Legal and administrative controls on the transfer of water in Arizona.

LEGAL AND ADMINISTRATIVE CONTROLS ON THE TRANSFER OF WATER IN ARIZONA

by

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August 1, 1968

Date

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ABSTRACT

A number of statutory and administrative regulations by the federal and state governments and by water distributing organizations inhibit the formation of an unrestrained market for property rights in water in Arizona. This thesis was undertaken in order to examine the hypothesis that relaxing these restrictions would lead to increased economic efficiency in the use of water.

In order to satisfy this objective, the relevant state and federal statutes and administrative regulations were reviewed, and a field survey of major irrigation distributing agencies was undertaken. The field survey, designed primarily to determine what regulations with respect to water transfer exist in irrigation water distributing agencies, permitted the collection of considerable other information concerning the organization and operation of these agencies. This additional information is also reported in the thesis.

The conclusion from the analysis are that given the present ground water law, present cost of alternative supplies of ground water, and the physical cost of transferring water, the evidence does not indicate that any great increase in economic efficiency would follow from alternation of present procedures.

CHAPTER I

INTRODUCTION

Background and Objectives

Water is widely regarded as the resource most important to the continued economic growth of the State of Arizona. Existing surface water sources are being almost completely utilized for human purposes, including irrigation, industrial and municipal uses. Groundwater supplies are being "mined" in the sense that withdrawals have for many years greatly exceeded the estimated recharge in the large groundwater basins in the state. As the readily available supplies have become fully utilized, interest has turned to ways of developing additional sources of water. Two examples of such efforts might be cited. One is the program to increase the water yield of the Salt-Verde watershed through control of vegetation. A second important example is the proposed Central Arizona Project which contemplates transfer of Colorado River water into central Arizona in an attempt to offset a portion of the overdraft on groundwater reserves.

In this context of scarce water supplies of a crucial resource, it is, therefore, important to seriously investigate any means at hand for increasing the efficiency with which water is allocated. The present

study which examines the legal and administrative devices for the allocation of water in Arizona represents a first step in this direction.

Institutions Interfering with Efficient Allocation of Water

Surface water rights in Arizona are for the most part governed under the appropriative doctrine in a form which imposes rigid restrictions on transfer away from the original place and purpose of use. In consequence, it may be hypothesized that possessors of surface water rights have experienced a high degree of security of tenure, which may have enhanced long-run investment in surface water development. On the other hand, urban and industrial growth, as well as extensive developments of lands irrigated from groundwater sources, have created situations where the marginal value productivity of water would be apparently higher at places and in uses other than those to which they are now confined. The institutions limiting flexibility in location and use of surface water may thus prevent the most economically efficient allocation of water resources.

In contrast, the riparian doctrine generally attaches to groundwater in Arizona with essentially no restrictions on removal or purpose of use. From this it may be hypothesized that a high degree of flexibility in location and use attaches to groundwater, which may have enhanced the short-run economic efficiency in its allocation and use. On the other hand, a low level of security of tenure relative to the

long-run physical supply resulting from uncoordinated acts of pumpers in the aggregate may have retarded investment in and development of groundwater supplies including "saving" of groundwater supplies for uses in the future.

This background suggests the value of an economic analysis of the legal-institutional-administrative devices in Arizona through which the transfer of water between uses and users takes place, in order to assess the net gains or losses in aggregate social economic efficiency of water use which might result from changes in these institutions.

Objectives

The primary purpose of this thesis is to describe the legal-institutional-administrative devices through which transfers of surface water between uses and users take place, and to identify those among these devices that might inhibit the most efficient allocation of water between uses and users. This represents the first part of a study, the later phases of which will attempt to assess the extent to which present institutions impede aggregate economic efficiency and to suggest modifications in these institutions which would enhance aggregate economic efficiency in the use of water resources.

Since achievement of the primary objective entailed a field survey of the major irrigation districts in the desert areas of central and southern Arizona, this opportunity was taken to gather other useful

information concerning organization, pricing policies, and administration of the districts. A secondary objective then is to report the results of this aspect of the survey.

Procedure

In the remainder of this chapter, the welfare framework for evaluating institutional changes will be briefly outlined. Chapter II will review the Arizona statutes as they relate to water and water transfer. Chapter III will present a summary of the findings of the field survey of the major irrigation districts in the state emphasizing organization, administrative controls, pricing policies and transfer mechanisms.

A Welfare Framework Within Which to Evaluate Changes in Institutions for Water Transfer

There has evolved in economics a normative field called "welfare economics" whose purpose is to develop criteria for evaluating public policy proposals. The developments since the 1930s have been termed the "new" welfare economics but are based on ideas developed by the Italian, Vilfredo Pareto, in the 1890s. The basic evaluative concept involved, called the "Pareto criterion", asserts that a change which makes at least one individual better off while leaving no other individual worse off represents an increase in welfare and, hence, is desirable. However, since there are scarcely any policies which would leave no

person worse off, the notion of "compensation" of losers is introduced and the Pareto criterion is usually interpreted with the understanding that after all losers from the policy are compensated, no person is to be left worse off.

A number of practical difficulties are encountered in any attempt to strictly apply the Pareto criterion in evaluating policies. Hence, neoclassical economists have focused on an increase in aggregate real income as the main criterion of economic welfare. This is not conceptually identical with the Pareto criterion. However, it serves as a practical first approximation, since by the compensation principle it is conceptually possible to allocate grains in income in such a way that no person is left worse off.

It is customary in economics to use the concept of "efficiency" when evaluating the outcomes of alternative policies. That organization of society providing the largest aggregate real income from a given set of resources is said to be the most "economically efficient" organization.

In order to serve as a satisfactory criterion for policy evaluation, the concept of real income must also meet the further restriction that the policy under consideration does not impinge upon values other than economic efficiency, (e.g., income distribution). In the event the proposed policy were to detract from competing values, as often is the case, then the analysis becomes quite complex. In principle, one would have to

determine if the value of gains in income was sufficient to offset the losses in other values. This process requires the development of social trade-off ratios (rates of substitution) among the competing values.

Accepting the concept of an increase in national income as a criterion for public policy does not imply that its application faces no difficulties of either a theoretical or practical nature. In problems where change or uncertainty are central issues, it may not be the most useful or relevant criterion. Furthermore, the criterion can only help determine the most preferable among indicated alternatives; it does not guarantee a maximum or optimum solution for any given problem.

With these reservations, we shall accept the concept of increases in real aggregate income as a working criterion for our policy evaluations, and with the further understanding thata diligent attempt shall be made to identify all consequences of proposed changes in policy for equality of income distribution and other important values.

Application of the Criterion: An Example

The general hypothesis of the overall study, of which this thesis represents a first phase, can be stated as follows: Legal restrictions on the free transfer of water rights in Arizona prevent the achievement of the most economically efficient allocation of water resources. An example will serve to illustrate the proposition. Suppose there are two firms labeled "A" and "B" who use water as a factor of production

in their operations. Each firm has rights to a limited supply of water. Assume that for firm "A" the value of the last unit (say an acre-foot) of water is $5, while for firm "B" the value of an additional acre-foot is $25. If "A" and "B" are free to trade (ignoring transfer costs for the moment), it is obvious that they could make an exchange with "B" paying "A" some price greater than $5 and less than $25 for the acre-foot of water, and both of them (and society as well) would be better off as a result of the bargain. "A" has received more than the $5 his marginal unit of water is worth to him, "B" has added to his output a return greater than the increased cost, and the real aggregate income has been increased, although the amount of resources used up remained unchanged.

This transaction does not end the possibilities for gain. There is still likely to be a disparity between the value of marginal units of water to "A" and to "B". However, because of diminishing returns, the marginal unit of water to "A" will now be valued at somewhat more than $5 (say $10) and to "B" somewhat less than $25 (say $20). Clearly, another exchange should be made. The obvious end point of this process is where the marginal unit is valued equally by each party. At this point, no more mutually advantageous trades can be attained, and the maximum efficiency in the use of the water resources available to these two parties is achieved.

Generalizing from the example, we may assert the principle of equimarginal value in use: "An efficient allocation of water is achieved when no mutually advantageous exchanges can be made between any pair of claimants." This can occur only when the marginal values of each claimant are equated, measured by the quantity of other resources he would be willing to trade for an additional unit of water.

In situations where water users are prevented from making exchanges by legal and administrative regulations, as is sometimes the case in Arizona, the existence of divergent marginal value productivities among users and uses can be said to suggest some degree of inefficiency in water resource allocation.

CHAPTER II

ARIZONA LAW AS RELATED TO WATER TRANSFER

The purpose of this chapter is to review the historical development and present status of water law in Arizona particularly as it relates to transfer of water between uses and users.

Early Developments in Arizona Water Law

General

Irrigation has been practiced in Arizona for hundreds of year. It is believed that the ancient Hohokam Indians diverted water from the Salt River as early as 200 B.C. The Spanish explorers first entered the area early in the 16th century and these were followed by church missionaries. The communities which developed near the missions were ruled by Spanish Law, which had developed from Roman Civil Law. In contrast, English Common Law was in effect in the newly settled Eastern states. Some of the present-day provisions concerning public ownership and appropriative use of water in Arizona can be traced to the Spanish influence during this early period. This influence extended to the time of the Treaty of Guadalupe Hidalgo in 1848 at which time much of the areas of New Mexico and Arizona were ceded to the United States.

In 1851, the Territorial Legislature enacted laws which in effect adopted the rule of prior appropriation for water use. This legislation implied that both nonriparian and consumptive uses were possible. (These provisions were in marked contrast to the common law doctrines relating to water in the Eastern states.) It also provided for private and public ditches for diversion and included the right to cross private land to obtain water. It failed to include any distinction between surface and underground waters as a source of the water that could be appropriated. In 1866, with some modification in 1870, the U. S. Congress passed legislation which authorized appropriation of water from public lands. This was primarily designed to settle the controversies between the government and the miners trespassing on public domain. In effect the Act has been construed by the several Western states as a recognition by the U. S. Congress of the rights of the states to promulgate their own water laws.

The Desert Land Act of 1877 contained the following passage:

> Providing, however, that the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres, shall depend upon bona fide prior appropriation; and such right shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights.

This law was passed for the purpose of reclaiming arid lands and encouraging the settlement of the West. It provided that the settler had three years to bring the land into irrigation, after which time and upon the payment of $1.25 per acre, he acquired title to the land. In 1893, the acreage limitation was later revised downward to 320 acres.

Territorial Law

The first Arizona Territorial Legislature met in 1864 and enacted a Bill of Rights of which Article 22 stated:

> All streams, lakes and ponds of water capable of being used for the purpose of navigation or irrigation are hereby declared to be public property; and no individual or corporation shall have the right to appropriate them exclusively to their own private use, except under such equitable regulations and restriction as the legislature shall provide for that purpose

The legislature subsequently adopted what is known as the Howell Code. Chapter 55 of the Code deals with the regulations for the control of water. The most important sections of the Code were as follows:

> Section 1. All rivers, creeks and streams of running water in the territory of Arizona are hereby declared public and applicable to the purposes of irrigation and mining as hereinafter provided.
>
> Section 3. All the inhabitants of this Territory, who own or possess arable and irrigatable lands, shall have the right to construct public acequias, and obtain the necessary water for the same from any convenient river, creek or stream of running water.

> Section 7. When any ditch or acequia shall be taken out for agricultural purposes, the persons or person so taking out such ditch or acequia shall have the exclusive right to the water, or so much thereof as shall be necessary for said purposes, and if at any time the water so required shall be taken for mining operations, the person or persons owning said water shall be entitled to damages, to be assessed in the manner provided in Section 6 of this chapter.

Section 17 was of particular interest. It provided that during periods of scarcity, the owners of lands shall have preference according to the dates of their respective title or occupation of the land, the oldest title having the precedence.

One important difference between the Bill of Rights and the Howell Code is found in Section 3. The Code broadened the scope of the concept of public water to include all running water, in addition to streams, lakes and ponds of water capable of being used for the purposes of navigation and irrigation. This point was to later become an issue in disputes regarding groundwater. Most of the other sections simply clarify the Bill of Rights.

During the period from 1866 to 1900, several important court decisions were rendered which added emphasis to the doctrine of prior appropriation. They illustrate that much of Arizona water law has been the product of judicial opinion. Some of these decisions are as follows:

1. Campbell v. Shrivers 1 Ariz. 161

The issue was concerned with the priority of use of appropriative water rights. The decision established the rule,

"first in use, first in right".

2. Dalton v. Rentaria 2 Ariz. 275

This concerned a senior appropriator who over a period of 16 years had not exercised his right to certain waters. The court decided that he could be stopped from claiming his right over a junior appropriator after this period of time. This established the precedent of loss of water right by abandonment.

3. Hill v. Lenormand 2 Ariz. 354

This decision affirmed that a superior right is held by prior appropriator even over a riparian landowner. It implied that riparian owners must also establish rights to water by appropriation.

4. Clough v. Wing 2 Ariz. 371

This decision provided that an appropriator is entitled only as much water as necessary to irrigate his land and could not waste his share of water, and established the "reasonable use" doctrine for water.

5. Dyke v. Caldwell 2 Ariz. 394

This opinion upheld the right of a party to cross another person's land to reach a source of water.

Water Law in the Twentieth Century

Surface Water

The U. S. Congress in 1902 passed the Reclamation Act which authorized the Department of Interior to construct dams and reservoirs where needed to make lands arable, and provided for procedures to pay off the costs of such construction and to insure the settlement of the irrigated lands. The expenditures under the Act were to be financed from the proceeds of the sales of government owned land. Later, these sources were supplemented with congressional appropriations. The payment for the construction is set up over a 40-year period and in most instances, a 10-year moratorium on payments may be declared during the early development stages. These projects were required only to pay the actual construction costs and not the interest on the funds used. Later this was modified so that certain costs which were attributable to flood control, navigation and recreation were not required to be reimbursed by the project. It is of special note that the Sale River Project in Maricopa County, Arizona, and the majority of irrigated land in Yuma County, Arizona, obtain water from projects which were constructed under the provisions of the Reclamation Act. The Salt River Project was the first one in the country authorized under this act according to Mann (1963, p. 5).

Section 8 of this Act contains a very important statement:

> . . . that nothing in this act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any state or territory relating to the control, appropriation, use or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of the Act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any state or the federal government or of any landowner, appropriator, or user of water into or from any interstate stream or the waters thereof.

In effect, this implies that only nonappropriated water can be obtained from the projects operated by the Bureau of Reclamation and that the prior rights of the users could not be interfered with in the construction and operation of the storage facilities. This Act created the need to establish some basis for the rights to the stored water. In Arizona in the Hurley v. Abbott et al case, Hurley, who was an early appropriator, filed against a large number of landowners in the Salt River Valley in order to quiet title to his water supply. This action resulted in the Kent Decree in 1910, which determined the date of priority for the water right to each parcel of land in the valley. The court determined the date of entry into agricultural production of each quarter section of land and gave priority to the normal flow of the river to each depending upon first and continuous use under the prior appropriation doctrine. The courts also determined what amount should be allocated to equal sized plots with equal rights in time of use. The stored water was divided among the users under three classes. Class A was land that had been

in continuous irrigated use since 1869. This was the date of the first recorded use for agricultural purposes by other than Indians. Class B was land that had been irrigated only during periods of above normal stream flow and then abandoned, and Class C was land that had no prior record of irrigation. This same pattern of settlement of rights has been used on the Gila River in the Benson Allison Decree for users in the valley below Phoenix, and for the construction of the Coolidge Dam on the upper portion.

A state water code was adopted by the Arizona Legislature in 1919. It made no radical departure from the existing practices but put into legal statutes the principles which had been laid down by the court decisions over time concerning water use in the state. It did provide for the establishment of a centralized administrative procedure for water right determination under a State Water Commissioner. Presently, the commissioner's duties are performed by the State Land Commissioner. It became necessary for persons, desiring to appropriate water, to submit an application giving pertinent information concerning source, nature and quantity of use and point of diversion. The Commissioner was empowered to accept or reject those applications, subject to a court review. The Commissioner was directed to approve those who did not interfere with prior vested interests and were not in conflict with the public interest or welfare. This 1919 Code is still the chief legal doctrine relating to surface water for the state. There have been

Some modifications over the past years, primarily only to clarify rather than to replace it.

Transfer of Surface Water Rights. The 1962 Arizona Legislature revised the statutes (ARS 45-172) governing the transfer of surface water between users and uses. The changes provided that the water right could be severed from the land to which it was appurtenant. The procedure for such transfer is as follows: an application for change must be filed with the State Land Department. The Department fixes a time for a public hearing at which time the following restrictions must be considered and satisfied:

1. Any vested rights of others must be upheld.
2. The right in question must be real not previously forfeited or abandoned.
3. If the proposed transfer is to be within the boundaries of an irrigation district, consent of the district must be obtained.
4. If the transfer is beyond district boundaries, approval is also required by district.
5. Approval of the State Land Department is required.

If conditions are such to make land holding a water right unsuitable for farming, substitution may be made to lands presently without water rights, subject to the same procedure described above.

A check of the records of the State Land Office in 1965 failed to uncover any evidence that any such transfer had been completed since the statutes were revised.

Groundwater

In direct contrast to the apparently settled legal status of the surface water rights and regulations are the groundwater rights. Apparently, the early legislators and judges had no conception of the vast demands which would develop for the state's water supply. The first Bill of Rights and the Howell Code made no mention of underground sources of water. In 1904, the Arizona Supreme Court in the Howard v. Perrin case (8 Ariz. 347) ruled that the common law governed the underground water supply. This, in effect, established the riparian doctrine for groundwater. The legislature in 1919 included in the state water code, "The water of all natural streams or flowing in any canyon, ravine, or other natural channel, or in a definite underground channel, and of springs and lakes, belong to the public." The Code was amended in 1921 to include floodwaters, waste or surplus water and lakes, ponds and springs on the surface as public waters. In 1948, direct action was taken by the state legislature toward some control of the underground sources of water. This statute is sometimes referred to as the Critical Groundwater Code. The purpose of the Act was to prevent the

further expansion of agricultural use of groundwater and did not include any provision to alleviate the already existing overdraft. It contained a provision which called for the State Water Commissioner to declare certain areas of the state's "critical groundwater areas". A critical area was defined as any groundwater basin . . . not having sufficient recharge to provide a reasonably safe supply for irrigation of the cultivated lands in the basin at the then current rates of withdrawal (Arizona Revised Statutes, 1956). The Commissioner could declare an area critical after public hearings called on his own initiative or on petition of users of groundwater. His decision was conclusive as to facts unless appealed within a stated time.

The Commissioner is empowered to refuse to permit the drilling of irrigation wells in critical areas except under certain conditions. Only the replacement or deepening of irrigation wells in existence during the previous five years was permitted in critical areas. Wells used for the purpose of domestic supply, stock watering, industry or transportation were specifically exempted. Shortly after the passage of the Act, the case Bristor v. Cheatham was filed in the Superior Court in Maricopa County which had much significance in use of groundwater. Both were landowners pumping from a common underground supply. Bristor's use was for domestic purposes and was first in time of beginning of the use. Cheatham was an agricultural irrigator pumping the water for

delivery to a point several miles from the area in question. The pumps lowered the water table to the point where the domestic well failed. The first decision came when the Superior Court granted a motion to dismiss the Bristor suit. The case was appealed to the Arizona Supreme Court in 1950 and a decision rendered in 1952 which in effect declared the percolating waters subject to appropriation. Several reasons were given for this decision. However, it was based mainly on the fact the state legislature had failed to provide any basis for the use of the underground supplies and in the absence of these, the ownership was public and appropriative under the statutes. This decision was again appealed to the Arizona Supreme Court and reversed in 1953.

The significance of the original Supreme Court decision would have been to give precedence to the doctrine of first in time, first in right in relation to groundwater. It would have prevented a junior user in time from affecting the supply of a senior user. Such a ruling would have probably slowed the draft on the underground supplies. The reversal of the decision left the situation as it had existed before the suit, where each party is trying to receive a portion of the common supply without regards to the decline in the water table.

The 1948 Code remains in effect but several court rulings have weakened it to a point where one must assume that it has little impact.

