Arizona Stream Navigability Study for the Salt River:

Granite Reef Dam to the Confluence of the White and Black Rivers

Draft Final Report

Prepared for the

Arizona State Land Department

Date of Original Report: March 1997

Prepared by

SFC Engineering Company
In Association with
George V. Sabol Consulting Engineers, Inc.,
JE Fuller/ Hydrology & Geomorphology, Inc.,
and
SWCA, Inc. Environmental Consultants

Revised:

June 2003: ***JE Fuller/ Hydrology & Geomorphology, Inc.***

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UPPER SALT RIVER PRELIMINARY REPORT

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PREFACE

This report was prepared on behalf of the Arizona State Land Department (ASLD) summarizing information relating to the navigability or non-navigability of the Upper Salt River as of the time of statehood on February 14, 1912. This report documents information relating to the Upper Salt River from the confluence of the White and Black Rivers to Granite Reef Dam. The information presented in this report is intended to provide data and evidence to the Arizona Navigable Stream Adjudication Commission (ANSAC) which will make a determination as to the navigability or non-navigability of the Upper Salt River. This report does not make a recommendation or conclusion regarding title navigability of the Upper Salt River.

The report consists of several related sections. First, an archaeological overview of the Upper Salt River relating to river uses is presented to set the long-term context of river conditions. Second, a historical study of the periods prior to and including statehood is presented that focuses on river uses, modes of transportation, and river conditions. Third, the historical geomorphology and hydrology of the Upper Salt River are summarized to illustrate past and potential flow conditions in the river. Fourth, information on federal boating criteria and the types of boating which have occurred historically on the Upper Salt River is provided. Finally, historical and current land use information is described and presented in a GIS format.

The Upper Salt River Navigability Study was originally performed by a project team consisting of George V. Sabol Consulting Engineers, Inc. (GVSCE), JE Fuller/ Hydrology & Geomorphology, Inc. (JEF), and SWCA, Inc., Environmental Consultants (SWCA). This original study was completed on behalf of the ASLD (Contract #A5-0092) as directed by Arizona Revised Statutes –37-1124. Project staff included V. Ottozawa-Chatupron, ASLD, Project Manager; P. Deschamps, GVSCE, Project Co-Manager; J. Fuller, JEF, Project Co-Manager; R. Borkan, SWCA, team leader; D. Gilpin, SWCA, historian; D. Greenwald, SWCA, archaeologist; M. Cederholm, SWCA, GIS specialist. The original study was revised in 2003 by JEF under ASLD contract #AD000150-010 to reflect changes in Arizona navigability legislation.

EXECUTIVE SUMMARY

George V. Sabol Consulting Engineers, Inc. (GVSCE), in cooperation with JE Fuller/ Hydrology & Geomorphology, Inc. (JEF), SWCA, Inc., Environmental Consultants (SWCA) and the Arizona Geological Survey (AZGS), was retained by the Arizona State Land Department (ASLD) to provide information to the Arizona Stream Navigability Adjudication Commission (ANSAC). The GVSCE report was revised by JEF in 2003 to reflect changes in Arizona navigability legislation. ANSAC will use information provided by the project team to help make a determination of navigability or non-navigability for the Upper Salt River. This report provides information on the Salt River between Granite Reef Dam and the confluence of the White and Black Rivers.

The basic approach to this study was to develop a database of information to be used by ANSAC in making a determination of navigability or non-navigability. Because the State's definition of navigability includes both actual navigation and susceptibility to navigation, the data collection effort was directed at two areas:

- Historical Uses of the River. Data describing actual uses of the river at the time of statehood were collected to help answer the question, "Was the river used for navigation?"

- Potential Uses of the River. Data describing river conditions at the time of statehood were collected to help answer the question, "Could the river have been used for navigation?"

Specific tasks for the study included agency contact, a literature search, summary of data collected from agencies and literature, and preparation of a summary report. The objectives of the agency contact task were to inform community officials of the studies, to obtain information on historical and potential river uses, and to obtain access to data collected by agency personnel on the Lower Salt River. For the latter task, public officials from communities, towns, cities, and counties located within the study reach were contacted. The objective of the literature search was to obtain published and unpublished documentation of historical river uses and river conditions. Information collected from agency contacts was supplemented by published information from public and private collections.

The literature search focused on five subject areas: (1) Archaeology, (2) History, (3) Hydrology, (4) Hydraulics, and (5) Geomorphology. Archaeological data augment the historical record of potential river uses at statehood by providing an extended record of river conditions, use of river water, climatic variability, and cultural history along the rivers. Historical data provide information on actual river uses at the time of statehood, but also provide information on whether river conditions could have supported certain types of navigation. SWCA historians

prepared a report summarizing use of the river and adjacent area in historic times, with special emphasis on the establishment, growth, and development of towns, irrigation systems, commercial activities, and developments. The hydrologic/hydraulic data are the primary source of information regarding susceptibility to navigation. These data include estimates of flow depths, width, velocity, and average flow conditions at statehood, based on the historical streamflow estimates, and available modern records for natural stream conditions at statehood, as well as for existing stream conditions. Geomorphic data provide information relating to river stability, river conditions at statehood, and the nature of changes to the river since the time of statehood. Another element of the study was collection of land use information. Land use data were compiled for the Lower Salt River and were entered in a GIS database. Land use data included existing title records from county assessors offices, state and federal land leasing records from ASLD, the Bureau of Land Management, and the US Forest Service. The land use data base was not updated as part of the 2003 revisions.

For the purposes of this study, the Upper Salt River was considered in three stream reaches:

- Reach 1 - White River/ Black River confluence to Roosevelt Reservoir
- Reach 2 - Roosevelt Reservoir to Stewart Mountain Dam
- Reach 3 - Stewart Mountain Dam to Granite Reef Dam

The data collected was organized into six main subject areas: archaeology, history, geology, hydrology, boating, and land use. Archaeological data indicate that the native American Hohokam civilization in central Arizona was dependent on water diverted from the Salt River to support their agricultural economy. The Hohokam built an extensive irrigation system downstream of the study reach that included about 315 miles of canals that provided water to about 140,000 acres of farmland, and supported a population of about 200,000. The water that supplied this extensive canal system flowed directly from the Upper Salt River. Within the Upper Salt River area, the prehistoric settlement pattern included small communities that relied on river flow for water supply and the river corridor for food, shelter, and building materials. In general, the pattern of settlement followed the perennial streams such as the Upper Salt River. Archaeological records also indicate that numerous fish species populated the Salt River and supplemented the diet of the Hohokam. Archaeological records indicate that climatic conditions and streamflow rates were not significantly different from conditions around the time of statehood.

The first Anglo explorers of the Upper Salt River found it in much the same condition that existed when the Hohokam and Apache settled in the area. The river had reliable streamflow, healthy beaver populations, a variety of large fish species, and dense riparian vegetation. Early Anglo residents floated canoes, flatboats, and logs down the river, although the primary mode of transportation was on foot, horseback or wagon. At least eight documented

accounts of commercial and recreational boating on the Upper Salt River between 1870 and 1910 were identified as part of this study. Some types of boating occurred throughout the year during the period leading up to statehood. One successful boating expedition intended to determine if logs could be floated to Tempe from the upper watershed above Roosevelt took place during the month of June (1885), typically a month of seasonal low flows.

Use of boats on the riverine portions of the Upper Salt River was limited to shallow water, low-draft, floating boats which were used primarily in the downstream direction. Steamboats and commercial shipping operations like those found on the Colorado and lower Gila Rivers apparently were not developed on the Upper Salt River. The boats used on the Salt River sometimes encountered some difficulties in transit due to snags, boulder riffles, narrow canyons, waterfalls, or other natural hazards, and experienced difficulties at man-made obstructions such as irrigation diversions. A variety of boats were used to construct Roosevelt and Granite Reef dams, including a gas launch and boats used to haul construction materials to the dam site. Since the closure of Roosevelt Damin 1911, recreational boating and some commercially-operated pleasure boating has been popular on Roosevelt Reservoir. Recreational and commercial rafting has been conducted on the Upper Salt River upstream of Roosevelt Reservoir since the 1950's.

By 1912, reservoir impoundments had lessened flow rates in the river channel itself, though the water supply upstream of Roosevelt Dam was no less reliable than in previous years. Documented accounts of boat use after 1911 on the Salt River downstream of Roosevelt Dam were limited to periods of high flow and floods. During the period after Roosevelt Dam was closed, and Roosevelt Reservoir was filling, streamflow in Reaches 2 and 3 of the Upper Salt River was limited to flood discharges and flow releases to downstream irrigation diversion points. However, even during this period of reduced low flow in the Salt River, winter discharges could occupy the channel for months at a time, making the river susceptible to a number of types of low-draft boating. Upstream of Roosevelt Reservoir, several commercial outfitters offer seasonal recreational boating trips in Reach 1. Since 1912, three additional reservoirs have been constructed in the Upper Salt River, all of which are popular boating areas.

Review of geologic conditions in the Upper Salt River indicates that the channel geomorphology is substantially unchanged from the conditions at or before statehood, except where the river has been inundated by the reservoirs. The Upper Salt River is formed within deep canyons. Bedrock in these canyons has prevented significant channel changes from occurring. In addition, the bedrock geology of the Upper Salt River area made access to the river difficult during the period around statehood, prevented development of extensive irrigation systems, and created impediments to some forms of river travel. However, the bedrock geology of the Upper Salt River was conducive to construction of large dams and water supply reservoirs. Construction of the four reservoirs induced the only significant changes in the natural geomorphology of the study Reach. In addition to the obvious

changes in downstream runoff rates caused by the reservoirs, the ordinary high watermark and ordinary low watermarks locations were changed by impounding water along the Upper Salt River system.

The Salt River Valley has a long history of reliance on the perennial flows from the Upper Salt River watershed. Without considering any disturbance by humans, the mean annual flow rate ranges from about 700 to 1,500 cfs, with relatively minor flow attenuation within the Reach due to shallow groundwater levels, narrow bedrock canyons, and perennial flow. In the year of statehood, 1912, the typical hydrologic condition of the river in Reaches 2 and 3 was, in part, a function of upstream water storage and downstream irrigation demands. For Reach 1, and for Reaches 2 and 3 prior to construction of Roosevelt Dam, periods of low flow usually occurred during the early summer months of June and July, and may have been as low as 100 to 300 cfs upstream of the Verde River confluence during the driest months of the year. Average winter flow rates typically exceeded 1,000 cfs prior to the closure of Roosevelt Dam, with annual flood discharges approaching 20,000 cfs in Reach 3. After closure of Roosevelt Dam, until it filled in 1915, winter flow rates were significantly reduced from the natural flow condition.

Typical flow depths during the lowest seasonal flows were probably one to three feet deep, with average flow widths ranging from about 50 to 100 feet depending on the channel geometry of the canyon bottom. Typical flow depths for the average annual flow were probably about three to five feet deep. At higher flow rates, such as for the 2- and 5-year flood peaks, velocities typically did not exceed 10 feet per second, which is within the range of boatable conditions for canoes, kayaks and rafts.

The Upper Salt River could have and did support some types of boating during the period prior to statehood. By 1912, use of boats on the river had declined, but was still possible during most years, a condition which persists today.

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Section 1

UPPER SALT RIVER PRELIMINARY REPORT
SECTION 1

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INTRODUCTION

George V. Sabol Consulting Engineers, Inc. (GVSCE), in association with JE Fuller/ Hydrology & Geomorphology, Inc. (JEF), and SWCA, Inc., Environmental Consultants (SWCA) was retained by the Arizona State Land Department (ASLD) to provide information to the Arizona Navigable Stream Adjudication Commission (ANSAC). ANSAC will use the data and evidence provided by the project team to make a determination as to the navigability or non-navigability of the Upper Salt River as of the time of statehood. This report documents information relating to the Upper Salt River from the confluence of the White and Black Rivers to Granite Reef Dam. No recommendation or conclusion regarding title navigability of the Upper Salt River is made in this report.

