.
CYPRESS DR.
DR.
CHERRY
ARBOR AVENUE
HENGHOLD AVE.
FIRST AVE.
SECOND AVE.
THIRD AVE.
SHORT AVE.
ROBERTS ST.
APACHE AVE.
GLENDALE
McKINNEY HILL
CENTRAL AVE.
COBB
DOMINION
ARROYA
CROSS DR.
BOYLES
VIEW AVE.
MONROE
MENDOZA
SCOTT AVE.
INSPIRATION DR.
BLACK WARRIOR
GLOBE
CANYON
BLOCK
MOUNTAIN AVE.
2ND ST.
4TH ST.
MILL ST.
PINE ST.
HILL ST.
YOUNG ST.
MAIN ST.
GOLDEN ST.
YUMA ST.
SOUTH ST.
3RD ST.
LINCOLN
SILVER ST.
THOMAS ST.
WASHBORN ST.
RUSSELL ST.
CANAL
MICHIGAN AVE.
WEST AVE.
ROBERTS DRIVE
ENGLISH AVE.
POND TAILINGS
TO SOLITUDE
RUSSELL AVE.
HUIE ST.
STORY ST.
WOODWARD ST.
UTILITY ST.
SNEDDEN ST.
LANCASTER ST.
PINAL DR.
PINAL DR.
TO RUSSELL GULCH
16 15
21 22
15 14
22 23
28
34
27 26
34 35
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
CENTRAL HEIGHTS, ARIZONA
LAND USE
ELEVATION: 3450 Feet
POPULATION: 3350
N
PLATE 23b


Tailings Pond No. 3
Consolidated Copper Company
International Smelter
Miami Stack
Bloody Tanks Wash
Miami Concentrator
Miami Tailings Pond
Consolidated Copper Company
Van Dyke Shaft
CLAYPOOL
LOWER MIAMI
MIAMI
MATCH TO CENTRAL HEIGHTS
Southern Pacific Railroad
LIVE OAK CANYON ROAD
CITY LIMITS
NORTH ST.
MAIN ST.
ROAD ST.
NEW ST.
GORDON
VERNON
MARION ST.
JEFFERSON ST.
MONROE
WASHINGTON
HILL ST.
MIAMI ST.
MONTANA
CENTER ST.
VAN WINKLE
LENERT
BRYANT
GREER
KINNEMUR
MORROW
RUTH
GROVER RD.
PINAL
COPPER
WILSON
HAMMOND
GLOBE
HILL
OAK
SOUTH ST.
1ST. ST.
2ND ST.
3RD ST.
4TH ST.
5TH ST.
LATHAM BLVD.
HARDY
LATHAM BLVD.
KELLY
HILLCREST
SUNNYSLOPE
LAFAYETTE
SUNSET AVE.
EUCLID
SOUTH DRIVE
FOREST SERVICE ROAD
PINTO
ORPHAN
GIBSON
SIKES
SULLIVAN
Pacific RD.
ROSE
KEEGAN ST.
MERRIT
SMITH
LEGEND
RESIDENTIAL
COMMERCIAL
INDUSTRIAL
PUBLIC/QUASI-PUBLIC
MIXED COMMERCIAL & INDUSTRIAL
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT
MIAMI & CLAYPOOL, ARIZONA
PROJECTED LAND USE
ELEVATION: 3400 Feet
POPULATION: 5800
N
PLATE 24a


MIDLAND CITY
MIAMI GARDENS
CENTRAL HEIGHTS
LITTLE ACRES
Match Line To MIAMI
Cobre Valley Country Club
Miami High School
Miami-Inspiration Hospital
TO ROOSEVELT LAKE
TO GLOBE
MAIN ST.
PAXTON AVE.
CYPRESS DR.
1 ST. AVE.
2 ND. AVE.
3 RD. AVE.
4 TH. AVE.
ELM AVE.
CHERRY AVENUE
ARBOR
HENGHOLD AVE.
FIRST AVE.
SECOND AVE.
THIRD AVE.
SHORT AVE.
APACHE AVE.
ROBERTS ST.
GLENDALE
MCKINNEY
HILL
CENTRAL AVE.
MENDOTA AVE.
MILL ST.
PINE ST.
MAIN STREET
WEST AVE.
ROBERTS DRIVE
ENGLISH AVE.
COBB AVE.
DOMINION ST.
CROSS DR.
BOYLES
VIEW AVE.
ARROYA
BLACK WARRIOR
GLOBE
CANYON
BLOCK
MOUNTAIN AVE.
MONROE ST.
SCOTT AVE.
INSPIRATION DR.
2ND ST.
4TH ST.
HILL ST.
YOUNG ST.
MAIN ST.
GOLDEN ST.
YUMA ST.
SOUTH ST.
3RD ST.
LINCOLN
SILVER ST.
THOMAS ST.
WASHBORN ST.
RUSSELL ST.
CANAL
MICHIGAN AVE.
TO SALT RIVER
TAILRACE POND
RUSSELL AVE.
HUIE ST.
STORY ST.
WOODWARD ST.
UTILITY ST.
SNEDDEN ST.
LANCASTER ST.
PINAL DR.
PINAL DR.
TO RUSSELL GULCH
16 15
21 22
15 14
22 23
28 27
34 26
34 35
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
INDUSTRIAL
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
CENTRAL HEIGHTS, ARIZONA
PROJECTED LAND USE
ELEVATION 3450 FeET
POPULATION 3550
N
PLATE 24b



LEGEND:

3/4"-2 1/2"	Gate Valve ○
3"	Well ⬡
4"	Hydrant □
6"	Fire Station
8"	Booster Pump △

400 200 0 200 400 600 1200

GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

MIAMI & CLAYPOOL, ARIZONA

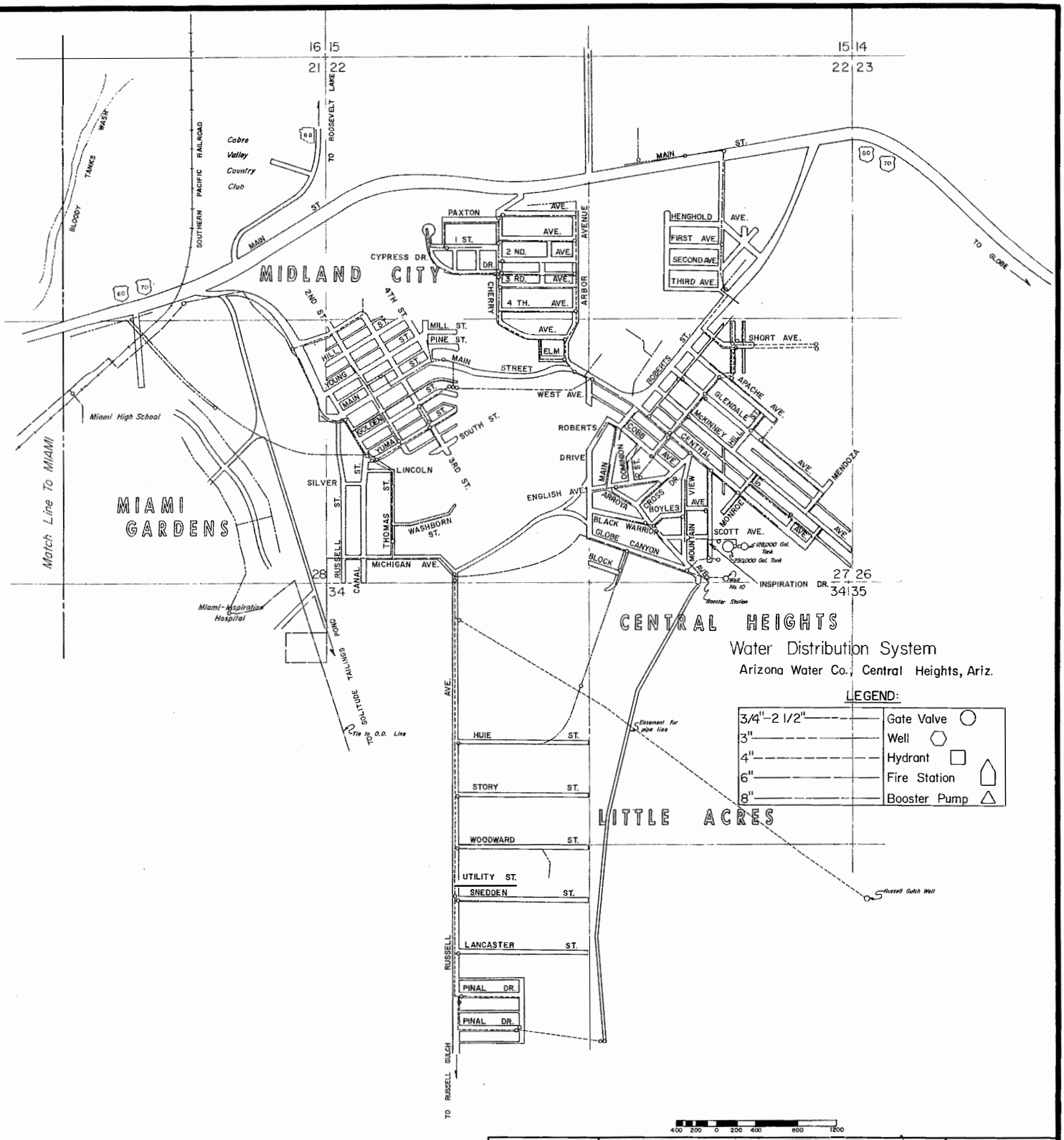
WATER SYSTEM

ELEVATION: 3400 Feet

POPULATION: 5800

N

PLATE 25a


MIDLAND CITY
MIAMI GARDENS
CENTRAL HEIGHTS
LITTLE ACRES
Water Distribution System
Arizona Water Co., Central Heights, Ariz.
LEGEND:
3/4"-2 1/2" Gate Valve
3" Well
4" Hydrant
6" Fire Station
8" Booster Pump
Cabre Valley Country Club
Miami High School
Miami-Inspiration Hospital
Match Line To MIAMI
SOUTHERN PACIFIC RAILROAD
TO ROOSEVELT LAKE
TO GLOBE
MAIN ST.
PAXTON AVE.
CYPRESS DR.
CHERRY AVE.
ARBOR AVENUE
HENGHOLD AVE.
FIRST AVE.
SECOND AVE.
THIRD AVE.
SHORT AVE.
APACHE AVE.
GLENDALE
McKINNEY HILL
CENTRAL
MENDOZA
ROBERTS ST.
WEST AVE.
ROBERTS DRIVE
ENGLISH AVE.
SOUTH ST.
LINCOLN
SILVER ST.
WASHBORN ST.
MICHIGAN AVE.
RUSSELL
CANAL
THOMAS
COBB
DOMINION
ARROYA
CROSS DR.
BOYLES
BLACK WARRIOR
GLOBE
CANYON
BLOCK
MOUNTAIN AVE.
MONROE
SCOTT AVE.
INSPIRATION DR.
Well No. 10
Booster Station
128,000 Gal. Tank
250,000 Gal. Tank
Russell Gulch Well
Easement for pipe line
TO SOLITUDE TAILINGS POND
Tie to O.D. Line
HUIE ST.
STORY ST.
WOODWARD ST.
UTILITY ST.
SNEDDEN ST.
LANCASTER ST.
PINAL DR.
TO RUSSELL GULCH
BLOODY TANKS WASH
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
CENTRAL HEIGHTS, ARIZONA
WATER SYSTEM
ELEVATION: 3450 Feet
POPULATION: 3350
N
PLATE 25b

The distribution system is supplied by a series of 11 wells with a total capacity of 1,060 gallons per minute (1,709 acre-feet per year). Ten of these wells have the capability of feeding directly into the system with one well source needing water treatment for high copper content. Copper concentration is reduced through lime-alum coagulation and sedimentation followed by chlorination. Water quality data for selected wells in the system are presented in TABLE III-13.

TABLE III-13

REPRESENTATIVE WATER QUALITY DATA FOR WELLS SERVING MIAMI-CLAYPOOL-CENTRAL HEIGHTS WATER DISTRIBUTION SYSTEM

	Well Designation		
Parameter	A(1-15)26-8	A(1-15)22-3	A(1-15)23-11
Hardness	130.0	104.0	140.0
Calcium	32.0	21.0	33.0
Magnesium	11.0	12.0	13.0
Sodium	47.0	30.0	24.0
Chloride	15.0	13.0	12.0
Sulfates	6.0	--	8.0
Total Dissolved Solids (TDS)	280.0	215.0	240.0
Fluorides	0.18	0.14	0.21
Nitrates	4.0	2.0	1.0

Source: Arizona State Department of Health, Water Supply Division

The entire distribution network has a total storage capacity of approximately 800,000 gallons. Storage tank and booster pump capacities, as well as the location for the installations, are outlined in TABLE III-14.

Water main pressures in the distribution system varies from 30 to 125 pounds per square inch (psi). There are no facilities in the system for pressure reduction in the high pressure zones.

The number of active customers using the system as of July 1, 1969 are: Miami - 1,023; Claypool - 740; and Central Heights - 874. The 2,637 customers are classed as follows: 232 commercial; 1 industrial and 2,404 residential.

TABLE III-14

STORAGE TANKS AND BOOSTER PUMP CAPACITIES AND LOCATION FOR MIAMI-CLAYPOOL-CENTRAL HEIGHTS WATER DISTRIBUTION SYSTEM

Storage Tanks

120,000 gallons, Miami - Warehouse Yard - Sec 25 TINR14E
10,000 gallons, Miami - Vicinity Woodrow St. - Sec 30TINR15E
10,000 gallons, Miami - Across Highway from Inspiration Copper Co.- Sec 30 TINR15E
40,000 gallons, Claypool - Vicinity Jefferson & Montana St. - Sec 29TINR15E
200,000 gallons, Claypool - (New) Vicinity State & First St. - Sec 29TINR15E
38,000 gallons, Central Heights - Sec 28TIN15E
250,000 gallons, Central Heights - Inspiration & Scott St. - Sec 22TINR15E
128,000 gallons, Central Heights - Inspiration & Scott St. - Sec 22TINR15E

Booster Pumps

325 gpm., Miami Warehouse Yard, Sec 25TINR14E
300 gpm., Miami Warehouse Yard, Sec 25TINR14E
30 gpm., Miami vicinity Woodrow St., Sec 30TINR15E
275 gpm., Claypool, vicinity of Jefferson & Montana St., Sec 29TINR15E
140 gpm., Claypool, vicinity of 3rd St. & SPRR, Sec 20TINR15E

Source: Arizona Water Company

Water use in the system for the year 1969 indicates a total yearly demand of 265,118,900 gallons (813.35 acre-feet). Peak for the 1969 period of record was reached in the month of July with delivery of 32,661,200 gallons (100.2 acre-feet). Low month of record was February with delivery of 15,442,000 gallons (47.4 acre-feet). Losses in the distribution system during 1969 were approximately nine percent or 73.7 acre-feet.

Future Needs

The present water supply system serving the areas of development appear capable of meeting the 1990 forecasts of domestic water needs (TABLE III-15).

TABLE III-15

PROJECTED AVERAGE DAILY AND YEARLY WATER DEMAND FOR MIAMI, LOWER MIAMI, CLAYPOOL AND CENTRAL HEIGHTS IN 1975, 1980 AND 1990*

Projection Level	Time of Year	YEAR 1975 Gallons/day	Acre feet per year	YEAR 1980 Gallons/day	Acre feet per year	YEAR 1990 Gallons/day	Acre feet per year
High	Summer	994,000	868	1,137,000	1,019	1,459,000	1,340
	Winter	527,000		671,000		919,000	
Median	Summer	946,000	827	1,029,000	922	1,195,000	1,098
	Winter	492,000		607,000		753,000	
Low	Summer	999,000	786	930,000	833	978,000	898
	Winter	468,000		549,000		616,000	

MIAMI ONLY

Projection Level	Time of Year	YEAR 1975 Gallons/day	Acre feet per year	YEAR 1980 Gallons/day	Acre feet per year	YEAR 1990 Gallons/day	Acre feet per year
High	Summer	396,000	346	453,000	406	580,000	533
	Winter	206,000		267,000		366,000	
Median	Summer	376,000	329	409,000	367	475,000	436
	Winter	196,000		241,000		300,000	
Low	Summer	358,000	313	371,000	332	389,000	357
	Winter	186,000		219,000		245,000	

*Project Staff estimates

Water distribution systems improvements may be necessary. Projected residential growth in the outlying areas adjacent to the communities will require additional water distribution and service mains. Also the small diameter feeder mains running parallel and adjacent to each other (PLATE 25a) could be replaced.

SEWERAGE AND WASTE WATER TREATMENT

Existing Facilities

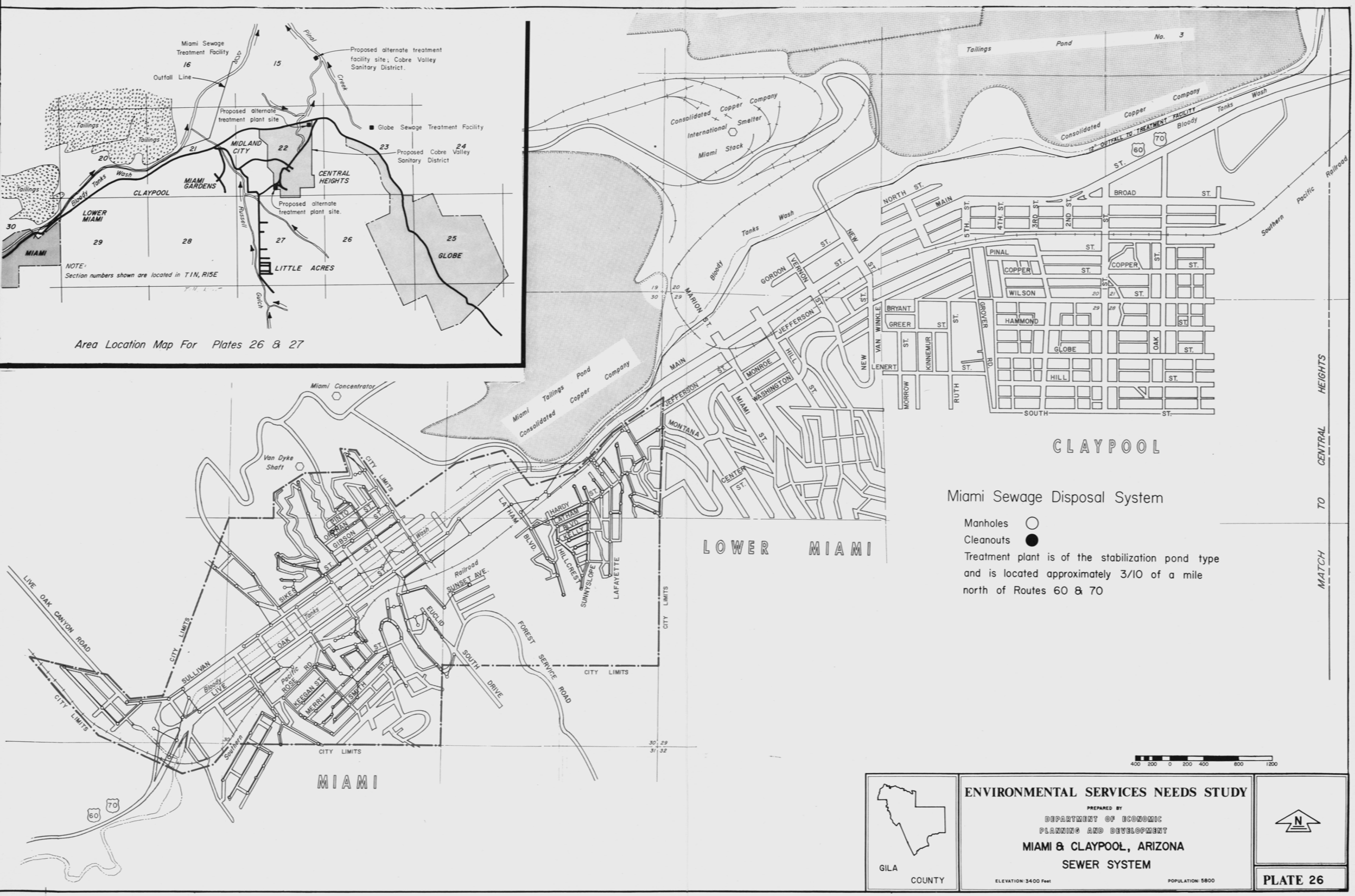
About 95 percent of Miami is sewered with a system which was built in the 1930's (PLATE 26). This collection system and waste water treatment facility were financed by a bond issue which was retired in 1954. The collection system is made up of vitrified clay pipe and has undergone very little expansion over the years but is presently in good condition due to good line grades and short lateral runs. Recent inspection of the outfall line to the original treatment plant site indicates this portion of the system is also in good condition.