Transfer of Groundwater Between Uses and Users. The definition of percolating water adopted by the Arizona Legislature refers to water under the surface of the earth, excluding, however, water flowing or moving in underground streams. The courts in Arizona have on several occasions held that the percolating water belongs to the riparian surface owner and is not subject to appropriation. The right to this water, therefore, can be transferred by sale or lease of the riparian land surface. The Bristor v. Cheatham decision suggests that. There are no legal restrictions upon the use of groundwater for whatever purpose the riparian landowner might desire:

CHAPTER III

ORGANIZATION AND OPERATING POLICIES OF WATER DISTRIBUTING AGENCIES IN CENTRAL AND WESTERN ARIZONA

The purpose of this chapter is to present descriptive information concerning the scope and organization as well as operating, pricing, and water transfer policies of the major organizations which distribute irrigation water in the desert areas of central and western Arizona. (These organizations are primarily corporations and public irrigation districts.) It is anticipated that this information will be of interest to agricultural extension agents, agricultural credit agencies, as well as to other persons interested in the development and distribution of water in Arizona.

Some 170 organizations may be identified in Arizona which distribute water for irrigation in the state. The large majority of these are relatively small in scope serving perhaps a few farms. In view of this situation, the investigation has been limited to only the largest of such organizations. The procedure for selecting the organizations for study are as follows: the organizations were ranked according to acreage of service areas, and then those organizations from the largest on down

was selected for study until approximately 90 percent of the acreage served by such agencies was accounted for. This procedure led to the 22 organizations in this chapter. The format of the description of each organization is similar, according to the following general headings:

1. Location, Service Area, and Form of Organization
2. Source of Water Supply
3. History of Organization
4. Quantity of Water Delivered, 1960-1964
5. Charges for Water Deliveried, 1964
6. Cropping Patterns in the Service Area

A general map of the service area of the organization accompanies each description. A map of Arizona showing the general location of the organizations included in the report is found on Figure 1.

In keeping with the general objectives of the thesis, the interviews were also designed to determine if any members or clients of the organization participated in the economic transfer of water from one user to another or from one use to another. These findings are summarized at the close of the chapter.

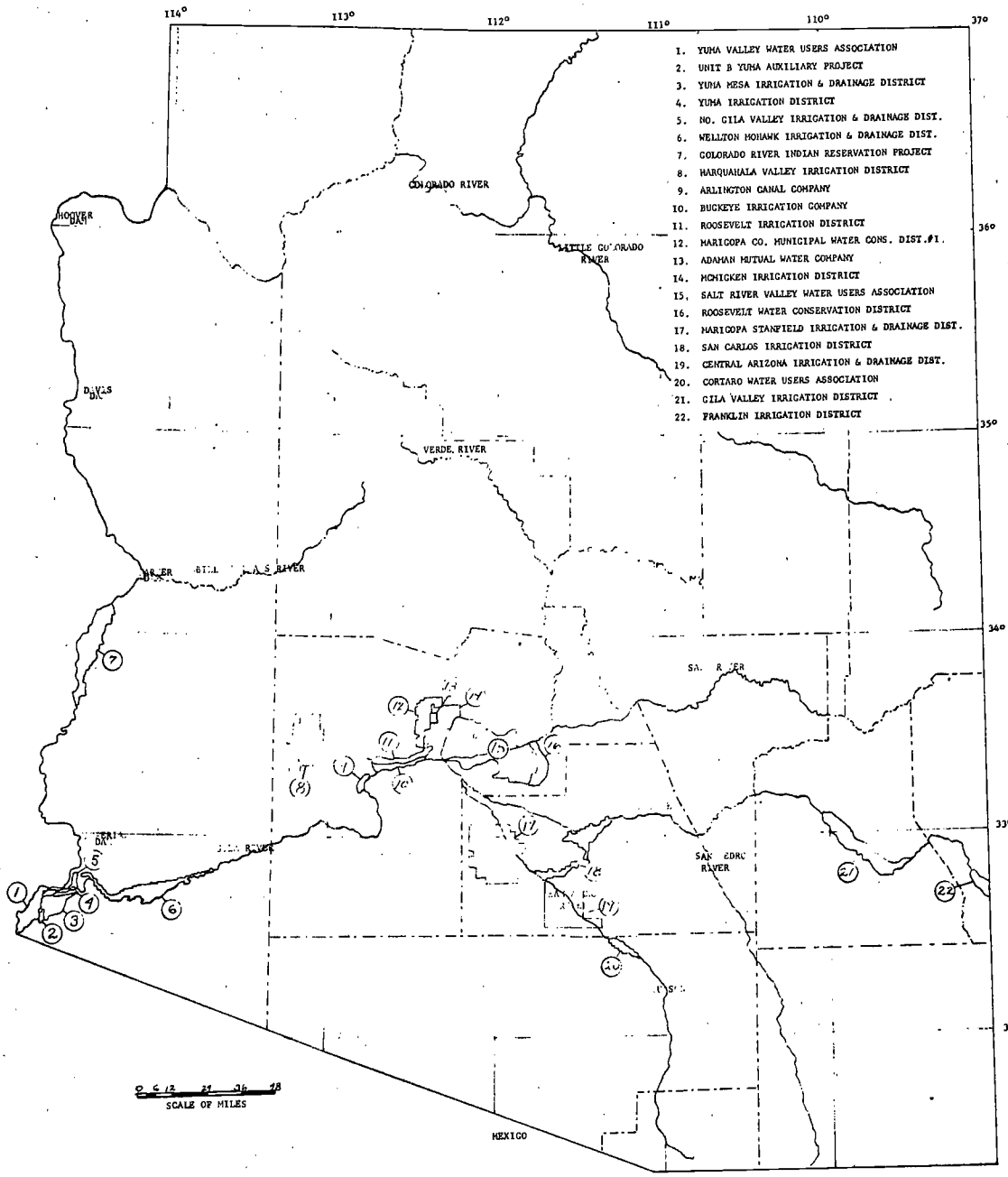

FIGURE 1 **MAJOR IRRIGATION ENTERPRISES IN ARIZONA**

Yuma Valley Water Users Association
Headquarters: Yuma

The service area includes 51,936 acres in southwestern Yuma County (Figure 2) which is all of the Colorado River floodplain that lies between the Yuma mesa and the international boundary.

Organization

The district is an incorporated water users association and is controlled by a 15-member board of directors.

The area served is made up of 328 farm units and, in addition, some water is also delivered to residential users residing in the service area.

Presently, there are 82 full-time employees of the organization.

Water Supply

The association receives its water supply from the Colorado River. The diversion is made on the California side of the river at the Imperial Dam which is located 18 miles north of Yuma. The water travels down the All American Canal to a siphon under the river in Yuma and then into the association's distribution system.

In addition to the distribution system, the association operates extensive drainage works to lower the artificially high water table

created by the irrigation. There are eleven wells and three drainage sumps with many miles of unlined canals. Some of the water is placed back into the distribution system, but the major portion is delivered to Mexico for credit under the International Treaty at the boundary pumping plant.

Other Sources of Income

The association generates electric power at the Siphon Drop Station. This is primarily sold within the organization to furnish power for the drainage pumps. Some is sold to other organizations for resale.

History

The first filings for water rights in the area occurred in 1890. The association was organized in 1903 for the purpose of contracting with the Bureau of Reclamation in the development of the Yuma Project. The association was formally approved by the President in 1911.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Diversions	225,044 to 261,464	240,914
Average Use Per Cropped Acre: 5.41		

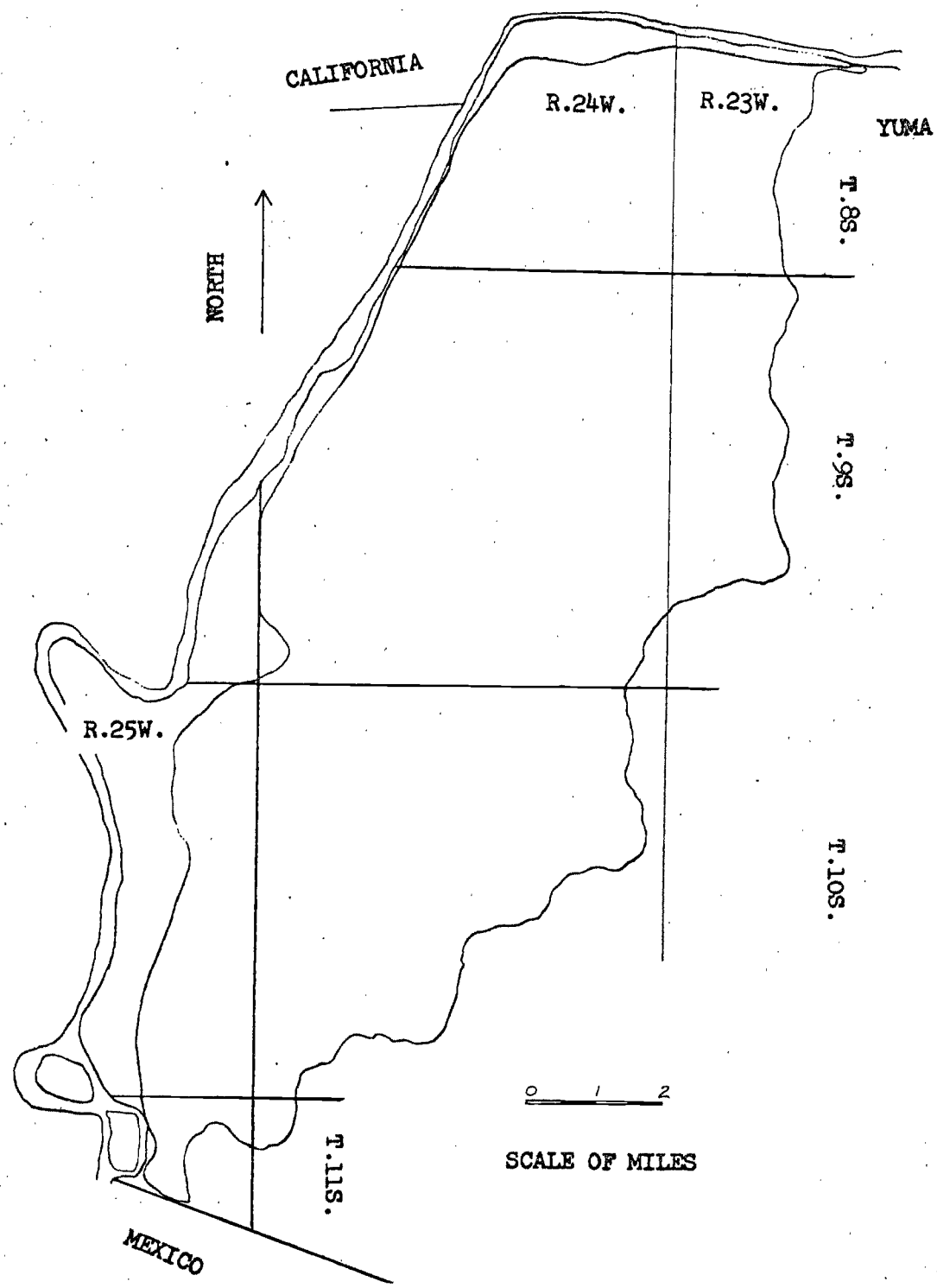

FIGURE 2 YUMA VALLEY WATER USERS ASSOCIATION

Water Charge -- 1964

Basic Assessment: $12.50 per acre

For this payment the user is entitled to 5 acre-feet with the exception of 4,866 acres which have been classed as sandy soils and these receive 8 acre-feet for the basis assessment.

Additional water may be purchased for $1.50 per acre-foot.

Conveyance System

	Percent Lined	Total Length
Canals	None	40 miles
Laterals	25	170 miles
Drainage Ditches	None	100 miles

Acreage of Major Crops Grown Within the Association

CROP	1964	1960-64 Average
Cantaloupe	15,333	13,880
Lettuce*	14,878	13,793
Cotton	9,625	10,128
Alfalfa Hay	10,416	12,740
Barley	2,030	2,431

*This includes acreage that is double-cropped.

Unit B - Yuma Auxiliary Project
Headquarters: 16½ Street & A Avenue, Yuma

The project's service area lies about 8 miles south of Yuma (Figure 3) and includes 3,290 acres of mesa land lying between the floodplain of the Colorado and the Yuma Mesa Irrigation and Drainage District.

Organization

The district is organized under irrigation district law of the State of Arizona and is governed by a three-member board of directors. There are 101 water users in the district. The agricultural land is completely devoted to citrus production. The district has four full-time employees plus a part-time accountant on a contractual basis.

The water supply for the area is the Colorado River with the diversion being made at Imperial Dam north of Yuma. The water is delivered in the Gila Gravity Main Canal to a lift unit east of Yuma where it is pumped to the mesa. From there it flows to the district in the A & B Canals. The district has a beneficial water right to 100 second-feet of flow (198 acre-feet).

History

This area was first served with water in 1922 from the East Main Canal of the Yuma Project by a 72-foot pump lift. The area was

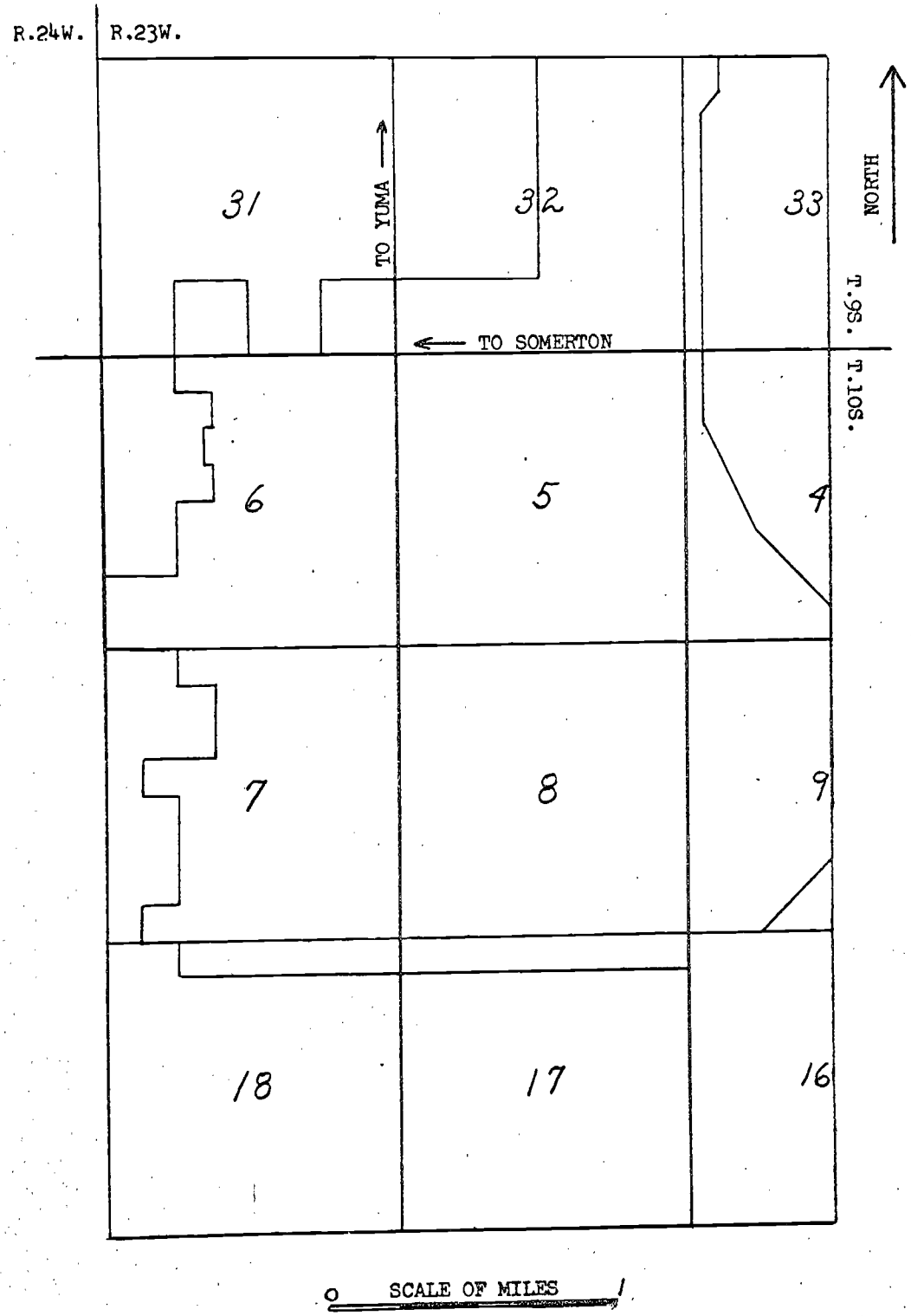

FIGURE 3 UNIT B YUMA AUXILIARY PROJECT

included in the plans for the Yuma Project of 1911, but construction of the delivery facilities was not authorized until the Auxiliary Project of 1917, when it was included in the proposed development of Units A, B, C, D of this project. However, because of limitations of funds, Unit B was the only one which became operational. The source of water supply was changed to the Gila Project in 1953 and the pump lift from the Yuma Main Canal was abandoned.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Annual Diversion	35,556 to 40,122	37,332
Average Use Per Acre: 12.02		

Water Charge -- 1964

Basic Assessment (per acre of land with water rights): $15.11

This entitled the holder to five acre-feet of water per year.

The basic assessment is broken down as follows:

Water	$10.00
Debt Retirement	5.11

Excess above 5 acre-feet is charged at $1.50 per acre-foot.

Conveyance System

	Percent Lined	Total Length
Canals	100	3.75 miles
Lateral		
Open Ditches	100	4.44 miles
Pipe Line	None	10.34 miles

Acreage of Major Crops Grown Within Project

CROP	1964	1960-64 Average
Grapefruit	1,158	1,200
Oranges	1,192	1,004
Lemons	718	645

Yuma Mesa Irrigation and Drainage District
Headquarters: 14½ Street & 4th Avenue, Yuma

The district's service area covers 19,970 acres located in south central Yuma County on the mesa above the Colorado River flood plain and south of the Southern Pacific Railroad east of Yuma (Figure 4).

Organization

The district is an incorporated irrigation and drainage district under Arizona law and controlled by a three-member board of directors. There are 435 farm units served, with the majority under 160 acres.

There are 32 full-time employees in the organization.