The report consists of several related sections:

Section 1 - General information is provided as to the project background, the definition of navigability, the study reach limits, the objectives of the project, and the method of approach;

Section 2 - An archaeological overview of the Upper Salt River valley prepared by SWCA relates to river uses and sets the long-term context of river conditions;

Section 3 - A historical review by SWCA addresses the periods prior to and including statehood with respect to river uses, modes of transportation, and river conditions;

Section 4 - The historical geomorphology of the Upper Salt River evaluated by JEF estimates river conditions and changes since statehood;

Section 5 - The hydrology of the Upper Salt River evaluated by JEF estimates flow rates and conditions at statehood and for existing conditions;

Section 6 - A review of information on boating criteria and use of the river for various types of boating by JEF;

Section 7 - Historical and current land use information compiled by SWCA is described and presented in a GIS format;

Section 8 - The results of the Upper Salt River study most pertinent to the legislatively mandated criteria of navigability or non-navigability are summarized.

A list of references cited, as well as an extended bibliography where appropriate, is included in each section. Appendices contain supporting documentation and the GIS work products. A glossary of terms and a list of acronyms used in the report are provided.

Project Background

Public Trust principles date back to English Common Law when the King held the beds of rivers affected by tides in Trust for the general public and for the public good. This provision was founded on the principle that there is a public need to use the waterways for commerce. When the United States gained independence from the British Crown, Public Trust principles were recognized so that the lands beneath navigable waters within the original thirteen states became the sovereign property of those states. The Equal Footing Doctrine provided that future states were entitled to sovereign ownership of riverbeds located within those new states on an 'equal footing' with the original thirteen states.

At the time of statehood on February 14, 1912, the State of Arizona received sovereign title to the beds of navigable rivers located within state boundaries. Under the Equal Footing Doctrine, the United States government previously held these lands in Trust pending the creation and admission of the State of Arizona to the Union. Although the State owned the land, in order to perfect title to the navigable streambeds, the State was required to make its claim of ownership. From statehood until the mid-1980's, Arizona claimed only the bed of the east half of the Colorado River. The State failed to act on all other claims of streambed ownership and other parties asserted title to certain streambeds lands. In assuming ownership of lands located in or near these streambeds, many of the current record title holders constructed projects and improvements to the land, paid property taxes, and altered the stream ecosystems and riparian habitat.

During recent years, the State, as well as a number of private and public entities, asserted claims of ownership of streambeds throughout Arizona. These claims turned on whether or not the streams were navigable or susceptible to being navigable at the time of statehood. The titles held by land owners whose property includes all or a portion of the streambed of potentially navigable streams are clouded. As a result of litigation addressing in-stream sand and gravel mining activities in the Verde River, the Arizona Legislature recognized the economic hardships created by the uncertainty of the State's potential future claims on streambed lands. In 1987, House Bill (HB) 2017 was passed outlining a procedure to quit claim any interest of the State in the beds of the Salt, Gila, and Verde Rivers for a nominal fee, reaffirming the State's claim to the Colorado River, and waiving any claim to all of the other streambeds in the State. A lawsuit challenging the constitutionality of HB 2017 was successful in 1991 and the Court found that one flaw in the bill was that it did not provide for an evaluation of the validity and value of the State's Public Trust interest on the individual watercourses.

In 1992, the Governor signed HB 2594 which repealed HB 2017 and established a systematic administrative procedure for gathering information and determining the extent of the State's ownership of streambeds. The main purpose of the legislation was to confirm State ownership in Public Trust lands located in the beds of streams determined to have been navigable at statehood. HB 2594 also created the Arizona Navigable Stream Adjudication Commission (ANSAC), a five member board appointed by the Governor. ANSAC was directed to establish administrative procedures, hold public hearings, and make determinations of navigability or non-navigability for specific watercourses. The legislation also directed the Arizona State Land Department (ASLD) to facilitate determination of navigability and to act as support staff for the ANSAC.

In early 1994, HB 2589, amending Arizona Revised Statutes (A.R.S.) —37-1101 through 37-1156, was adopted. HB 2589 set the criteria to be used for determination of navigability and non-navigability and established an ombudsman office to represent the interests of private property owners in proceedings involving governmental action. HB 2589 required ANSAC to set priorities for investigating and conducting hearings on watercourses within this state, and then to report its recommendation as to which watercourses or reaches of watercourses were navigable or non-navigable as of the time of statehood to the Legislature which would enacts legislation in response to the determination. The original GVSCE report for the Upper Salt River was prepared under HB 2589 criteria.

In 1999, after the Arizona Legislature ratified ANSAC's recommendations that the Salt River (and other Arizona rivers) be found non-navigable, lawsuits were filed challenging the constitutionality of certain provisions in HB 2589. In response to the subsequent Arizona Court of Appeals decision, the Arizona Legislature enacted SB 1275, which removed the unconstitutional presumptions of non-navigability and limitations on information considered, and restored the applicable burden of proof in line with the so-called federal test of navigability. The 2003 revision of the original GVSCE report was prepared to reflect changes in the navigability statutes made under SB 1275.

Definition of Navigability

A.R.S. —37-1101 (6) sets out the definition of "navigable" or "navigable watercourse" to be used to address the ownership of streambeds. That definition is:

> "Navigable" or "navigable watercourse" means a watercourse, or a portion or reach of a watercourse, that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water.

The data collection effort for this study provides information that will assist ANSAC in determining if a given river meets the criteria of the statutory definition.

Project Limits

The project team is to collect data and information relevant to the navigability or non-navigability and, hence, to title to the streambed lands of the Upper Salt River from the confluence of the White and Black Rivers to Granite Reef Dam, as shown in Figure 1.

Study Reach Lengths

The lengths of the study reaches were estimated using data reduced from the Arizona Land Resource Information System (ALRIS) GIS database. Those data were converted to an AutoCad drawing file and the lengths of the subreaches calculated using that program. The resulting total lengths of the study reaches are shown in Table 1-1.

Table 1

Study Reach Lengths

River Study Reach	Length (miles)	Length (kilometers)
Upper Salt River	153	246

Lateral Study Limits

The maximum lateral extent of the study limits for each study reach is the 100-year floodplain boundary. The identification of the lateral limits of the study reaches was conducted in two steps. First, a set of key maps was developed for all study reaches indicating sources of floodplain maps, topographic information, aerial coverage, and other pertinent information. The primary source of floodplain boundary delineations was the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). Then, a GIS map layer was developed for each study reach showing the 100-year floodplain to establish the maximum lateral extent of the study limits for the purpose of information and data collection in subsequent work tasks. For those subreaches mapped by FEMA, the 100-year floodplain boundary was digitized in GIS format directly from the FIRM maps. No FEMA maps are available for those portions of the study reaches which are on Federally-owned or Indian reservation lands; therefore, no floodplain boundary delineations were generated or mapped for those subreaches due to budget limitations. The GIS was not updated for the 2003 revision of the GVSCE report.

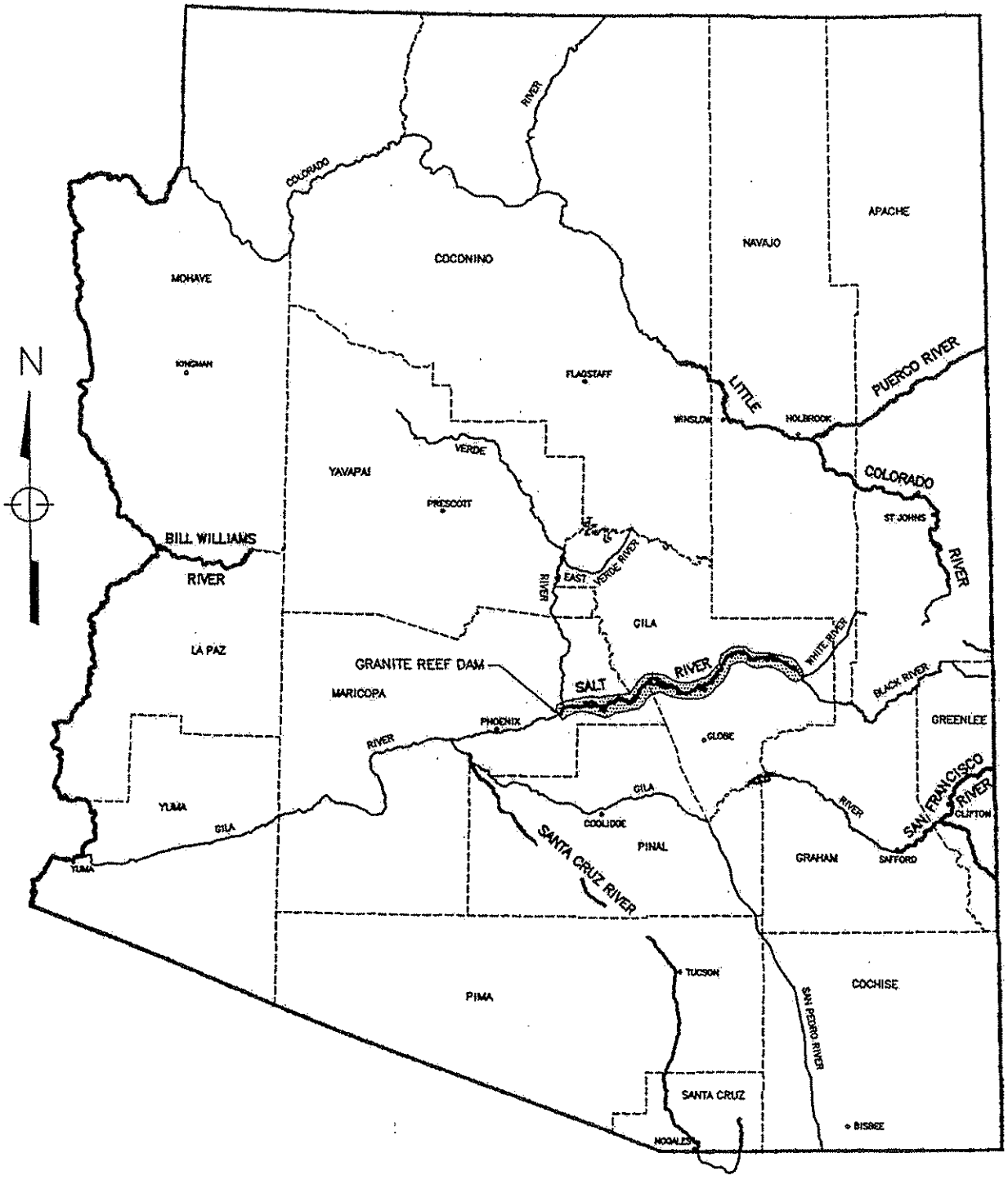

FIGURE 1
General Location Map for Arizona Stream Navigability Studies

Study Objectives

The primary objective of this project is to provide information concerning the factors addressing navigability set forth in A.R.S. –37-1101 *et seq.* to assist in the determination of navigability or susceptibility to being navigable as of statehood. Specific technical goals include the following:

- Perform a literature search to identify and catalog existing historical, archaeological, hydrologic, hydraulic, geomorphic, and land use information.
- Review existing historical, archaeological, and land use information to identify and evaluate evidence of navigable uses of the study areas.
- Review existing hydrologic, hydraulic, and geomorphic materials to identify and evaluate discharge characteristics of the study reaches.
- Identify title owners, lessees, improvements, and current uses of land located in or near the study reaches using existing information.
- Prepare reports, maps, and other information describing the results of the archaeological, historical, hydrologic, hydraulic, geomorphic, and land use investigations.

PROJECT METHODOLOGY

The basic approach to the stream navigability studies is to develop a database of information to be used by ANSAC in making navigability determinations. To that end, the scope of services for this study includes five main tasks:

- Agency Contact
- Literature Search
- Data Summaries
- Land Use
- Final Report

Because the legislative definition of a navigable watercourse includes both actual navigation and susceptibility to navigation, the data collection effort was focused on two areas:

- Historical Uses of the River - Data describing actual uses of the river at the time of statehood were collected. Specific tasks included agency contact and literature search.
- Potential Uses of the River - Data describing river conditions at the time of statehood were collected.

Specific tasks included agency contact, literature search, and hydrologic, hydraulic and geomorphologic assessments.

Agency Contact

The objectives of the agency contact task were to inform community officials of the studies, to obtain information on historical and potential river uses, and to obtain access to data collected by agency personnel in regard to the study reaches. For the latter task, public officials from communities, towns, cities, and counties located along the Upper Salt River study area were contacted. Contact consisted of an initial letter describing the stream navigability study, its potential impacts on the community, and requesting information to be used in the study. Each community official was then contacted by telephone to answer questions about the study and to provide a second opportunity to provide information for the study. In addition, officials from most local, state, and federal agencies with jurisdiction or interest in the river study areas were contacted by letter and telephone.