The original waste water treatment plant was retired in 1959 with the construction of a lagoon sewage stabilization facility in Miami Wash. The facilities are located approximately three miles northeast of the Miami City Limits.

The original plant was, through growth of Miami and adjacent areas, eventually surrounded by residential and commercial development. As Miami's population grew, the facility became overloaded and odor problems occurred. During 1958 the community of Miami entered into an agreement with Miami Copper Corporation for 15 acres of land in Miami Wash. The land was leased to the community at minimal cost with the stipulation that Miami Copper would have rights to the effluent from any waste water treatment facility constructed on the site. It was further agreed that Miami Copper could take the effluent whenever a need developed for the water, otherwise the effluents would be allowed to flow down Miami Wash.

Once the community established the site for a new waste water treatment facility, construction was initiated on a forced accent basis to build stabilization ponds. The lagoons were built without the use of an engineered set of plans and are basically a four-celled set of ponds dyked to the southern side of Miami Wash. The ponds total approximately seven acres in area and are reported to be ten feet deep. However, inspection of the first pond in the series indicated very shallow depth.

Area Location Map For Plates 26 & 27



Miami Sewage Disposal System

Manholes ○

Cleanouts ●

Treatment plant is of the stabilization pond type and is located approximately 3/10 of a mile north of Routes 60 & 70

400 200 0 200 400 800 1200

GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

MIAMI & CLAYPOOL, ARIZONA

SEWER SYSTEM

ELEVATION: 3400 Feet

POPULATION: 5800

N

PLATE 26

Although the ponds are of irregular shapes, flow through the facility does not appear subject to short circuiting. The initial pond in the series does appear undersized in surface area for a primary loading cell. This has resulted in sludge buildup which will add to odor problems in future years.

Sewage is transported to the facility through a 12-inch asbestos cement outfall line which follows Bloody Tanks Wash between the tailings piles and highway bordering the developed areas of Claypool and Miami Gardens. Both the outfall and the stabilization ponds are in danger of washout during high runoff periods as Miami Wash is the main drainage water course for the region. The lack of dike protection on the pond may add to this eventuality.

Sewage flows into the lagoons are estimated to range from 165,000 to 220,000 gallons per day for winter and summer respectively. During the summer period there appears to be very little effluent leaving the ponds. This may be the result of seepage and evaporation losses. Miami Copper Corporation maintains a well field downstream from the facility for industrial purposes and is undoubtedly utilizing the groundwater seepage from these ponds.

The areas east of Miami and west of Globe have no form of public waste disposal systems. The standard septic tanks and leach field or seepage pit method of sanitary waste disposal is utilized. Within this area are two package plant sewage disposal systems located at the Miami-Inspiration Hospital and Miami High School.

The Central Heights area is presently served by the individual septic tank means of waste disposal. A major portion of this area has been incorporated into sanitary and improvement districts which are illustrated on PLATE 27. The Cobre Valley Sanitary District has had a private consulting engineering firm draw up alternatives for the location of a sewage treatment plant to serve the collection system.[10] Financing of this combined project has not been arranged to date.

Future Needs

An apparent need in this area of Gila County is the formation of a regional sewage collection and waste water treatment system. Such a system could serve the communities of Miami and Globe, built up areas of Central Heights, Midland City, Lower Miami and Claypool.

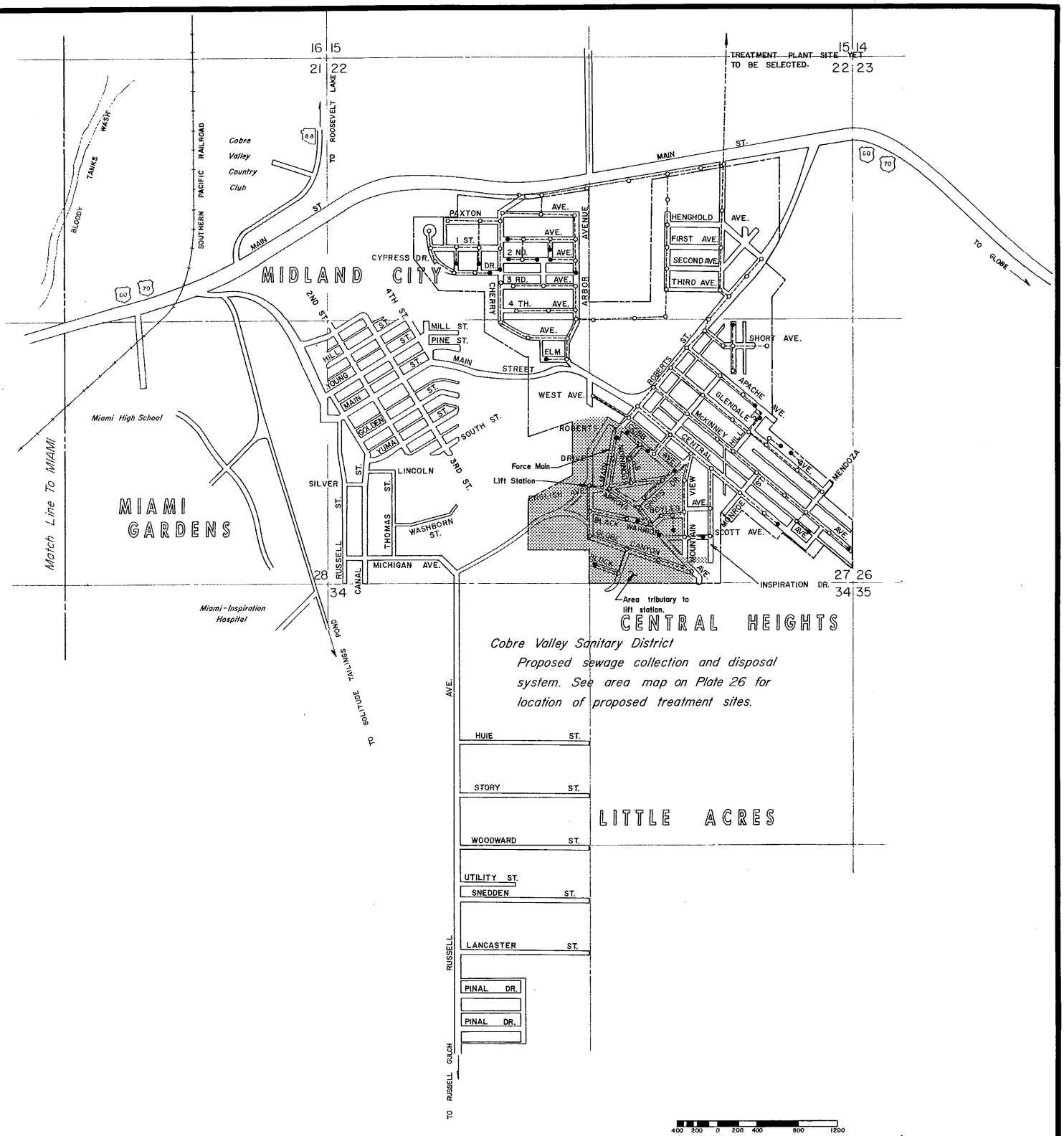
Miami presently has a collection system. A portion of Central Heights known as Cobre Valley has formed a sanitary district and has completed engineered plans for a collection system. These factors tied to the topography of the region would make construction of an areawide system ideally suited for the region.

The Miami treatment facility has minor deficiencies related to construction features. Shallow depths in the lagoon cells and lack of dyke protection are features which will decrease treatment efficiency and endanger the facility during high surface water runoff periods in the region carried by Miami Wash. The Miami ponds should be modified to allow for a minimum depth of four feet. This would increase detention times and decrease the periods of time when odors evolve from the facility. Also the minimum four foot depth would insure compliance with standards for surface loading and retention times established by the Arizona State Department of Health.[11]

Expected average daily sewage flows for the Miami area and the developed areas from the Globe City limits to and including Miami are outlined in TABLE III-16. By the year 1990 the built-up areas noted in TABLE III-16 will dispose of an estimated 177,000,000 gallons of water per year through the lagoons belonging to Miami and the septic tanks serving the other areas.

The conservation of this resource by reclamation would be a worthy consideration for leaders of the community and county governmental leaders. As mining activity for the region increases, reclamation of the sewage waters for industrial use may provide incentive for such action.

The community of Globe is currently having problems with their existing waste treatment facility due to overloading. Areas of Claypool, Lower Miami and Central Heights are reportedly experiencing septic tank-leach field disposal problems. The community of Miami has an existing waste treatment facility that is inefficient with respect to biological treatment but efficient in disposal of the liquid portion of sewage wastes through seepage. Considering these factors and the total area of development from Miami to Central Heights, the obvious advantages of a joint regional waste collection system and disposal facility are apparent. This region is uniquely suited for such a proposal, as the topography and community locations are ideal for construction of a joint system. The community of Miami at this time has sewer outfall following Bloody Tanks Wash that could possibly serve the lower Miami and Claypool areas. Other than the extension of their outfall along Pinal Creek to the site of the Miami treatment facility, very little



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

CENTRAL HEIGHTS, ARIZONA

SEWER SYSTEM

ELEVATION: 3450 Feet

POPULATION: 3350

N

PLATE 27

TABLE III-16

PROJECTED AVERAGE DAILY SEWAGE FLOWS FOR MIAMI, LOWER MIAMI-CLAYPOOL, MIDLAND CITY, AND CENTRAL HEIGHTS IN 1975, 1980 AND 1990*

Projection Level / Time of Year	YEAR 1975 Gallons/day		YEAR 1980 Gallons/day		YEAR 1990 Gallons/day		
Summer	547,000		625,000		802,000		
High		513		613		809	Acre feet per year
Winter	369,000		470,000		643,000		
Summer	520,000		566,000		657,000		
Median		487		555		663	
Winter	344,000		425,000		527,000		
Summer	494,000		512,000		538,000		
Low		463		502		543	
Winter	328,000		384,000		431,000		

MIAMI ONLY

Projections Level / Time of Year	YEAR 1975 Gallons/day		YEAR 1980 Gallons/day		YEAR 1990 Gallons/day		
Summer	218,000		249,000		319,000		
High		204		244		322	Acre feet per year
Winter	144,000		187,000		256,000		
Summer	207,000		225,000		261,000		
Median		194		221		263	
Winter	137,000		169,000		210,000		
Summer	197,000		204,000		214,000		
Low		185		200		216	
Winter	130,000		153,000		172,000		

*Project Staff estimates.

modification of the Globe collection system would be needed. The drainage area of Pinal Creek has soil characteristics that would allow for the construction of such an outfall. The development of a sophisticated waste treatment plant at the Miami site would result in the production of water acceptable for industrial uses.

SOLID WASTES DISPOSAL PRACTICES AND TECHNIQUES

Existing Facilities

The citizens of Miami are provided with a biweekly garbage collection service which is operated by the municipality. Commercial areas are served once daily.

Collected waste materials are disposed of at a dumpsite west of the community off of Highway 60-70. The dumpsite is located in very rugged terrain and is leased to a concern which operates a small-scale salvage business. Accumulated materials are controlled by burning with resulting smoke visible in Miami and environs.

The remaining strip of development between Miami and Globe is without solid wastes collection or disposal services. Residents of this area must transport collected and stored materials to the Miami or Globe community dumpsites.

Future Needs

Production of solid waste materials for the developed areas are outlined in TABLE III-17.

The quantities of wastes estimated are sizable and indicate there is a need for an efficient, coordinated regional collection service.

OTHER RURAL DEVELOPMENT IN GILA COUNTY AND RECREATION AREAS

The rural communities of Payson, Hayden, Winkelman, Miami and Claypool-Central Heights are moderately sized areas with respect to total population (1,000 or more). Community services such as water supply and/or sewage disposal systems (if present) are well-defined as a result of the population needs within the community. Other rural development in Gila County refers to those areas which have populations

TABLE III-17

PROJECTED AVERAGE YEARLY SOLID WASTES PRODUCTION LEVELS FOR MIAMI, LOWER MIAMI, CLAYPOOL, MIDLAND CITY, AND CENTRAL HEIGHTS IN 1975, 1980 AND 1990

Population Projection YEAR	PRODUCTION LEVELS POPULATION PROJECTION LEVELS LOW	MEDIAN	HIGH
1975	7,315	7,695	8,080
1980	7,885	8,725	9,640
1990	8,820	10,785	13,160
MIAMI ONLY			
1975	2,910	3,060	3,220
1980	3,143	3,470	3,840
1990	3,510	4,290	5,240

Source: Project Staff Estimates.

much less than 1,000 and in all cases are unincorporated. These areas have fragmented public water supply services and in all instances lack centralized sewage disposal services. Such areas should be discussed as to their environmental services needs for they are, in essence, the starting point from which the larger rural communities will develop in future years. Also, areas which are used for recreational activities have needs for environmental services.

This section will discuss in general the areas of Pine-Strawberry, Young and the recreation regions of Gila County.

COMMUNITIES OF PINE AND STRAWBERRY

HISTORICAL AND SOCIO-ECONOMIC PROFILE

Pine and Strawberry are two unincorporated communities located on State Highway 87, approximately 15 miles northeast of Payson. Settlement in the Pine-Strawberry area began around 1880 and ranching was the base of the economy. The communities are separated by a distance of approximately three miles. Like Payson, the communities of Pine and Strawberry have never specifically appeared in the U.S. Census and, therefore, few statistical data are available. The 1970 population in the Pine-Strawberry area is estimated to be 350. This population is largely dependent upon ranching and increasing recreational activity in the area. A small retail trade and services sector is in existence which serves the immediate economic area.

During the latter portion of the preceding decade, Pine and Strawberry have experienced a considerable growth in construction of summer and retirement houses and cabins. This growth has added a small boost to the retail trade and services sales in the area. However, most of this increased economic activity is of a seasonal nature.

The population projection of the Pine-Strawberry area is shown in FIGURE III-5. This projection was carried out in the same manner as that of Payson. (Growth rates of 4.4 percent, 3.5 percent and 2.8 percent) It should be noted that an additional projection also appears in FIGURE III-5 which designates peak population of the area related to the influx of summer residents. The peak summer population of Pine-Strawberry is sometimes as much as four times its year-round resident population. It is this peak population that should be considered for purposes of future water and sewer needs.

PHYSIOGRAPHY-GEOLOGY

The community of Pine is located in the Pine Valley at an elevation of 5,448 feet, within the upper reaches of the East Verde River Watershed (PLATE 28). Surface drainage from the community and surrounding area is carried southward to the East Verde River by Pine Creek. The community utilizes Pine Creek as a water source for domestic and agricultural purposes.

The soils throughout the area are predominately clay with swelling and cracking characteristics. These soils are developed over

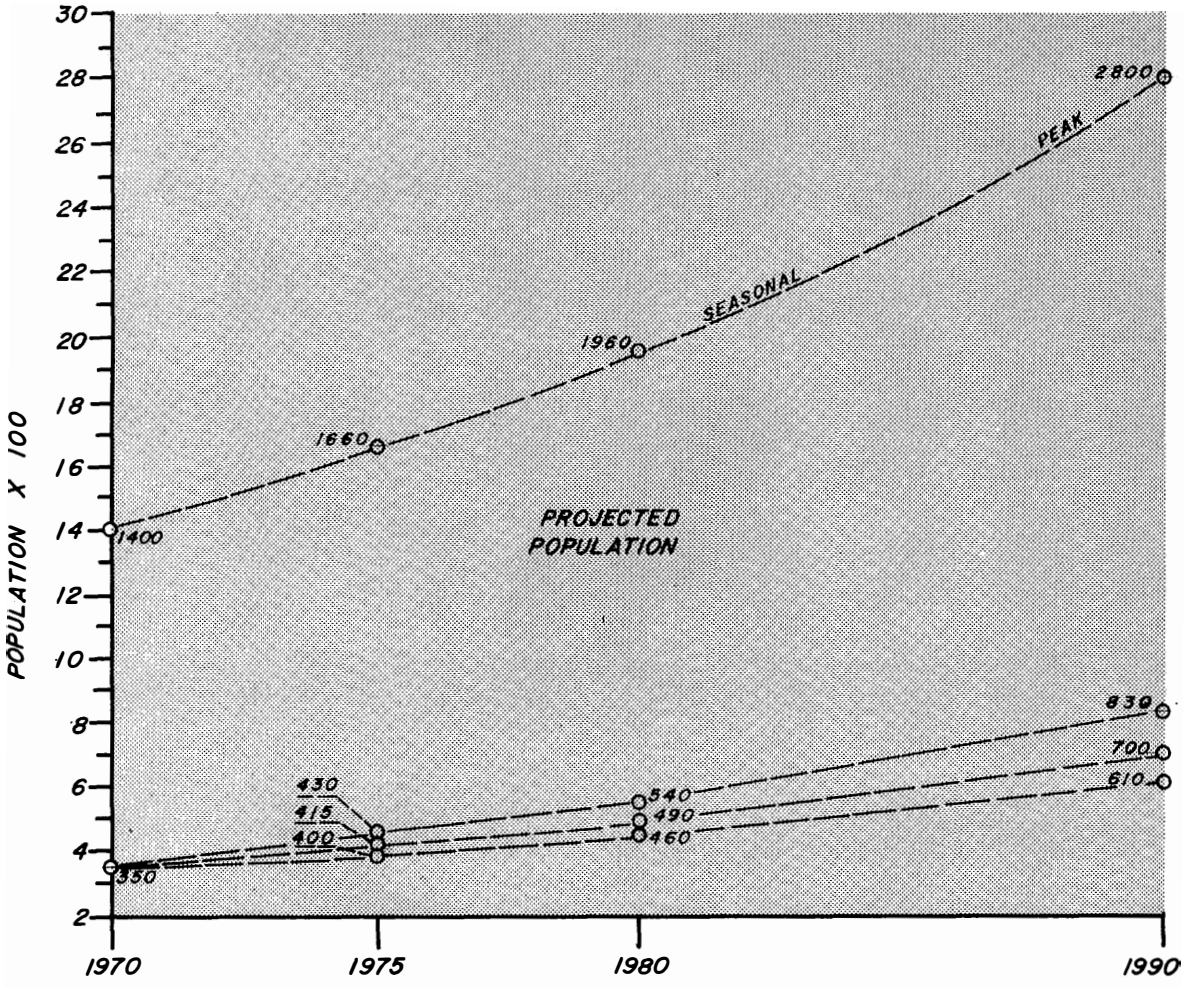


FIGURE III-5. POPULATION OF PINE AND STRAWBERRY AND PROJECTIONS TO 1990

basaltic rock with Montmorillonite being the basic clay type. The area is generally level with several dissections generated by drainage patterns.