Water Supply

The district receives its water from the Colorado River through

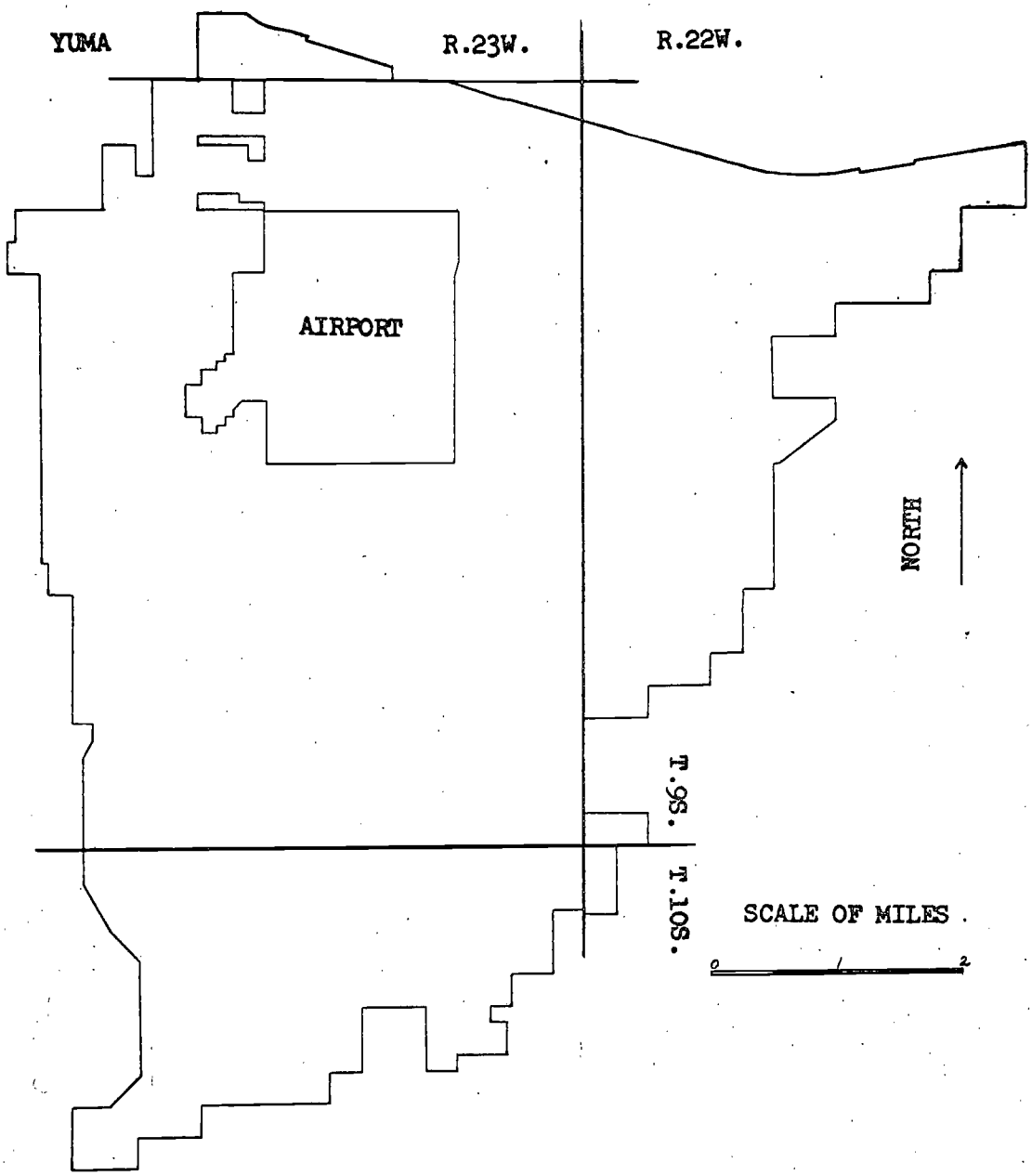

FIGURE 4 YUMA MESA IRRIGATION & DRAINAGE DISTRICT

diversion at Imperial Dam. It travels in the Gila Gravity Main Canal to a point east of Yuma where it is lifted 52 feet to the mesa. The soil of the area served is excessively sandy, and the water requirements are much higher than the adjoining floodplain. The district has a physical limitation in that its canal can deliver a maximum of 520 second-feet (1,040 acre-feet) per day. With high water requirement of developing citrus, the district is presently operating on a prorate delivery limit of 6.67 acre-inches per acre every 10 days.

History

The mesa area was originally contained in Yuma Reclamation Project which was approved for construction in 1911. In 1917, Congress authorized the construction of a project known as the Yuma-Mesa Auxiliary. This area was to receive water from the Main Canal of the Yuma Valley, the water to be pumped up to the mesa south of Yuma. However, due to a lack of funds, only one unit (Unit B) was developed. The development of the remainder of the mesa was delayed until the authorization of the Gila Project in 1937.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Diversion	220,722 to 246,563	232,204
Average Acre-Feet Use Per Cropped Acre: 14.02		

Water Charge - 1964

Basic Assessment: $12.15 per acre

This assessment entitles the user to nine acre-feet of water. Additional water may be purchased at $1.60 per acre-foot for the first four acre-feet and $2.25 for all over that amount. In addition to the basic assessment, there are other charges. All users pay a general fund payment of $2.50 and some pay a construction and predevelopment charge for areas which were improved and cultivated prior to district organization.

Conveyance System

	Percent Lined	Total Length
Canal	100	23 miles
Lateral Ditches	100	43.3 miles
Tile Drain	None	5.7 miles

Acreage of Major Crops Grown Within Project

CROP	1964	1960-64 Average
Grapefruit	306	261
Oranges	3,754	1,511
Lemons	4,157	3,954
Devel Citrus	6,593	7,540
Alfalfa	1,649	2,168

Yuma Irrigation District
Headquarters: Yuma

The district's service area lies in west central Yuma County between the Gila River channel and the mesa area at the east edge of Yuma (Figure 5). The total area within the district covers 12,128 acres.

Organization

The district is organized under Arizona irrigation district law and is goverened by a three-member board of directors. The district presently has one full-time employee and hires a local accountant on a part-time basis to handle the financial records.

Water Supply

At the present time, the district serves only to distribute electric power and all irrigation water is supplied by privately owned pumps. Gravity irrigation facilities have been constructed and were to be turned over to the district by the Bureau of Reclamation in 1965. The district will have a total allotment of 125 second-feet of Colorado River water. It is assumed this will be sufficient to irrigate 8,000 acres. The balance needed will be supplied by pumping.

Other Sources of Income

The district supplies power to approximately 110 residential

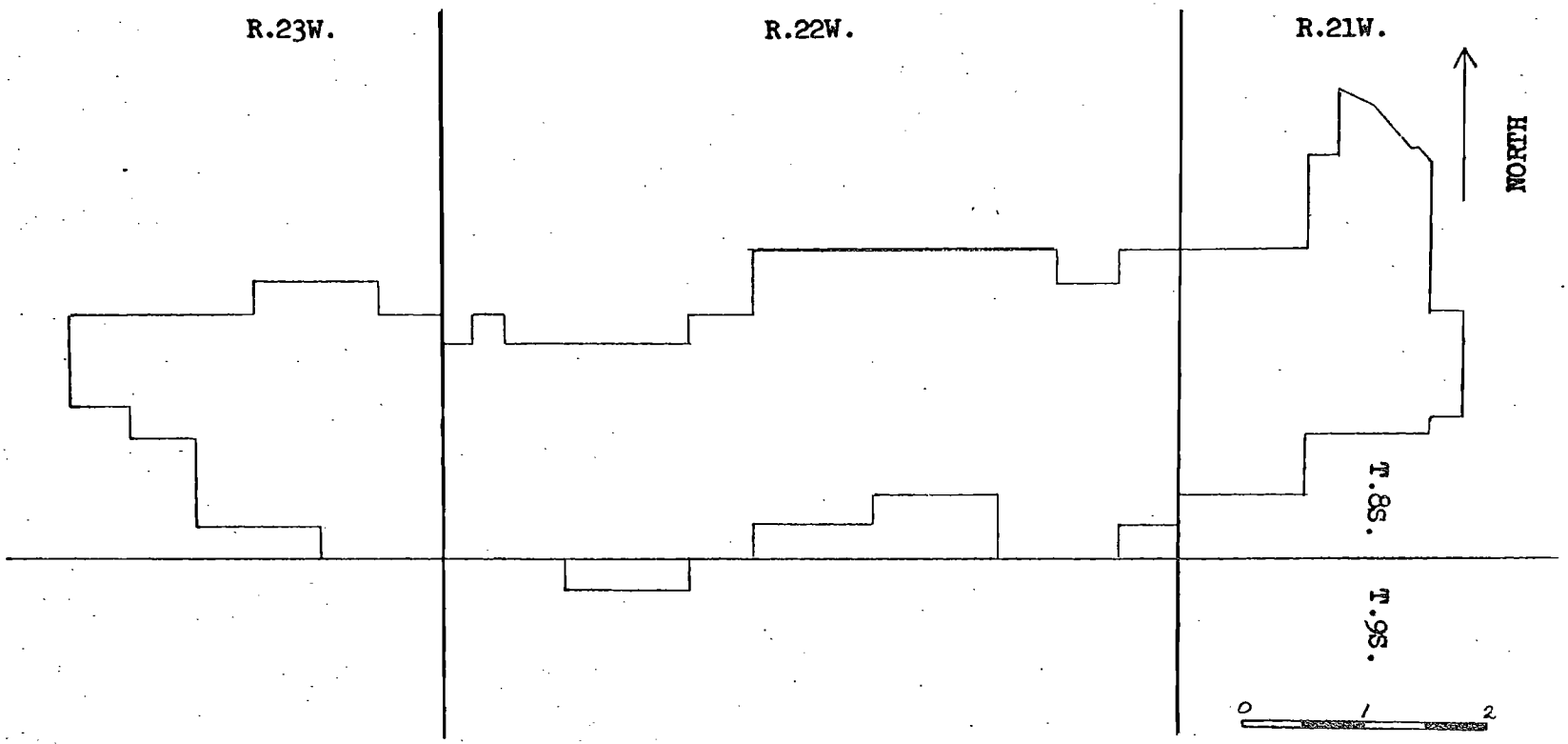

FIGURE 5 YUMA IRRIGATION DISTRICT

and municipal users in addition to 26 irrigators. Power is purchased from the bureau of Reclamation.

History

The area was originally included in the plans for the Yuma Project, but no river diversionary works were constructed. Later, the area was included in the Gila Project as authorized in 1937.

There are no records of water use available at this time because of the present nature of the operation.

The district collects a basic assessment of $1.00 per acre for general fund purposes. When full operation is started, this will be increased to cover the cost of operations.

Acreage of Major Crops
Grown Within Project

CROP	1964	1960-64 Average
Cotton	1,024	1,306
Alfalfa Hay	4,456	3,439
Alfalfa Seed	889	1,010
Barley	656	339
Grass Seed	3,296	3,509

*This includes acreage that is double-cropped

North Gila Irrigation District
Headquarters: Yuma

The service area includes 7,020 acres in southern Yuma County and lies north of Yuma extending to the Laguna Dam between the River and the Gila Gravity Main Canal (Figure 6).

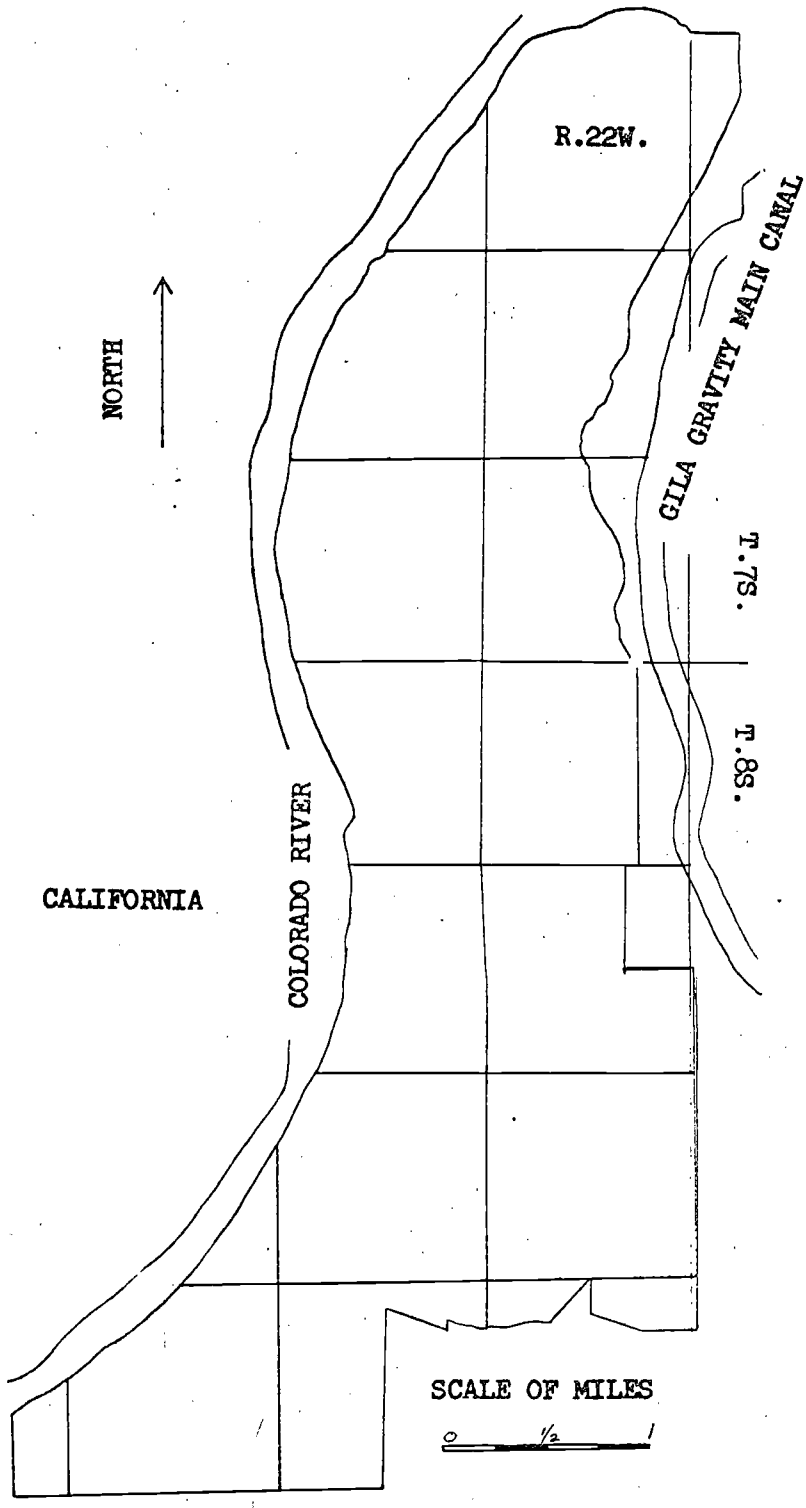

FIGURE 6 NORTH GILA IRRIGATION DISTRICT

Organization

The district is organized as an incorporated irrigation district. It is controlled by a three-member board of directors, each serving a three-year period. The financial office work is handled on a contractual basis with a Yuma accountant. There are two full-time employees of the district. Forty-eight farm units are served, of which 37 are full-time operations.

Water Supply

The district receives its supply from the Colorado River. The diversion is made on the east side of the Imperial Dam and the water travels in the Gila Gravity Main Canal to a turnout located in the northeastern portion of the project. The landowners are not limited in the amount of water used except for the beneficial use doctrine and total use may not exceed 150 second-feet (300 acre-feet) per day.

History

The area was included in the Yuma Project of 1911 with the first delivery of water being made that year. The water was supplied from the Laguna Dam. When the Gila Project was authorized in 1937, this area was included. The diversion was changed in 1954 to the Gila Gravity Main Canal which eliminated the need for a pump lift from the Arizona Main Canal for a portion of the district.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Diversion	33,491 to 44,802	40,133
Average Use Per Cropped Acre: 6.74		

Water Charge -- 1964

Basic Assessment: $8.50 per acre.

This pays for all water demanded by irrigation.

Assessment includes $1.076 per acre debt retirement payment.

Conveyance System

	Percent Lined	Total Length
Canal	None	8 miles
Lateral Ditches	25	20 miles

Acreage of Major Crops Grown Within District

CROP	1964	1960-64 Average
Cotton	1,247	1,358
Alfalfa Hay	1,977	1,740
Lettuce	1,327	1,240
Cantaloupe	1,120	1,093
Barley	330	395

Wellton-Mohawk Irrigation and Drainage District
Headquarters: Wellton

The service area includes 75,000 acres in east central Yuma County lying generally in the floodplain of the Gila River east of Yuma (Figure 7). There are 12,000 acres of mesa land included in the total area.

Organization

The district is organized as an irrigation and drainage district under state law and controlled by a nine-member board of directors. There are about 200 farm units served by the districts. The organization has 84 full-time employees.

Water Supply

The district receives its water supply from the Colorado River at Imperial Dam. It flows in the Gila Main Gravity Canal to a siphon at the Gila River which is at the western border of the project. The entire system, including the laterals, are cement lined. The water table in some areas has been artificially raised by irrigation to a point where it has caused damage to some of the cropland, both from the high water table and also the salt content. To combat this, an extensive