Historians, librarians, and archivists from public and private museums, libraries, and other collections were also contacted. Letters requesting summaries of information pertaining to historical stream uses or conditions were sent to each institution, with follow-up telephone contact. Other contacts included letter and telephone requests for information from clubs, professional organizations, special interest groups, and environmental groups. In most cases, contacts led to other persons thought to have information pertinent to the study.

Literature Search

The objective of the literature search was to obtain published and unpublished documentation of historical river uses and river conditions. Information collected from agency contact was supplemented by published information from public and private collections. The literature search focused on the following main categories:

- Archaeology
- History
- Hydrology
- Hydraulics
- Geomorphology

Historical literature searches were conducted to obtain information on the historical uses of the rivers and adjacent lands. Library research identified books, professional journals, magazine and newspaper articles, and unpublished materials that provide information on the history of the use of the rivers. City directories, Sanborne fire insurance maps, and General Land Office maps were also consulted to identify businesses located near the rivers. Literature searches in archaeology provided data on prehistoric and historic settlement patterns along the river,

including evidence on paleoenvironment and irrigation agriculture. This research included published books and articles and "gray literature" or technical reports. Hydrologic, hydraulic, and geomorphic studies relating to historic navigability of each stream reach were also collected from city, county, state, and federal agencies. Published journal articles, books, and reports available from public library collections were also consulted. Bibliographies of documents and resources for each area of expertise are included in the corresponding report sections.

Data Summaries

Data collected from the agency contact and literature search tasks was organized and synthesized by these subject areas: archaeology, history, hydrology, hydraulics, geomorphology, boating, and land use.

Archaeology

Archaeological data augment the historical record of potential river uses at statehood by providing an extended record of river conditions, use of river water, climatic variability, and cultural history along the rivers. SWCA archaeologists reviewed literature and other information collected during the literature search and agency contact tasks. An overview summarizing previous archaeological work in the area, paleoenvironment, the culture history, settlement patterns, and evidence relevant to navigability of the river is presented in Section 2.

History

Historical data provide information on actual river uses at the time of statehood, and also provide information on whether river conditions would have supported navigation. SWCA historians prepared a report summarizing use of the river and adjacent area in historic times, with special emphasis on the establishment, growth, and development of towns, irrigation systems, commercial activities, and developments. The historical overview is presented in Section 3.

Geomorphology

Geomorphic data provide information on river stability, river conditions at statehood, and the nature of river changes since statehood. A summary of the geology and geomorphology of the Upper Salt River was prepared by JEF. These summaries were based on literature and other information collected during agency contact and the literature search. The objectives of these summaries were to estimate channel positions at the time of statehood, assess the possibility of and mechanism for historical channel movement from its current position, provide evidence of geologic control of flow rates, and to estimate the location of the ordinary high and low watermarks. The geomorphologic summaries are presented in Section 4.

Hydrology/Hydraulics

Hydrologic/hydraulic information is a key source of information regarding susceptibility to navigation. These data include estimates of flow depths, width, velocity, and average flow conditions at statehood, based on the available records. JEF evaluated information collected during the agency contact and literature search tasks. Literature, stream gage records, topographic maps, aerial photographs, and other data were used to develop an estimate of natural stream conditions at statehood, as well as for existing stream conditions. Depth, velocity, and topwidth rating curves for existing and (circa) statehood channel conditions were developed from historical gaging records. Estimates of 2-year, 5-year, and average annual flow rates were obtained from gage data or other sources. Flow duration curves and average monthly flow rates were also summarized. Section 5 contains the hydrologic/hydraulic summaries.

Boating

Section 6 of the report provides information on federal boating criteria and the types of boating which have occurred historically on the Upper Salt River. Several types of information are presented including federal navigability criteria, historical accounts of boating, and modern boating records.

Land Use

Land use data were compiled for the Upper Salt River and entered in a GIS database. Land use data included existing title owner records from county assessors offices, state and federal land leasing records from ASLD, the Bureau of Land Management, and the U.S. Forest Service. Existing improvements, commercial activities, and present use of lands were identified from land use mapping and reports, aerial photographs, and in some cases, by field visits. Other data collected for the Upper Salt River, such as floodplain limits, were also entered in the GIS. The land use data summary description is presented in Section 7; the GIS work product was provided separately. Land use data were not updated as part of the 2003 revision of the GVSCE report.

SUMMARY

A comprehensive summary is presented in Section 8 of this report which itemizes the key findings of the preceding archaeological, historical, hydrologic, hydraulic, geomorphologic, boating, and land use sections. The most pertinent findings relative to evidence of navigability or non-navigability, or evidence of susceptibility to navigation, are summarized to provide information to support a determination by others of navigability or non-navigability for each study reach. This report does not make a recommendation or conclusion regarding title navigability of the Upper Salt River.

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ARCHAEOLOGICAL OVERVIEW OF THE UPPER SALT RIVER VALLEY

Dawn M. Greenwald & Dennis Gilpin/SWCA

Archaeology along the upper Salt River, which centers mostly around the Hohokam and Salado cultural traditions, has been fairly well documented from the confluence of the Salt and Verde rivers to just east of Roosevelt Lake (Figure 1) (Table 1). Some survey and limited excavations have been completed in the vicinity of Seneca Lake, but other portions of the study area have not been investigated and data are lacking. To compensate for this lack, the discussions below include available information from surrounding areas (Globe-Miami, Mazatzal piedmont, San Carlos) to present a more complete picture.

INTRODUCTION

Archaeological studies of the Salt River provide several lines of evidence pertaining to navigability of the river. First, such studies have permitted reconstructions of the river in its natural state. Second, archaeologists working in the area from the nineteenth century to the present have recorded information on the river, its history, and its uses. Third, archaeological studies of historic sites have yielded both historical and archaeological data on the river during the late nineteenth and early twentieth centuries. An isolated Clovis projectile point from Tonto Creek provides evidence for human use of the Tonto Basin about 9500-9000 B.C. Prior to about A.D. 100, people using the upper Salt River subsisted on wild plants and animals. From about A.D. 100 to 1450 the subsistence base was agriculture, and settlement was centered in the lower Tonto Basin, where conditions were most favorable for agriculture. Archaeological reconstructions suggest that streamflow changed little between the period from A.D. 740 to 1370 and the period from A.D. 1800 to 1979. Although a few canals have been identified in the Tonto Basin, floodwater farming was apparently more important than irrigation agriculture in the prehistoric period. The entire upper Salt River area appears to have been abandoned from about A.D. 1450 to 1540, when the Yavapai, and subsequently the Apache, began using the area. Like their predecessors, the Yavapai and Apache also practiced floodwater farming in the lower Tonto Basin. Anglo-European exploration of the region began in the 1860s, followed by settlement in the 1870s; archaeologists have studied some sites dating to the period of white settlement, especially those related to twentieth-century dam construction. In the late nineteenth century, archaeologist Adolph Bandelier provided a detailed description of the Tonto Basin, as elaborated in Section 3 of this report. Although the archaeological data suggest few changes in the flow regime of the upper Salt River and little in the way of agricultural diversions or impediments to navigation, archaeological research has not documented any use of the river for commercial trade and travel or for any regular flotation of logs.

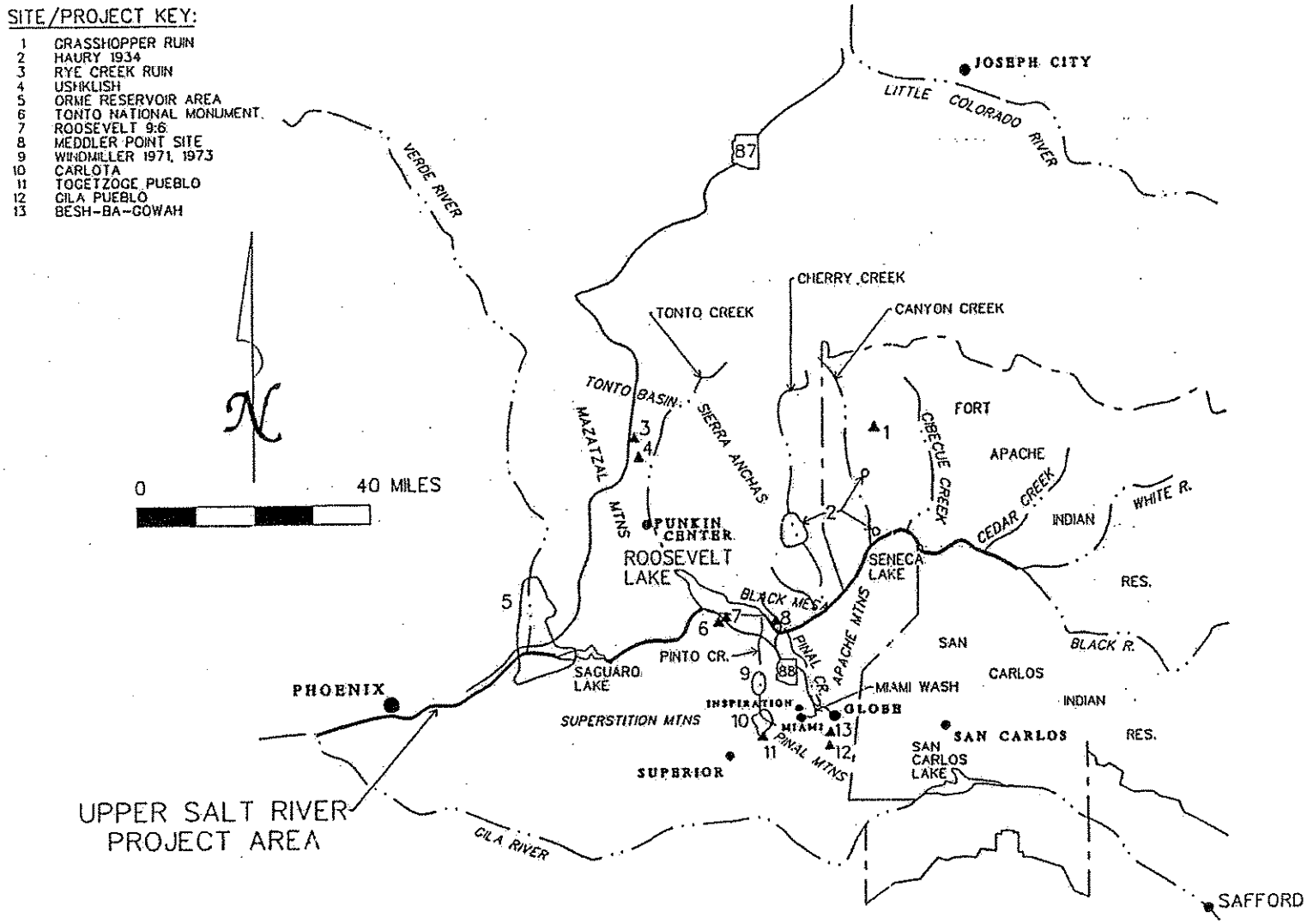

FIGURE 1
Archaeological sites in the Upper Salt River area

Table 1. Major Archaeological Projects along the Upper Salt River

Sponsor	Type of Project	Areal Extent	Number of Sites	References
Archaeological Institute of America	reconnaissance	Tonto Basin, San Carlos, and Globe areas	ca. 32	Bandelier 1892; Lange and Riley 1970; Wood and Kelley 1987
Mrs. William Boyce Thompson; American Museum of Natural History	reconnaissance and excavation	Tonto Basin and Globe	"15	Hohmann and Kelley 1988; Schmidt 1926
Gila Pueblo	reconnaissance	Central and south-central Arizona	>200	Gladwin and Gladwin 1929, 1930, 1935
Gila Pueblo	excavation	Rye Creek Ruin	1	Haury 1930
Gila Pueblo	excavation	Roosevelt 9:6	1	Haury 1932
Gila Pueblo	reconnaissance and excavation	In and east of the Sierra Ancha Mountains	19	Haury 1934
Works Progress Administration	excavation	Besh-ba-gowah	1	Vickrey 1939
Works Progress Administration	excavation	Inspiration I	1	Vickrey 1945
National Park Service	excavation and stabilization	Tonto National Monument cliff dwellings	2	Steen et al. 1962
University of Arizona	excavation	Grasshopper Ruin	1	Longacre and Reid 1974
Arizona State University	survey	Vosberg area	87	Morris 1970
Cities Service Company	excavation	Near Miami, Arizona	6	Grady 1974
Cities Service Company	survey	Near Miami, Arizona; 16 mi^2	50	Windmiller 1971, 1973