Ground water data indicate the soils are very tight, yielding very little water prior to hitting bedrock. Sedimentary deposits are found slightly south and west of the community.

Strawberry is approximately three miles northeast of Pine situated in a three-mile long by one-mile wide oval valley just below

the Mogollon Rim (PLATE 29). Elevations average 5,950 feet on the valley floor. Surface water drainage starts in Strawberry Canyon immediately north of the area and drains through the community from East to West in intermittent stream beds toward Hardscrabble Creek. The surface soils in this area have a high clay content and are characteristically related to those found in the Pine area.

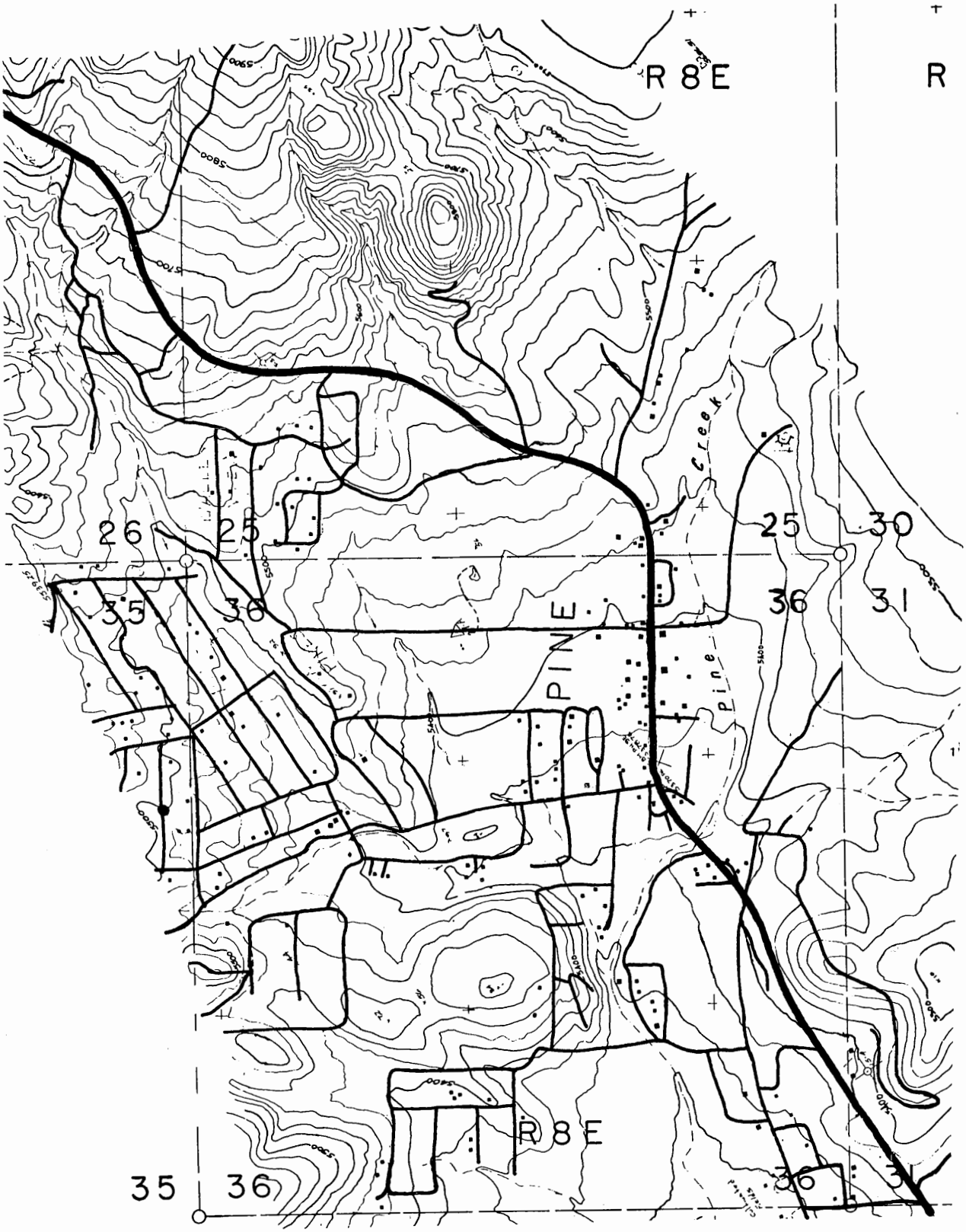
LAND USE

The communities of Pine and Strawberry are changing from small agricultural settlements to summer home and retirement communities. PLATE 30 illustrates the present general land use patterns and future patterns which may be found in these communities. The primary land use pattern is subdivision development. Major commercial development exists along the main thoroughfare of the communities which is Highway 87. Projected land use patterns for these areas will be predominantly residential.

WATER SUPPLY AND DISTRIBUTION SYSTEM

Existing Facilities

The facilities for Pine are comprised of two primary distribution systems. (The location of waterlines in these systems is doubtful, therefore a schematic for the systems was not formulated.) The smaller of these systems is operated by the Pine Water Association which is principally concerned with providing irrigation water for farming activity in the area. The water source is developed from the surface water flow in Pine Creek, north of the community. Water enters an irrigation diversion structure on Pine Creek two miles north of Pine. From this point a 12-inch transit pipe carries irrigation water to agricultural areas. Approximately 1,000 feet north of the community a four-inch gravity line carries water to a 9,000 gallon concrete, wood-covered, sedimentation tank from which the water is pumped through a diatomaceous earth filter to a 10,000 gallon storage-pressure tank. The storage tank has facilities for chlorination of the water prior to delivery in the distribution system. Distribution is carried out in a single 500 foot stretch of three-inch and two-inch lines along the highway that serves residence and commercial establishments to a point just south of the Post Office. Water quality data for this source (TABLE III-18) indicate that as of April 24, 1969, water chemistry, with respect to iron, does not comply with the 1962 U.S. Public Health Service (USPHS)



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

PINE, ARIZONA

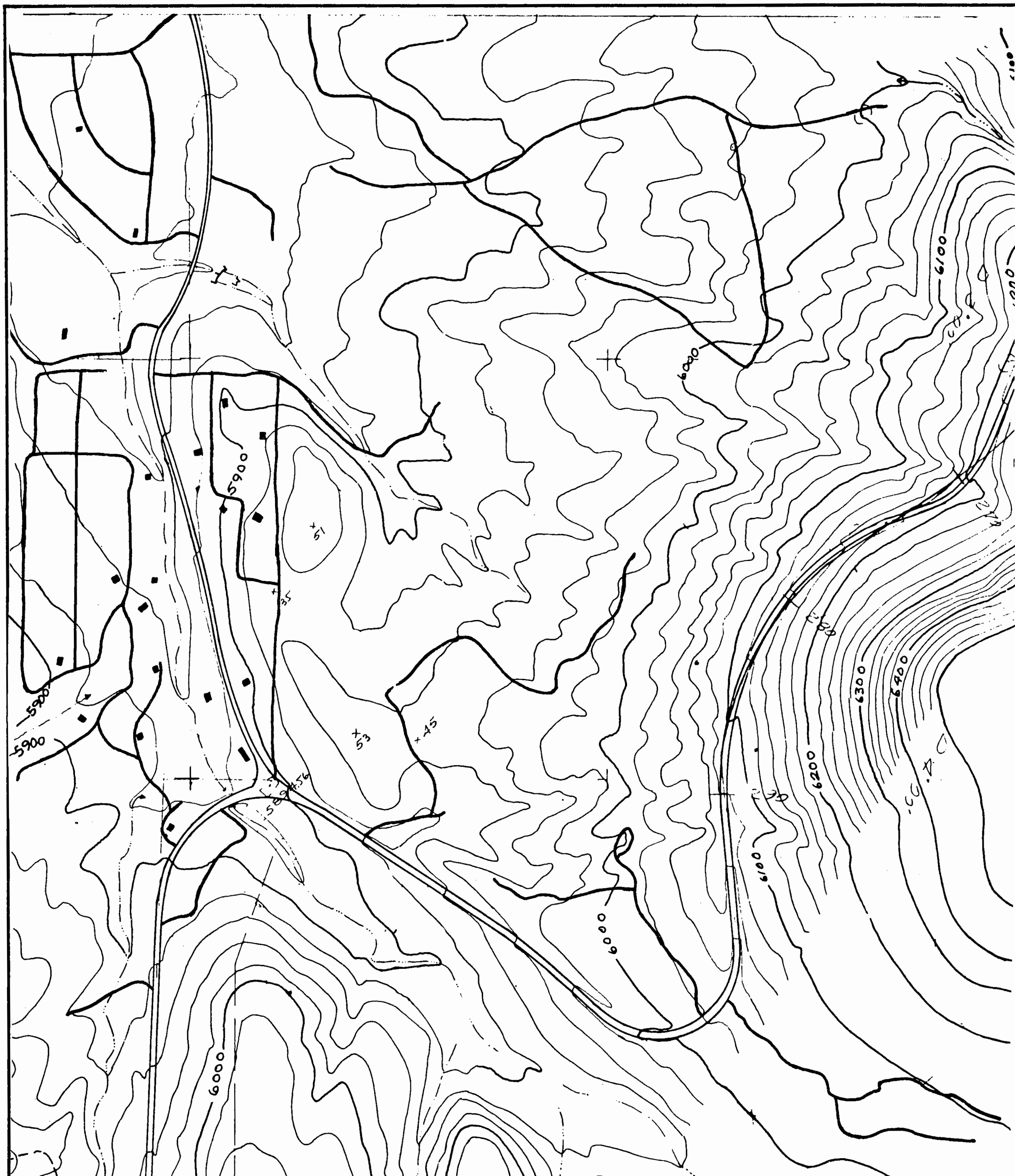
TOPOGRAPHIC FEATURES

ELEVATION: 5448 Feet

POPULATION: 200 (EST.)

N

PLATE 28



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

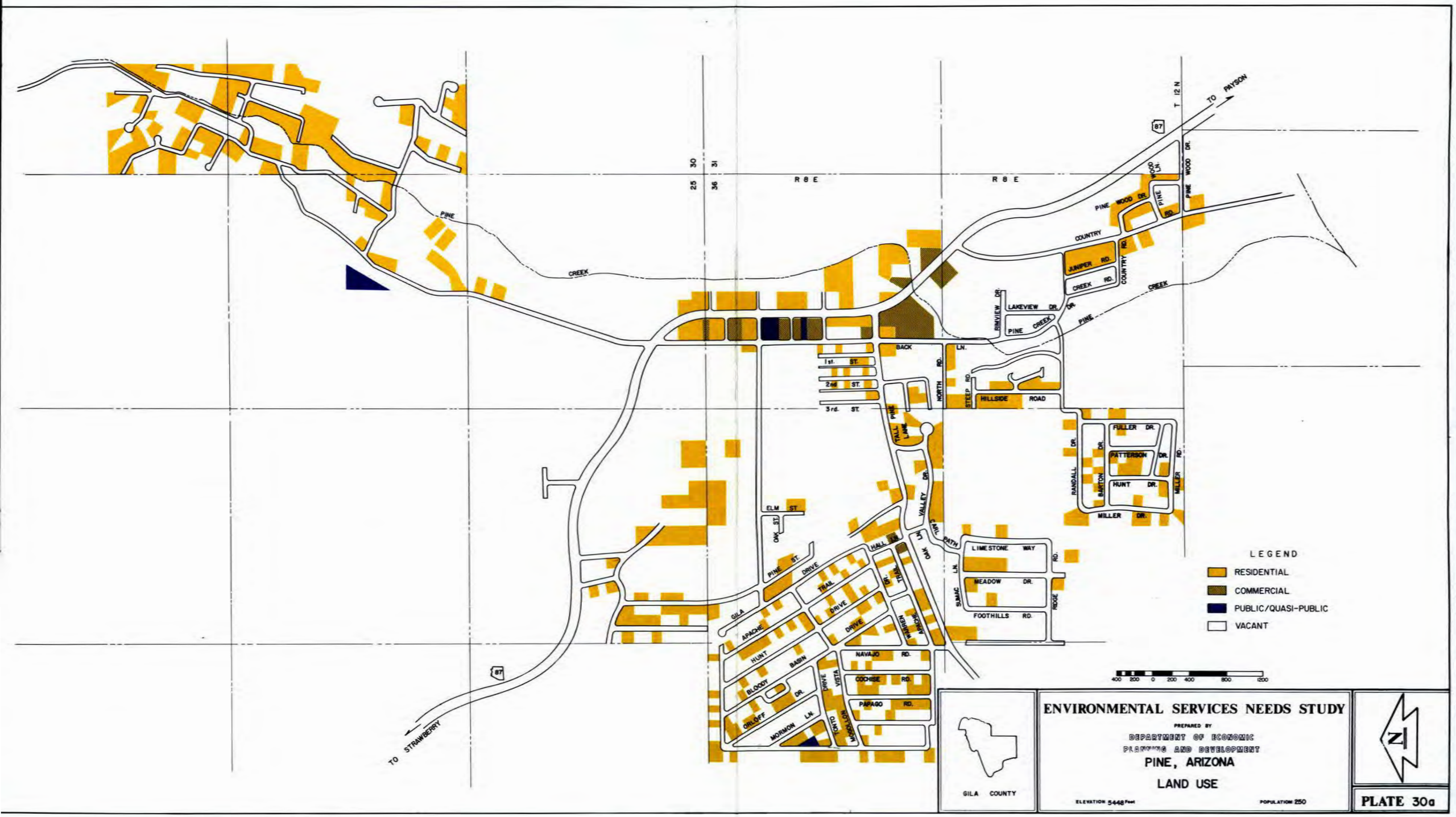
STRAWBERRY, ARIZONA TOPOGRAPHIC FEATURES

ELEVATION: 5950 Feet

POPULATION: 150 (EST.)

N

PLATE 29


ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
PINE, ARIZONA
LAND USE
ELEVATION: 5448 Feet
POPULATION: 250
GILA COUNTY
PLATE 30a
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
VACANT
400 200 0 200 400 800 1200
N
TO PAYSON
TO STRAWBERRY
T 12 N
R 8 E
R 8 E
25
30
36
31
87
PINE CREEK
PINE WOOD DR.
PINE WOOD LN.
PINE RD.
COUNTRY RD.
JUNIPER RD.
CREEK RD.
LAKEVIEW DR.
RIMVIEW DR.
BACK LN.
NORTH RD.
STEEP RD.
HILLSIDE ROAD
1st. ST.
2nd ST.
3rd. ST.
PINE HALL LANE
VALLEY DR.
CARL PATH
OAK LN.
ELM ST.
OAK ST.
PINE ST.
DRIVE
TRAIL
HALL
GILA
APACHE
HUNT
BASIN
BLOODY
DR.
ORLOFF
MORMON LN.
PINE VISTA
CHITO
MESCALERO
MESQUITE
NAVAJO RD.
COCHISE RD.
PAPAGO RD.
LIMESTONE WAY
MEADOW DR.
FOOTHILLS RD.
SUMAC
RIDGE
FULLER DR.
PATTERSON DR.
HUNT DR.
MILLER DR.
RANDALL DR.
BARTON DR.
MILLER RD.

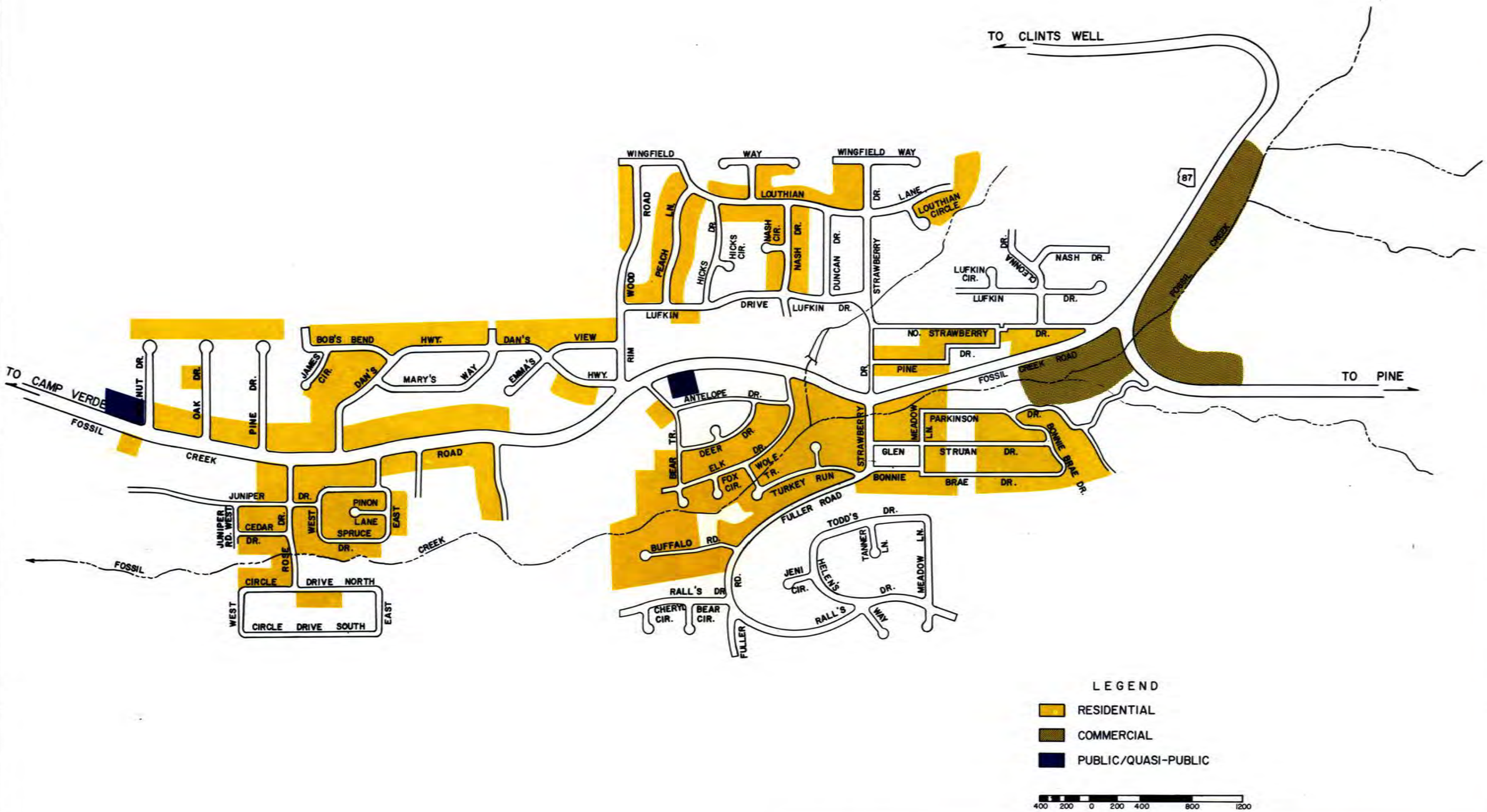

TO CLINTS WELL
TO CAMP VERDE
TO PINE
87
FOSSIL CREEK
FOSSIL CREEK ROAD
WINGFIELD WAY
WINGFIELD WAY
LOUTHIAN
LOUTHIAN CIRCLE
LANE
WOOD ROAD
PEACH LN.
HICKS DR.
HICKS CIR.
NASH CIR.
NASH DR.
DUNCAN DR.
STRAWBERRY DR.
LUFKIN DRIVE
LUFKIN DR.
LUFKIN CIR.
LUFKIN DR.
OLEOMA DR.
NASH DR.
NO. STRAWBERRY DR.
PINE DR.
RIM
BOB'S BEND HWY.
DAN'S VIEW
JAMES CIR.
DAN'S
MARY'S WAY
EMMA'S
HWY.
NUT DR.
OAK DR.
PINE DR.
ANTELOPE DR.
BEAR TR.
DEER DR.
ELK DR.
FOX CIR.
WOLF TR.
TURKEY RUN
STRAWBERRY
MEADOW LN.
PARKINSON DR.
BONNIE BRAE DR.
GLEN
STRUAN DR.
BONNIE BRAE DR.
ROAD
JUNIPER DR.
JUNIPER RD. (WEST)
CEDAR DR.
DR.
ROSE
PINON LANE
SPRUCE DR.
WEST
EAST
CREEK
FOSSIL
CIRCLE DRIVE NORTH
CIRCLE DRIVE SOUTH
WEST
EAST
BUFFALO RD.
FULLER ROAD
TODD'S DR.
TANNER LN.
HELEN'S
JENI CIR.
DR.
MEADOW LN.
RALL'S DR.
RALL'S WAY
RD.
CHERYL CIR.
BEAR CIR.
FULLER
LEGEND
RESIDENTIAL
COMMERCIAL
PUBLIC/QUASI-PUBLIC
400 200 0 200 400 800 1200
GILA COUNTY
ENVIRONMENTAL SERVICES NEEDS STUDY
PREPARED BY
DEPARTMENT OF ECONOMIC
PLANNING AND DEVELOPMENT
STRAWBERRY, ARIZONA
LAND USE
ELEVATION: 5950 Feet
POPULATION: 100
N
PLATE 30b

TABLE III-18

REPRESENTATIVE WATER QUALITY DATA
FOR PINE WATER ASSOCIATION
WATER SYSTEM (1969)

Parameter		Concentration mg/liter
Hardness (as Calcium Carbonate)		70.0
Calcium		19.0
Magnesium		6.0
Sodium	(less than)	3.0
Chloride		2.0
Sulfate		7.0
Fluorides		0.13
Nitrates	(less than)	1.0
Iron		0.61*

*Exceeds recommended limit of 0.3 milligrams per liter.[8]

Source: Arizona State Department of Health, Division of Water Supply

Standards. The iron content of the water exceeds the recommended level for this parameter by 0.31 milligrams per liter. Past reports indicate the system has experienced filter failures as well as poor chlorination practices although bacteriological quality has been satisfactory.