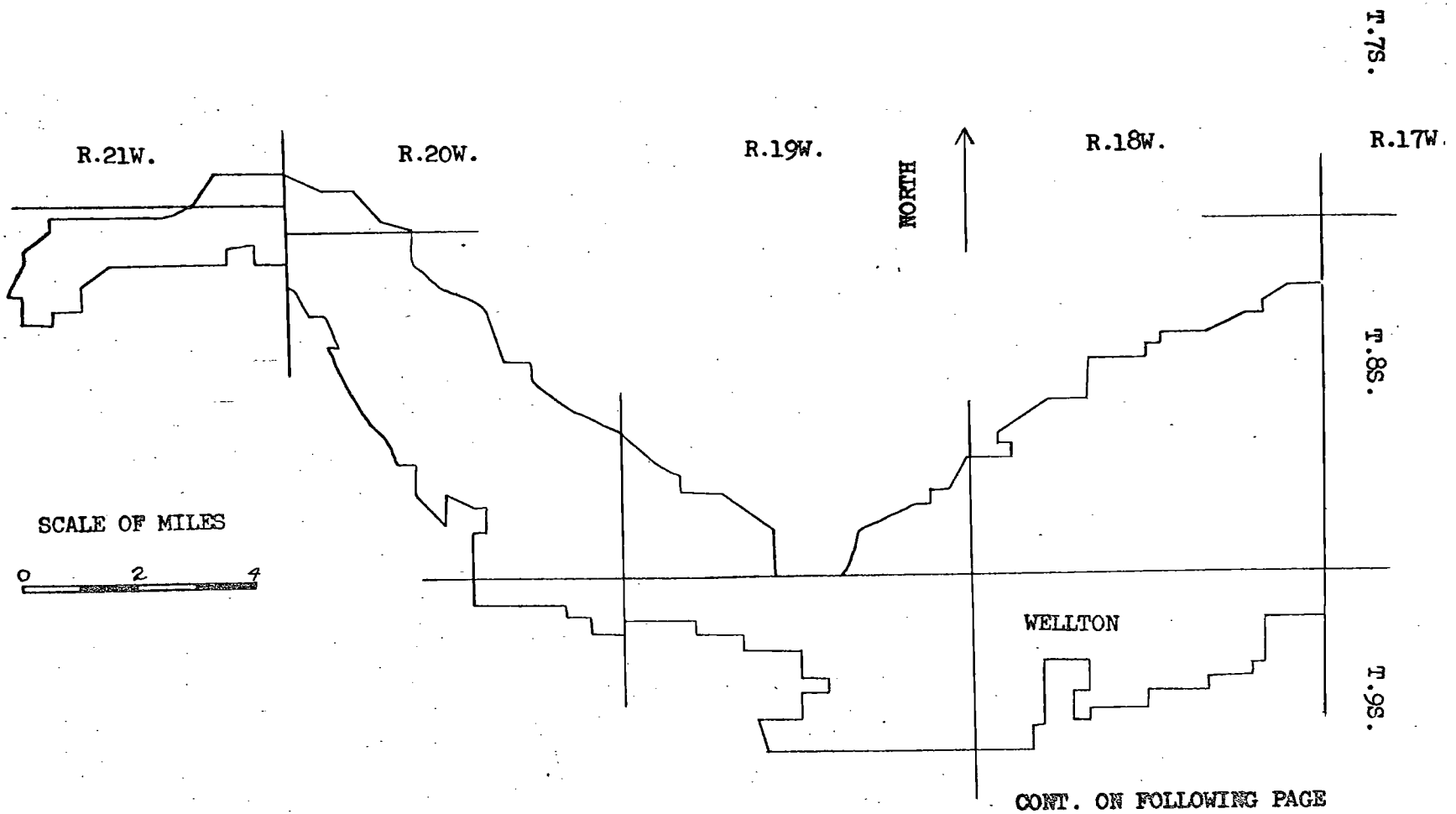

FIGURE 7

WELLTON MOHAWK IRRIGATION AND DRAINAGE DISTRICT

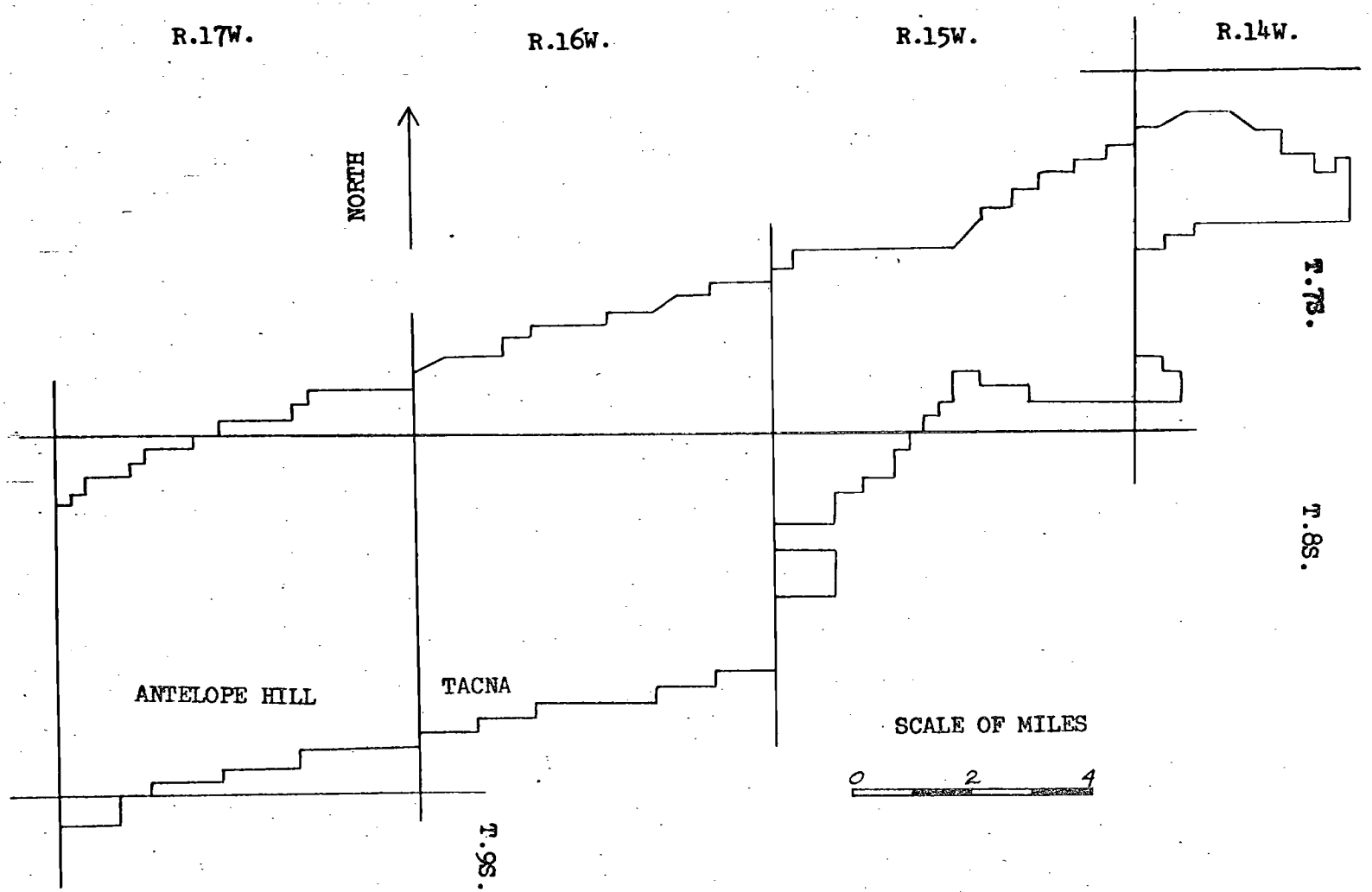

FIGURE 7 CONT.

WELLTON MOHAWK IRRIGATION & DRAINAGE DISTRICT

drainage system has been developed. Presently, the district operates 95 wells and 70 miles of open ditches to remove this excess water. The Bureau of Reclamation controls the operation of this sytem so as to stabilize the salt level of the effluent when it is discharged back into the Colorado River at Yuma. To comply with the entrance treaty with Mexico concerning maximum salinity levels, a new canal is being constructed to carry the drainage water by the river to a point below Morales Dam in Mexico when the salt level is high.

Other Sources of Income

The district operates on an electricity distribution system and presently serves about 1,000 users. It also supplies power for the district drainage wells and lift pumps necessary to serve the mesa area. The power is purchased from the Parker Dam system of the Bureau of Reclamation.

History

The first irrigation in the area began in 1875 with water supplied from diversions of the Gila River. With construction of the Gillespie Dam and further development of agriculture upstream, the river flow ceased. In 1920, the electricity district was formed to provide power for the irrigation pumps which had replaced the river diversion. During the late 1930s and 1940s, the salt concentration became such a

problem that many acres were abandoned. In 1937, the Gila Project was authorized, which provided that Colorado River water would be used to replace the existing supplies. The first water was delivered in 1952.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Deliveries	325,042 to 372,085	349,688
Average Use Per Cropped Acre: 6.21		

Water Charge - 1964

Basic Assessment: $12.60 per acre

The basic assessment includes $10.60 for water charges and $2.00 for general district tax.

This basic charge entitles the user to four acre-feet. Supplemental water can be obtained at the rate of $3.40 per acre-foot. An exception to this price is for land classed as mesa for which the charge for supplemental water is $1.85 per acre-foot for the first three additional units and $2.45 per acre-foot for more than three acre-feet. Residential lots will be served at the annual rate of $25.00.

The general district tax will be replaced with a debt retirement payment beginning in 1968.

Conveyance System

	Percent Lined	Total Length
Canal	100	105 miles
Lateral Ditches	100	200 miles
Open Drainage Ditches	100	70 miles

Acreage of Major Crops
Grown Within Project

CROP	1964	1960-64 Average
Cotton	8,798	7,912
Alfalfa Hay	20,944	20,813
Sorghum	8,690	5,913
Barley	5,058	3,061
Grass Seed	6,300	6,142

Colorado River Indian Reservation Project
Headquarters: Parker

Organization

This project is under the control of the Bureau of Indian Affairs and the Colorado River Tribal Council. The area served covers 107,500 acres of the 260,000-acre reservation in northwestern Yuma County lying east of the Colorado River between Ehrenberg and Parker (Figure 8). There are 43 full-time employees supplemented at times with a varying number engaged in construction.

Water Supply

Water is diverted from the Colorado River at Headgate Rock Dam

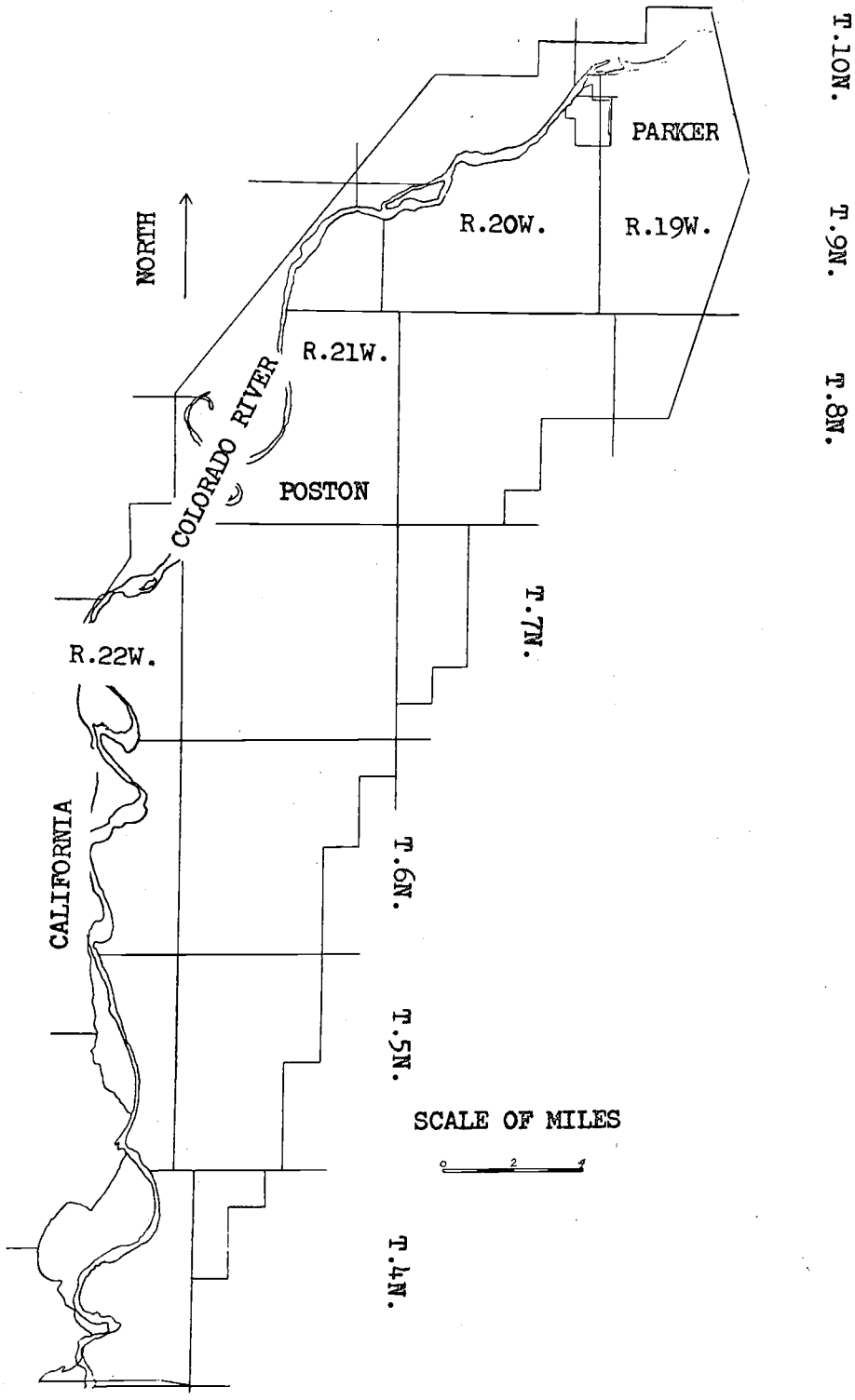

FIGURE 8 COLORADO RIVER INDIAN RESERVATION PROJECT

which is operated by the project. The reservation is entitled each year to 717,148 acre-feet or the quantity necessary for consumptive use with irrigation on 107,588 acres, whichever is less (Rifkind, 1960). The date of this priority is March 1865 for 75,000 acres and the balance has varying dates up to 1915.

Other Sources of Income

Electric power is purchased by the project from the Bureau of Reclamation and Arizona Power. In addition to the area within the project, electricity is distributed also to some residential users. It is planned that a generator with a 10,000 K.W. capacity will be installed at the diversion dam and the power will be used to supplement the present amount purchased. The reservation presently is undergoing rapid development of new agricultural cropland. It is one of the largest underdeveloped areas in the Southwest which has an assured supply of water. It is planned that about 6,000 to 8,000 acres will be brought into cultivation each year until the total area of 98,000 acres of cropland is fully developed. This is being accomplished through development leases to non-Indians. The Bureau and the reservation extend the main supply canal to the area and the lessee constructs to the Bureau specification all of the laterals and drainage ditches. All costs of the construction and leveling are borne by the lessee and are non-recoverable when the land reverts to the Tribal Council at the

termination of the lease. It is estimated the total development cost will average $350.00 per acre. The leases are on a bid basis and are for periods up to 25 years.

History

The Indian reservation was established in 1865. Subsequent additions since that time have increased the total size to 260,000 acres. Irrigation diversion facilities were completed in 1941.

Water Supplied -- 1960 to 1964*

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Diversion	178,400 to 186,700	182,475
Average Use Per Cropped Acre: 5.82		

*1961 figures are not included in the average due to incomplete records.

Water Charge -- 1964

Basic Assessment: $9.00 per acre

This entitles the user to 5 acre-feet with the exception of 5,000 acres which have been classified "sandy" which have been entitled to 8 acre-feet. Additional water may be purchased for $2.00 per acre-foot.

Conveyance System

	Percent Lined	Total Length
Canal	33	18 miles
Lateral Ditches	10	177 miles
Open Drain	None	120 miles
Tile Drain	None	40 miles

Acreage of Major Crops Grown Within Project

CROP	1964	1960-64 Average
Cotton	6,041	6,036
Barley	3,382	4,922
Alfalfa Hay	9,753	6,876
Sorghum*	5,652	6,613
Melons	2,028	1,513

*This includes acreage that is double-cropped.

Harquahala Valley Irrigation District
Headquarters: Buckeye

The district, in west central Maricopa County, was organized in January of 1964. The area included in the district totals 60,000 acres (Figure 9). All irrigation water is presently being supplied by private wells. The district was organized for the purpose of distributing supplemental water which may become available with the establishment of the Central Arizona Project.

The major crops of the area are cotton and barley. Presently, only about one-half of the total acres included within the district are being cultivated.

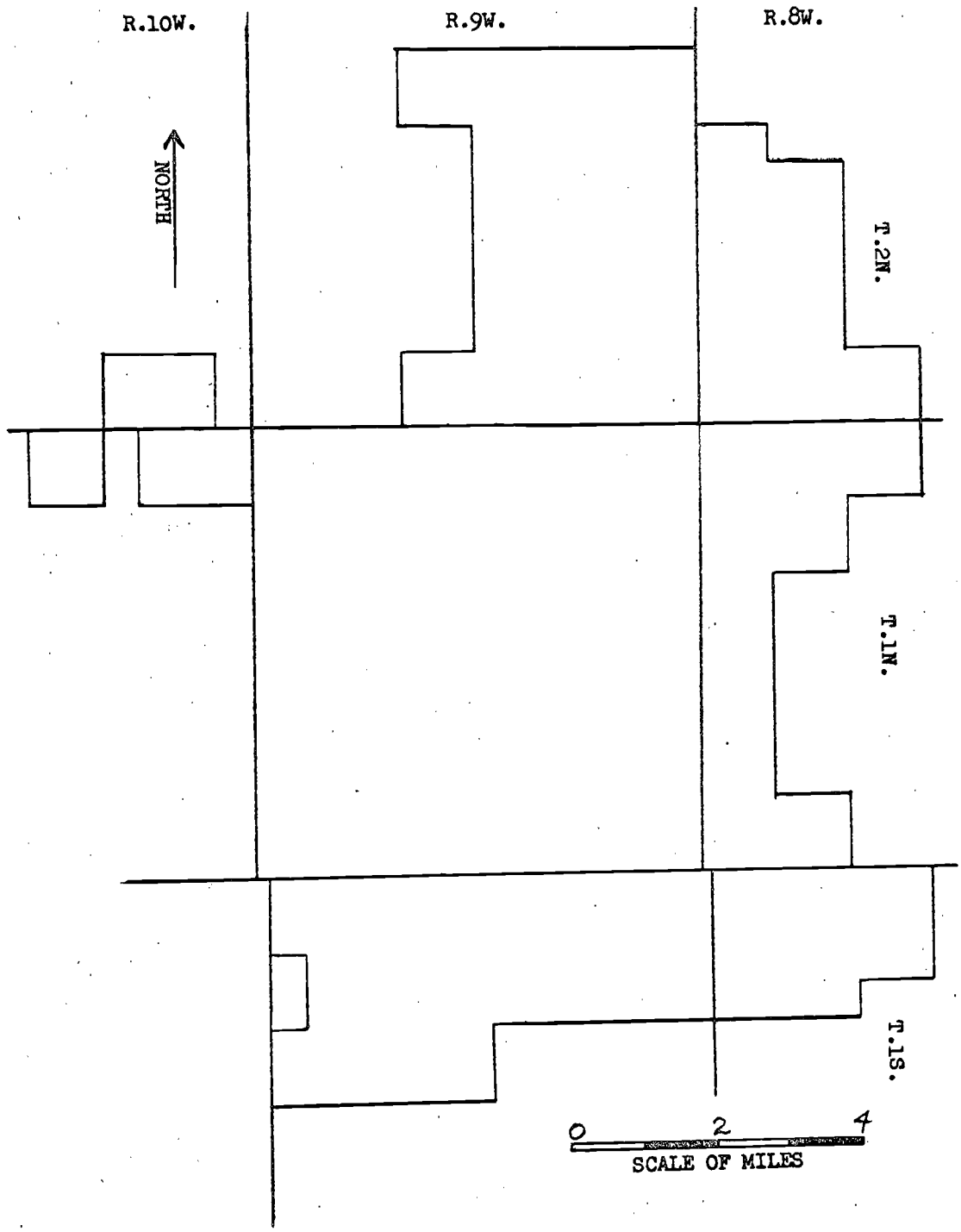

FIGURE 9

HARQUAHALA VALLEY IRRIGATION DISTRICT

Arlington Canal Company
Headquarters: Arlington

The company's service area covers 4,800 acres in southwestern Maricopa County and lies west of the Gila River and immediately north of the Gillespie Dam (Figure 10).

Organization

The company was organized in 1899 and is operated under Arizona Corporation Commission regulations. It is controlled by a three-member board of directors. The company has one full-time employee and the part-time service of a bookkeeper.

Water Supply

The major portion of the irrigation water is obtained from nine wells that are operated by the company. Some additional water may be obtained from the Gila River. The river water is normally return flow from the Buckeye Irrigation Company. Some floodwater is also obtained from the river.

Water Supplied -- 1960 to 1964

It is estimated that the district supplies 10,000 acre-feet of water per year and this is supplemented by private wells operated by the individual farmers.

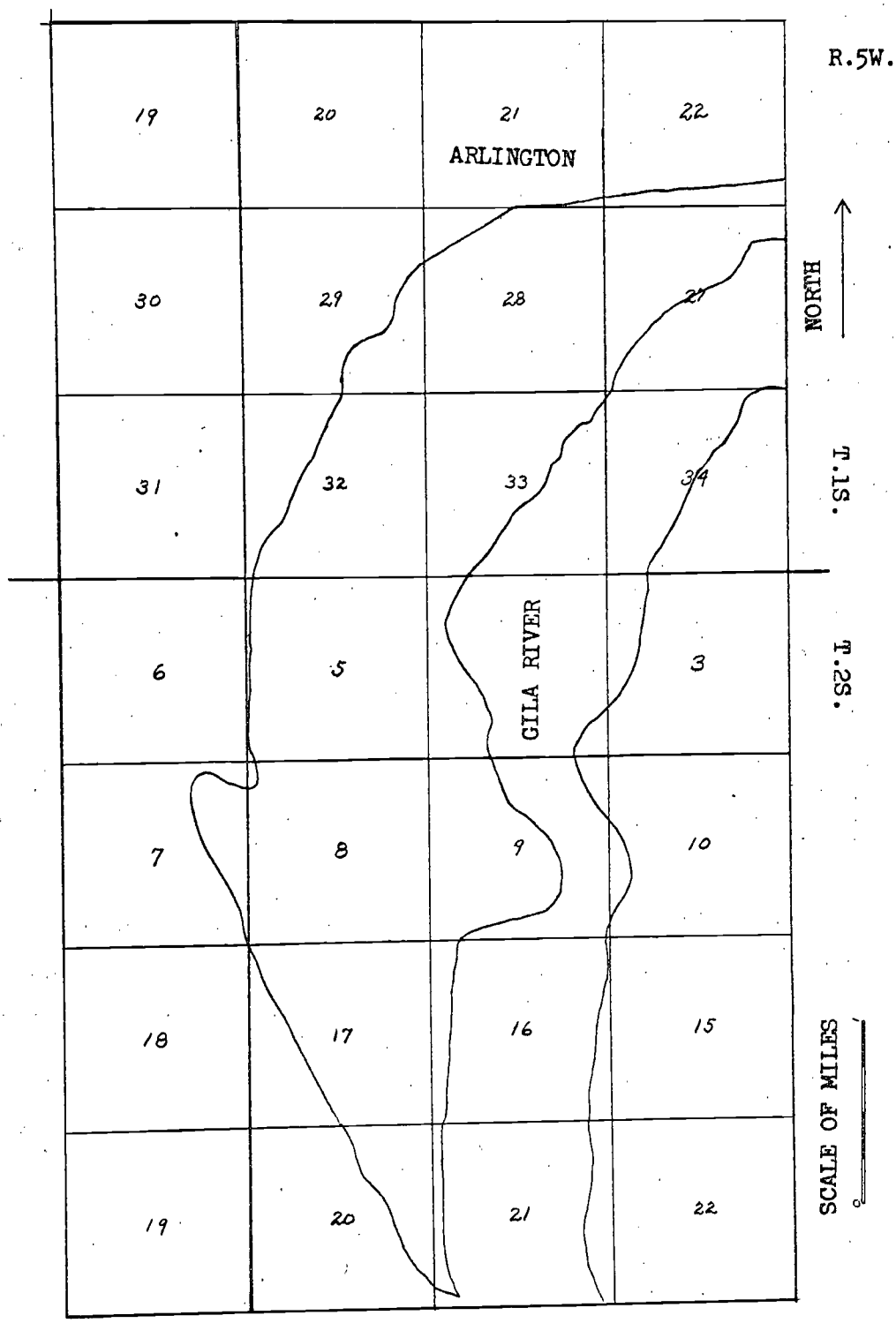

FIGURE 10

ARLINGTON CANAL COMPANY

Water Charge

Water supplied from wells is priced at $3.50.