Table 1. Major Archaeological Projects along the Upper Salt River

Sponsor	Type of Project	Areal Extent	Number of Sites	References
Bureau of Reclamation	survey	Orme Reservoir; 24,320 acres	47 (Salt arm); 130 (Verde arm)	Canouts 1975
San Carlos Apache Tribe and U.S. Economic Development Administration	excavation	Seneca Lake area	7	Stafford 1978
Arizona Department of Transportation	excavation	Miami Wash sites	8 prehistoric	Doyel 1978
Arizona Department of Transportation	excavation	Near Punkin Center	5	Jeter 1978
Tonto National Forest	survey	610 ha; Upper Cherry Creek area	21	Wood 1980
Arizona Public Service	survey	Red Rock to Joseph City, Arizona; 15 mi^2	Total 158; Tonto-Roosevelt portion 79	Teague and Mayro 1979
San Carlos Apache Tribe and U.S. Economic Development Administration	excavation	San Carlos River Valley	40	Mitchell 1986
Arizona Department of Transportation	excavation	Mazatzal piedmont	24	Ciolek-Torrello 1987
Bureau of Reclamation	surveys	Roosevelt Lake area; approx. 12.7 mi^2	529 prehistoric	Dames and Moore 1979; Fuller, Rogge, and Gregonis 1976; Rice and Bostwick 1986; Rice and Most 1984
Bureau of Reclamation	excavation	Roosevelt Platform Mound Study	64	Jacobs et al. 1992; Redman, Rice, and Pedrick 1992; Rice 1990

Table 1. Major Archaeological Projects along the Upper Salt River

Sponsor	Type of Project	Areal Extent	Number of Sites	References
Bureau of Reclamation	excavation	Roosevelt Rural Sites Study	29	Ciolek-Torrello et al. 1990; Ciolek-Torrello, Shelley, and Benaron 1994
Bureau of Reclamation	excavation	Roosevelt Community Development Study	29	Doelle et al. 1992; Elson and Swartz 1994; Elson et al. 1994
Carlota Copper Company	survey	Globe uplands, near Miami; 2600 acres	87	Ahlstrom, Euler, and Doak 1993
Carlota Copper Company	excavation	Globe uplands, near Miami; 2600 acres	51 prehistoric	Mitchell and Zyniecki 1994

ARCHAEOLOGICAL PROJECTS

Archaeological study of the upper Salt River Valley began with the travels and journal documentation of Adolph Bandelier. While Bandelier was doing research in New Mexico for the American Archaeological Institute of Boston, the territorial governor of Arizona entrusted him with writing and illustrating a history of the Southwest. In 1883 Bandelier visited the Tonto Basin and nearby areas such as San Carlos and Globe (Figure 1). He described and mapped numerous sites and conducted limited excavations and artifact collections (Wood and Kelley 1987:8). In 1925-1926, Erich Schmidt led the Mrs. William Boyce Thompson Expedition to record and excavate ruins around Globe and in the Tonto Basin. He conducted test excavations on sites around Roosevelt Lake and excavated the 120-room Togetzoge Pueblo between the towns of Superior and Miami. According to Hohmann and Kelley (1988):

> *His research program was the first to incorporate extensive site survey and test excavations in a regional synthesis of Salado culture history. Schmidt was the first to recognize the Salado as a distinct, geographically identifiable cultural entity; the first to establish a stratigraphic and chronological relationship between the Hohokam and the Salado; and the first to identify the wide range of Salado site variability--including the presence of Hohokamlike platform mounds in selected Salado site complexes.*

In 1928 the Gila Pueblo Foundation (GPF) in Globe began a series of reconnaissance surveys throughout central Arizona to determine the extent of the Hohokam culture based on the presence of its distinctive red-on-buff pottery (Gladwin and Gladwin 1930, 1935). Between 1928 and 1930, the GPF excavated and reconstructed the site of Gila Pueblo near Globe, a large cobble and adobe pueblo of 100-150 rooms assigned to the Salado culture. In 1930-1931 GPF sponsored excavations, directed by Emil Haury, at several sites; one of them was the Roosevelt 9:6 site, for many years the type site for pre-Classic Hohokam traits (Haury 1932). Haury also conducted limited excavations at Rye Creek Ruin in the upper Tonto Basin, a cobble-masonry pueblo of 150+ rooms with a plaza and two platform mounds (Haury 1930).

Around 1931 Haury conducted a reconnaissance in and east of the Sierra Ancha Mountains to collect wood samples from cliff dwellings for dendrochronological studies. He visited 18 cliff dwellings, dating between approximately A.D. 1278 and 1348, and excavated one, Canyon Creek Ruin. Canyon Creek Ruin contained approximately 125 rooms and was occupied from circa A.D. 1350 until probably around 1400-1450 (Haury 1934:24, 152). Haury also visited and described an aboriginal turquoise quarry on the east side of Canyon Creek at its confluence with the Salt River.

During the Depression era, Irene Vickrey conducted excavations at the sites of Besh-ba-gowah and Inspiration I in the Globe-Miami area for the Works Progress Administration. Vickrey excavated 200 rooms and 300 burials at Besh-ba-gowah, a large Classic period Salado settlement near Gila Pueblo (Vickrey 1939). Inspiration I, located on a mesa overlooking Miami Wash, was a pre-Classic Hohokam/Classic period Salado site that demonstrated that the Hohokam tradition preceded the Salado tradition (Vickrey 1945).

A hiatus followed these early excavations. Then, in the 1960s, academic researchers became involved in projects that provided a regional context for the large sites. Starting in 1963, the University of Arizona (UA) Archaeological Field School began work at Grasshopper Ruin on the Salt Draw Plateau north of the Salt River and in the surrounding area. Grasshopper Ruin is a pueblo of 800+ rooms that was occupied from circa A.D. 1275 to 1400 (Longacre and Reid 1974). Approximately 300 sites have been identified by UA surveys in the area bounded by Canyon Creek, Carrizon Ridge, Cibecue Creek, and the Salt River (Effland and Macnider 1991:11). The Vosberg area (the upper reaches of Walnut Creek) of the Sierra Ancha was the focus of the Arizona State University (ASU) Field School between 1967 and 1969. ASU surveys located 87 sites in the area, and several sites, including Walnut Creek Village, were excavated (Morris 1970).

The period since the 1970s has seen an increased number of small surveys, more systematic survey methods, and the excavation of smaller sites due to the implementation of federal mandates requiring salvage and contract archaeology projects. These factors have provided archaeological studies with important information on settlement pattern, intra- and interregional interaction, cultural systems, and cultural development. One of the largest of these projects (24,320+ acres), conducted at the confluence of the Salt and Verde Rivers to assess the impact of the Orme Reservoir on cultural resources, recorded 47 historic and prehistoric sites within the Salt River arm of the proposed reservoir (Canouts 1975). The wide range of prehistoric site types included habitations, rockshelters, artifact concentrations, petroglyphs, plant procurement sites, a flaking station, and a quarry. Prehistoric cultural associations were both Hohokam and Salado, with some ceramics from the Mogollon and Anasazi areas. During the early 1970s, the Arizona State Museum (ASM) conducted survey and limited excavations in the Globe-Miami area to mitigate impacts from proposed mining projects. Recorded sites were both Hohokam and Salado and included small camps, small 1- or 2-room structures, large villages with 30-65 rooms, plazas, and compounds (Windmiller 1971, 1973). The realignment of State Highway 88 prompted the investigation of eight prehistoric sites by ASM in 1974 (Doyel 1978). The sites, located above the floodplains of Miami Wash and Pinal Creek, ranged in time from A.D. 550 to post-A.D. 1450 and included Hohokam, Salado, and Apache components. As a result of this project, a new phase, transitional between the pre-Classic Hohokam and later Salado occupations, was proposed, called the Miami phase. Several years later ASM conducted the Cholla Transmission Line Project (Reid 1982), a

linear project that ran along the Little Colorado River from near Joseph City to upper Devore Wash south of Lake Roosevelt. The majority of the 79 sites identified in the Tonto-Roosevelt portion of the corridor were within the upper Devore Wash drainage basin; the remaining 10 sites were associated with lower Cherry Creek, Coon Creek, and Black Mesa (Mitchell and Zyniecki 1994:4). ASM also surveyed a 305-m-wide corridor along State Route 87 on the eastern slopes of the Mazatzal Mountains in 1980, recording 42 new sites (Ferg and Dongoski 1980). In 1982 the Museum of Northern Arizona conducted excavations at 24 sites along a segment of the State Route 87 corridor. Most of the sites contained small pueblos dating to the twelfth and thirteenth centuries A.D. and represented seasonally occupied field houses, permanently occupied homesteads and courtyards, and agricultural features associated with the Salado and Sinagua cultures (Ciolek-Torrello 1987:xxix). In addition, Archaic and Apache occupations were investigated.

SWCA, Inc., Environmental Consultants, conducted a large block survey covering 2600 acres in the upper drainages of Powers Gulch and Pinto Creek for the proposed Carlota copper mine (Ahlstrom, Euler, and Doak 1993). The survey identified 55 sites with prehistoric components, including artifact scatters, single-room sites, sites with a small number of rooms, and a few 10-20 room pueblos, representing Archaic period, Classic period Salado, and protohistoric Apache occupations (Mitchell and Zyniecki 1994:5).

The largest project to date along the upper Salt River, which is still on-going, is the Roosevelt Project. It was initiated by the U.S. Bureau of Reclamation as part of the Central Arizona Project because of potential impacts from proposed modifications to Roosevelt Dam. A number of surveys were conducted to completely inventory the area threatened by potential flooding (Dames and Moore 1979; Fuller, Rogge, and Gregonis 1976; Rice and Bostwick 1986; Rice and Most 1984), documenting a total of 529 prehistoric sites. The archaeological mitigation program was divided into three parts: (1) excavations on platform mound complexes, with 64 sites sampled (the Roosevelt Platform Mound Study, undertaken by Arizona State University) (Redman, Rice, and Pedrick 1992; Rice 1990); (2) excavations on a sample of 29 small, or rural, sites in six study areas (the Roosevelt Rural Sites Study, completed by Statistical Research) (Ciolek-Torrello et al. 1990; Ciolek-Torrello, Shelley, and Benaron 1994); and (3) excavations at 29 sites within a continuous 4-mile study area along the north side of the Salt River at the east end of Roosevelt Lake (the Roosevelt Community Development Study, undertaken by Desert Archaeology) (Doelle et al. 1992; Elson and Swartz 1994; Elson et al. 1994) (Figure 1).

CULTURE HISTORY

The history of the cultural occupation of the upper Salt River Valley is fairly well known only from approximately A.D. 800 to 1450 (Figure 2). Evidence of occupation prior to and after that time is limited; thus, interpretations must be drawn from broad regional comparisons along with the sparse data from the study area.

The Preceramic Periods

Prehistoric lifeways prior to the ceramic periods (post-A.D. 100) are represented by the Paleoindian and Archaic periods. During the Paleoindian period, circa 10,000-8000 B.C., prehistoric hunters followed large Pleistocene mammals such as mammoth and bison as their primary means of subsistence. The climate during this time was cooler and moister than today. As it became drier and the weather pattern changed from winter-dominant moisture to summer monsoon rains, the megafauna became extinct. In the Archaic period, circa 8000 B.C. - A.D. 100, hunters concentrated on smaller game such as deer, and seasonal residence patterns were based on the availability of wild plants that were gathered to supplement the diet.

Although there is no evidence of Paleoindian occupation along the upper Salt River, two Clovis projectile points (ca. 9500-9000 B.C.) have been found, one at Gila Pueblo and one on the east side of Tonto Creek near Punkin Center (Huckell 1982:Figures 2 and 7), suggesting that early big-game hunters passed through the area in pursuit of food. Evidence of the Archaic period is more widespread, although site density is low and sites often occur away from the river; however, traces of Archaic occupation are probably partially obscured by flooding, the ephemeral nature of the sites, and later occupations. Archaic manifestations have been found in the upper Tonto Basin, on the Mazatzal piedmont (Ciolek-Torrello 1987), along lower Cherry Creek (Wells 1971), near the Roosevelt Lake area (Rice 1990), and in the Payson Basin (Huckell 1978). In the Mazatzal piedmont, Ciolek-Torrello (1987:253-257) described Archaic sites as large, dense scatters of diverse lithic materials probably representing base camps and work areas. Most of these sites occurred on the upper slopes of terraces along the middle of the Corral Creek Valley (Ciolek-Torrello 1987:277).