The second and larger of the two community systems serves the newer areas of development and is operated by the United Utilities Corporation. The remaining portion of Main Street, not served by the smaller system, and the subdivision developments in the surrounding area are served by this system. The United Utilities distribution system is supplied by six wells in the Pine Valley area that produce a good quality of water for domestic use as indicated by TABLE III-19.

At present 326 customers (163 metered and 163 unmetered) are served by the United Utilities distribution system which is basically a consolidation of several smaller systems that initially served the area. Resulting from this agglomeration of systems are operational deficiencies related to the inter-connection of systems with the wrong size and type of pipe materials. Problems such as low pressure have seriously

TABLE III-19

REPRESENTATIVE WATER QUALITY DATA
FOR THE PINE VALLEY WATER SYSTEM
(UNITED UTILITIES)

Parameter	Concentration mg/liter
Total Hardness (as Calcium Carbonate	256.0
Calcium	80.0
Magnesium	13.0
Sodium	8.0
Chloride	14.0
Sulfate	12.0
Total Dissolved Solids	300.0
Fluorides	0.34
Nitrates	0.1

Source: Water Supply Division, Arizona State Department of Health

limited the delivery capacity, although it must be noted that managers of the system are earnestly attempting to correct problems as quickly as their resources will permit.

The community of Strawberry and surrounding area is served by four private water systems. The two largest systems are operated by the Strawberry Knolls Water Company and Strawberry Water Company. The Strawberry Knolls system consists of two wells and a 5,000 gallon storage-pressure tank located at each well site. Problems have occurred with respect to the provision of a conscientious program of bacteriological sampling, while from an operational standpoint, trouble occurs in maintaining a minimum pressure of 20 pounds per square inch in the higher elevations of the system. Problems like these may be related to equipment deficiencies or the lack of an efficient maintenance program.

The Strawberry Water Company serving a large subdivision development consists of two wells and a 2,000 gallon pressure tank located next to the 10,000 gallon main storage reservoir.

Future Needs

The increasing levels of subdivision development in the areas surrounding Pine and Strawberry for retirement and recreation living will produce a strong need for water supply services. This future need may best be met by the coordinated development of a regional water supply and distribution system. Raw water supplies are adequate to meet future needs, however, the present fragmented water systems will decrease the delivery efficiencies of potable water to all who now reside and will reside in the region.

SEWERAGE AND WASTE WATER TREATMENT

Existing Facilities

The Pine and Strawberry region relies on the septic tank-leach field form of sanitary waste disposal. The characteristics of soils found in this part of Gila County indicate that this form of waste disposal system does not operate adequately over long periods of time. The surface soils have a clay-loam texture and the subsoils are predominately clays of low permeability. The situation is complicated by a seasonally high water table adjacent to Pine Creek in the Pine Valley area and intermittent stream beds in Strawberry.

Subdivisions in the outlying areas of Pine and Strawberry are in various stages of development. Some of these areas are located in rugged mountainous terrain and surveys of these home sites and of existing structures indicate that in some of the more rugged terrain, construction of septic tank and to a larger extent leach field systems, will be difficult. Granting that a system can be built in terrain of this nature, the feasibility of the leach fields working properly is doubtful as topography and clay characteristics of soils will work against the efficient operation of this type system. At present, cabin and home use is predominately seasonal which is an important factor in prolonging the life of existing septic tank systems.

Future Needs

Planning should be initiated in these communities for a regionally oriented waste collection and disposal system. The anticipated rate of growth with respect to retirement living and recreational activity, supports the preliminary stages of sewerage planning.

SOLID WASTE DISPOSAL PRACTICES AND TECHNIQUES

Existing Facilities

The Pine-Strawberry areas are without an established form of garbage collection service. Individual responsibility for disposal of solid wastes prevails in these areas at dumpsites noted on PLATE 29.

Future Needs

Again the rate of development in these areas for retirement and recreation living indicate that an area-wide solid waste collections service should be developed. Planning for this service prior to 1975 may resolve disposal problems which can develop through increasing population densities in future years.

COMMUNITY OF YOUNG

HISTORICAL AND SOCIO-ECONOMIC PROFILE

Young is a small unincorporated community located on State Highway 288 approximately 17 miles south of State Highway 160 which connects Payson and Heber. Young and the surrounding Pleasant Valley area have been settled since the 1880's with the past and present economy depending largely upon ranching. Also important to Young are the U.S. Forest Service personnel who work in the area and reside in the community. Young has a very small retail base that serves the needs of the immediate vicinity.

At present, Young is relatively isolated largely due to the rough access roads. This will be changed within the seventies with the construction of a new paved highway from Young to State Route 160. This highway will certainly effect the development of Young and Pleasant Valley and will tie them closer to the recreation-oriented economy of northern Gila County.

The population of Young in 1970 is estimated to be approximately 150. This includes those residing on ranches in the surrounding area. At this time no census data are available for Young. The new highway which will provide access to the recreational opportunities of the area is expected to give Young approximately the same growth potential as

that of Payson and Pine-Strawberry. Thus, the same growth rates are used to project Young's population as seen in FIGURE III-6.

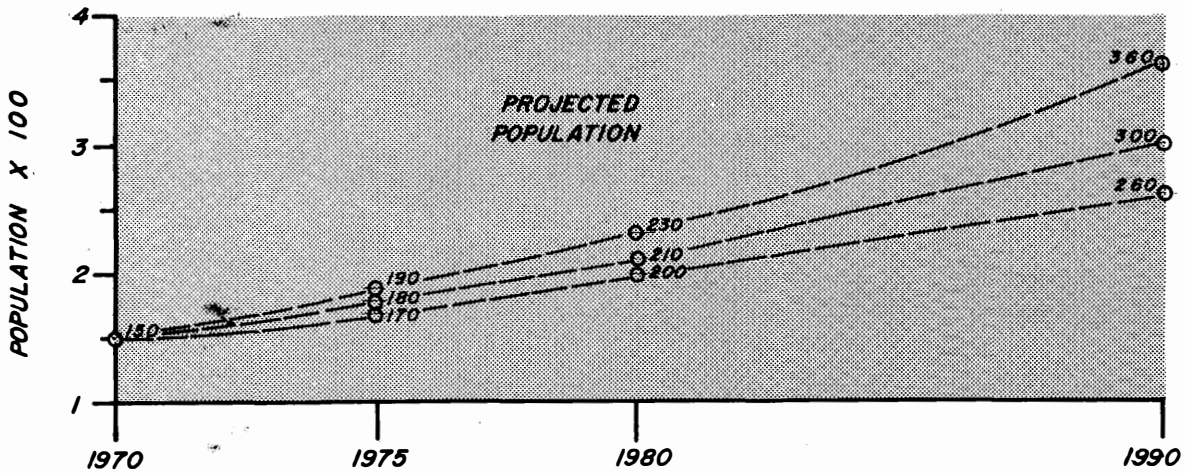


FIGURE III-6. POPULATION PROJECTIONS FOR YOUNG TO 1990

PHYSIOGRAPHY-GEOLOGY

The community lies at an elevation of 5,095 feet on a gently rolling plain of alluvial soil deposits. Elevations reach 6,720 feet northeast, 6,180 feet in the west and 7,135 feet to the south of the community. The alluvial soils, originating from the steep slopes of the surrounding mountains, were developed from sandstone and associated sandy materials.

Young is situated in a 62.1 square mile watershed that is drained by Cherry Creek which is gaged 0.3 miles downstream from Deadman Canyon and two miles southeast of the community. Annual water flow at

this point has averaged 8,250 acre-feet over the last five years.[12] Low flows occur in Cherry Creek during July with a corresponding drop in the water table in wells used by residents of the community. Static water levels are approximately 60 feet. Most wells in the area are capable of producing ten gallons per minute.

LAND USE

Existing land use patterns for Young are presented in PLATE 31. The future of Young as a recreation and retirement area appears excellent. With the new highway from the rim, this area will become a major attraction for outdoor recreation enthusiasts. Summer and retirement homesites should appear rapidly upon completion of this roadway changing the characteristics of this small community radically.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

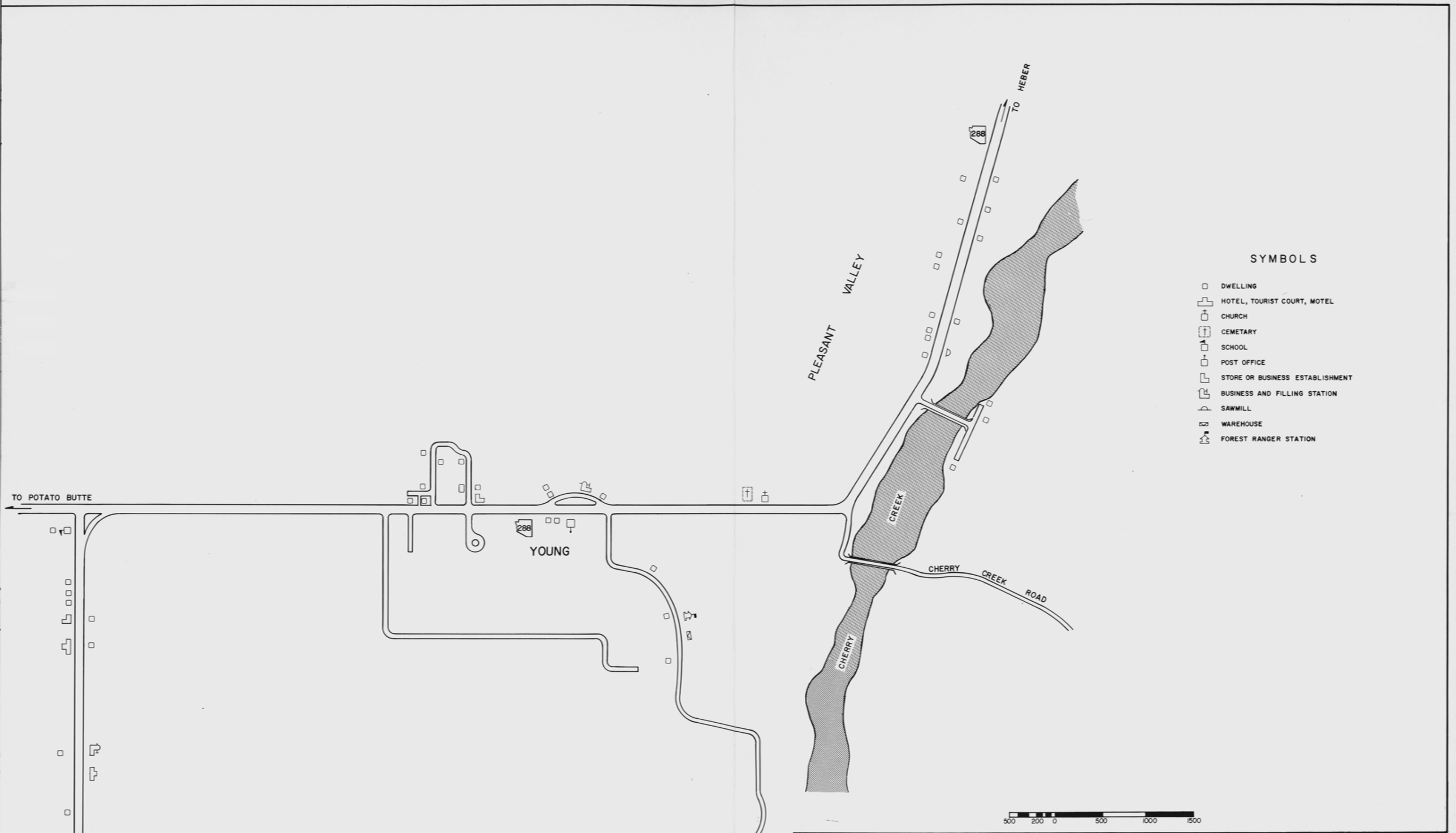
Existing Facilities

The community is without a public water distribution system and present water needs are met by private wells. Within the community itself there are 18 wells serving approximately 22 families. Ten other families live on ranches surrounding the community and are also served by private wells.

Future Needs

In the near future a proposed highway will be constructed between the community and State Highway 177. This event will no doubt lead the way for development of subdivisions in the area and the subsequent formation of water companies. Citizens of the area look at the new highway with mixed interest. Many fear that rapid development in the area will generate poorly coordinated and designed subdivisions that will destroy the aesthetic character of the valley. In one respect, however, development may be advantageous in that a public water system could result for the community.

Community leaders should plan for the eventual needs of a public water supply system. Incorporation of the community and the securing of water company franchising rights in the area would possibly be most advantageous to the residents of Young.



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

YOUNG, ARIZONA

EXISTING LAND USE

ELEVATION: 5095 Feet

POPULATION: 150

N

PLATE 31

SEWERAGE AND WASTE WATER TREATMENT

Existing Facilities

The community is served by the septic tank form of sewage disposal. Community residences for the most part are served by leach fields and it is probable that filter fields for some of the older homes are close to failure due to plugging in the leach bed soils. Homes in the area are on private wells, adding to the possibility of contamination by sewage where wells and septic tanks are in proximity to each other. The water table is approximately 60 feet from the surface and soils have fairly good permeability characteristics which adds to the possibility of the water supply becoming contaminated.

Future Needs

A need for centralized sewage collection and disposal facilities may arise as completion of the new highway facilitates rapid development in the region. The septic tank systems utilized in the valley for waste disposal may generate water degradation problems in Cherry Creek. Good soil permeability and relatively high water tables in proximity to drainage courses leading to Cherry Creek are conditions which may influence degradation of surface waters moving through the area.

Planning should be considered in this area for an areawide sewerage project prior to major development of subdivisions and the community.

SOLID WASTES DISPOSAL PRACTICES AND TECHNIQUES

Young is without an established form of garbage collection service. Individual responsibilities for disposal prevails in the area at dumpsites noted on PLATE 36. Burning is also practiced at homesites.

The eventuality of this area opening up to development with construction of the new highway is virtually assured. Future development will generate a need for the efficient and coordinated disposal of solid wastes.

RECREATION AREAS

Recreational aspects of land use in Gila County were presented previously. It was also pointed out that recreational activity plays a dynamic role in the economy of the county. The high intensity use of recreational areas will result in needs for environmental services. High intensity recreational use areas of Gila County are discussed, in general, below with respect to water supply, sewage disposal and solid waste disposal services.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

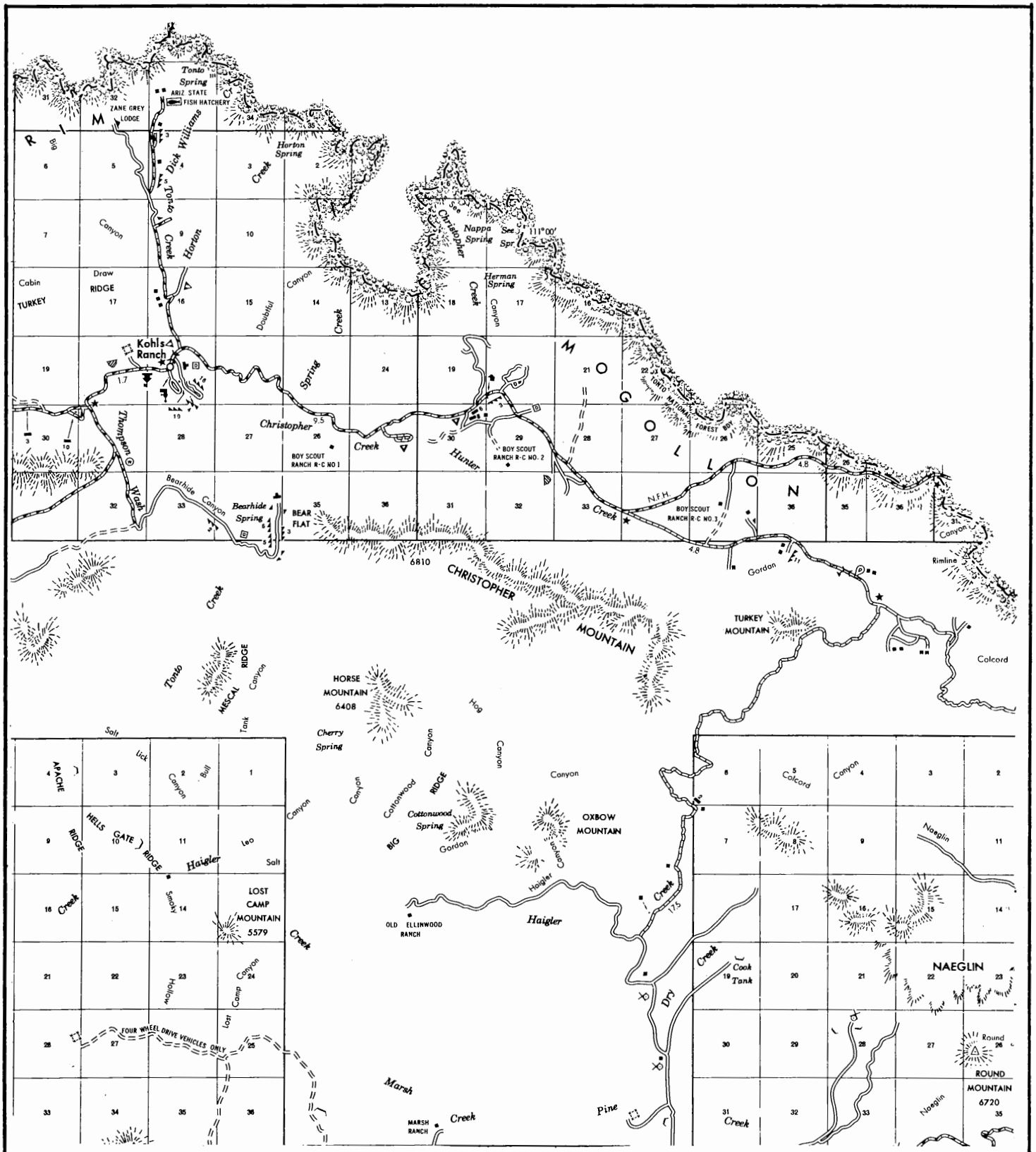
Christopher Creek-Tonto Creek

This area begins approximately 12 miles east of Payson on State Highway 160 and extends nine miles easterly along the highway. The region is situated just below the Mogollon Rim in rugged heavily forested terrain with the nucleus for development centered around Kohl's Ranch. This area is serviced by four investor-owned water companies which supply several trailer parks and motels. The trailer park systems are in most cases roughly constructed facilities often having serious operational problems. Older systems fall short in complying with regulations of the Arizona State Department of Health governing the design and construction of water supply systems as these systems were built prior to the establishment of guidelines. In addition to motels and trailer parks there are three camps (2 Boy Scout and 1 Church) and 120 cabins or part-time residences in the region. This includes the areas of Bear Flats and the development along the road to Tonto Fish Hatchery, as illustrated in PLATE 32.