Water diverted from the river is priced at $1.50.

There is a basic assessment of $2.00 per acre on all irrigable land. Special assessments may be levied to cover canal cleaning and well drilling.

Conveyance System

	Percent Lined	Total Length
Canals and Laterals	25	19 miles

Acreage of Major Crops
Grown Within Project

The company maintains no cropping record. The major crops are cotton, alfalfa and barley. During the past years, approximately 4,250 acres have been cultivated within the area served by the company.

Buckeye Irrigation Company
Headquarters: Buckeye

The service area of the district covers 17,998 acres in west central Maricopa County lying principally between the Southern Pacific Railroad and the Gila River and west of the junction of the Agua Fria and Gila Rivers (Figure 11).

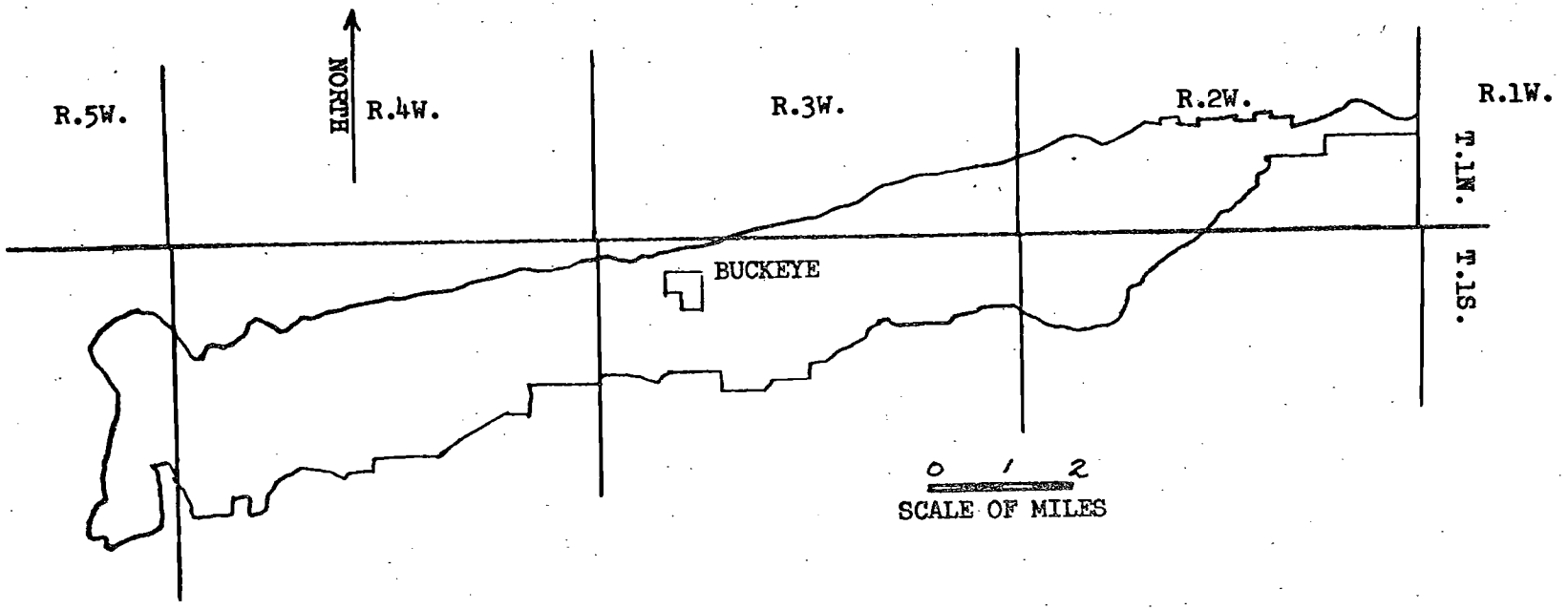

FIGURE 11 BUCKEYE IRRIGATION COMPANY

Organization

A nonprofit mutual company, it is incorporated under Arizona statutes with seven directors each serving one year. One hundred and fifty farm units are served by the company. Each share of stock in the company represents one acre of land and cannot be transferred without sale of that land.

The company has 17 full-time employees.

Water Supply

The area is entitled to normal flow of the Gila and Agua Fria Rivers of up to 80 miner's inches per quarter section (3.9 acre-feet per acre per year) as adjudicated under the Benson Allison Decree of 1917. (This limit has not been approached in recent years.) The company operates a diversion dam with no storage capacity below the junction of the rivers, and a canal carries the water to farmland.

A contract with the Salt River Valley users provides water in the amount of 1.1 percent of the SRP diversion for agricultural purposes at Granite Reef Dam. This water is supplied on demand of the company at a point in southwest Phoenix.

Most of the company's water, (approximately 80 percent) is supplied from underground sources. The company operates 48 wells with an average pumping depth of 60 feet. In addition to this amount of pumped water, individuals within the area operate 20 wells. The major problem with the pumped water is its high salinity which averages

approximately 3,600 PPM.

History

The first notice to serve water in the area was filed in July 1885. The present company was organized in 1907.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Annual Production	95,473 to 102,757	99,650
Surface Water	11,909 to 25,336	18,189
From SRP		
(Diversion at Granite Reef)	9,031 to 11,937	10,245
Normal Flow from River	2,878 to 15,329	7,944
Pumped Water	70,137 to 87,093	81,461

Water Charge -- 1964

Water Supplied from April to October	$3.50 per acre-foot
Water supplied from October to April	$3.00 per acre-foot
Floodwater when available	$1.00 per acre-foot
Basic assessment in addition to water charge	$2.00 per acre.

Conveyance System

	Percent Lined	Total Length
Canals	None	30 miles
Lateral or Ditches	50	38 miles
Pipe Lines	None	1¼ miles

Acreage of Major Crops
Grown Within Service Area

CROP	1965	1963-65 Average
Cotton	3,570	3,849
Alfalfa	4,156	4,653
Barley	5,611	4,400
Sorghum for Grain & Silage	4,085*	1,997*

*This includes acreage that is double-cropped.

Roosevelt Irrigation District
Headquarters: Buckeye

The service area covers 38,000 acres in west central Maricopa County lying between the Agua Fria and Hassayampa Rivers and north of the Buckeye Irrigation District (Figure 12).

Organization

The district is organized under the Arizona irrigation district law and is controlled by a three-member board of directors. The district serves 144 farm units.

Water Supply

The entire supply of water for the district is obtained by pumping. A number of wells owned by the district are located in the western service area of the Salt River Project and a canal carries the water to the district. The district also operates pumps within its own boundaries.

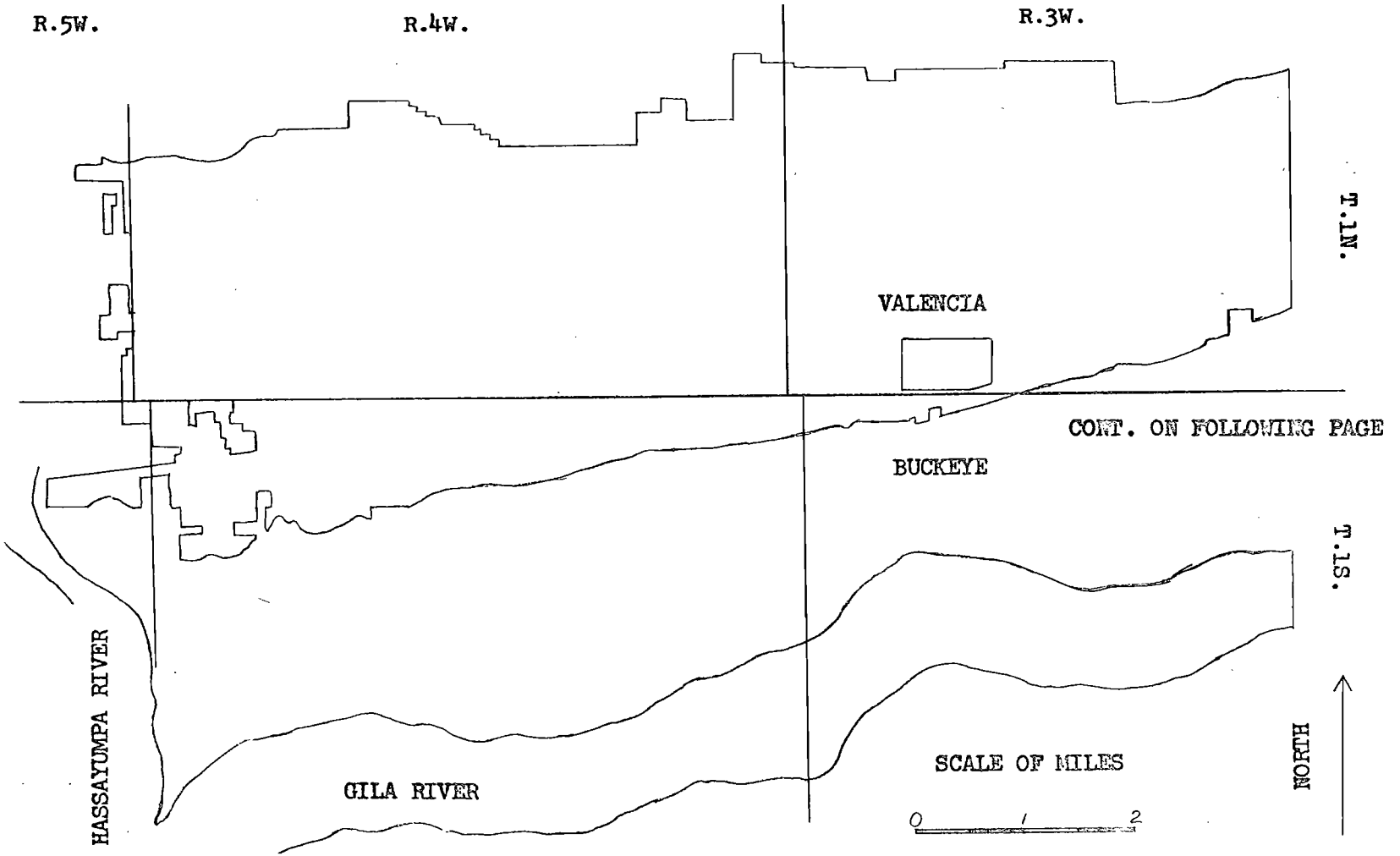

FIGURE 12

ROOSEVELT IRRIGATION DISTRICT

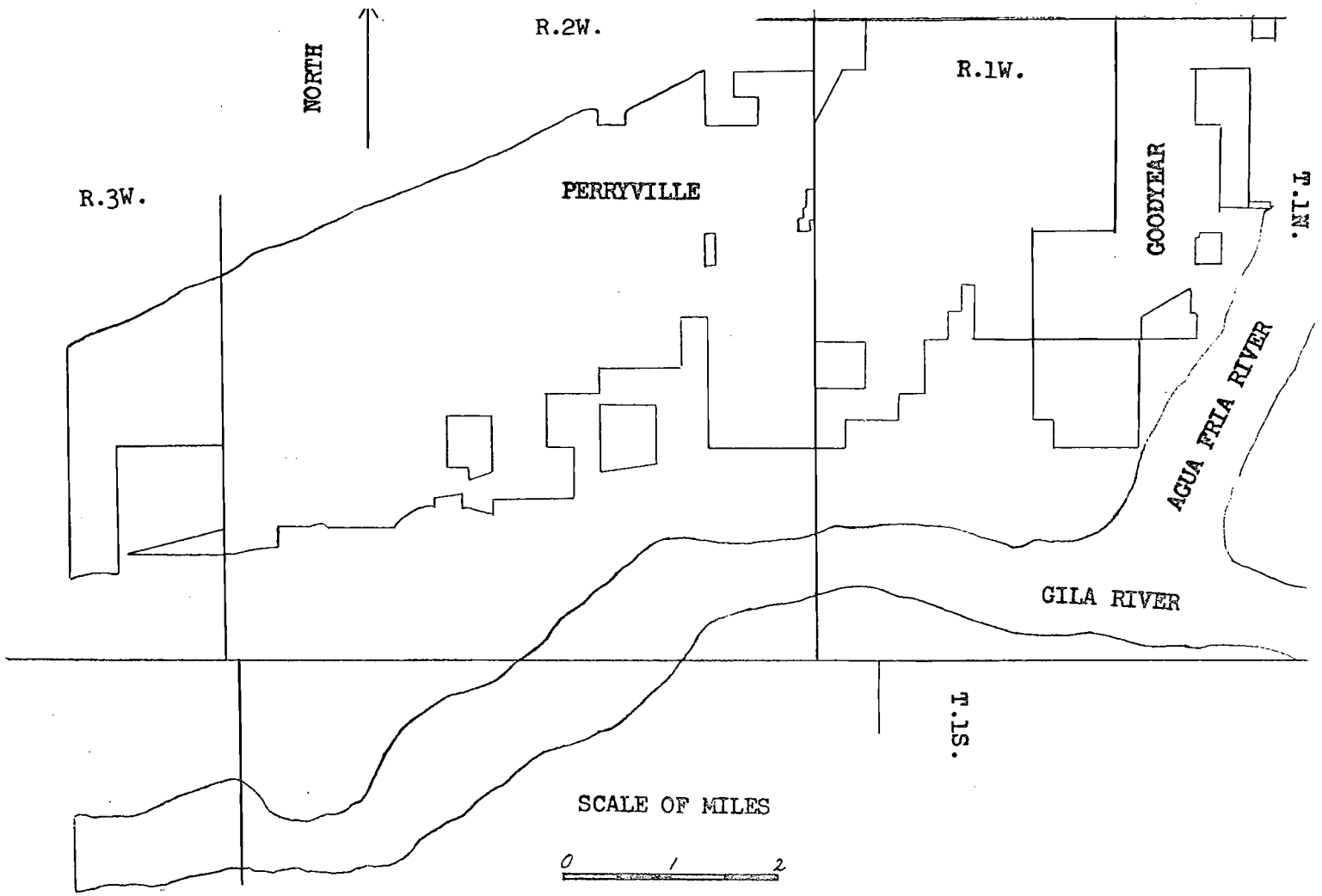

FIGURE 12 CONT. ROOSEVELT IRRIGATION DISTRICT

History

The district was organized June 4, 1923. In 1925, an agreement was reached between the Salt River Project and the district whereby water would be pumped from land lying in the SRP. The wells were needed to alleviate a serious drainage problem caused by an excessive high water table in the SRP distribution area. This agreement was modified in 1950 to limit the quantity of water that could be pumped. The district cannot remove more than 155,000 acre-feet per year or exceed 725,000 acre-feet in 5 consecutive years.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Total Annual Deliveries	122,784 to 132,329	126,734

Water Charge -- 1964

The district has a dual price system depending upon the qualify of water delivered.

Water with a salt content of less than 2,500 PPM is $5.00 per acre-foot.

Water with a salt content in excess of $2,500 PPM is $3.50 per acre-foot.

Of the 126,617 acre-feet of water delivered in 1964, 116,488 acre-feet contained less than 2,500 PPM.

In addition, the district has an assessment of $4.88 on each acre within the area-- this divided about equally for debt retirement and operation and maintenance expenses.

Conveyance System

	Percent Lined	Total Length
Canals	50	27 miles
Lateral Ditches	50	58 miles

Acreage of Major Crops Grown Within District

CROP	1964	1960-64 Average
Cotton	10,675	12,559
Alfalfa	6,658	6,527
Barley	4,862	5,240
Sorghum*	1,070	890
Safflower	1,095	1,861

*This includes acreage that is double-cropped.

Maricopa County Municipal Water Conservation District #1 Headquarters: Beardsley

The district's service area covers 33,666 acres lying in west central Maricopa County northwest of Phoenix. It is bordered on the south by the Roosevelt Irrigation District and the Adaman Mutual Water Company and on the west by the White Tank Mountains (Figure 13).

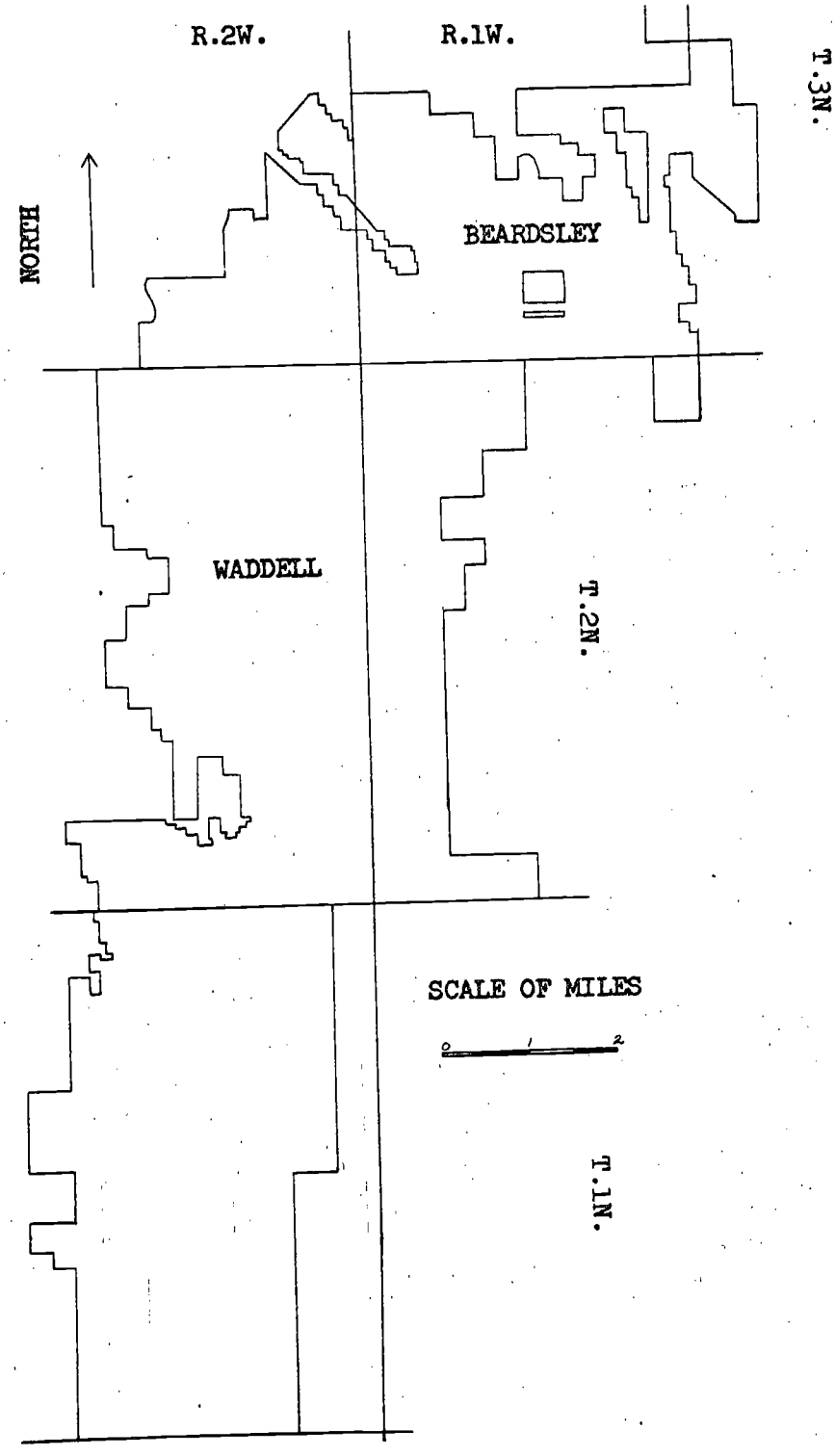

FIGURE 13 MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT #1

Organization

The district is organized under the Arizona irrigation district law and is controlled by a three-member board of directors. The district serves 55 farm units and has 25 full-time employees.