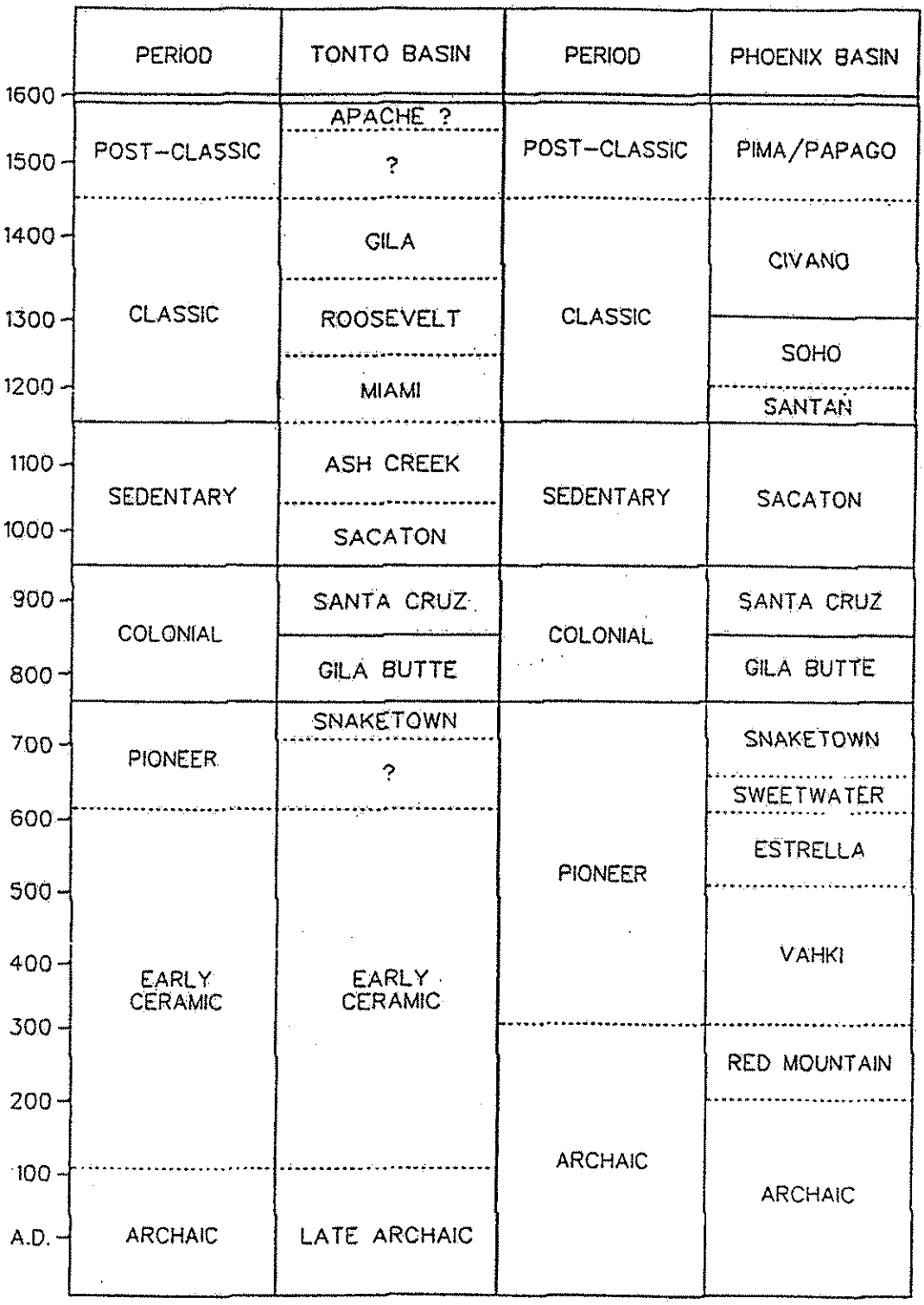

FIGURE 2

Chronological framework for the Tonto Basin compared with the Phoenix Basin

The Pre-Classic Periods

The early, or pre-Classic, periods are represented primarily by the Hohokam tradition in the western portion of the upper Salt River and by the Mogollon cultural phenomenon in the eastern portion. Recent investigations for the Roosevelt Community Development Study, however, have determined that the Eagle Ridge Site, located east of Roosevelt Lake and on a small ridge on the north side of the Salt River, "is now the earliest documented ceramic period site in the Tonto Basin, and it provides definitive evidence for an indigenous pre-Hohokam population" (Elson and Swartz 1994:vii). The initial occupation, which dates between A.D. 100 and 600, potentially includes 50-60 pit houses, with evidence of maize agriculture, wild plant gathering, and hunting (Elson and Lindeman 1994:115). Data from this early component of the site show similarities to Hohokam, Mogollon, and Anasazi culture groups, suggesting to the researchers that there was an early pan-Southwestern culture at the same time that regional differentiation was emerging. This early period represented at the Eagle Ridge Site has been termed the Early Ceramic period, since it lacks specific cultural affiliation (Elson 1994). The Hohokam, Mogollon, and Western Pueblo traditions that influenced pre-Classic populations along the upper Salt River Valley are described below.

The Hohokam Tradition

The "core" of the Hohokam tradition, which begins approximately A.D. 300-500 with the introduction of pottery, is in the Phoenix Basin, along the lower Salt and middle Gila rivers. The Pioneer period, the earliest pre-Classic period (Figure 2), is typified by pit structures with clay-lined hearths, well-defined entryways, and a roof-support configuration of 2-4 posts, both inhumation and cremation burials, and a biseasonal settlement pattern in which permanent winter villages and temporary summer hamlets co-occurred. Houses varied in size and shape from small and square to large and rectangular. Structures excavated within the original townsite of Phoenix ranged from 9.62 square meters (m^2) to 18.62 m^2 in floor area (Cable and Doyel 1984:259). Smaller, oval, bent-pole structures, thought to represent field houses during the late Pioneer period, ranged between 7 m^2 and 13 m^2 in area (Cable et al. 1985). By the late Pioneer period, population had increased, and, in the core area, settlements began to aggregate into clusters and large-scale irrigation was adopted. During the next period, the Colonial (A.D. 750-950), there was a general expansion of Hohokam traits outside of the Phoenix Basin due to growing populations and an increase in interregional interaction through trade and social functions; other cultural manifestations were probably involved as well. Large agricultural villages emerged, as well as ballcourts, new pottery styles, ritual paraphernalia, and a new association of clay figurines with cremations. House size decreased, with habitation floor areas averaging approximately 9 m^2 and field houses averaging about 4-5 m^2. The Sedentary period, A.D. 950-1150, was characterized by stability. Hohokam material culture was at its peak aesthetically, while population continued to increase and the Hohokam tradition reached its greatest spatial extent. With the expansion of settlement onto land less accessible for canal irrigation, other agricultural techniques became more widespread. The exploitation of diverse wild plant and animal resources continued with an increasing reliance on agave (Gasser

1988; Huntington 1986:268). The average house size increased, ranging from approximately 13 m^2 to 15 m^2.

The Mogollon Tradition

The Mogollon tradition was centered in the mountainous regions of western New Mexico and eastern Arizona. Although the Mogollon tradition has been divided into five different branches (Mimbres, Pine Lawn, Forestdale, Black River/Point of Pines, and San Simon [Wheat 1955]) that reflect different ecological adaptations, a number of generally consistent characteristics define this broad tradition: (1) plain brown pottery from around A.D. 300, followed at approximately A.D. 700 by painted brownwares such as red-on-brown (with black-on-white ceramics in the western area) and slightly later by a red-on-white ware in the eastern region (Mitchell 1986:7-8); (2) round to subrectangular pit houses with narrow entryways prior to approximately A.D. 1000; and (3) surface masonry or cobble-lined structures after approximately A.D. 1000.

The Western Pueblo Tradition

This tradition is a blending of Mogollon and Anasazi traits found in east-central Arizona and western New Mexico after about A.D. 1000; some researchers believe that Hohokam elements occur here as well (Johnson 1965). The Western Pueblo tradition is characterized by multiroom surface masonry structures, sometimes enclosed in compounds, a planned site layout, both inhumation and cremation burials, and formal kivas (ceremonial structures). It is loosely defined by excavations in the Bylas area (east of San Carlos Lake on the Gila River) and the Globe-Miami area, and may represent "a localized branch of Mogollon adapted to the riverine environment" (Mitchell 1986:8).

Archaeological Evidence Around the Upper Salt River Valley

In the area near the confluence of the Verde River, Hohokam habitation sites occur along the Salt River throughout the pre-Classic sequence. Orme Reservoir survey data indicated that all but one of the 30 habitation sites were located on the first terrace of the river, and of the 14 smaller plant procurement sites, 2 were on the floodplain, 9 were on the river terrace, and 3 were in other zones (Canouts 1975:233, 244). The location of plant-procurement sites was thought to be based on water availability and maximum access to a variety of vegetation types (Canouts 1975:244). The largest sites and the greatest site density occurred during the Sedentary period. During this time sites were located at regular intervals along the Salt River (Canouts 1975:266), and other sites, including large habitations, were located in nonriverine settings; the Apache Trail Site, for example, is a large habitation site on the bajada of the Superstition Mountains (Greenwald 1987). It was occupied during the entire pre-Classic sequence and contained trash mounds, hornos (roasting pits), pit houses, burials, miscellaneous pits, and rock piles (Greenwald 1987).

In the Tonto Basin, Pioneer period occupation is represented by the Roosevelt 9:6 site (Haury 1932), Ushklish (Lekson, Elson, and Craig 1992:24), and the Deer Creek Site (Swartz 1992). Colonial period sites occur throughout the lower Tonto Basin (Elson 1994) and in the Globe-Miami area (Doyel 1978). Some of these sites, such as AZ V:11:11(ARS), which is near San Carlos, include a substantial number of Hohokam ceramics, while at others, such as the Deer Creek Site, the frequencies are low (Lekson, Elson, and Craig 1992:24-25). The Roosevelt studies have found that during the Sedentary period Cibola whitewares (Anasazi) replaced Hohokam-derived buffwares. This change, which occurred some time after A.D. 1025, in the late Sedentary period, identifies the Ash Creek phase (Figure 2). At the Meddler Point Site, ceramic affiliation was the only characteristic that appeared to change significantly. The site layout and material culture seemed to retain the Hohokam "look" (Craig and Clark 1994:196-198). Pre-Classic period structures excavated as part of the Roosevelt Rural Sites Study (RRSS) were larger than similar sites in the Phoenix Basin, averaging 19.5 m^2, and were usually subrectangular. In contrast, Sedentary period structures averaged 25.9 m^2 and were oval or subrectangular. The RRSS also found that during the Pioneer and Colonial periods, only a few, widely scattered small hamlets were located on the lower terraces of the floodplain (Ciolek-Torrello 1994a:669-670). During the Sedentary period, there is evidence that occupation expanded onto the higher terraces that form the bajada zone, although along the Salt River inhabitants continued to exploit the prime agricultural land in the floodplains of the Salt River and its tributaries.

East of the Tonto Basin, pre-Classic sites reflect Mogollon characteristics (Stafford 1978:25), although to the south, near the town of San Carlos, there is evidence for pre-Classic occupation by people whose settlements may exhibit predominantly Hohokam or Western Pueblo characteristics as well (Mitchell 1986). One habitation site displayed typical Hohokam traits such as pit houses, hornos, cremations, buffware pottery, and a canal segment. A late Colonial/Sedentary site contained two cobble-foundation rooms, similar to Mogollon field houses, and a Sedentary period site contained both pit house and roomblock (adobe-encased cobble-foundation rooms) occupations, the latter postdating the former. Ceramics indicated that the pit houses were of Mogollon affiliation; the architecture of the roomblock, with room floor areas ranging between 18 m^2 and 22 m^2, indicated that is was Western Pueblo (Mitchell 1986:57).