Theodore Roosevelt Lake

Development related to recreation for this area is primarily located on the southeastern shore of the lake as illustrated in PLATE 33. Boat marinas and trailer parks are the major forms of development with few scattered subdivisions east of the game refuge boundaries.

For this area there is one registered private water company which serves a marina and accompanying trailer park. All other areas are served by private wells.



GILA COUNTY

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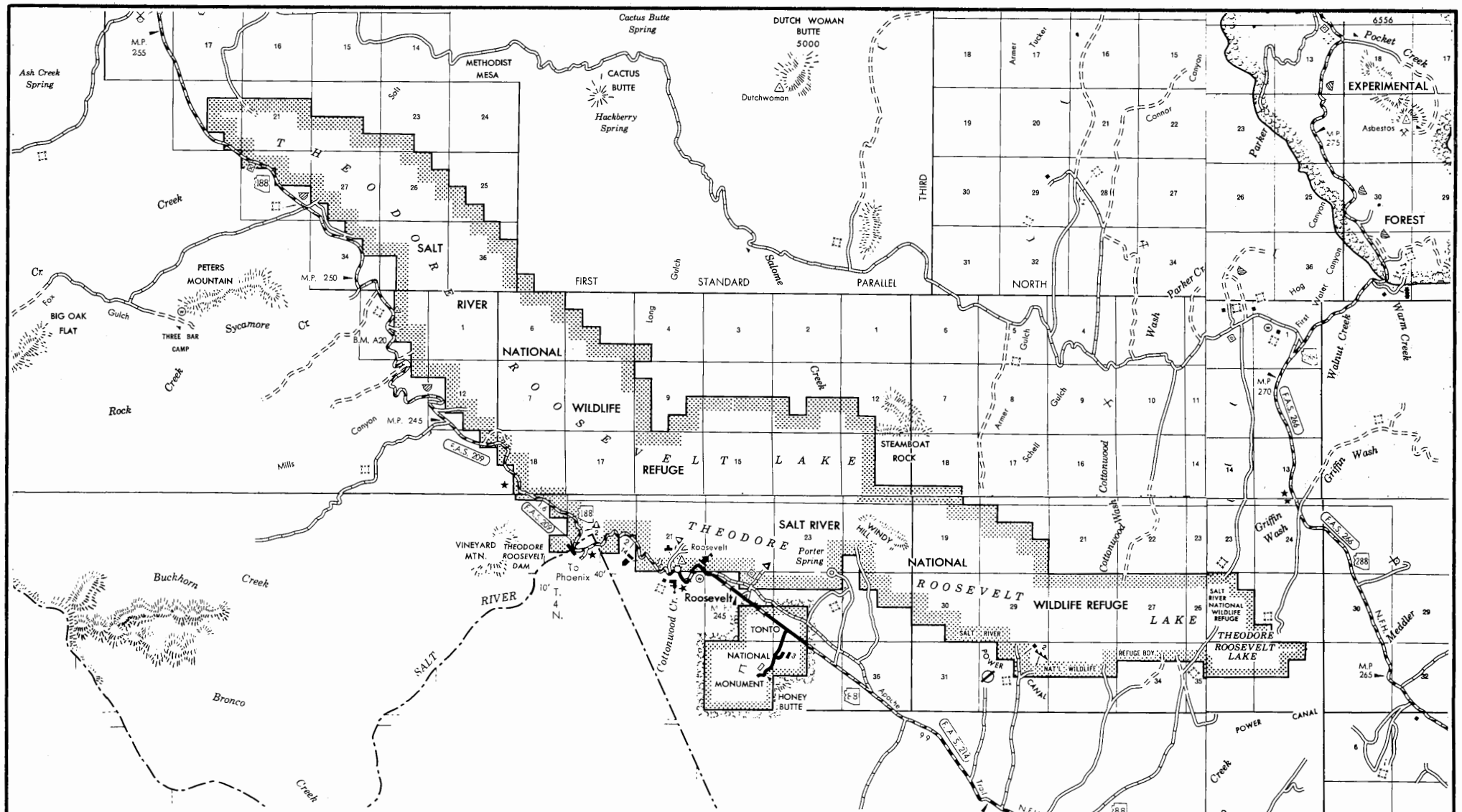
CHRISTOPHER CREEK RECREATION AREAS

N

PLATE 32



GILA COUNTY

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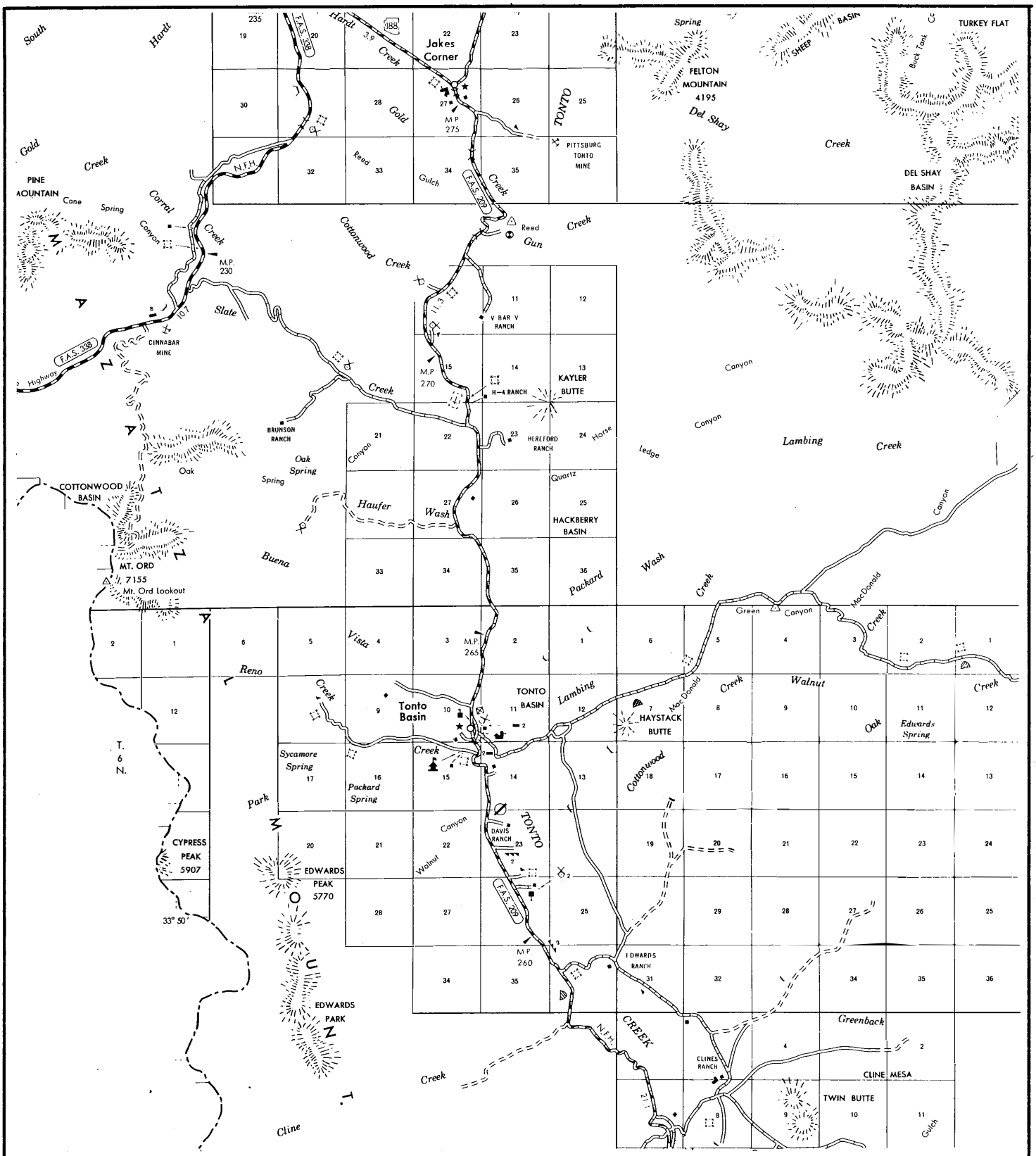
THEODORE ROOSEVELT LAKE RECREATION AREAS

PLATE 33



GILA COUNTY

ENVIRONMENTAL SERVICES NEEDS STUDY

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TONTO BASIN RECREATION AREAS

PLATE 34

Tonto Basin

This area lies approximately 24 miles due south of Payson (PLATE 34). Development occurs along Tonto Creek from Jakes Corner down to the Edwards Ranch which is about six miles north of Theodore Roosevelt Lake. Three private investor owned water companies serve subdivision developments while all other built-up areas are served by private wells.

SEWERAGE AND WASTE WATER TREATMENT

All recreational use oriented areas of Gila County are served by septic tanks, chemical toilets and pit or vault privy systems with one area being provided with a sewage treatment facility. The boat marina and accompanying trailer park-motel at Theodore Roosevelt Lake are served with a modern package plant. The effluent from this facility is chlorinated and used for irrigation when needed or disposed of in the lake. The Forest Service makes use of chemical toilets in the campgrounds which are serviced through a private concern under contract to pump these facilities on a routine schedule.

All campgrounds in the county are served by pit privy and/or septic tank systems. Subdivision developments in the areas of Tonto Basin, East Verde River, Christopher Creek and Tonto Creek are on septic tanks.

SOLID WASTE DISPOSAL PRACTICES AND TECHNIQUES

Recreational activity throughout the forested and lake regions of the county is a solid wastes source of considerable magnitude. Summer residences located in subdivision developments scattered within these areas present a problem in that no service is provided for waste collection.

Solid waste production figures for recreational activity have been estimated at 1.25 pounds of assorted materials per visitor day (one visitor for a 12-hour stay).[13,14] Combined-use data for the recreational use-oriented areas of the county for 1969 were estimated to be 1,362,000 visitor days. These figures indicate that in 1969 approximately 1,700,000 pounds of solid wastes were generated as a result of recreational activity. These wastes were either buried or burned at campsites (non-public campgrounds), disposed of in trash collection stations (public campgrounds), buried or burned at summer or retirement residences

(isolated subdivisions) or left along roadways. This sizable quantity of material must be absorbed by the physical environment if there is to be negligible evidence of degradation or unsightliness.

SUMMARY OF PROJECTED COUNTY DEMAND NEEDS FOR ENVIRONMENTAL SERVICES

Water Supply

Future domestic water demands for each of the communities that are a part of this study have been discussed. On a county basis future water demands, representing average annual domestic needs for the county as a whole have been projected for the years 1975, 1980 and 1990 and are shown in TABLE III-20.

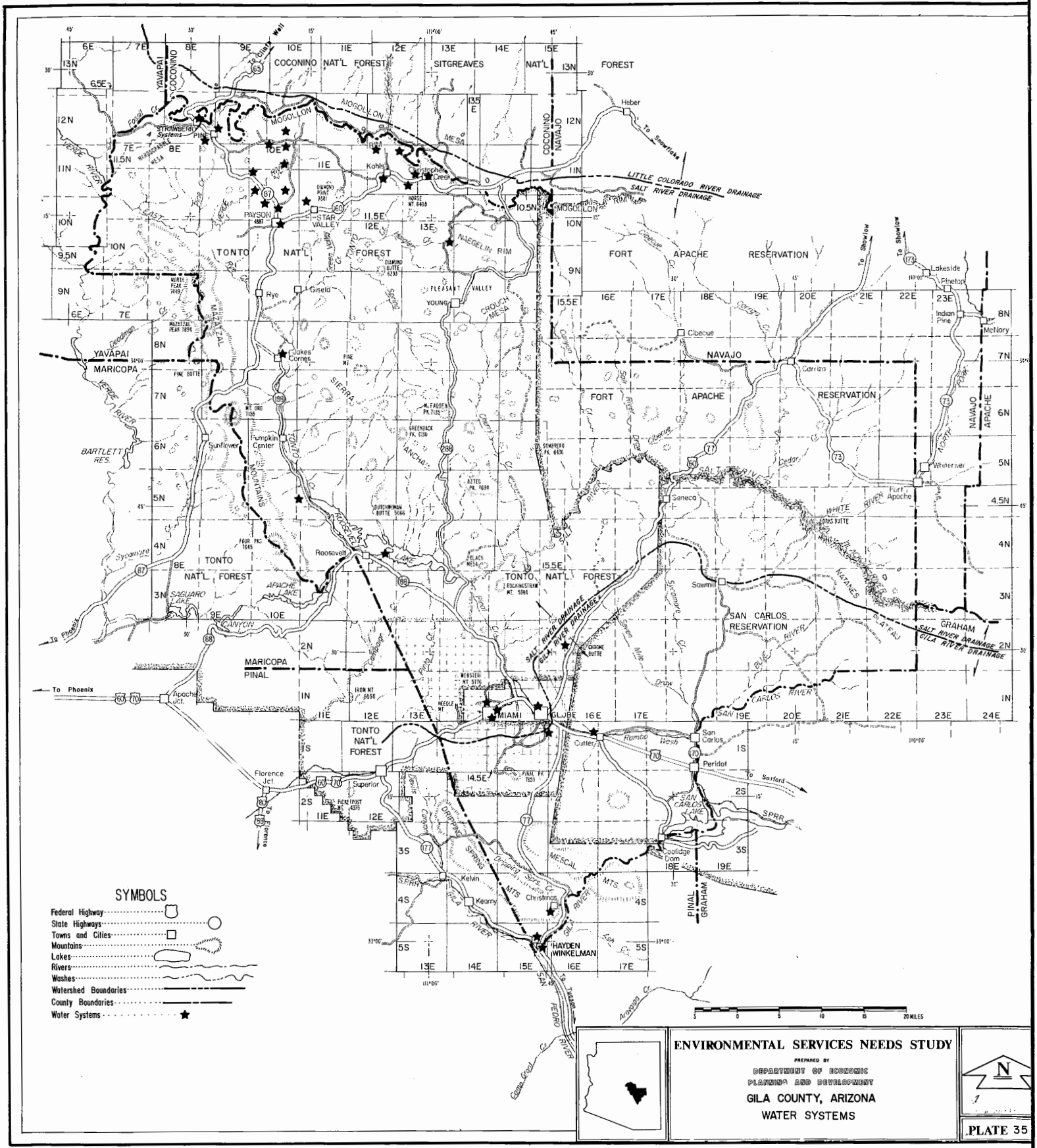
On a county basis, excluding the Indian Reservation land, there are 61 water utilities. A breakdown of the type of utility is presented in TABLE III-21. Roughly 75 percent of the public water systems are private investor-owned corporations. PLATE 35 gives location of these water systems in the county. Thirty-five of the investor-owned systems serve scattered and isolated subdivisions and 11 serve areas which have a community status.[6]

The projected increase in water demands will be met by the water systems existing in the county and new systems yet to be constructed. The development of the new water resources will rest mostly upon the municipality type of system owners.

The development of new water resources to meet future demands will rest mostly upon those systems serving the existing communities in the county. The water resources yet to be developed in Gila County appear adequate to meet the future needs.

Waste Water Treatment

Corresponding with an increase in domestic water demands will be the production of sewage wastes. As the urban areas develop and land use patterns become intensified, the needs for more sophisticated waste treatment facilities will become more apparent. Sewage production levels are outlined in TABLE III-22 for the next twenty-year interval.



ENVIRONMENTAL SERVICES NEEDS STUDY

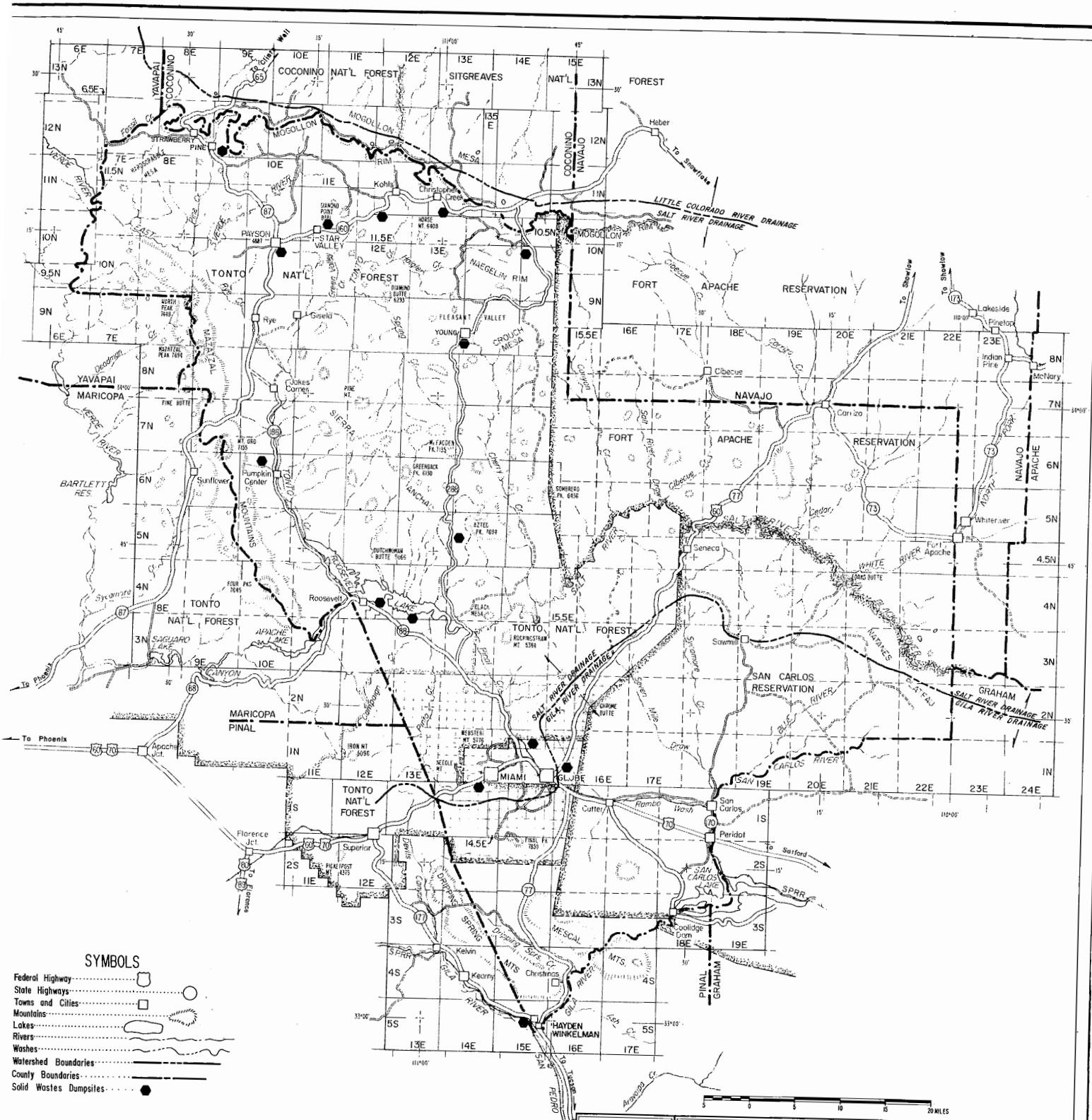
PREPARED BY

DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

GILA COUNTY, ARIZONA

WATER SYSTEMS

PLATE 35



ENVIRONMENTAL SERVICES NEEDS STUDY

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GILA COUNTY, ARIZONA

SOLID WASTES DUMPSITES

PLATE 36

(isolated subdivisions) or left along roadways. This sizable quantity of material must be absorbed by the physical environment if there is to be negligible evidence of degradation or unsightliness.