Water Supply

The major portion of the water provided by the district is pumped from underground supplies. The limited amount of runoff from the Bradshaw Mountains is stored in Lake Pleasant north of the project. Water from this source is used to supplement the underground pumping during periods of high use. The district operates 60 wells with an average static pumping level of 405 feet. In addition to these, most individual farms within the area operate their own private wells to supply needs in excess of the district supplies.

Other Sources of Income

As of June 1, 1965, the district entered the electricity distribution business to supply power to private pumpers. They are to purchase the power from Arizona Power which will also service the electricity distribution system.

History

The first water was delivered from surface sources with the completion of the dam forming Lake Pleasant in 1927. The first wells

of the district was established in 1940.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Production of Water	41,816 to 62,539	51,602
Surface Water	0 to 17,196	8,324
Pumped Water	41,604 to 45,343	43,278

Water Charge -- 1964

The flat rate for all water supplied regardless of source is $10.00 per acre-foot.

Basic assessment in addition to water charge is $9.00 per acre. (This includes both debt retirement and operation maintenance.)

Conveyance System

	Percent Lined	Total Length
Canals	50	33.3 miles
Lateral Ditch	50	120 miles
Pipe Line	None	2. miles

Water Storage Facilities

Name	Watershed	Capacity	Generating Capacity
Lake Pleasant	Agua Fria	163,820 acre-feet	None

Acreage of Major Crops
Grown Within Project

CROP	1964	1960-64 Average
Cotton	10,680	10,837
Lettuce	2,640	3,725
Potatoes	1,240	1,213
Grapes	1,040	685
Citrus	861	879
Roses	500	424

Adaman Mutual Water Company
Headquarters: Litchfield Park

The service area covers 2,493 acres in central Maricopa County north of Litchfield Park and between Luke Air Force Base and Maricopa County Municipal Water Conservation District (Figure 14). The area served by the water company lies within the boundaries of the newly formed McMicken Irrigation District.

Organization

The company is organized under Arizona statutes as a corporation. It is governed by a seven-member board of directors. The stock in the company is allotted on the basis of one share per each acre.

History

The company was formed to supply irrigation water to the purchasers of land that had been owned by the Goodyear Farms. It was established in 1943 and became active January 1, 1944. The funds

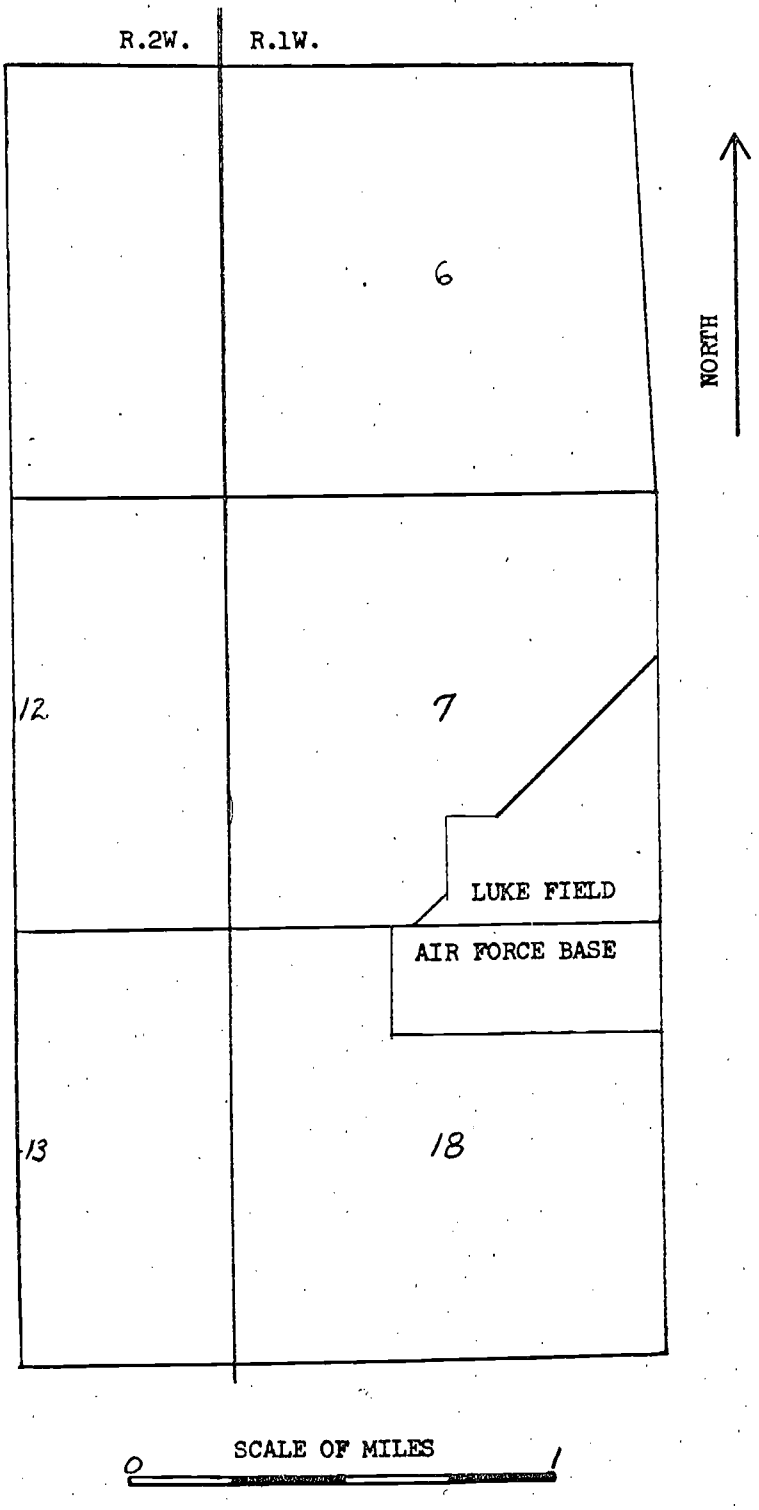

FIGURE 14 ADAMAN MUTUAL WATER COMPANY

which were used to provide service were loaned by Goodyear Farms and these have since been repaid.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Annual Net Deliveries	10,652 to 12,595	11,621

Water Charge -- 1964

The company charges $10.00 per acre-foot delivered.

In addition, a basic assessment of $6.457 per acre is collected; this is used to retire debts.

Conveyance System

	Percent Lined	Total Length
Canals	100	3 miles
Pipe Line	None	7 miles

Major Crops Grown Within Corporation Area

The company does not maintain crop acreage records.

McMicken Irrigation District
Headquarters: Litchfield Park

The district, encompassing 44,000 acres, was formed in 1964 in west central Maricopa County for the purpose of distributing any

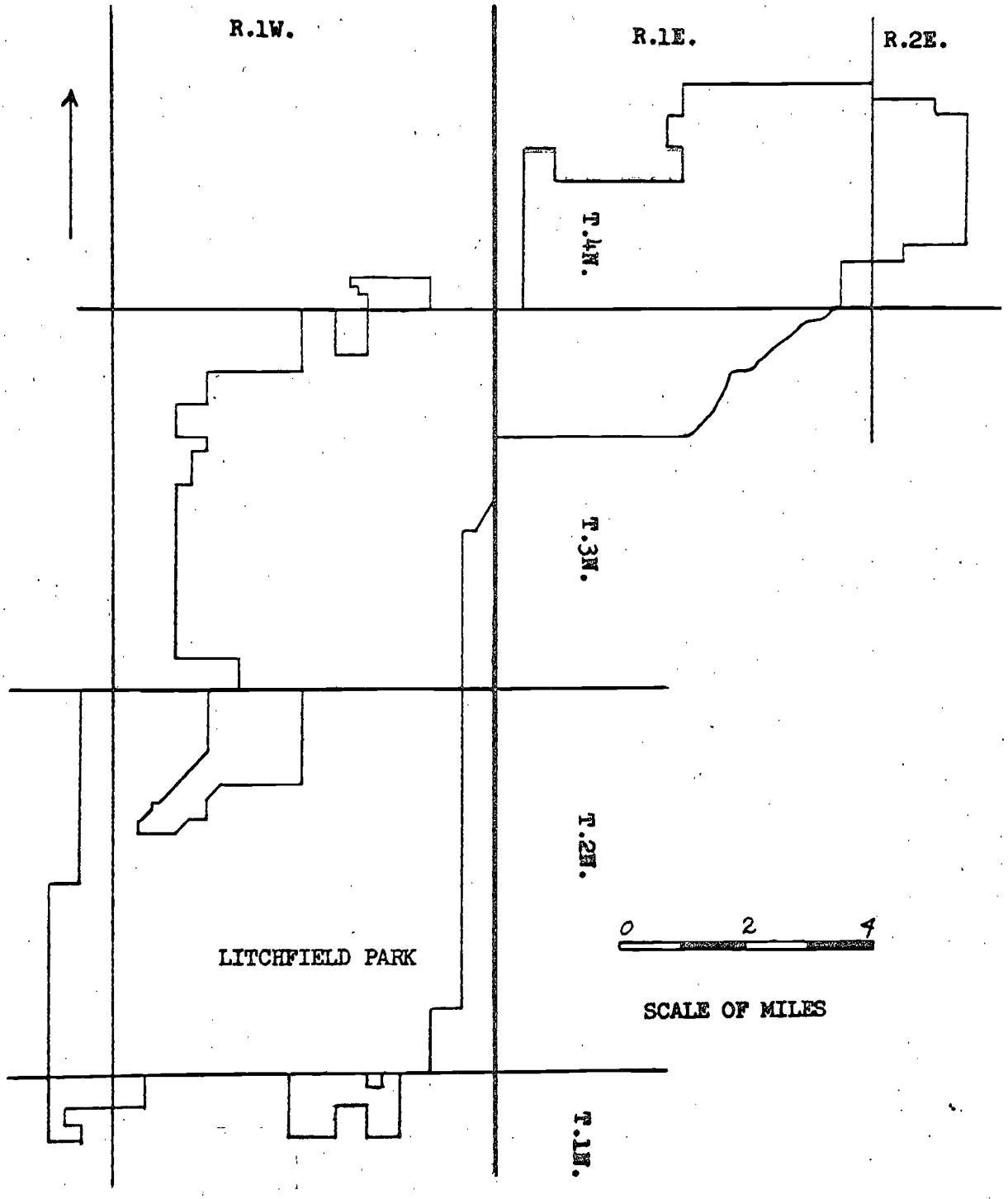

FIGURE 15

McMICKEN IRRIGATION DISTRICT

water that may become available to the area when the Central Arizona Project becomes operational (Figure 15). At the present time, the district supplies no water. All water presently being used is pumped from underground sources.

The service area includes the presently operating Adaman Mutual Water Company. It lies between the Salt River Project on the east and the Maricopa County Municipal Water Conservation District on the west.

Salt River Valley Water Users Association
Headquarters: Phoenix

The service area includes 238,252 acres in central Maricopa County. In 1965, approximately 70,000 acres of the total were devoted to residential, commercial, or industrial subdivisions. The area irrigated lies north and south of the Salt River in the angle formed by the intersection of Salt and Gila Rivers, plus the angle formed by the intersection of the Salt-Gila and the Agua Fria Rivers.

Organization

The entity known as the Salt River Project comprises two organizations which have identical geographic boundaries: the Salt River Valley Water Users Association and the Salt River Project Agricultural Improvement and Power District. The district is organized

as a municipality and was formed to secure for the properties of the association certain rights, privileges, exemptions and immunities granted to public corporations or political subdivisions. Under terms of a contract between the association and the district all properties of the association have been transferred to the district. The association operates the irrigation system as agent of the district.

History

The association was originally incorporated under the laws of the territory of Arizona, February 9, 1903, primarily to establish a central organization which could represent the individual water users in dealings with the Secretary of the Interior.

The project was authorized for construction in March 1903 and was the first project undertaken under the National Reclamation Act of 1902. The original project system, composed of Roosevelt storage dam and power plant, Granit Reef diversion dam, and the improved main canals, was placed in service in 1910 and completed in 1911. It was turned over to the Salt River Valley Water Users Association in 1917 for operation and maintenance. Prior to that date the project was under control of the Bureau of Reclamation. Additional water storage and flood control facilities were completed in the following year: Cave Creek Dam for flood control on a tributary of the Salt River in 1923;

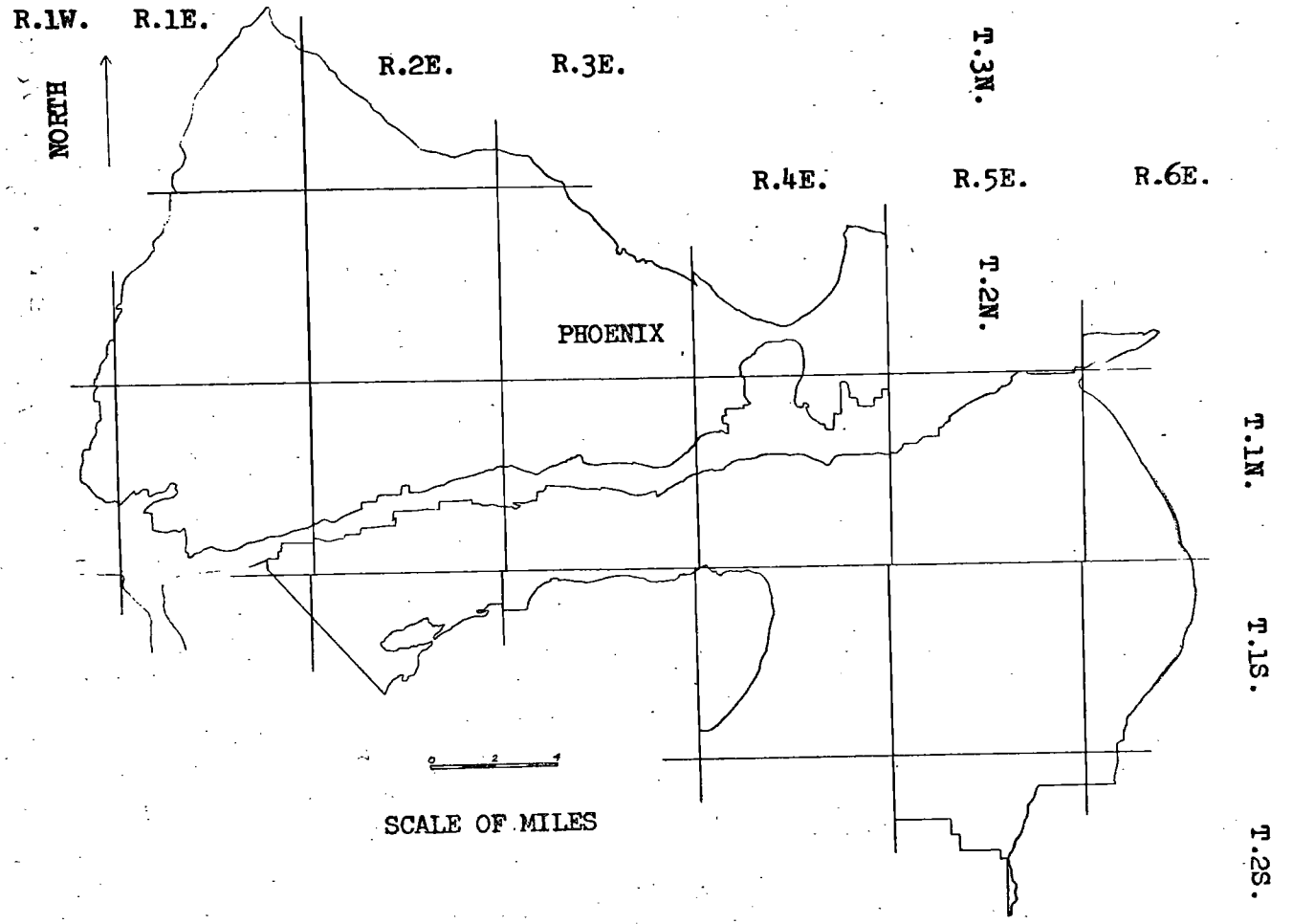

FIGURE 16

SALT RIVER VALLEY WATER USERS ASSOCIATION

Mormon Flat Dam for water storage on the Salt River in 1925; Horse Mesa Dam for water storage on the Salt River in 1927; Stewart Mountain Dam for water storage on the Salt River in 1930; Bartlett Dam for water storage on the Verde River in 1939; and Horseshoe Dam for water storage on the Verde River in 1946. Spillway gates were added to Horseshow Dam in 1949 to increase the domestic water supply for the City of Phoenix

Water Supply

The combined regulated flow of the Salt and Verde Rivers is diverted at Granite Reef diversion dam. In addition, supplemental water is provided by pumping from the groundwater basin within the project boundaries.

Water Rights in the Salt River Project

Several classes and priorities of water rights exist within the project.

"Normal Flow Water" Rights. "Normal flow water" is that water carried by the rivers and which is not restricted by impounding. These rights existed prior to the development of the project, and the first priorities date back to 1869. All normal flow rights enjoy priorities over any other right. The "Kent Decree" of 1910 established the date of appropriation and the right to normal flow for each parcel of land. The

earliest appropriation has priority in right over later normal flow rights, ranging from 1869 (the date of first appropriation) to 1909. During periods of less than adequate flow, many of the lands with later priority would not receive any water under this right. Many landowners do not take advantage of all their normal flow right. This occurs in part because the normal flow water must be used at the time it flows, and most of the flow occurs in the winter and early spring months. Approximately 150,000 acres in the project have a normal flow right.

"Stored and Developed Water" Rights. Water in the rivers over and above that covered under the normal flow right is stored in the project's system. All lands in the project (240,000 acres) having capital stock in the association, and having filed a water right application with the United States, have equal rights to stored and developed water. On payment of an annual assessment, two acre-feet of water per acre are received, which is termed "assessment" water. In case of any excess of stored water over and above that required for assessment water, rights to "excess water" are allocated on equal basis among project members. Excess water has been one acre-foot per acre per year.

"Pumped Water" Rights. The project in 1929 and again in 1948 developed underground water sources. Each landowner had the privilege of purchasing a right for up to two acre-feet of pumped water per acre. The right entitled the purchase of pumped water when and as needed up

to the maximum of the right. As of December 31, 1959, 156,990 acres in the project had pumped water rights to a total of 233,765 acre-feet of water.

Townsite Water Rights (For Lands Designated "Townsite Lands" by the Secretary of the Interior. This is a right provided for under the Reclamation Act of April 16, 1906, permitting the project to supply water to cities and towns within the project under a special contract. The water is to come from the same source as that of the project, in an amount deemed necessary by the project, and the charges are to be not less than nor the terms more favorable than those to other lands of the project.

Water Charge -- 1964

Each acre in the project with a water right is charged a basic assessment of $4.00. In addition to the assessment, all surface water delivered is priced at $3.00 per acre-foot and pumped water is priced at $7.50 per acre-foot.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Total Net Deliveries	1,034,957 to 1,130,925	1,075,059
Surface Water	553,544 to 727,404	656,401
Pumped Water	352,747 to 497,205	418,705

Conveyance System

	Percent Lined	Total Length
Canals	33	138 miles
Lateral Ditches	45	870 miles
Waste Water Ditch	11	286 miles

Dams

	Power Generation	Storage Capacity (Acre-Feet)
1. Roosevelt	Yes	1,381,580
2. Horse Mesa	Yes	245,138
3. Mormon Flat	Yes	57,852
4. Stewart Maintain	Yes	69,765
5. Horseshoe	No	143,830
6. Bartlett	No	179,584

Acreage of Major Crops Grown Within District

CROPS	1964	1960-64 Average
Cotton	59,397	58,595
Alfalfa	41,870	37,516
Barley*	22,999	25,859
Sorghum*	19,152	22,249
Citrus	4,586	4,929

*This includes acreage that is double-cropped.