The Classic Period

The Classic period is best known for changes in architecture, from pit architecture to above-ground dwellings, and in material culture, although changes also occurred in demography, settlement pattern, and social organization. The Classic period is divided into the Miami, Roosevelt, and Gila phases (Figure 2), with the first phase representing a transitional time with mixed cultural patterns, including puebloan elements, and the other two phases reflecting the dominant Salado tradition. The Salado tradition, first identified by a series of pottery types such as Pinto, Gila, and Tonto polychromes, was represented by a complex of characteristics centered around the Tonto-Globe area. Other traits include puebloan architecture of coursed masonry or solid adobe, cliff dwellings, compounds or defense walls, and inhumation burials. There is considerable disagreement among archaeologists whether the tradition represents in situ development of earlier indigenous Hohokam populations (Doyel 1976:254), the migration of Puebloan people to the area (Gladwin and Gladwin 1935:27), a peripheral Hohokam manifestation of a distinct group that comprised the Hohokam regional tradition (Wood 1985; Wood et al. 1981), the migration of people from the Gila Valley near Safford (Steen et al. 1962), or in situ development from indigenous Mogollon populations (Whittlesey and Reid 1982). Since there is no commonly accepted view, the following discussion will treat the Salado phenomenon as a series of cultural characteristics that forms a tradition without emphasizing derivation.

The Miami phase is typified by large permanent settlements with up to five above-ground cobble-lined rooms and an enclosing wall. It is represented by AZ V:9:57(ASM), a site located on a ridge above Pinal Creek (Doyel 1978), sites in the Mazatzal piedmont (Ciolek-Torrello 1987), and sites excavated as part of the RRSS (Ciolek-Torrello 1994b). During this phase, habitation sites were dispersed throughout all environmental zones of the Tonto

Basin and adjacent areas. Along the Salt River, population was distributed in farmsteads and small hamlets on the terraces above the floodplain. Upland areas away from the river were associated with large numbers of field houses and agricultural features. Field-house data examined during the RRSS indicate that these sites served a variety of functions, including temporary storage associated with cultivation or extraction of wild plant foods and native cultivars and seasonal habitations associated with corn agriculture (Ciolek-Torrello 1994b:666). Most habitation sites were contained within small rectangular compounds, with functionally distinct rooms and granaries.

During the Roosevelt phase, Salado traits became a well recognized and distinctive regional tradition. The Roosevelt phase is marked by Pinto Polychrome and Roosevelt Black-on-white ceramics and generally small sites, with a maximum range of from 6 to 20 low-walled, boulder-outlined rooms, often surrounded by a compound wall. Rooms were scattered throughout the compound, and some were placed against the compound wall. Most sites were located on the floodplain terraces (Ciolek-Torrello et al. 1990:13). The Roosevelt Community Development (RCD) project investigations discovered that the platform mound and most of the compounds at the Meddler Point Site were occupied during the Roosevelt phase (Craig and Clark 1994:60). Residential compounds at this site were arranged in a dispersed rancher's pattern around a central plaza and platform mound complex (Craig and Clark 1994:175-176). Site data also showed an overlap in architectural styles during this phase, which included oval pit rooms and other structures, constructed of either upright cobbles with post-reinforced adobe or stacked cobbles with adobe.

During the Gila phase, population aggregated into large and compact multistory pueblos (often 150+ rooms) and compounds. Sites were larger than ever before, and Gila and Tonto polychromes were the hallmark ceramics of this phase. Sites representing the Gila phase include the Tonto Cliff Dwellings (Steen et al. 1962), Rye Creek Ruin (Gladwin 1957; Haury 1930), Gila Pueblo, Besh-ba-gowah, and Togetzoge. Smaller pueblos and specialized sites also contributed to the settlement pattern, which included abandonment of many areas such as the uplands, in favor of populations centralized into a few very large, nucleated pueblos.

The Protohistoric Period

After approximately A.D. 1450 there is no evidence for prehistoric occupation along the upper Salt River. The cause(s) for the abandonment of sites is unknown, although explanations for the collapse of the cultural system have included pressure from Apache raiders (Gladwin 1957), population decimation by disease, environmental degradation, and over-stressing of a complex and probably fragile social system (Wood 1986:11-12). Little information is available for the timespan between the collapse and the Historic Period, termed the Protohistoric Period (Wood 1989:29).

Protohistoric Western Apache and possibly Yavapai are thought to have occupied this general region (Ciolek-Torrello et al. 1990:15). Ferg (1992) believes that the Tonto Basin was used exclusively by the Yavapai from about A.D. 1540 to 1750, when the Apache also began to use the area. By about A.D. 1850, the Southern Tonto Apache controlled the Tonto Basin. Horticulture (small-scale irrigation and dry farming), hunting, and wild plant gathering were practiced, and small settlements comprised households whose members were related by extended family ties (Basso 1970:24). Sites contain wickiups (circular, perishable residential structures usually 3-5 m in diameter) and roasting pits; ceramics are occasionally present, and manos and metates (often salvaged from prehistoric sites) are infrequently present. An Apache camp site excavated in the Payson area consisted of three wickiups, a sweat lodge, and a wind break (Hohmann and Redman 1988). Other evidence of Apache occupation has been found in the Globe-Miami area (Doyel 1976, 1978), and in the Mazatzal Piedmont (Ciolek-Torrello 1987:335).

The Historic Period

Historic documentation of the upper Salt River basin began with the Coronado Expedition in 1540, but until the 1870s Euroamericans visited the river only to trap or follow the trails along the river. Historic sites thus are considered to date after about 1970. Historical archaeology on the upper Salt River has focused on dam construction camps, although a few other site types (including ranches, corrals, historic roads, and trash dumps) have been identified. The archaeology of the construction camp at Granite Reef Dam is described in Brown (1978). Hantman and McKenna (1985) describe the archaeology of O'Rourke's Camp, the construction camp of the private contractor at Roosevelt Dam; Ayres et al. (1994) describe the other Roosevelt Dam construction camps. The construction camps associated with Mormon Flat, Horse Mesa, and Stewart Mountain dams are described by Douglas et al. (1994). Each of these studies summarizes historical information about the construction of the dams and the ethnicity and daily lives of the workers. One of the most interesting conclusions of these studies is that a large number of the construction workers were Apaches; less than twenty years after the end of the Apache wars, most of the Western Apache were working on one of the largest, most technologically advanced construction projects in U.S. history.

ENVIRONMENTAL RECONSTRUCTIONS

Within recent years, enormous strides have been taken toward interpreting the prehistoric natural environment, particularly in the form of retrodictions and reconstructions. These studies have included the paleoclimatic and hydrological conditions of the lower Colorado Plateau, the paleobotanical and paleofaunal taxa native to the Salt River Valley that were used by prehistoric inhabitants, and the annual streamflow of the Salt River for the years A.D. 740 to 1370.

Euler et al. (1979) produced a paleoenvironmental record for the American Southwest by plotting geoclimatic and bioclimatic indicators for the Colorado Plateau. Data from tree rings, pollen records, and alluvial sediments were analyzed within a temporal framework, and fluctuations through time were noted (Table 2). Dean et al. (1985) used similar data to produce a model of interaction between the cultural system (prehistoric populations) and the natural system (environment) and to identify periods of stress. In general, low water tables and channel entrenchment, or degradation, would have had an adverse effect on agriculture; on the other hand, high effective moisture and aggradation, or surface stability, would have been favorable to the development of irrigation systems and other agricultural technologies. Variability in the dendroclimatic record might have produced some short-term responses to accommodate unusually high or low precipitation, such as relocation of agricultural fields or the expansion of irrigation systems (Dean et al. 1985:542-543).

The paleoenvironmental data provided in Table 2 for the annual discharge of the Salt River were reconstructed from a series of tree rings from the Salt and Verde River drainages for the period A.D. 740-1370 (Graybill 1989). The tree-ring series were calibrated with gaged records of Salt River flow (A.D. 1914-1979) and Verde River flow (A.D. 1895-1979). It was found that the average flow from A.D. 740-1370 was somewhat less than modern average flows, due to a larger number of extremely high flow events after A.D. 1800. The statistics for Salt River reconstructed flows are presented in Table 3. Tree-ring series used in the reconstructions are referred to as AZNOF, those taken from archaeological sites within the N and O Arizona geographic quadrangles and from the Flagstaff area, and as GRCMN, tree rings from archaeological sites near Grasshopper Ruin and from data published (Dean and Robinson 1978:19-20) as the Central Mountain North Chronology. According to reconstruction statistics, the summer flows were less variable than the winter flows and thus were more predictable in terms of average amount of flow.

Table 2. Environmental Reconstructions Applicable to the Salt River Valley

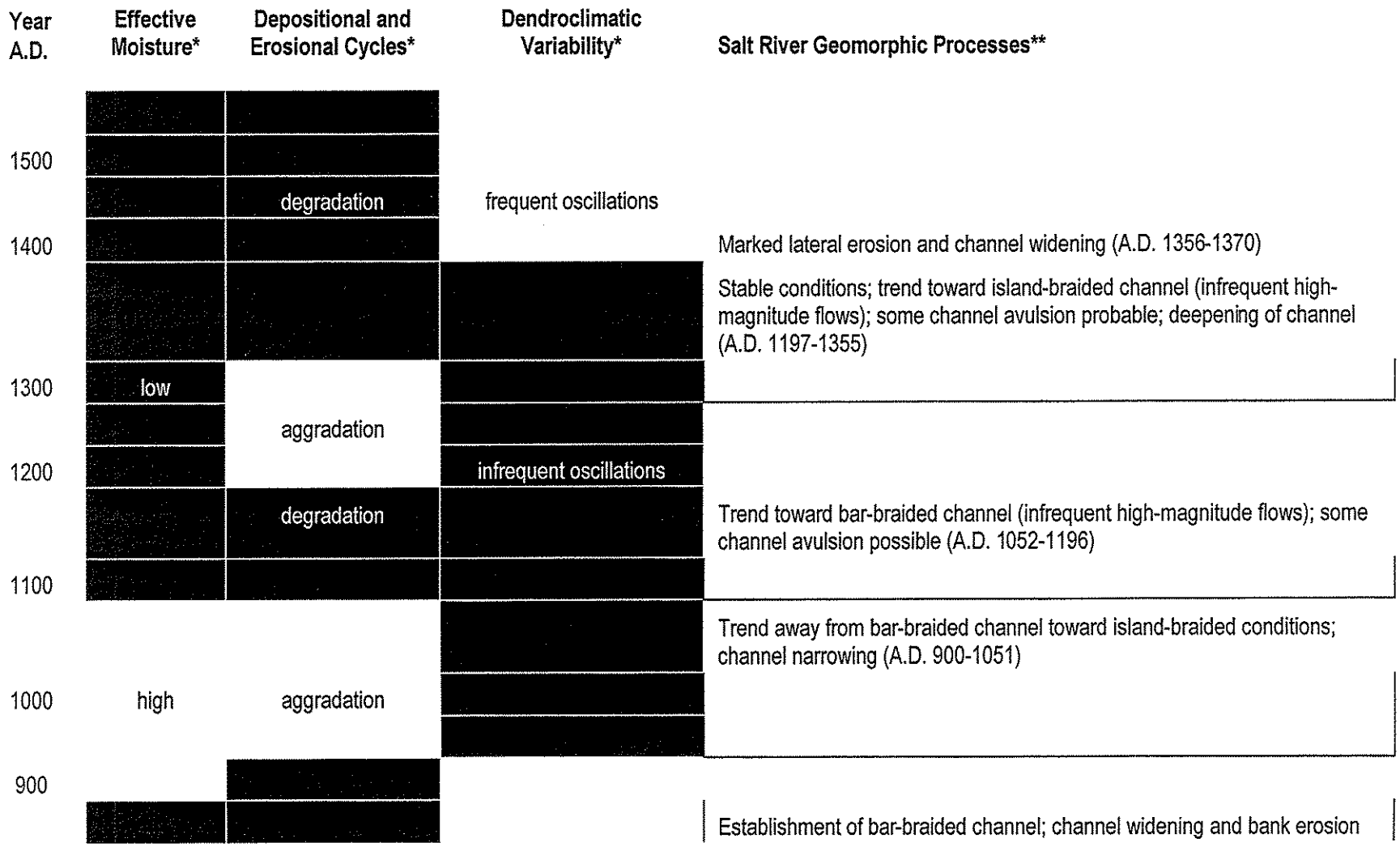

Table 2. Environmental Reconstructions Applicable to the Salt River Valley

Year A.D.	Effective Moisture*	Depositional and Erosional Cycles*	Dendroclimatic Variability*	Salt River Geomorphic Processes**
800	low	degradation	frequent oscillations	(A.D. 798-899)
				Channel stabilization (A.D. 740-797)
700	high	aggradation	infrequent oscillations	
600				

*From Masse 1991, after Dean et al. 1985 and Euler et al. 1979.
**From Gregory 1991, after Nials, Gregory, and Graybill 1989.