SUMMARY OF PROJECTED COUNTY DEMAND NEEDS FOR ENVIRONMENTAL SERVICES

Water Supply

Future domestic water demands for each of the communities that are a part of this study have been discussed. On a county basis, future water demands representing average annual domestic needs for the county as a whole have been projected for the years 1975, 1980 and 1990 and are shown in TABLE III-20.

TABLE III-20

SUMMARY OF PROJECTED ANNUAL WATER NEEDS FOR GILA COUNTY AND SELECTED RURAL AREAS IN 1975, 1980 AND 1990* (acre feet per year)

Developed Area	Population Projection Year	Population Projection Levels		
		Low	Median	High
Payson	1975	248	258	267
	1980	321	342	362
	1990	517	592	705
Miami Claypool Central Heights	1975	786	827	868
	1980	883	922	1,019
	1990	898	1,098	1,340
Hayden	1975	143	151	167
	1980	150	164	202
	1990	160	193	290
Winkelman	1975	96	99	111
	1980	101	110	134
	1990	108	132	195
All Other Areas	1975	1,829	1,839	1,821
	1980	2,423	2,435	2,392
	1990	4,118	3,995	3,688
County Total	1975	3,102	3,174	3,234
	1980	3,828	3,973	4,109
	1990	5,801	6,010	6,218

*Project Staff Estimates

On a county basis, excluding the Indian Reservation land, there are 61 water utilities. A breakdown of the type of utility is presented in TABLE III-21. Roughly 75 percent of the public water systems are private investor-owned corporations. PLATE 35 gives location of these water systems in the county. Thirty-five of the investor-owned systems serve scattered and isolated subdivisions and 11 serve areas which have a community status.[6]

The projected increase in water demands will be met by the water systems existing in the county and new systems yet to be constructed. The development of the new water resources will rest mostly upon the municipality type of system owners.

The development of new water resources to meet future demands will rest mostly upon those systems serving the existing communities in the county. The water resources yet to be developed in Gila County appear adequate to meet the future needs.

TABLE III-21

TYPES OF WATER UTILITIES IN GILA COUNTY[6]

Type of Owner	Number
Investor	46
Municipality	1
State	14
TOTAL	61

Waste Water Treatment

Corresponding with an increase in domestic water demands will be the production of sewage wastes. As the urban areas develop and land use patterns become intensified, the needs for more sophisticated waste treatment facilities will become more apparent. Sewage production levels are outlined in TABLE 22 for the next twenty-year interval. Here, as with water supply systems, these wastes will be treated by existing facilities (TABLE III-23) and facilities yet to be constructed. Worthy of consideration is the concept of waste water reclamation and reuse. The high projection level of 4,175 acre feet is a considerable quantity of water to be neglected as it might otherwise be utilized to benefit the citizens of Gila County.

The concept of reuse is best promoted when discussed on a county-wide basis. The development of regional control programs by an arm of county government will be the best approach to this aspect of resources development.

TABLE III-22

SUMMARY OF PROJECTED AVERAGE ANNUAL SEWAGE PRODUCTION LEVELS FOR GILA COUNTY AND SELECTED RURAL AREAS IN 1975, 1980 AND 1990*
(Acre-feet per Year)

Developed Area	Population Projection Year	Population Projection Levels		
		Low	Median	High
Payson	1975	171	177	184
	1980	221	235	256
	1990	356	408	486
Miami Claypool Central Heights	1975	463	487	513
	1980	502	555	613
	1990	543	663	809
Hayden	1975	84	88	98
	1980	86	94	116
	1990	89	107	162
Winkelman	1975	70	72	82
	1980	81	83	102
	1990	102	105	155
All Other Areas	1975	1,233	1,240	1,228
	1980	1,666	1,675	1,645
	1990	2,862	2,776	2,563
County Total	1975	2,021	2,064	2,105
	1980	2,556	2,642	2,732
	1990	3,952	4,059	4,175

*Project Staff Estimates

TABLE III-23

INVENTORY OF EXISTING WASTE WATER TREATMENT FACILITIES IN GILA COUNTY

Installation	Location	Type Installation	Type Treatment
American Smelter & Refining Co.	Hayden	Industry	Tailings
Globe		Municipality	Stabilization Lagoon
Hayden		Municipality	Tailings
Inspiration		Company Town	Tailings
Inspiration Consolidated	Christmas	Industry	Tailings
Inspiration Consolidated	Miami	Industry	Tailings
Magma Copper Co.	Miami	Industry	Tailings
Miami		Municipality	Stabilization Lagoon
Miami High School	Miami	School District	Extended Aeration
Miami Inspiration Hospital	Miami	Private	Extended Aeration
Pueblo Heights Mobile Home Park	Globe	Private	Extended Aeration
Roosevelt Marina	Roosevelt Lake	Private	Extended Aeration
San Carlos		San Carlos Indian Reservation	Stabilization Lagoon
San Carlos-Apache Globe Dev Corp	Cutter	Industrial Park	Extended Aeration

Source: Arizona State Department of Health, Division of Water Pollution Control

SOLID WASTES MANAGEMENT

The production of refuse, garbage and other forms of solid waste will also accompany growth of Gila County's population. Projected levels of solid waste production are presented in TABLE III-24.

The county has about 25 dumpsites at present located in all areas of the county (PLATE 36). The future production levels will be disposed of in these dump areas.

The development of areawide sanitary landfills with salvage operations would be an asset to the county rural and urban areas. A county-wide program of solid wastes control with inspection and maintenance could lead to such a program. The present program of solid wastes management by the County Health Department is on a part-time basis which may be sufficient at the present, however, as the urban and recreation areas receive higher use, the control efforts will need to increase as well. Initiation of a program of development planning for solid waste management in the next few years will serve to benefit Gila County.

TABLE III-24

SUMMARY OF PROJECTED AVERAGE ANNUAL SOLID WASTES PRODUCTION LEVELS FOR GILA COUNTY AND SELECTED RURAL AREAS IN 1975, 1980 AND 1990*
(Tons per year)

Developed Area	Population Projection Year	Population Projections Levels		
		Low	Median	High
Payson	1975	2,500	2,596	2,688
	1980	3,260	3,470	3,784
	1990	5,330	6,110	7,280
Miami Claypool Central Heights	1975	7,315	7,675	8,080
	1980	7,885	8,725	9,640
	1990	8,820	10,785	13,160
Hayden	1975	1,110	1,168	1,300
	1980	1,210	1,325	1,630
	1990	1,365	1,640	2 470
Winkelman	1975	881	908	1,020
	1980	946	1,030	1,260
	1990	1,040	1,273	1,884
All Other Areas	1975	16,464	16,556	16,340
	1980	22,338	22,454	22,054
	1990	39,060	37,891	34,980
County Total	1975	28,270	28,923	29,428
	1980	35,639	37,004	38,368
	1990	55,615	57,699	59,774

*Project Staff Estimates

REFERENCES SECTION I

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SECTION III

CHAPTER I. WATER SUPPLY, SEWAGE TREATMENT AND SOLID WASTES SYSTEMS COSTS

It is the responsibility of municipal officials faced with the need for environmental services to know how much required installations should cost. Actual project costs do not become available until plans and specifications have been completed and approved, bids for construction work, materials and equipment have been received, and contracts have been let. Yet there is need for preliminary concepts of what the eventual cost will be long before these finalization steps have been taken. In short, there is need for valid "measuring sticks" or guidelines which will supply preliminary cost estimates for projects.

There is no substitute for actual cost information, but costs estimates play an important role in the preliminary stages of environmental services planning, despite the fact that decisions often must be based on needs within a community or the availability of funds. While the size of a project may be firmly established by the population to be served or regulatory requirements, knowledge of what the project may cost will be of great value:

- Cost estimates may dictate whether a project should be phased out in stages rather than a full scale works on a one time basis.

- Cost estimates may ascertain the future period for which capacity will be provided or for which actual construction will be scheduled on a long-range plan.

- Cost estimates can help municipal and county officials develop planning for rational financing on a long-range basis.

- Cost estimates can serve as a guide in judging the validity of competitive bids when contracts are to be let.

- Cost estimates can help guide bond issue referenda and assure investors in such bonds of the stability of the offerings.

These examples of the serviceability of construction cost estimates point up the responsibility in establishing guidelines. They demonstrate the need for using cost statistics of known validity in offering cost-estimating guidelines and for clear interpretation of such data in terms of their limitations as well as their proven values. They also serve as warnings that estimates are no more than estimates; that the estimates must be used by persons versed in their application; that estimates are no substitute for actual cost experiences by public officials; and that estimates, cannot and do not reflect total project costs.

The cost data found in the succeeding sections do not cover certain important items in the overall cost of the actual completion of a constructed project. Non-covered items include administrative, engineering, financing and other services, and land costs. These factors should be kept in mind during review of the following costs data.

SEWERAGE AND SEWAGE TREATMENT PROJECTS

The difference between sewerage and sewage treatment plant projects is best illustrated by a comparison of the percentage breakdown of their four major components of construction -- material, labor contractor's plant, and overhead and profit -- as shown in TABLE I-1.[1] The costs of sewer lines installed in trenches (TABLE I-2)

TABLE I-1

MAJOR COMPONENTS OF CONSTRUCTION FOR SEWAGE TREATMENT PLANTS AND SEWERS (1967)

Item	Percent Of Total Cost			
	Material	Labor	Contractors Plant	Overhead and Profit
Sewage Treatment Plants	54.49	25.33	6.45	13.73
Sewers	35.42	18.48	31.30	14.80

Source: Federal Water Pollution Control Administration.

includes (a) excavation, (b) cost of pipe, (c) placing and joining of the pipe, and (d) backfilling of the trench. Sheeting and shoring, gravel foundation cradle or incasement of pipe and surface restoration are excluded. The ranges of costs depicted are based on construction cost indexes for July 1970. It should be understood that the range of

prices indicated here are influenced further by the size of the project and the inplaces soil characteristics. Definite economics of scale result with larger sewer projects. Consideration should also be given to

TABLE I-2

ESTIMATED AVERAGE UNIT COSTS FOR CONSTRUCTION OF SEWAGE COLLECTION LINES - 1970
(For Illustrative Purposes)

Vitrified Clay Pipe		Asbestos Cement Pipe	
Diameter, inches	Cost/foot	Diameter, inches	Cost/foot
8	$3.65-$4.55	8	$3.66-$4.58
10	$6.00-$7.50	10	$4.93-$6.16
12	$8.00-$10.02	12	$6.28-$7.85
15	$12.05-$15.10	15	$9.27-$11.60

Source: Project Staff Estimates.

the type of pipe to be used in a project. Factors such as life expectancy, durability, unit weight, strength and ease of assembly and inclusion of service connections all influence final cost figures in sewerage projects.

Costs for waste water treatment facilities are primarily based on the degree of treatment which may be required by regulatory agencies. As the degree of treatment moves from primary to secondary to tertiary the costs increase correspondingly as illustrated in FIGURE I-1.

Generalized costs for basic waste water treatment processes are presented in TABLE I-3. The costs for waste treatment facilities are also influenced by economics of scale. The possibilities of areas joining together in regionally organized waste treatment projects can be advantageous for communities in proximity to each other. Economies of scale through consolidation of waste sources and the resulting cost advantages are exemplified in FIGURE I-2.

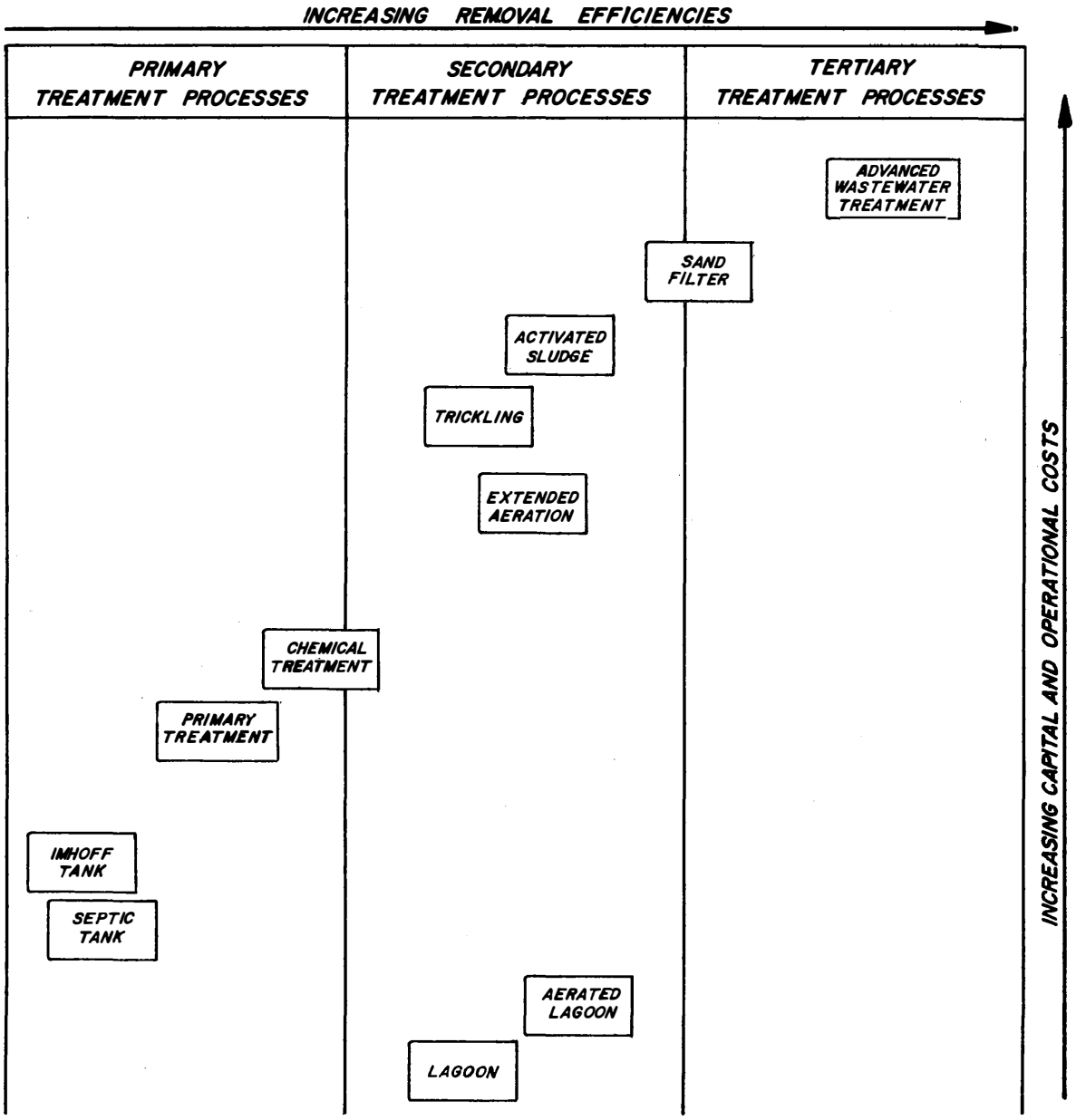
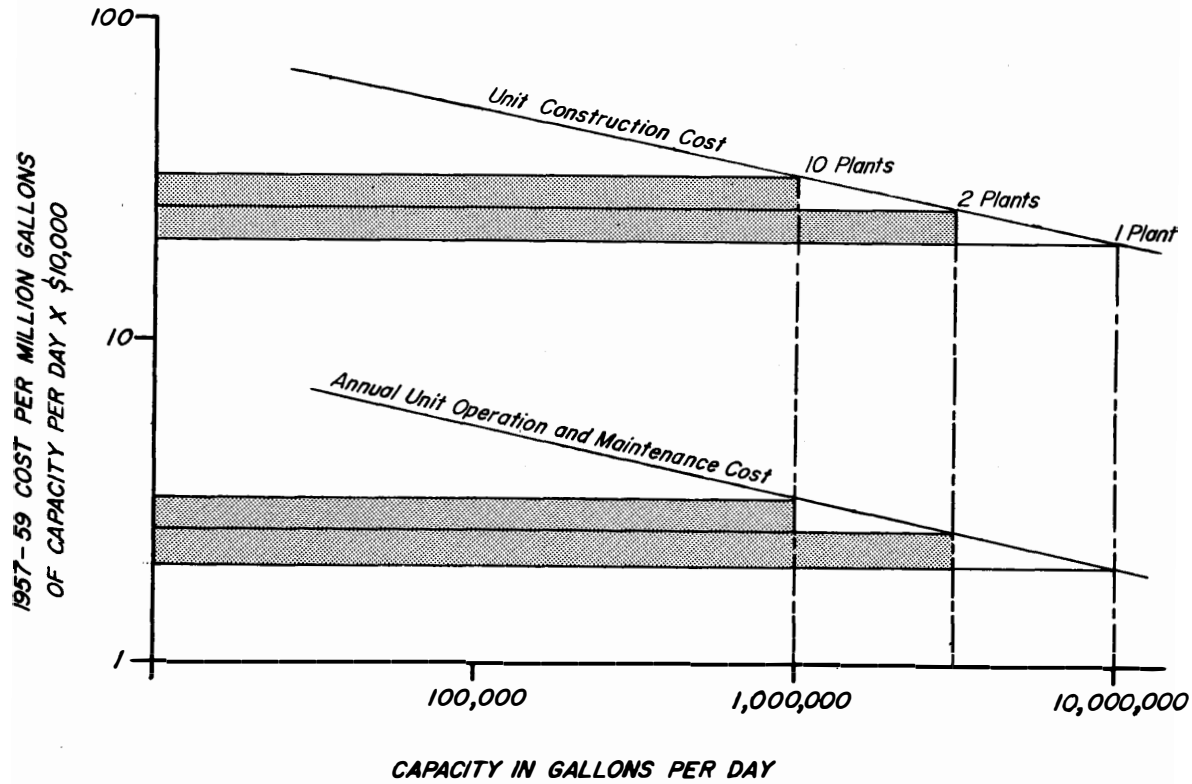


FIGURE I-1, GENERALIZED RANKING OF UNIT COST AND REMOVAL EFFICIENCIES OF CONVENTIONAL WASTE TREATMENT PROCESSES



	Construction Cost	Interest Charges	25 Years Operation	Lifetime Costs
10 plants	$4,200,000	$2,600,000	$7,800,000	$14,600,000
2 plants	$3,200,000	$2,000,000	$6,000,000	$11,300,000
1 plant	$2,500,000	$1,500,000	$4,300,000	$ 8,300,000

FIGURE I-2. APPLICATION OF ECONOMIES OF SCALE THROUGH CONSOLIDATION OF WASTE SOURCES PRODUCING 10 MILLION GALLONS PER DAY OF SEWAGE

TABLE I-3

GENERALIZED COST TO SIZE RELATIONSHIPS OF BASIC WASTE TREATMENT PROCESSES

Process	Million Gallons Per Day Capacity				
	.01	.10	1.0	10.0	100.0
	Construction Cost, $1000's*				
Primary		58.7	308.6	1,247.7	6,559.0
Primary, Separate Sludge Digestion		85.2	305.1	1,092.2	3,084.0
Activated Sludge	11.7	70.8	417.3	2,458.9	14,487.6
Trickling Filter		101.8	288.9	1,374.4	5,045.2
Lagoons	6.2	23.4	88.0	330.3	1,080.0
	Annual Operating & Maintenance Charges, $1000's**				
Primary		4.5	19.7		
Primary, Separate, Sludge Digestion		5.5	20.6		
Activated Sludge		6.3	31.3	172.3	
Trickling Filter		5.1	18.3	83.3	
Lagoons	0.1	0.6	3.0		

*Source: Modern Sewage Treatment Plants, How Much Do They Cost and Sewage Treatment Plant Cost Index for June 1969.