Roosevelt Water Conservation District
Headquarters: Higley

The district's service area includes 39,425 acres in southeast Maricopa County, 2,400 acres of this is owned by the district and the water rights to these have been withdrawn. The district is located

southeast of Phoenix and joins the eastern border of the lands within the Salt River Project (Figure 17).

Organization

The district is organized under Arizona irrigation district statutes and is controlled by a nine-member board of directors. The district serves 400 farm units and has 45 full-time employees.

Water Supply

The district supplies are derived from both surface and underground sources. Normally, about 25 percent comes from surface sources and the balance is pumped. It is necessary to prorate the supply during the period of heavy use; this is normally March 1 to October 1. In 1964, each acre with a water right was entitled to a 2.5 acre-feet during this period. The prorated water is transferable between users within the district. When a farmer has excess water, he may sell this to someone else. The selling price varies from $2.50 to $10.00 per acre-foot in addition to the $8.50 water charge. The selling price is generally higher earlier in the season. In most cases, the sellers have private wells which can be used to replace the district water sold.

History

The district was formed in 1920 and at that time a filing was made to appropriate a portion of the flow from the Salt and Verde Rivers

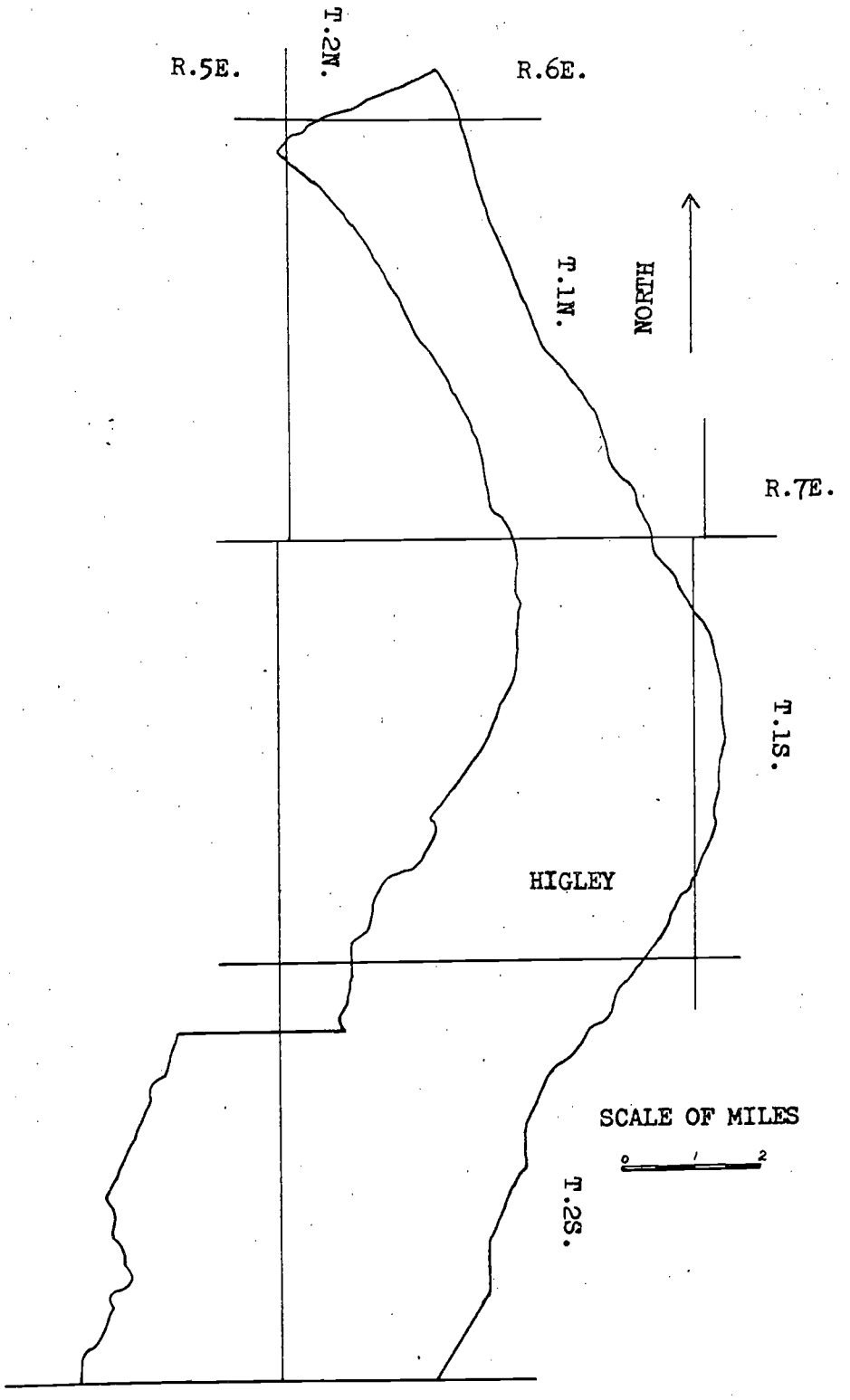

FIGURE 17 ROOSEVELT WATER CONSERVATION DISTRICT

to irrigate the area. In 1924, an agreement was completed between the Roosevelt Water Conservation District (RWCD) and the Salt River Project (SRP) whereby the district conveyed certain property rights to dam sites and agreed to pay the cost of rehabilitation for certain canals of the SRP. In return the RWCD was granted the right to use 5.6 percent of SRP diversion for agricultural purposes at Granite Reef Dam. This was to be stored and delivered on demand.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Deliveries	103,532 to 113,466	109,443
Surface Water	21,961 to 31,436	28,041
Pumped Water	77,536 to 83,689	81,402

Water Charge -- 1964

All water sold by the district is priced at $8.50 per acre-foot.

In addition, each acre with a water right pays an assessment of $7.00 per acre per year which is used to cover debt retirement as well as operation and maintenance expenses.

Conveyance System

	Percent Lined	Total Length
Canal	100	25 miles
Lateral Ditches	None	123 miles
Pipe Line	None	2 miles

Acreage of Major Crops
Grown Within Project

CROP	1964	1961-64 Average
Cotton	13,373	13,934
Alfalfa	8,423	8,095
Citrus	3,877	3,577
Lettuce*	673	1,025
Sorghum*	452	1,284

*This includes acreage that is double-cropped.

Maricopa-Stanfield Irrigation District
Headquarters: Stanfield

The district was organized in July 1962. It includes 135,000 acres in west central Pinal County (Figure 18). The district was formed for the purpose of obtaining supplemental water which may become available when the Central Arizona Project obtains Colorado River water. Presently, the area is supplied by approximately 500 privately owned wells.

The principal crops being produced are cotton, alfalfa, and barley. At the present time, because of excessive water lifts, only a portion of the 135,000 acres is being cropped. The area included in the district has been facing increasing costs for the production of the irrigation water due to increased pumping depths. Curtailment of some operations may become necessary unless other sources of water become available.

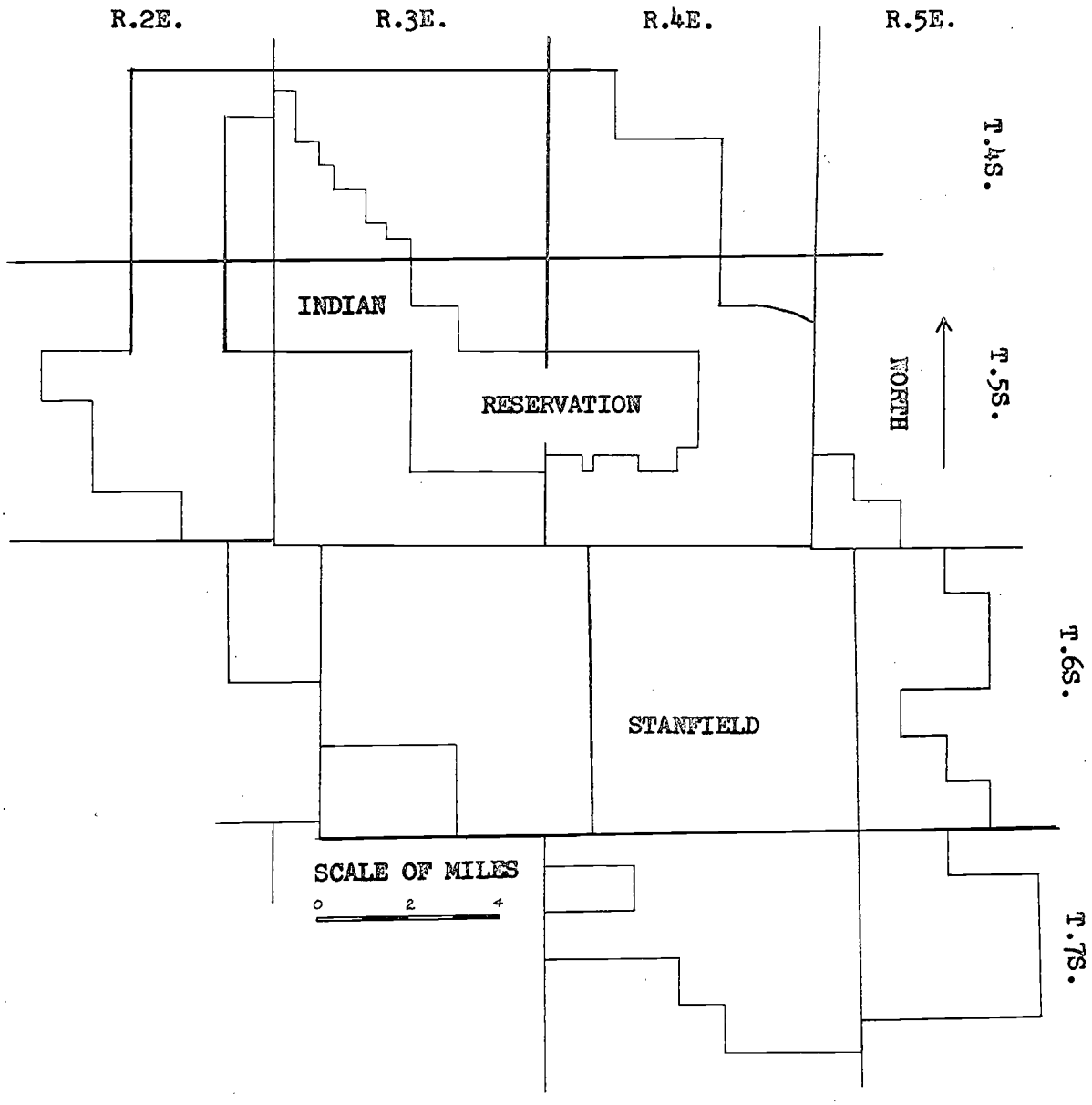

FIGURE 18 MARICOPA-STANFIELD IRRIGATION DISTRICT

San Carlos Irrigation District
Headquarters: Coolidge

The service area of the district covers 50,000 acres in west central Pinal County (Figure 19). The district, along with the irrigated Indian land of the Gila Reservation, make up the San Carlos Project.

Organization

The district is organized under Arizona statutes and is controlled by a nine-member board of directors. The district serves 468 farm units and several residential and institutional users. There are 27 full-time employees.

Water Supply

The district water supply is obtained from normal flow and storage on the Gila River and from pumps. Storage is provided by the San Carlos Reservoir behind Coolidge Dam, which was constructed and is operated by the San Carlos Project. The amount available to the district has varied over the past 25 years, from a high of 4.20 acre-feet to a low of .65 acre-feet per acre of land with rights. A commissioner has been appointed by the courts to apportion the available water between the project and other lands lying above it on the Gila each year. It becomes necessary each year for the users in the district

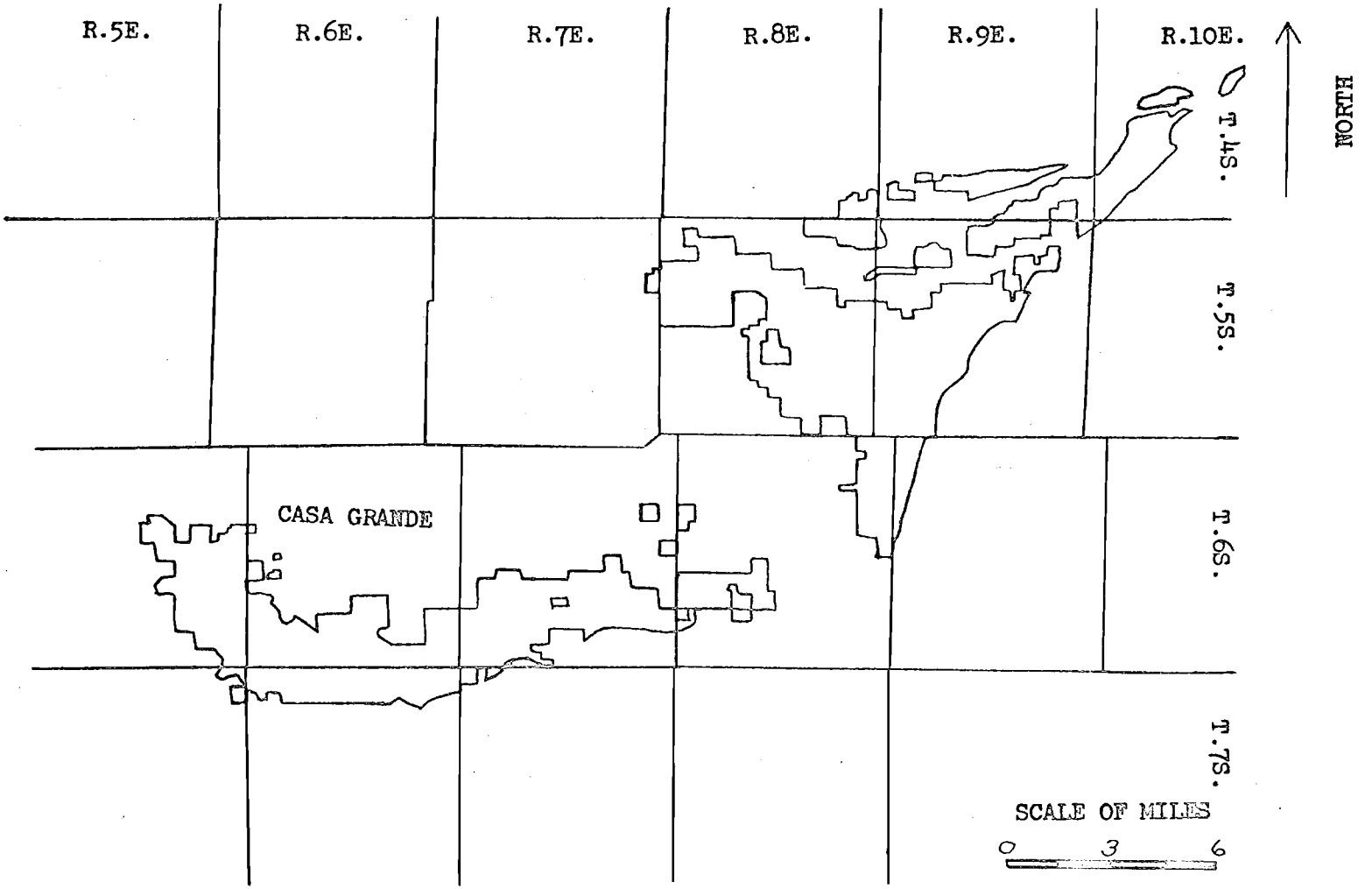

FIGURE 19 SAN CARLOS IRRIGATION DISTRICT

to establish a cropping pattern in line with the available supply. Over the past five years, the percent of irrigable land in crops has ranged from less than 50 percent in 1961 to a high of almost 75 percent in 1960. An agreement between the non-Indian landowners and Secretary of Interior, which was executed at the time the project was formed in 1924, provided that all underground water, (with the exception of domestic supply) shall be available for project development. This prevents individuals from operating supplemental wells within the project boundaries. At the present time, there are an estimated 100 wells owned by persons holding rights in the district but located outside the district boundaries which supply irrigation water to lands within the district. No attempt has been made to estimate the amount of water derived from this source.

History

The area includes land that has been irrigated by the Indians for many hundreds of years. The first white settlers arrived in the late 1860s. In 1924, Congress passed the legislation known as the San Carlos Project Act. It was to provide storage and regulate the flow of the Gila River. The project was organized to jointly serve 100,546 acres. Approximately one-half of this was Indian lands on the San Carlos Reservation and the balance became district land. The district shares the water supply with the Indian lands as established by the

Gila River Decree of 1935.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Production	51,509 to 107,648	74,064
Surface Water	19,361 to 80,962	50,582
Pumped Water	17,885 to 26,752	23,482

Water Charge -- 1964

$9.00 per acre-foot.

A portion of this price includes repayment of a government loan made for construction purposes. This repayment is based on the available water stored at the Coolidge Dam as of March 1. When the supply ranges from zero to 100,000 acre-feet, the charge is $.25 per acre. Higher charges are provided in cases of larger storage supplies, but this level had never been reached on March 1 as of 1965.

The conveyance system and dam are part of the total project and not separated between the Indian land and the district.

Acreage of Major Crops
Grown Within District

CROP	1964	1960-64 Average
Cotton	14,575	15,940
Alfalfa Hay	2,449	2,711
Barley	5,879	4,992
Sorghum	1,383	1,339
Wheat	847	641

Central Arizona Irrigation and Drainage District
Headquarters: Eloy

This district was organized in May of 1964. The area covers 117,591 acres in southern Pinal County (Figure 20). At the present time, all water is being supplied from private wells. It was organized for the purpose of distributing supplemental water when the Central Arizona Project becomes operational.

The major crops in the area are cotton, barley, and alfalfa. Presently, about 75,000 acres of the total are being cropped. This area has been experiencing a severe drop in the static water level, and the resulting high pumping cost may force curtailment in production if this supplemental water is not made available.

Cortaro Water Users Association
Headquarters: Marana

The service area covers 14,600 acres in north central Pima County lying primarily west of Interstate Highway 10 between Tucson and the Pinal County Line (Figure 21).