As part of the Roosevelt Rural Sites Study Statistical Research, Inc. developed Palmer Drought Severity Indices for local soils in the Tonto Basin (Rose 1994). Soil moisture conditions for early summer in the Tonto Basin from A.D. 740-1370 were reconstructed by using historic tree-ring width indices to derive the prehistoric tree-ring sequence and predict crop yield values per arable soil type. This information was then used to calculate an estimate of maximum annual maize supply potentially available from various agricultural techniques and the maximum yearly population size that could be supported by the annual maize supply (Van West and Altschul 1994:365). Using a model of non-canal irrigation systems, it was determined that there were 71 extremely dry years and 49 extremely wet years in the lower Tonto Basin between A.D. 740 and 1370, with a total of 38 extremely wet or dry years in the Colonial period (A.D. 750-949), 27 during the Sedentary period (A.D. 950-1149), 34 in the early Classic (A.D. 1150-1299), and 15 during the late Classic (A.D. 1300-1370). The authors interpret the data to mean that "the Sedentary period, particularly between A.D. 1042 and 1134, was likely the era of greatest predictability in agricultural production in the Tonto Basin" (Van West and Altschul 1994:404). This time period corresponds to apparent population expansion in the lower Tonto Basin.

Prehistorically, the floodplain and terraces of the Salt River contained a wide variety of plant and animal species. In recent times desertification and reduction in this habitat (Crosswhite 1981:67; Hastings and Turner 1965; Rea 1983) have decreased species diversity and changed some of the types of flora and fauna that characterize the Sonoran Desert landscape. Man's influence over only the past 100 years has created changes along the river in the amount of groundwater, erosion, and depletion of native vegetation. The riparian forest is mostly gone or replaced by feral salt cedar, and weedy species proliferate. The water table, previously a few feet below the surface, now averages hundreds of feet underground (Rea 1983:3). The archaeological and historic records document the change in riparian and desert scrub communities from historic to modern times, yet the natural resources used prehistorically by the Hohokam have remained relatively constant. Data from pollen, macrobotanical, and faunal remains from archaeological sites indicate that there were no radical differences in the natural environment prehistorically.

Table 3. Statistical Description of Actual and Reconstructed Flows for the Salt River: July-June, October-April, and Summer (Estimated)

	A.D. 1914-1979			A.D. 1800-1979	A.D. 740-1370
Statistic	**Actual**	**Reconstructed**		**Reconstructed**	**Reconstructed**
		GRCMN	**AZNOF**	**GRCMN**	**GRCMN and AZNOF**
Jul-Jun					
mean	626.42	554.63	556.83	568.24	537.91
s.d.	497.34	291.66	318.57	339.56	237.25
Oct-Apr					
mean	458.63	399.21	393.29	408.10	376.82
s.d.	413.13	243.89	261.04	289.78	192.60
Statistic	**Actual**		**Estimated**	**Estimated**	**Estimated**
Summer[1]					
mean	167.79		160.41	160.14	161.09
s.d.	103.56		49.65	53.87	45.93

Note: From Graybill 1989
[1]Summer flow in thousands of acre-feet. Actual summer flow includes the values for July, August, and September plus May and June of the succeeding year. Estimated summer flow is the simple remainder resulting from subtraction of the October-April reconstructed values from the July-June reconstructed values.
s.d. = standard deviation

PREHISTORIC AGRICULTURAL POTENTIAL

The potential for prehistoric agriculture along the upper Salt River Valley was highest in the lower Tonto Basin. From the confluence of the White and Black rivers, the Salt River descends rapidly through a rugged, bedrock-confined canyon before discharging into Lake Roosevelt. The river emerges from its narrow canyon about 17 miles above Roosevelt Dam (Welch 1994:32), and, according to Gregory (1979:2), the alluvial floodplain around Roosevelt Lake is the first place where water from the upper Salt River would have been available for canal irrigation. Although floodwater farming and farming with the aid of rock features such as alignments and rock piles for collecting runoff are evident in many areas excavated to date, there are very few examples of canal irrigation. Five examples of prehistoric canals are given by Van West and Altschul (1994:362-363): (1) multiple canals in the vicinity of the Tonto Cliff Dwellings that are now inundated by Lake Roosevelt (Tagg 1985:31); (2) a possible canal segment east of the Armer Ruin complex on the north side of the Salt River (Wood 1986:Figure 4); (3) a canal off of Tonto Creek one mile upstream from the VIV Ruin (Wood 1989:36); (4) a canal segment in the Livingston Group study area near a residential compound (Jacobs et al. 1992:16); and (5) a canal on the south side of the Salt River being investigated as part of the Roosevelt platform mound study (Van West and Altschul 1994:363). All of these canals date to the Classic period. A Colonial period canal was reported by Mitchell (1986) on the San Carlos River, and although pre-Classic canals have not been identified along the upper Salt River to date, there is good reason to assume that some were probably in use. Wood (1986) has pointed out that before Lake Roosevelt was formed, 44 miles of irrigable perennial stream coursed along the Salt River and Tonto Creek, and according to Van West and Altschul (1994:404), there were years during the A.D. 740-1370 period when climates were so extreme as to have encouraged the development of and dependence on irrigation systems in the lower Tonto Basin.

SUMMARY AND CONCLUSIONS

In summary, archaeological studies in the upper Salt River area have documented some 11,000 years of human use of the region. People began practicing agriculture in the study area about A.D. 100, and most agricultural settlements were in the lower Tonto Basin, which provided the best conditions for agriculture. Archaeological reconstructions of streamflow suggest that although streamflow changed little between A.D. 740-1370 and A.D. 1800-1979, floodwater farming was apparently more important than irrigation agriculture in the prehistoric period. Archaeological research has not documented any use of the river for commercial trade and travel or for any regular flotation of logs.

REFERENCES

Ahlstrom, Richard V. N., R. Thomas Euler, and David P. Doak
1993 *A Cultural Resource Survey of 2600 Acres of Tonto National Forest and Patented Land near Miami, Gila, and Pinal Counties, Arizona: The Carlota Project.* SWCA Archaeological Report No. 93-46. SWCA, Inc., Environmental Consultants, Tucson.

Ayres, James E., A. E. Rogge, Melissa Keane, Diane L. Douglas, Everett J. Bassett, Diane L. Fenicle, Cindy L. Myers, Bonnie J. Clark, and Karen Turnmire
1994 *The Historical Archaeology of Dam Construction Sites in Central Arizona: Sites in the Roosevelt Dam Area.* Dames & Moore Intermountain Cultural Resource Services Research Paper No. 11, Vol. 2A. Phoenix.

Bandelier, Adolph F.
1892 *Final Report of Investigations among the Indians of the Southwestern United States Carried on Mainly in the Years 1880 to 1885.* Papers of the Archaeological Institute of America, American Series, Vol. 4, Part 2. J. Wilson & Son, Cambridge, England.

Basso, Keith H.
1970 *The Cibecue Apache.* Holt Rinehart and Winston, New York.

Brown, Patricia E.
1978 *Archaeological Investigations at AZ:6:2 (ASU), an Historic Camp on the Banks of the Salt River, Maricopa County, Arizona (Granite Reef Dam).* Office of Cultural Resource Management Report No. 32. Arizona State University, Tempe.

Cable, John S., and David E. Doyel
1984 The Implications of Field Houses for Modeling Hohokam Agricultural Systems. In *City of Phoenix Archaeology of the Original Townsite: Murphy's Addition*, edited by John S. Cable, Susan L. Henry, and David E. Doyel, pp. 259-270. Soil Systems Publications in Archaeology No. 3. Phoenix.

Cable, John S., Kathleen S. Hoffman, David E. Doyel, and Frank Ritz (editors)
1985 *City of Phoenix Archaeology of the Original Townsite: Block 24-East.* Soil Systems Publications in Archaeology No. 8. Phoenix.

Canouts, Veletta (assembler)
1975 *An Archaeological Survey of the Orme Reservoir.* Arizona State Museum Archaeological Series No. 92. University of Arizona, Tucson.

Ciolek-Torrello, Richard
1987 *Archaeology of the Mazatzal Piedmont, Central Arizona.* 2 vols. Museum of Northern Arizona Research Paper No. 33. Flagstaff.

1994a Some Thoughts on Rural Settlement. In *The Roosevelt Rural Sites Study: Prehistoric Rural Settlements in the Tonto Basin*, edited by Richard Ciolek-Torrello, Steven D. Shelley, and Su Benaron, pp. 669-688. Statistical Research Technical Series No. 28, Vol. 2, Part 2. Tucson.

1994b Settlement Type and Function. In *The Roosevelt Rural Sites Study: Prehistoric Rural Settlements in the Tonto Basin*, edited by Richard Ciolek-Torrello, Steven D. Shelley, and Su Benaron, pp. 623-668. Statistical Research Technical Series No. 28, Vol. 2, Part 2. Tucson.

Ciolek-Torrello, Richard, Steven D. Shelley, Jeffrey H. Altschul, and John Welch
1990 *The Roosevelt Rural Sites Study Research Design.* Statistical Research Technical Series No. 28, Vol. 1. Tucson.

Ciolek-Torrello, Richard, Steven D. Shelley, and Su Benaron (editors)
1994a *The Roosevelt Rural Sites Study: Prehistoric Rural Settlements in the Tonto Basin.* 2 parts. Statistical Research Technical Series No. 28, Vol. 2. Tucson.

Craig, Douglas B., and Jeffery J. Clark
1994 The Meddler Point Site. In *The Roosevelt Community Development Study: Meddler Point, Pyramid Point, and Griffin Wash Sites*, by Mark D. Elson, Deborah L. Swartz, Douglas B. Craig, and Jeffery J. Clark, pp. 1-198. Center for Desert Archaeology Anthropological Papers No. 13, Vol. 2. Tucson.

Crosswhite, Frank S.
1981 Desert Plants, Habitat and Agriculture in Relation to the Major Pattern of Cultural Differentiation in the O'odham People of the Sonoran Desert. *Desert Plants* 3(2):47-76.

Dames and Moore
1979 First Level Environmental Inventory, Central Arizona Water Control Study. 2 vols. Working paper. Ms. on file, Dames and Moores, Inc., Phoenix.

Dean, Jeffrey S., Robert C. Euler, George J. Gumerman, Fred Plog, Richard H. Hevley, and Thor N. V. Karlstrom
1985 Human Behavior, Demography, and Paleoenvironment on the Colorado Plateaus. *American Antiquity* 50:537-554.

Dean, Jeffrey S., and William J. Robinson
1978 *Expanded Tree-Ring Chronologies for the Southwestern United States.* Chronology Series No. 3. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Doelle, William H., Henry D. Wallace, Mark D. Elson, and Douglas B. Craig
1992 *Research Design for the Roosevelt Community Development Study.* Center for Desert Archaeology Anthropological Papers No. 12. Tucson.

Douglas, Diane L., A. E. Rogge, Karen Turnmire, Melissa Keane, James E. Ayres, Everett J. Bassett, and Cindy L. Myers
1994 *The Historical Archaeology of Dam Construction Sites in Central Arizona: Sites at Other Dams along the Salt and Verde Rivers.* Dames & Moore Intermountain Cultural Resource Services Research Paper No. 13, Vol. 2C.. Phoenix.

Doyel, David E.
1976 Revised Phase System for the Globe-Miami and Tonto Basin Areas, Central Arizona. *The Kiva* 42:241-266.

1978 *The Miami Wash Project: Hohokam and Salado in the Globe-Miami Area, Central Arizona.* Contribution to Highway Salvage Archaeology in Arizona No. 52. Arizona State Museum, University of Arizona, Tucson.

Effland, Richard W., Jr., and Barbara S. Macnider
1991 *An Overview of the Cultural Heritage of the Tonto National Forest.* Cultural Resources Report No. 49. Archaeological Consulting Services, Ltd., Tempe.

Elson, Mark D.
1994 Introduction. In *The Roosevelt Community Development Study: Introduction and Small Sites*, by Mark D. Elson and Deborah L. Swartz, pp. 1-22. Center for Desert Archaeology Anthropological Papers No. 13, Vol. 1. Tucson.