**Source: R. L. Michels, et al "Operation and Maintenance of Municipal Waste Treatment Plants," Journal of the Water Pollution Control Federation, March 1969. 1962-64 dollars raised to 1968-69 conditions by use of BLS Craftsmen's median earning, 1968 ÷ craftsmen's median earnings, 1963 x table value.

WATER SUPPLY AND DISTRIBUTION SYSTEMS

Predicting costs for capital improvements in water systems is extremely difficult, in part because of the variety of equipment and techniques utilized in providing domestic water. Water chemistry and bacteriologic quality have established standards to which all water sources must adhere prior to use by the public.

The means by which these standards are approached is dependent upon the initial characteristics of the water to be used in a

water distribution system. These inherent characteristics establish the basic capital costs for water treatment facilities. For well water meeting chemical criteria, capital outlay merely involves pumping equipment and storage reservoirs with provisions for protection against bacterial contamination in the system. The larger the distribution system the more sophisticated chlorination equipment becomes as well as the cost.

Well systems have basic operational costs in power consumption for pumps used in the system. FIGURE I-3 gives a generalized presentation of pumping costs versus depth to water on the supply end of a system.[2]

Average cost figures for a hypothetical project involving modification of a water supply and distribution system with a total cost of $123,075.00 in 1970 are illustrated in TABLE I-4. The estimates

TABLE I-4

COST ESTIMATES FOR A HYPOTHETICAL WATER SUPPLY AND WATER DISTRIBUTION PROJECT - 1970

Water Supply		
1. Drill and case well (300'-10" diameter)		$10,000.00
2. Water Storage tank (1,000,000 gallon)		47,000.00
3. Delivery Line (10"-4,000')		20,400.00
	Sub-total	$77,400.00
Water Distribution System		
1. 10" pipe (3,200')		13,120.00
2. 6" pipe (6,250')		16,875.00
3. 4" pipe (8,200')		11,480.00
4. Valves		4,200.00
	Sub-total	$35,675.00

Source: Project Staff Estimates.

in TABLE I-4 do not include engineering and contingencies or land right-of-way acquisition.

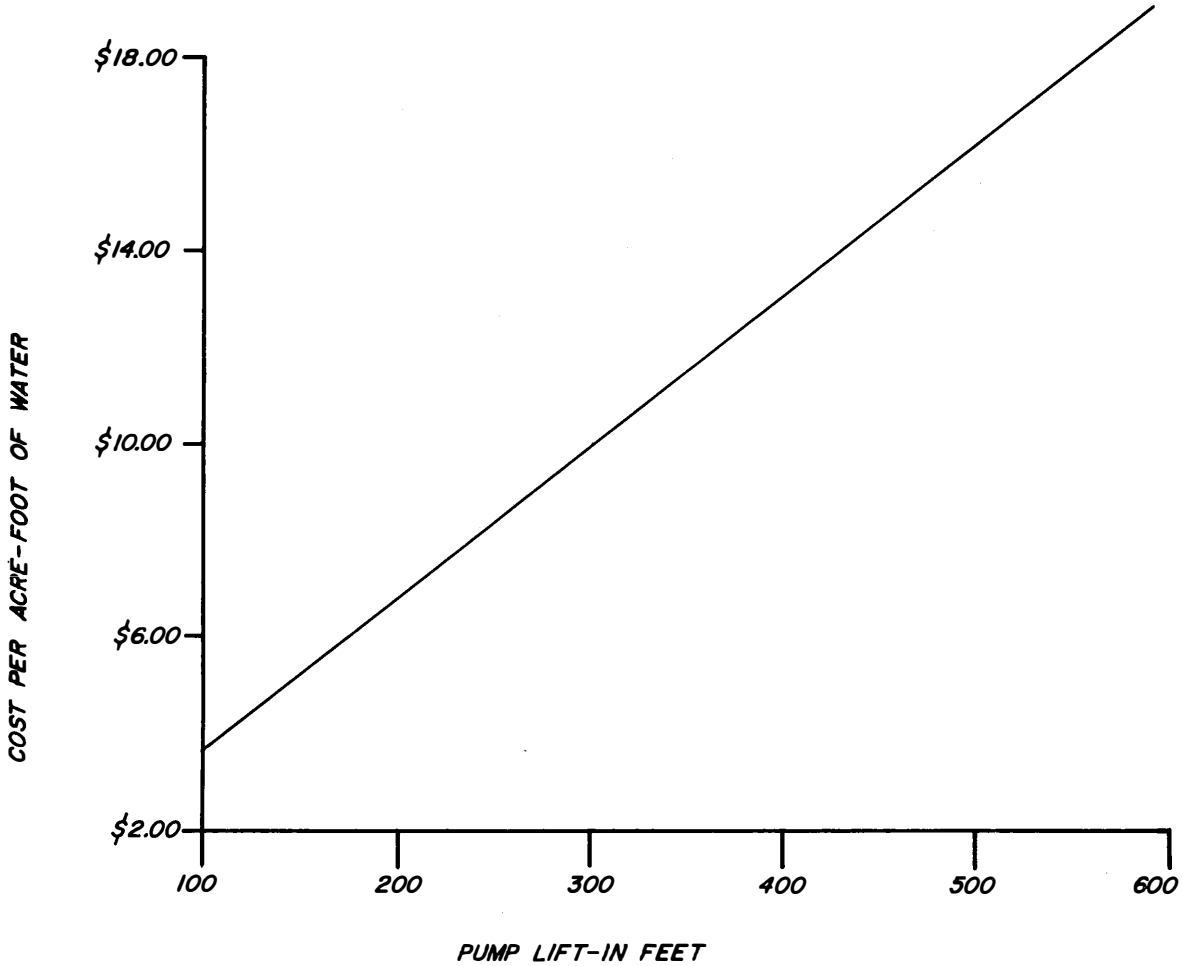


FIGURE I-3, RELATIONSHIP BETWEEN LIFT AND COST PER ACRE-FOOT OF GROUND WATER PUMPED

Another major consideration for costs in water systems development is the amortization of equipment to be used. These costs will be reflected in water service rates particularly if a community is served by a private utility corporation.

SOLID WASTE MANAGEMENT

One of the most popular means for control of solid wastes is the sanitary landfill. Other forms of processing or disposal are, incineration, composting, grinding to sewers, salvage and reclamation, open burning and pyrolypes. Land filling and salvage operations appear to be the best suited operations for environmental control and service to small communities.

Sanitary landfills have the advantages of being inexpensive and applicable to a wide variety of terrain. Land requirements are the only limiting factor for use of this form of disposal. Sanitary landfills have relatively low outlay and cost of operation and are traditionally accepted by the public. They are adaptable and flexible to accept a wide variety of wastes of varying composition and amount with no pre-treatment required.

The cost of a sanitary landfill consists of the initial investment for land, equipment, and construction features, and the operating costs.

The magnitude of the initial investment depends on the size and sophistication of the landfill. A typical breakdown of the major items that normally constitute the initial investment is as follows:

1. LAND
2. PLANNING AND DESIGNING
   a. Consultant
   b. Solid Wastes Survey
   c. Site investigation
   d. Design, plans, specifications
3. SITE DEVELOPMENT
   a. Land development -- clearing, landscaping, drainage features, etc.
   b. Access roads
   c. Utilities -- water, electricity, telephone
   d. Fencing, signs
4. FACILITIES
   a. Administration
   b. Equipment maintenance
   c. Sanitation
   d. Weight scales
5. EQUIPMENT -- TRACTOR, SCRAPER, ETC.

Generally, the major portion of the initial investment is for the purchase of the land and equipment. Often a sizable part of the initial investment for land and equipment can be recovered through the development or use of the land and the salvage value of the equipment.

If funds are not available for the proposed investment, consideration should be given to leasing land or equipment, or both, to spread the cost over the life of operation.

The operating cost of a sanitary landfill depends on the cost of labor and equipment, the method of operation, and the efficiency of the operation. The principal items in operating cost are:

1. PERSONNEL
2. EQUIPMENT
   a. Operating expenses -- gas, oil, etc.
   b. Maintenance and repair
   c. Rental, depreciation, or amortization
3. COVER MATERIAL -- MATERIAL AND HAUL COSTS
4. ADMINISTRATION AND OVERHEAD
5. MISCELLANEOUS TOOLS, UTILITIES, INSURANCE, MAINTENANCE TO ROADS, FENCES, FACILITIES, DRAINAGE FEATURES, ETC.

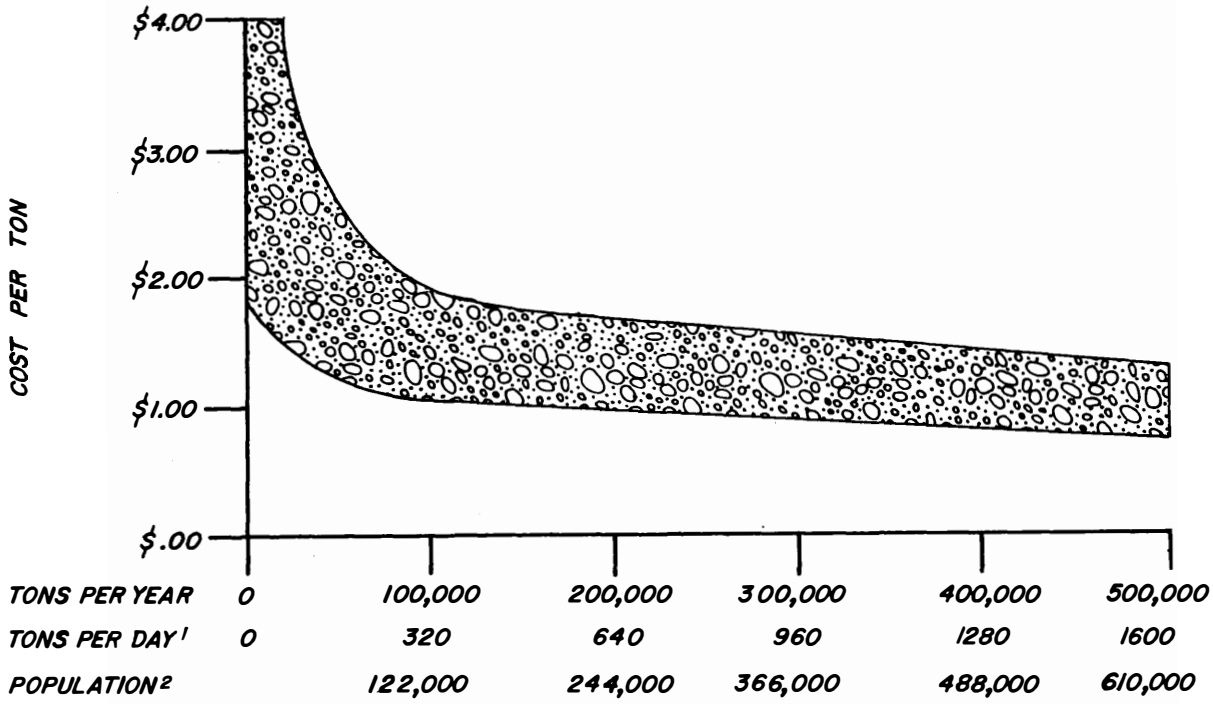
Wages ordinarily make up about 40 to 50 percent of the total operating cost. Equipment equals 30 to 40 percent; cover material, administration, overhead, and miscellaneous amount to about 20 percent.

Operating costs per ton versus the amount of solid wastes handled in tons and the population equivalent may be charted (FIGURE I-4). Operating costs for a small operation handling less than 50,000 tons per year varies from $1.25 to approximately $5.00 per ton. This wide range is primarily due to the low efficiency of the smaller operations which are usually operated on a part-time basis.

Full-time personnel, full-time use of equipment, specialized equipment, better management, and other factors that lead to high efficiency are possible at large sanitary landfill operations. The increased efficiency results in lower unit cost of disposal. The unit cost of a large landfill handling more than 50,000 tons per year will generally fall between $0.75 to $2.00 per ton.[3]

To compare the true cost of sanitary landfilling with that of incineration or composting, it is essential that the costs and returns of the initial investments and the hauling costs be considered along with the total disposal costs including the disposal of incinerator residue and noncompostable materials. The hauling costs of a collection system that uses the sanitary landfill disposal method may be higher than the hauling costs of a system using incineration or composting, since sanitary landfills are generally located farther from the waste-generating area than are incinerators or compost plants. A sanitary landfill, however, may increase the value of a plot of unusable land

by converting the site to a playground, golf course, park....., thereby obtaining a major investment cost advantage over incineration and composting.



[1] Based on 6-day work week

[2] Based on national average of 4.5 lbs. per person per calender day

FIGURE I-4, SANITARY LANDFILL OPERATING COSTS

CHAPTER II. FINANCING ENVIRONMENTAL SERVICES

The intent of this chapter is to acquaint the local community with the different means available for financing environmental services systems. The descriptions are meant only as references and not as a substitute for either the opinions of city and county attorneys or the advice of qualified federal program specialists or bond council.

Local communities have found it necessary to construct, improve and expand their water and sewer systems, sewage treatment facilities, and solid waste disposal facilities. However, due to the growing complexities of municipal and county finance, careful examination must be made of the various sources of funding to insure that each dollar is spent wisely.

BONDING

Cities and towns often find it necessary to incur a large debt to finance capital improvements, i.e., water and sewage facilities. The state has authorized incorporated cities and towns to issue various kinds of bonds to finance this debt. There are three types of bonds which can be used for financing capital improvements for environmental systems: they are general obligation bonds, revenue bonds and special improvement bonds.

General Obligation Bonds

The most common method of bonding for general municipal purposes is the general obligation bond. These bonds are retired from revenues generated from property taxes, which are part of the municipalities general revenue sources. These bonds are often referred to as "full faith and credit" bonds because they are guaranteed by the taxing authority of the issuing governmental unit.

Because these bonds are backed by the taxing powers of the issuing governmental body and they use general municipal revenues for retirement, the local government is limited to the amount of debt incurred and the interest rate paid. The Arizona Revised Statutes (ARS) allow a

maximum interest rate of nine percent per annum. The ARS states that the amount of debt incurred with general obligation bonds cannot exceed four percent of the total assessed valuation of the taxable property.[5]

This type of bonding is generally not encouraged for water and waste disposal projects. The debt limit as defined by the Arizona Revised Statutes is often very low for small communities. This type of bonding is usually reserved for other types of capital expenditures which cannot be financed by other forms of bonding or federal assistance.

Communities may find that mixing general obligation bonds with revenue bonds can be advantageous in marketing the bonds and acquiring federal backing. This is a decision which is dependent upon the bond market, current interest rate and the community's financial planning.

Revenue Bonds

Revenue bonds are used to finance revenue generating facilities. This form of bond is secured by the revenue of the facilities for which they were issued. If these revenues are not sufficient to repay the bonds, the related governmental unit is not obligated to provide tax revenues for repayment. Because these bonds are not secured by the taxing power of the government, they usually bear a higher interest rate than general obligation bonds.

A lower interest rate may be achieved through the assistance of federal insurance and support. The federal government (in the case of rural areas, the Farmers Home Administration) will buy issues which cannot be sold at a reasonable rate of interest. The issuing communities must meet specific conditions to qualify for such support, one of which is that the project will reduce the user costs for required services to a level equal to the average of the surrounding communities.

Arizona authorizes the issuance of revenue bonds for specific purposes, including electric, water, gas, transportation, waste disposal systems, and airport and off-street parking facilities. Revenue bonds do not have to meet the debt limitation required by ARS for general obligation bonds. They do have to meet the following statutory requirements; they must be approved by a majority of the voters in a referendum; they must mature within thirty years of the date of issue; they may not bear an interest rate over nine percent and may not be sold for less than par.[6]

Special Improvement Bonds

Special improvement bonds are issued to finance capital improvements on projects such as streets and sewers. The bonds are secured by assessments levied against the properties which are receiving benefits by the improvements.[7]

SPECIAL DISTRICTS

Special Improvement Districts

There are two types of special districts which may be formed to finance environmental improvements. The first is the Special Improvement District. This type of improvement district is formed by the County Board of Supervisors for a defined geographic area and for specific functions. The creation of a special improvement district is easy and straightforward, however each district has its own set of required procedures for initiation. (Special districts which may be used in supplying environmental services are: Sanitary District, ARS 36-1301 - Irrigation District, ARS 45-1501, Drainage District, ARS 45-1201 - Flood Control District, ARS 45-2301 - Irrigation Water Delivery District, ARS 45-1901.) To determine what functions each special district may perform and the required procedures for delineation, a review of the appropriate statutes and legal precedent should be carried out.

Special Assessment Improvement District

The second type of special district is the special assessment district. This is the common method of financing capital improvements, especially for small areas.[7] The basic premise of this type of districts is that the individual properties receiving the primary benefits of the improvement should pay for the improvement. An improvement district may be formed by the city or town council by its own initiative or by petitition of the local property owners.

FEDERAL GRANTS AND LOAN PROGRAMS

The federal government is increasingly being asked to assist local governments in financing public facilities. There are five federal departments which make moneys available for water systems and waste disposal facilities.

Rural communities with a population up to 5,500 are eligible to receive federal assistance from the Farmers Home Administration (FHA) of the Department of Agriculture. FHA provides assistance in the form of loans, grants and technical assistance to rural communities, nonprofit organizations, new towns and, under special conditions, responsible land developers. (In Arizona the Arizona Corporation Commission is responsible for regulating private profit and non-profit businesses and utilities. They should be consulting along with FHA on any assistance application.) Eligibility and grant approval is on an individual project basis within the guidelines established by the administrating agency. (See TABLE II-1).