Organization

The association is organized as a non-profit corporation under Arizona statutes with a seven-member board of directors. It serves as an operating body for the Cortaro-Marana Irrigation District which has

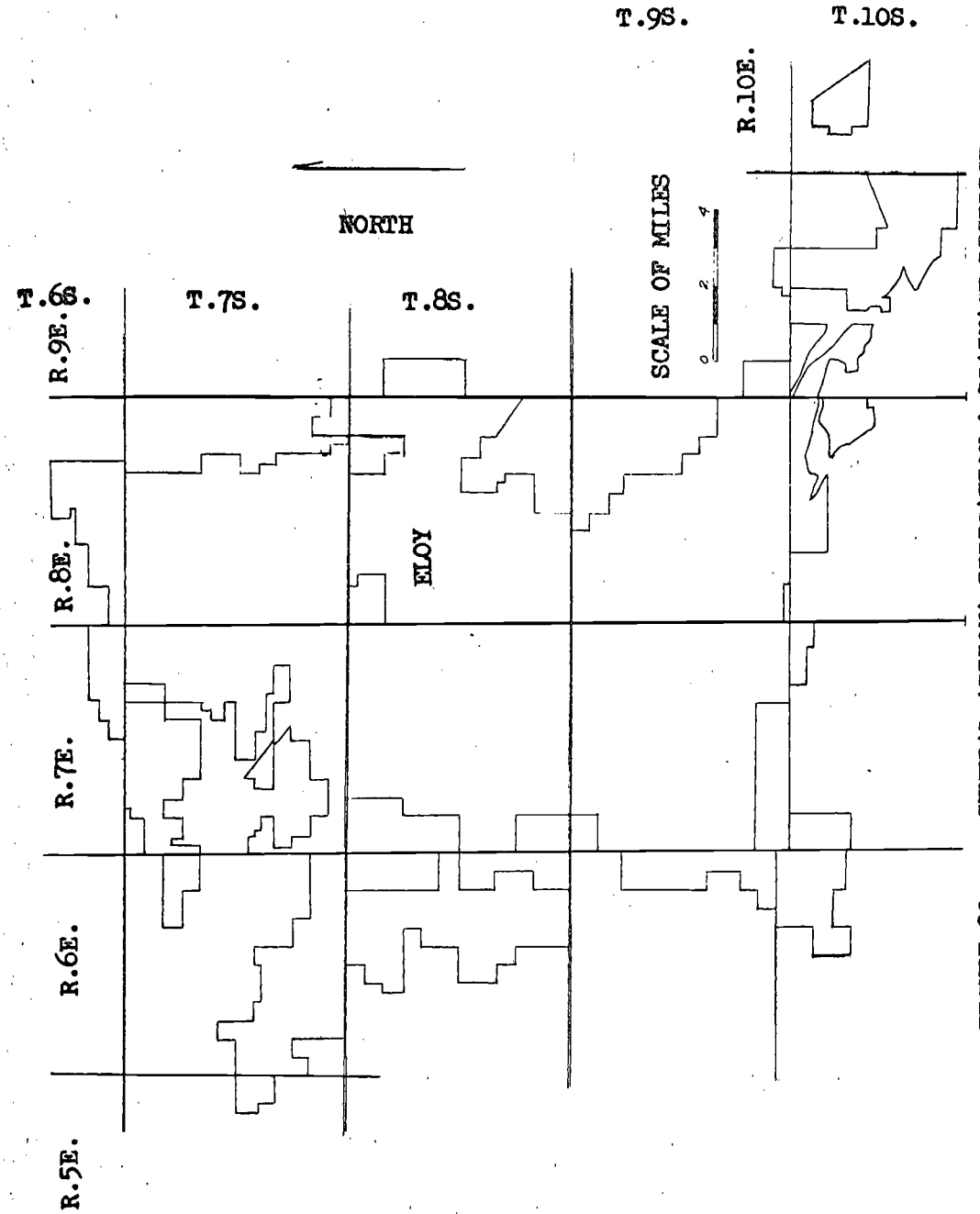

FIGURE 20 CENTRAL ARIZONA IRRIGATION & DRAINAGE DISTRICT

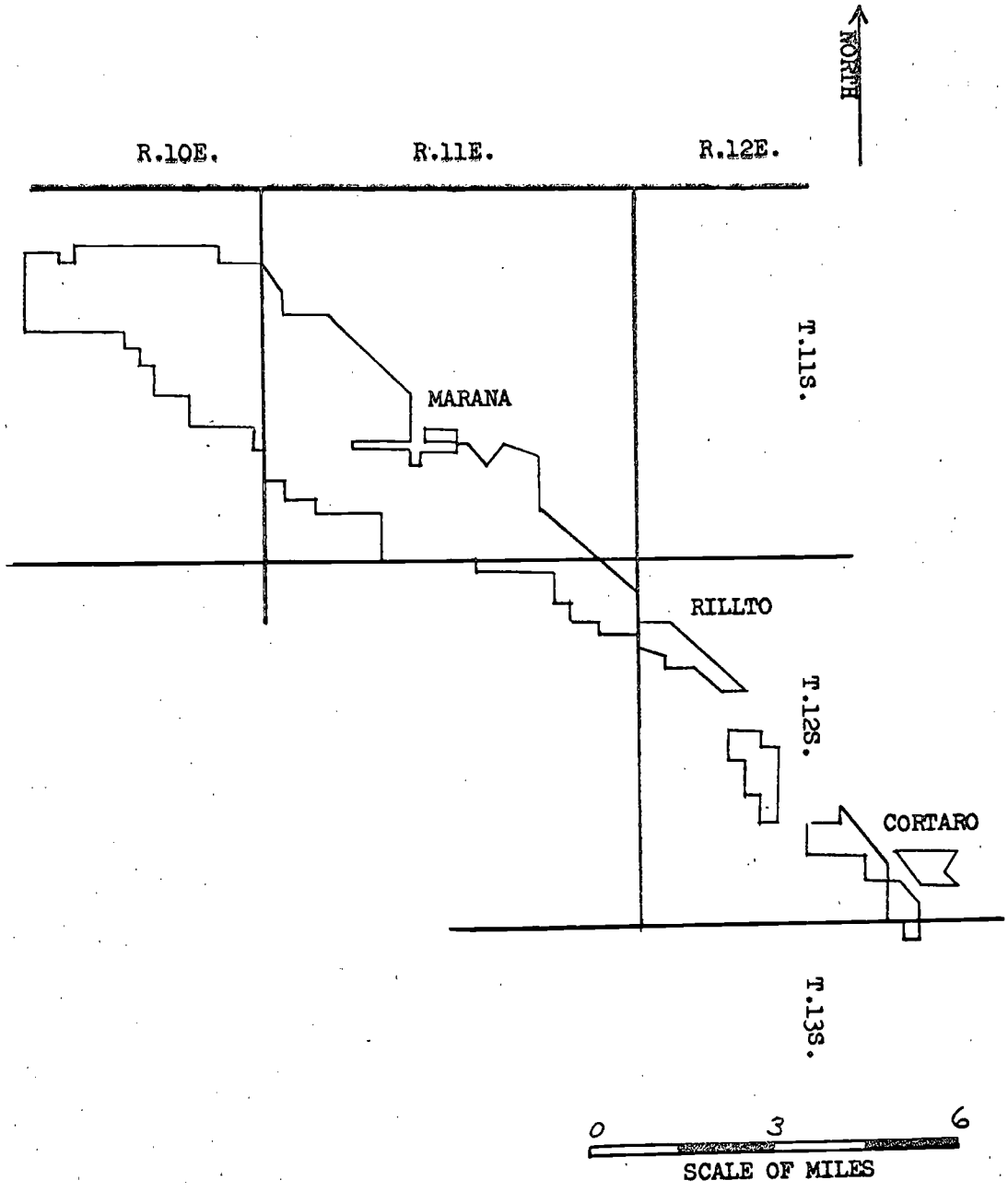

FIGURE 21 CORTARO WATER USERS ASSOCIATION

the same boundaries and is organized under Arizona irrigation district laws.

Water Supply

The area is served by pump water produced by district wells. Presently, they operate 42 wells; of these, 27 are located near Cortaro and 15 near Marana. The well field is divided into two parts by a natural fault, and those in the Marana area have a 150-foot deeper average static water level. All rights to underground water in the project boundaries are held by the association with the exception of 50 GPM wells for domestic use.

History

The association was formed in 1946 from the Cortaro Farms and the irrigation district was organized in 1961.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Net Annual Production	28,000 to 35,000	32,500

Water Charge -- 1964

The basic assessment per acre is $12.00. The user is entitled to one and one-half acre-feet for this payment. Additional water is charged at $8.00 per acre-foot.

Conveyance System

	Percent Lined	Total Length
Canals	50	24 miles
Ditches	100	56 miles

The association does not maintain cropping records.

Safford Valley Irrigation District
Headquarters: Safford

The district serves as a central clearing agency for the 13 separate irrigation companies that supply water in the Safford Valley. The area with water rights totals 32,512 acres lying in the Gila River Valley east and west of Safford.

Water Supply

Water for irrigation is obtained from the flow of the Gila River as allocated by the Water Master in Safford and from wells operated by the individual companies.

History

The first diversion of record in the Safford Valley dates to 1872 by the Montezuma Water Company. The present system of rights to the flow of the Gila River was established in 1935 in a decree known as Globe Equity No. 59. This decree was the result of a suit to distribute the river flow and was made necessary by the construction of the San Carlos Reservoir. The decree made no distinction in determining priorities between the diverters of surface water or groundwater use in

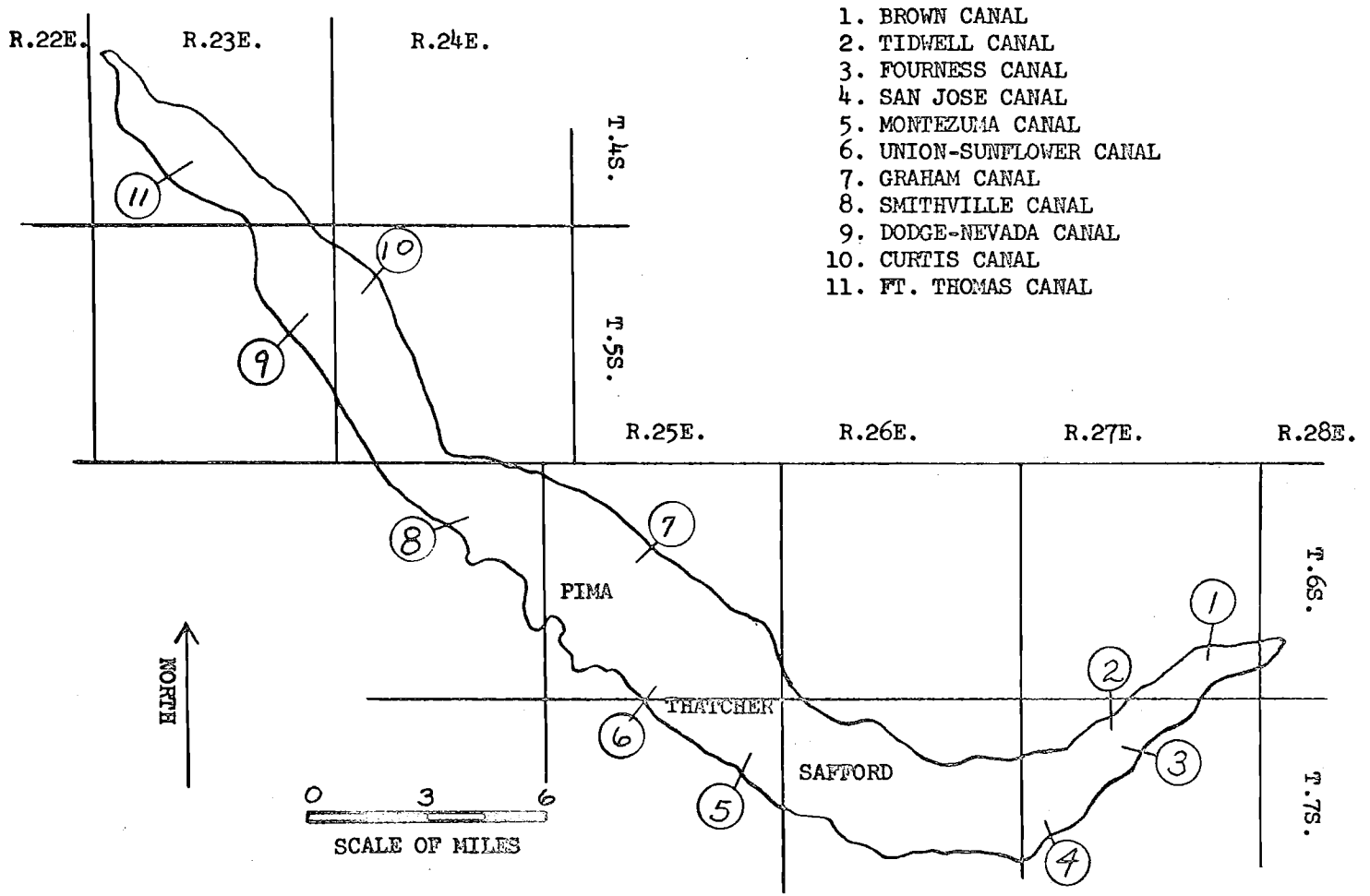

FIGURE 22 SAFFORD VALLEY IRRIGATION DISTRICT

the bottomland of the Gila River Valley under the assumption that the underground water was a part of the river water supply.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Total Net Deliveries	35,814 to 134,551	90,574
Average Per Acre		2.78
Range Per Acre	1.10 to 4.14	

Water Charge -- 1964

Because of the number of companies served by this district, the price paid for water vary considerably. The range of charges per acre is from $10.00 (which includes the assessment for repair and maintenance for and rights to receive 2.30 acre-feet to a high of $20.25 for 2.71 acre-feet.

Cropping Pattern

There are no records kept by the various companies of the cropping practices on their service areas.

Duncan Valley Irrigation District
Headquarters: Franklin

The district was formed in 1922 as a central agency for 15 separate companies in the Duncan Valley. A portion of the service area is in Hidalgo County, New Mexico, with 4,736.3 acres of the total of 8,061.3 in Greenlee County, Arizona.

Water Supply

The water supply is from diversion of the Gila River and supplemented by pumping by the individual companies. Only 5 of the 13 companies operating in Arizona have made deliveries of water since 1960.

History

The first diversion was made by the Sunset Water Company in 1874. The present system of rights to the flow was established in 1935 by a decree known as the Globe Equity No. 59. The same decree established rights in the Safford Valley to waters of the Gila River.

Water Supplied -- 1960 to 1964

	Range (Acre-Feet)	Average (Acre-Feet)
Total Net Diversion	8,448 to 20,894	15,173
Average Per Acre		1.88
Average Per Acre	1.05 to 2.59	

Water Charge -- 1964

Because of the nature of the organization, it was not possible to establish a price range for water supplied.

Cropping Pattern

No records are kept by the individual companies as to the crops grown in the area.

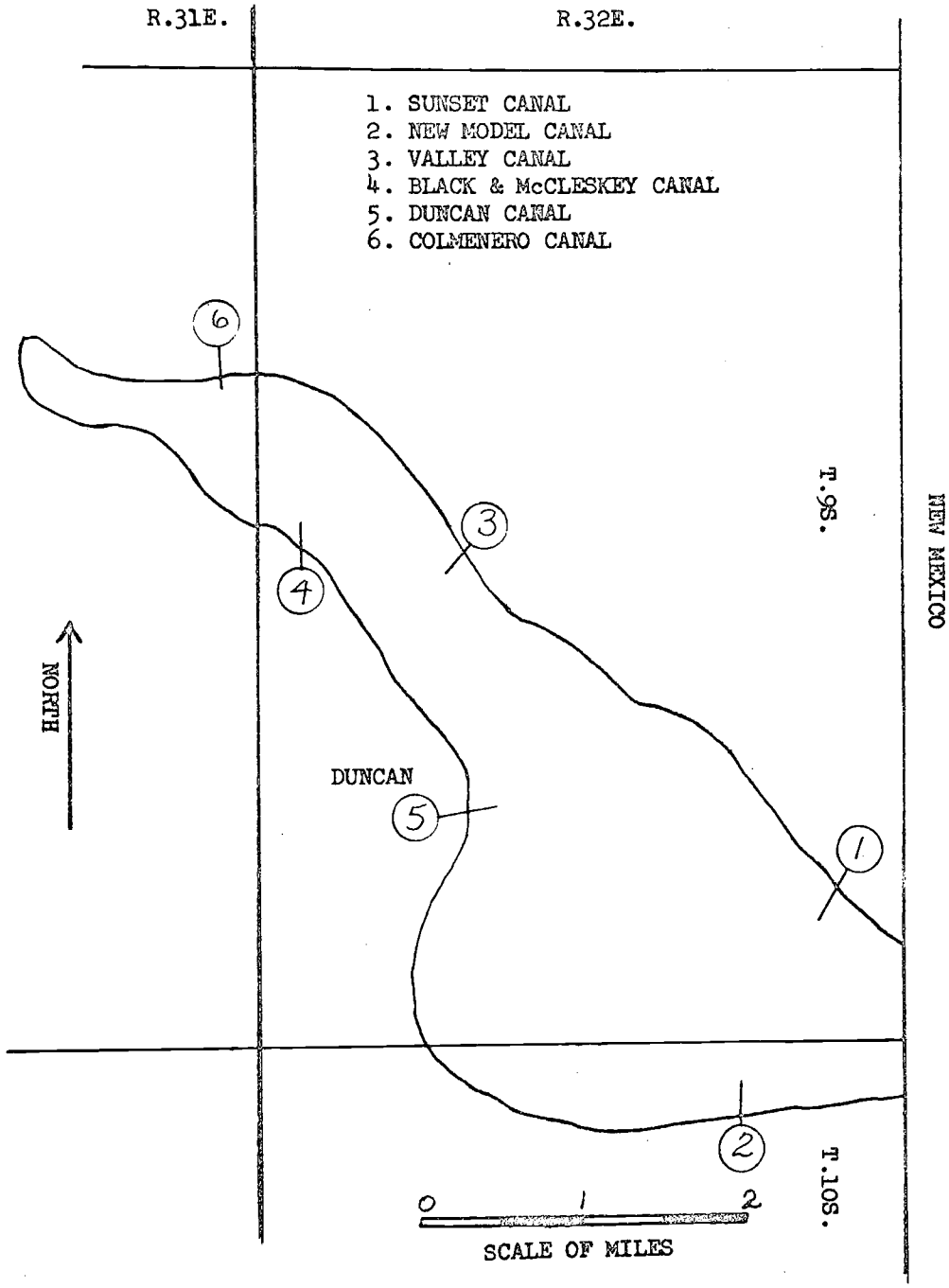

FIGURE 23 DUNCAN VALLEY IRRIGATION DISTRICT

CHAPTER IV

FINDINGS CONCERNING THE ACTUAL TRANSFER OF WATER RIGHTS IN ARIZONA

It was found that there are few transfers of water rights taking place within the agencies studied and even less information publicly available as to the quantity of water involved, remuneration, the timing, and other details regarding those transfers actually occurring.

Influence of Reclamation Law

One of the major inhibitions to the transfer is the legal limitations that have been imposed upon the districts. Projects that have been developed with Bureau of Reclamation funds, which constitute a significant portion of the agencies studied, are prohibited from making any tranfer from one point of use to another even though the ownership of each may be the same. The Reclamation Act of 1902 provided that the right to use water acquired under the act "shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right" (President's Water Resources Commission, 1950, p. 186).

Some of the organizations are making some exceptions to this

limitation and are allowing a change in the point of delivery when the ownership of the two points were the same and it did not interfere with rights of others. In most cases such instances were limited to land within one canal distribution system. The extent of such transfers is unknown because no public records are available, but it is assumed to be of little consequence.

Loss of Right by Abandonment

A problem that has possibly prevented or at least inhibited any effective transfer of water between uses and users is the possibility of losing a water right by abandonment. Arizona statutes provide that if a right is not exercised for a period of five years, the right is forfeited and water is subject to appropriation by others. This is the basis for the recent claim by the City of Phoenix and other cities for the right to the water on lands that have been urbanized and removed from agricultural production.

Several years ago Buckeye Irrigation Company arranged a transfer to a mining company of water for which it had a historical right. The agreement was limited to a four-year period so as not to jeopardize the seller's right over time. A relaxation of this restriction to permit renting water rights for beneficial uses could possibly lead to a more efficient use of the available water.

Other Transfers

The Roosevelt Water Conservation District does have a provision in its bylaws that provides for the transfer of water between users. The district is not a party to the transfer other than in making a change in the point of delivery. The individual parties involved negotiate the price over and above the district charge and the timing of the change. The original owner of the water right is charged on the district records for the delivery and makes payment to the district. It was not possible to determine the extent or market value of water transfers occurring in this market. The sellers of the water have been primarily persons with developed wells capable of providing crop needs.

Undocumented reports by field interviewers on other research projects indicate that there exists within certain irrigation districts an informal "market" for water under which irrigators exchange rights to water deliveries. Thus, an irrigator can trade part of his water allotment at one point in the season for the right to receive the other party's water at a more favorable occasion. Such a practice cannot exist without the cooperation of the "zanjeros" or ditch riders, but is a natural consequence of restrictions which inhibit the optimal allocation of the resource.

In conclustion, the lack of evidence concerning an unsatisfied

demand for water rights transfers does not support the hypothesis that a freer market for water rights would lead to substantial reallocations and efficiency gains in the use of water in Arizona. An alternative hypothesis is thus offered to the effect that (excepting in those relatively uncommon instances noted) the existing pricing system for water, the availability or relatively inexpensive alternative supplies, and the rather high cost of implementing physical transfers of water combine to create a situation where the existing allocation does not appreciably differ from the optimal. It is suggested that additional research be undertaken to confirm or refute the latter hypothesis.

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