Both FHA and the Department of Housing and Urban Development (HUD) provide federal assistance to communities between 2,500 and 5,500 population. Communities in excess of 5,500 population must apply to HUD for federal community services assistance. Also included under HUD's jurisdiction are councils of government, counties, special districts, states and non-profit organizations serving urban communities.

To encourage the expansion and development of a designated areas' economy, the Economic Development Administration (EDA) of the Department of Commerce also provides grants and loans for water and waste disposal facilities. To quality, a state, county or community must be designated an economic redevelopment district or area. In certain cases these EDA grants can be used to supplement other Federal grant-in-aid programs which may be received by the applicant.

The Department of Health, Education and Welfare provides grants for the development of solid waste disposal projects which demonstrate new techniques of disposal or recycling. At the present time Arizona does not have a state agency designated to administer this program nor a statewide solid waste disposal plan. This means that all inquiries for this must be directed to the Public Health Service in San Francisco, and must be of such scope as to serve a large area that it can be considered a district.

The Environmental Protection Agency administers grants for the construction of sewage treatment facilities and outfalls which are needed to prevent inadequately treated sewage from being discharged into public waterways. TABLE II-1 provides an outline of the Federal programs available to assist rural communities in providing the basic water and waste disposal facilities required by their residents.

TABLE II-1

MAJOR FEDERAL AID PROGRAMS UTILIZED FOR PROVIDING ENVIRONMENTAL SERVICES*

Program Title	Authorizing Legislation	Administering Agency	Program Description
Rural Water and Waste Disposal Assistance	Consolidated Farmers Home Administration	Farmers Home Administration U.S. Dept. of Agriculture Andrew J. Mayberry Room 6026, Federal Building 230 North 1st Avenue, Phoenix, Arizona 85025	Loans, grants and technical assistance are made available to towns under 5,500 population or profit and non-profit organizations for the engineering, construction, repair or expansion of domestic water, sewage collection systems, sewage treatment and solid waste disposal facilities.
Public Works Planning Advances	Section 701, Housing Act	Community Resources Development Administration, Dept. of Housing and Urban Development, 2500 Wilshire Blvd. Los Angeles, Calif. 90056	Interest free advances are to states, municipalities & other public bodies to aid in financing the engineering & architectural design work which is preliminary to the construction of a public works project.
Advance Acquisition of Land	Section 704 Housing and Urban Development Act	Community Resources Development Administration, Dept. of Housing & Urban Development, 2500 Wilshire Boulevard Los Angeles, California 90056	Grants for interest charges on funds borrowed to provide for the propitious acquisition of land needed up to 5 years in advance of public works projects

TABLE II-1
(Continued)

Program Title	Authorizing Legislation	Administering Agency	Program Description
Public Works and Economic Development Facilities	Public Law 89-136 Title II	Economic Development Administration, Dept. of Commerce, Paul Luke, 522 North Central Phoenix, Arizona 85025	Grants up to 50 percent of project costs & loans up to 100 percent of land acquisition and improvements for public works and service facilities to encourage industrial or economic expansion. Only projects designated "redevelopment areas" eligible.
Basic Water and Sewer Facilities Grants	Section 702 Housing and Urban Development	Community Resources Development Administration, Dept. of Housing and Urban Development, 2500 Wilshire Boulevard Los Angeles, Calif. 90056	Direct grants up to 50 percent of the cost of land & construction are made to assist communities in the construction of basic water & sewer facilities, excluding sewage treatment, necessary to improvement of health and living standards.
Public Facility Loans	Title II Housing Amendments of 1955	Community Resources Development Administration, Dept. of Housing & Urban Development 2500 Wilshire Boulevard Los Angeles, Calif. 90056	Long term, low interest loans are made to finance local public works projects where credit is not otherwise available on reasonable terms.

TABLE II-1
(Continued)

Program Title	Authorizing Legislation	Administering Agency	Program Description
Grants for Waste Treatment Works Construction	Section 8, FWPC Act 33 U. S. C. 466 et seq	Environmental Protection Agency, Dept. of Interior c/o Arizona State Dept. of Health, Water Pollution Control Division Joe Obr, Director 4019 North 33d Avenue Phoenix, Arizona	Grants are made to states & municipalities to assist in the construction of waste treatment works, including outfall & interceptor sewers, which are needed to prevent discharge of inadequately treated sewage.
Solid Waste Disposal	Solid Waste Disposal Act	Bureau of Solid Waste Management, Dept. of Health, Education and Welfare, 760 Market St., San Francisco, Calif. 94102	State and local agencies may receive grant support for demonstrations relating to the application of new or improved methods of solid waste collection, storage, processing and ultimate disposal.

*Compiled by Project Staff. For further information contact State of Arizona Department of Economic Planning and Development, 3003 North Central, Suite 1704, Phoenix, Arizona 85012. Phone: 602--271-5371.

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4. Constitution of Arizona, Article IX, Sec. 8 and ARS 35-451 through 475.

5. Arizona Revised Statutes 9-521 through 9-540.

6. Arizona Revised Statutes 9-692 and 9-731.

7. ARS 36-1301; 45-1501; 45-2301; and 45-1901.

8. ARS 35-451.

SECTION III

CHAPTER I. POPULATION PROJECTIONS METHODOLOGY

In this study, population projections are presented for the county and all well-defined communities with less than 5,500 residents. In general, county projections are easier to make, and a wider choice of method is available than for communities. A lengthy time series is available for Arizona county populations and these data are sufficient to lend themselves to several different approaches for population projections. Community data, however, are quite often difficult to find, and this limitation constrains the choice of projected population method that can be utilized. For these reasons, different methodological approaches are used for the county and the community level.

COUNTY POPULATION PROJECTIONS

This projection basically utilized a ratio of the county population to the state total. The method is explained below, and Graham County is used as an example.

TABLE I-1

GRAHAM COUNTY POPULATION PROJECTION

Year	Arizona Population	Graham County Population	County as a % of State	Annual Average Rate of Growth
1950	749,857	12,985	1.73	
1960	1,306,161	14,045	1.08	-4.6
1970	1,777,482	16,578	0.93	-1.48
1975	2,081,500	18,525	0.89	-0.98
1980	2,381,500	21,195	0.89	-0.48
1990	3,108,500	27,355	0.88	-0.15

TABLE I-1 shows the data used to project Graham County's population. The first row shows the population of the state and below that is the population of Graham County. The third row shows Graham County's population as a percent of the state's and the fourth row shows at what rate that ratio has declined over time. For instance in 1950 Graham County had 1.73 percent of the state's population and by 1960

it had only 1.08 percent. Over the ten-year period, Graham County's share of the total state population declined at an average annual rate of -4.6 percent per year. Likewise, the rate of decline of the county's share of state population between 1960 and 1970 was -1.48 percent per year. That is, the ratio of the county's population to the state still declined, but not as fast as it did from 1950 to 1960. The ratio of the county's population to the state's declined at an annual average rate of 4.6 percent per year between 1950 and 1960 and at an annual average rate of 1.48 percent per year between 1960 and 1970. The projected annual average rate of growth of the ratio between 1970 and 1975 is -0.98 percent per year and this seems to be in line with the past trend. If the ratio between 1970 and 1975 does decline at this annual rate (-0.98 percent per year) then in 1975 Graham County will contain 0.89 percent of the state's population as seen in row three, column four. That percent is then applied to the projected state population for 1975 to get a county projection for that year of 18,525. (The state population projection has previously been made by the U.S. Bureau of Census.) The same method is then used to project the county's population for 1980 and 1990. One final refinement is then made. After each county's population was projected in the above manner, the projections were forced (proportionally increased or decreased) to sum to the projected total for the state.

COMMUNITY POPULATION PROJECTIONS

Small Arizona communities for which good population time series are available seem to be the exception rather than the rule. Payson, for instance, is one of the communities under study in Gila County and a Payson population projection is required. However, no census population data have ever appeared for that particular community, thus eliminating the use of the ratio method in projecting Paysons' population. Other communities, for which good historical data are available, have demonstrated wide population swings in past years and there often appear to be no close relationships between the community population and the county. Once again, the ratio method is inappropriate.

The method that has been chosen for community population projections is based upon annual average growth rates. Where a good community time series is available, the annual average rate of growth over the previous twenty years is calculated. If there are no apparent factors that are expected to cause the community to deviate from that rate, then the population is simply extrapolated into the future using the historical rate. If dynamic factors are apparent that can cause a significant deviation from past trends, then the seasoned judgment of the researcher is required to anticipate the magnitude and direction of these

changes. There is no "formula" available to accomplish this, and oftentimes local knowledge, plans and judgment are the most important factors in the projection. Judgment is usually preferable to a strict adherence to a rigid methodology.

Judgment also plays an important role in projecting population for a community such as Payson. Where no officially documented current population data are available, estimates by local sources (banks, utilities, post offices, etc.) are used as a base. If no past trends are available to indicate future growth, then judgment is again called for and potential growth rate that seems appropriate for the community must be selected and extrapolated to the future. Again this rate is based upon knowledge of local resources and plans for exploitation.

Rates of growth based upon the above method are designated the medium projection and are thought to be the most probable. But, since a high degree of error is possible, a projection range is desirable. By reviewing the historical growth of a cross section of small Arizona towns, it appears that the growth rate for a short period (ten years, for instance) may deviate by as much as two percentage points from the long-term growth rate. Thus, a community may have increased in population at an annual rate of growth of four percent per year over a thirty-year period. But in one particular decade of that period it may have increased as little as two percent per year or as much as six percent. This range of plus or minus two percent could, then, be taken as the high and low projections for the community and the probability should be quite high that the actual future population will fall somewhere in that range. The problem is that by ranging the high and low projections by plus or minus two percent from the medium rate, the resultant projections are so wide as to be practically meaningless. An alternative range was therefore chosen.

The majority of the small communities in the state have not exhibited deviations significantly greater than plus or minus one percentage point in terms of the annual average rate of growth. The exceptions are those that annexed large numbers of persons in a particular decade and those that either gained or lost population due to dramatic changes in employment opportunities. But, it is felt that these types of dramatic population changes cannot be accurately incorporated into a twenty-year projection. Therefore, the range of plus or minus one percent is utilized herein.

CHAPTER II. PROJECTION METHODOLOGIES FOR WATER SUPPLY DEMANDS AND SEWAGE PRODUCTION LEVELS

GENERAL DISCUSSION

Good management and design of water-supply and wastewater-removal systems demand a knowledge of the volumes and flows involved and their relation to population and time. An idea of water demands is obtained by review of past and current rates of water use stated in terms such as gallons per day per capita or gallons per day and month etc. The per capita and related figures generalize the experience and are, therefore useful in comparing the use records of different communities and in estimating future needs of individual communities and areas (County).

The quantities of water delivered in North American communities tend towards values shown in TABLE II-1, but with wide variations, because of differences in (1) climate, (2) standards of living, (3) extent of sewerage, (4) type of commercial and industrial activity, (5) cost of water, (6) chemical quality of water, (7) distribution system pressures, (8) completeness of meter age and (9) irrigation practices.

TABLE II-1

NORMAL WATER CONSUMPTION

	Quantity, gpcd*	
Class of Consumption	Normal Range	Average
Domestic	15- 70	50
Commercial & Industrial	10-100	65
Public	5- 20	10
Water Unaccounted For	10- 40	25
TOTAL	40-230	150

*Gallons per capita per day.

Source: Fair, G.M.; J.C. Geyer; D.A. Okun, Water and Wastewater Engineering, Volume 1, Water Supply and Wastewater Removal, 1966 John Wiley and Sons.

The "normal range" of variations noted in TABLE II-1 are complicated, with respect to projecting future needs, in that water use practices of people over time have been increasing.[1,2]

Concomitant to water use will be the production of sewage wastes. These wastes are disposed of by some form of individual facility or, if available, in a sewage collection system. The qualities of wastewaters, produced are related to the factors stated above with the exception of irrigation practices. Sewage flows are usually 60 to 70 percent of domestic water use rates and sometimes greater where sewage collection systems are relatively new and moderate climates prevail.[3,4]

SPECIFIC PROCEDURES

Future water demands for small rural communities were based on review and analysis of current and past water use data obtained through public works directors or private water utilities. Data obtained for long periods of time were considered as most reliable while, in some cases, where limited amounts of data were available, generalizations had to be made. Water use for a years time and the variations for the time of year were tabulated. From this information, each month of the year was quantified as a percentage of the maximum month of water use which in all cases occurred during the summer. From these monthly percentages an average was obtained for the year's average monthly use which for most areas surveyed, was in the range of 60 to 80 percent of the maximum month.

From the maximum and minimum month consumption data, which corresponds basically to the summer and winter periods of the year respectively, per capita water consumption rates were calculated. These figures were calculated for each year in which past data were available. Those communities with long series of data, i.e., 10 years, indicated an increasing trend in per capita water use. In some cases where a definable industrial sector of economic activity was present, the increasing trends for domestic water use were, in a sense, overshadowed by the industrial water use rates. For example, the community of Fredonia has an industrial classed water user which demands 1,600,000 gallons of water per month while residential classed users demand an average of 18,500 gallons per month.

Considering the increasing trends exhibited by the rural communities under study and information derived from a limited literature review, an assumption of increasing per capita water use amounting to an average of two (2) gallons per capita per year was used

in this report. Although there are definite possibilities of variations in this figure, depending on the local situations, it was felt that for rural areas with populations less than 5,000, two (2) gallons per capita per year is indicative of these areas.

Determination of present per capita water use rates and the expansion of these rates to the years 1975, 1980 and 1990; and then multiplied by the population projections for the area results in projected water needs.

Determination of county needs for the years 1975, 1980 and 1990 were obtained by averaging the per capita summer and winter demands for all areas of development in the county. In Coconino County for example, water use rates for the community of Flagstaff were included in the determination of present average county per capita water uses. These figures were again expanded by use of the two (2) gallons per capita per year and multiplied by the residual population figures determined by subtracting from the projected total population figures for the county, the population of selected communities outlined individually. A summation was then carried out to arrive at a total county demand estimate for water needs. These figures were developed in terms of total yearly water needs in acre-feet.

Sewage production rates levels were assumed proportionate to the domestic water use rates. Sewage flows during winter within an individual community were estimated as being 70 to 75 percent of the water used. Summer sewage flows were estimated at 60 - 65 percent of the water used in the community.[4] The lower percentage during summer months is indicative of more fresh water used for irrigation and cooling purposes which would correspondingly decrease the contribution to sewage flows by residents of an area.

CHAPTER III. PROJECTION METHODOLOGY FOR SOLID WASTES PRODUCTION LEVELS

GENERAL DISCUSSION

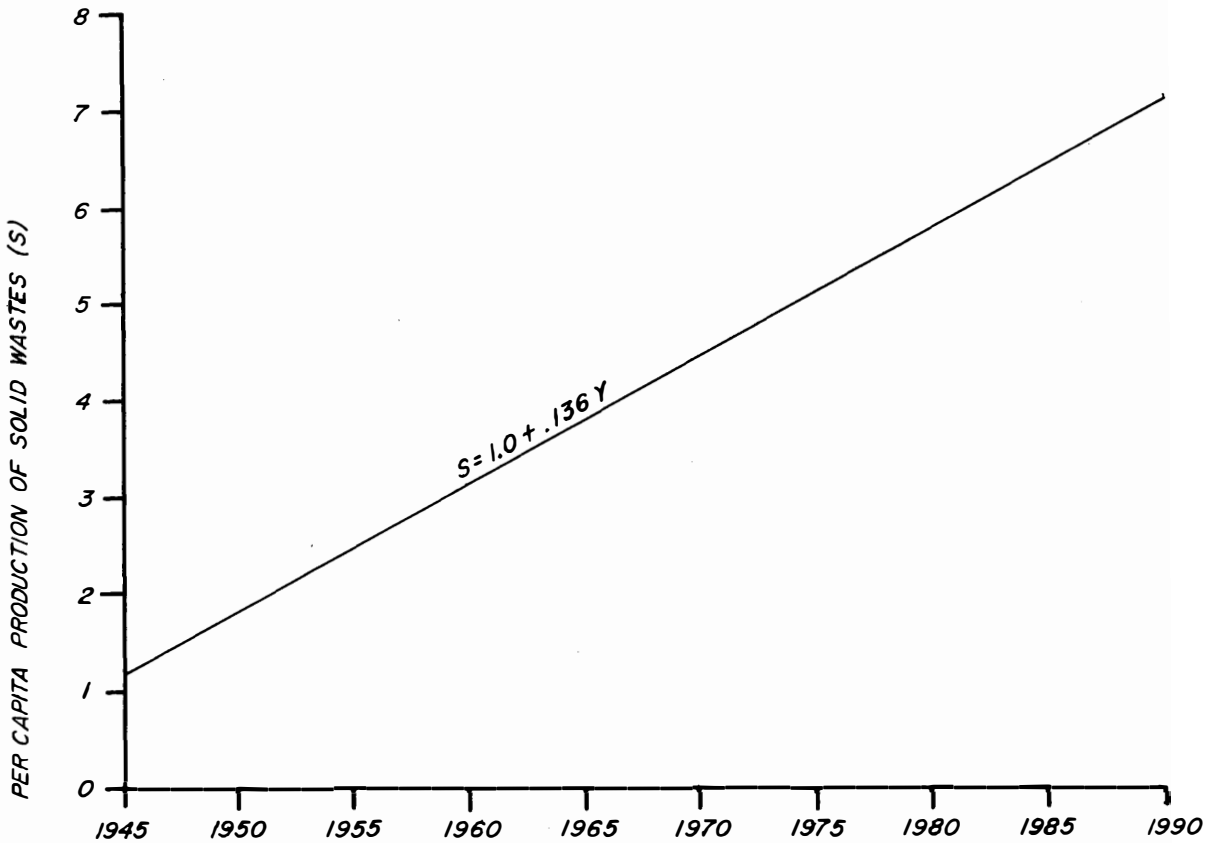
The measurement of rates of solid wastes production have never been attempted in Arizona for rural areas. Some studies have been prepared for the major metropolitan areas of Arizona on solid waste disposal problems and rates of production. The smaller urban areas and rural types of communities in Arizona have not been a part of any form of study related to defining disposal problems and techniques or actual rates of waste production.

Generally solid wastes are defined as those materials that are solid or semi-solid consisting of refuse, garbage and rubbish. Solid wastes and by-products related to their breakdown constitute one of the forms of environmental pollution that is growing at an alarming rate! It is estimated that per capita quantities of garbage produced in the 1970's will increase 50 percent and that by the 1980's production levels are estimated to double.[5,6]

SPECIFIC PROCEDURE

As no valid indicators of solid waste production levels were available with which to quantify levels of production, a literature review was undertaken to develop per capita solid waste production figures. Articles and publications were reviewed which made some reference to rural areas or small communities. Waste production levels on a per capita basis were used to develop an equation which would give an idea of the future solid waste production levels and the anticipated increasing trends.

FIGURE III-1 depicts the increase of per capita solid wastes production levels according to the equation indicated which was obtained from regression analysis of data for the 23 year period from 1946 to 1968.



S = Solid wastes production, lbs. per capita per day

Y = (A - 1945)

A = Year for which "S" is to be determined from 1946 thru 1990

FIGURE III-1, PER CAPITA SOLID WASTES PRODUCTION LEVELS FROM 1946 TO 1968 AND PROJECTIONS TO 1990 (Source: References 7 through 21)

Production levels in tons per year outlined for individual communities and county totals were obtained by multiplying population figures by the per capita production levels obtained from FIGURE III-1 for the respective projection years.

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