Elson, Mark D., and Michael Lindeman
1994 The Eagle Ridge Site. In *The Roosevelt Community Development Study: Introduction and Small Sites*, by Mark D. Elson and Deborah L. Swartz, pp. 23-116. Center for Desert Archaeology Anthropological Papers No. 13, Vol. 1. Tucson.

Elson, Mark D., and Deborah L. Swartz
1994 *The Roosevelt Community Development Study: Introduction and Small Sites.* Center for Desert Archaeology Anthropological Papers No. 13, Vol. 1. Tucson.

Elson, Mark D., Deborah L. Swartz, Douglas B. Craig, and Jeffery J. Clark
1994 *The Roosevelt Community Development Study: Meddler Point, Pyramid Point, and Griffin Wash Sites.* Center for Desert Archaeology Anthropological Papers No. 13, Vol. 1. Tucson.

Euler, Robert C., George J. Gumerman, Thor N. V. Karlstrom, Jeffrey S. Dean, and Richard H. Hevly
1979 The Colorado Plateaus: Cultural Dynamics and Paleoenvironment. *Science* 205:1089-1101.

Ferg, Alan
1992 Western Apache and Yavapai Pottery and Features from the Rye Creek Project. In *The Rye Creek Project: Archaeology in the Upper Tonto Basin: Synthesis and Conclusions,* edited by Mark D. Elson and Douglas B. Craig, pp. 3-28. Center for Desert Archaeology Anthropological Papers No. 11, Vol. 3. Tucson.

Ferg, Alan, and Kurt Dongoske
1980 An Archaeological Survey Investigation of Arizona Department of Transportation Project F-053-1-511, SR 87 from Ord Mine Road to Junction with SR 188, Tonto National Forest, Gila County, Arizona. Ms. on file, Arizona State Museum, Tucson.

Fuller, Steven L., A. E. Rogge, and Linda M. Gregonis
1976 *Orme Alternatives: The Archaeological Resources of Roosevelt Lake and Horseshoe Reservoir.* Arizona State Museum Archaeological Series No. 98, Vol. 1. University of Arizona, Tucson.

Gasser, Robert
1988 Flotation Studies. In *Hohokam Settlement along the Slopes of the Picacho Mountains: Environment and Subsistence,* edited by Donald E. Weaver, Jr., pp. 143-235. Museum of Northern Arizona Research Paper No. 35, Vol. 5. Flagstaff.

Gladwin, Harold S.
1957 *A History of the Ancient Southwest.* Bone-Wheelwright, Portland, Maine.

Gladwin, Winifred, and Harold S. Gladwin
1929 *The Red-on-buff Culture of the Gila Basin.* Medallion Papers No. 3. Gila Pueblo, Globe, Arizona.

1930 *The Western Range of the Red-on-buff Culture.* Medallion Papers No. 5. Gila Pueblo, Globe, Arizona.

1935 *The Eastern Range of the Red-on-buff Culture.* Medallion Papers No. 16. Gila Pueblo, Globe, Arizona.

Grady, Mark
1974 *Archaeological Sites within the Copper Cities Mine Area: A Preliminary Report.* Arizona State Museum Archaeological Series No. 55. University of Arizona, Tucson.

Graybill, Donald A.
1989 The Reconstruction of Prehistoric Salt River Streamflow. In *The 1982-1984 Excavations at Las Colinas: Environment and Subsistence,* by Donald A. Graybill, David A. Gregory, Fred L. Nials, Suzanne K. Fish, Robert E. Gasser, Charles H. Miksicek, and Christine R. Szuter, pp. 25-38. Arizona State Museum Archaeological Series No. 162. University of Arizona, Tucson.

Greenwald, David H.
1987 *Archaeological Investigations at the Apache Trail Site (NA19,509), Apache Junction, Arizona.* Department of Anthropology, Museum of Northern Arizona, Flagstaff.

Gregory, David A.
1979 The Tonto-Roosevelt Area. In *An Archaeological Survey of the Cholla-Saguaro Transmission Line Corridor*, edited by Lynne S. Teague and Linda Mayro, pp. 175-265. Arizona State Museum Archaeological Series No. 135, Vol. 1. University of Arizona, Tucson.

1991 Form and Variation in Hohokam Settlement Pattern. In *Chaco and Hohokam: Prehistoric Regional Systems in the American Southwest*, edited by Patricia L. Crown and W. James Judge, pp. 159-193. School of American Research Press, Santa Fe.

Hantman, Jeffrey L., and Jeanette A. McKenna
1985 *O'Rourke's Camp: Social Archaeology of an Early Twentieth Century Construction Town.* Anthropological Field Studies No. 7. Arizona State University, Tempe.

Hastings, James R., and Raymond M. Turner
1965 *The Changing Mile: An Ecological Study of Vegetation Change with Time in the Lower Mile of an Arid and Semi-Arid Region.* University of Arizona Press, Tucson.

Haury, Emil W.
1930 A Report on Excavations at the Rye Creek Ruin. Ms. on file, USDA Forest Service, Tonto National Forest, Phoenix.

1932 *Roosevelt 9:6: A Hohokam Site of the Colonial Period.* Medallion Papers No. 4. Gila Pueblo, Globe, Arizona.

1934 *Canyon Creek Ruin and the Cliff Dwellings of the Sierra Ancha.* Medallion Papers No. 14. Gila Pueblo, Globe, Arizona.

Hohmann, John W., and Linda B. Kelley
1988 *Erich F. Schmidt's Investigations of Salado Sites in Central Arizona: The Mrs. W. B. Thompson Archaeological Expedition of the American Museum of Natural History.* Museum of Northern Arizona Bulletin No. 56. Flagstaff.

Hohmann, John W., and Charles L. Redman
1988 *Continuing Studies in Payson Prehistory.* Arizona State University Anthropological Field Studies No. 21. Tempe.

Huckell, Bruce
1978 *The Oxbow Hill-Payson Project.* Contributions to Highway Salvage Archaeology in Arizona No. 48. Arizona State Museum, The University of Arizona, Tucson.

1982 *The Distribution of Fluted Points in Arizona: A Review and an Update.* Arizona State Museum Archaeological Series No. 145. University of Arizona, Tucson.

Huntington, Fredrick W.
1986 *Archaeological Investigations at the West Branch Site: Early and Middle Rincon Occupation in the Southern Tucson Basin.* Institute for American Research Anthropological Paper No. 5. Tucson.

Jacobs, D. F., G. E. Rice, O. Lindauer, A. W. Simon, J. L. Cameron, J. P. Dering, S. K. Fish, C. A. Griffith, J. D. Irish, D. W. Kintigh, J. C. Ravesloot, M. H. Regan, K. A. Spielmann, and C. G. Turner, II
1992 *Roosevelt Platform Mound Study: Report on the Livingston Management Group.* Roosevelt Monograph Series No. 3 and Archaeological Field Studies No. 20. Office of Cultural Resource Management, Arizona State University, Tempe.

Jeter, Marvin D.
1978 *The Reno-Park Creek Project.* Contributions to Highway Salvage Archaeology in Arizona No. 49. Arizona State Museum, University of Arizona, Tucson.

Johnson, Alfred E.
1965 *The Development of Western Pueblo Culture.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Lange, Charles H., and Carroll L. Riley (editors)
1970 *The Southwestern Journals of Adolph F. Bandelier, 1883-1884.* University of New Mexico Press, Albuquerque.

Lekson, Stephen H., Mark D. Elson, and Douglas B. Craig
1992 Previous Research and Culture History. In *Research Design for the Roosevelt Community Development Study,* by William H. Doelle, Henry D. Wallace, Mark D. Elson, and Douglas B. Craig, pp. 19-34. Center for Desert Archaeology Anthropological Papers No. 12. Tucson.

Longacre, William A., and J. Jefferson Reid
1974 The University of Arizona Archaeological Field School at Grasshopper: Eleven Years of Multidisciplinary Research and Teaching. *The Kiva* 40(1-2):3-38.

Masse, W. Bruce
1991 The Quest for Subsistence Sufficiency and Civilization in the Sonoran Desert. In *Chaco and Hohokam: Prehistoric Regional Systems in the American Southwest,* edited by Patricia L. Crown and W. James Judge, pp. 195-223. School of American Research Press, Santa Fe.

Mitchell, Douglas R.
1986 *Hohokam, Mogollon, and Western Pueblo Settlement Systems in the San Carlos River Valley, Arizona.* Archaeological Research Services, Inc., Tempe.

Mitchell, Douglas R., and M. Zyniecki
1994 *The Carlota Copper Mine Testing Project: Prehistoric Occupation in the Globe Uplands, Gila and Pinal Counties, Arizona.* SWCA Archaeological Report No. 94-30. SWCA, Inc., Environmental Consultants, Flagstaff and Phoenix.

Morris, Donald H.
1970 Walnut Creek Village: A Ninth Century Hohokam-Anasazi Settlement in the Mountains of Central Arizona. *American Antiquity* 35:49-61.

Nials, Fred L., David A. Gregory, and Donald A. Graybill
1989 Salt River Streamflow and Hohokam Irrigation Systems. In *The 1982-1984 Excavations at Las Colinas: Environment and Subsistence,* by Donald A. Graybill, David A. Gregory, Fred L. Nials, Suzanne K. Fish, Robert E. Gasser, Charles H. Miksicek, and Christine R. Szuter, pp. 59-76. Arizona State Museum Archaeological Series No. 162, Vol. 5. University of Arizona, Tucson.

Rea, Amadeo Michael
1983 *Once a River: Bird Life and Habitat Changes on the Middle Gila.* University of Arizona Press, Tucson.

Redman, Charles L., Glen E. Rice, and Kathryn E. Pedrick (editors)
1992 *Developing Perspectives on Tonto Basin Prehistory.* Roosevelt Monograph Series No. 2 and Anthropological Field Studies No. 26. Office of Cultural Resource Management, Arizona State University, Tempe.

Reid, J. Jefferson (editor)
1982 *Cholla Project Archaeology: The Tonto Roosevelt Region.* Arizona State Museum Archaeological Series No. 161, Vol. 4. University of Arizona, Tucson.

Rice, Glen E. (editor)
1990 *A Design for Salado Research.* Roosevelt Monograph Series No. 1 and Anthropological Field Studies No. 22. Office of Cultural Resource Management, Arizona State University, Tempe.

Rice, Glen E., and Todd W. Bostwick (editors)
1986 Studies in the Prehistory of Central Arizona: The Central Arizona Water Control Study. vol. 2, part 1. Anthropological Field Studies. Ms. on file, Office of Cultural Resource Management, Arizona State University, Tempe. Draft.

Rice, Glen E., and Rachel Most
1984 Research Issues in the Prehistory of Central Arizona: The Central Arizona Water Control Study. vol. 1. Anthropological Field Studies. Ms. on file, Office of Cultural Resource Management, Arizona State University, Tempe. Draft.

Rose, Martin R.
1994 Long Term Drought Reconstructions for the Lake Roosevelt Region. In *The Roosevelt Rural Sites Study: Changing Land Use in the Tonto Basin*, edited by Richard Ciolek-Torrello and John R. Welch, pp. 311-360. Statistical Research Technical Series No. 28, Vol. 3. Tucson.

Schmidt, Erich F.
1926 The Mrs. William Boyce-Thompson Expedition. *Natural History* 26(6):635-644.

Stafford, C. Russell
1978 *Archaeological Investigations at Seneca Lake, San Carlos Indian Reservation, Arizona.* Arizona State University Technical Paper No. 1 and Anthropological Research Paper No. 14. Tempe.

Steen, Charlie R., Lloyd M. Pierson, Vorsila L. Bohrer, and Kate Peck Kent
1962 Excavations at the Upper Ruin, Tonto National Monument, 1940. In *Archaeological Studies at Tonto National Monument, Arizona*, edited by Louis P. Caywood, pp. 1-30. Southwestern Monuments Association Technical Series No. 2. Globe, Arizona.

Swartz, Deborah L.
1992 The Clover Wash Site, AZ O:15:100(ASM). In *The Rye Creek Project: Archaeology in the Upper Tonto Basin: Introduction and Site Descriptions*, edited by Mark D. Elson and Douglas B. Craig, pp. 189-209. Center for Desert Archaeology Anthropological Papers No. 11, Vol. 1. Tucson.

Tagg, Martyn D.
1985 *Tonto National Monument: An Archaeological Survey.* Western Archeological and Conservation Center Publications in Anthropology No. 31. USDI National Park Service, Tucson.

Teague, Lynn S., and Linda L. Mayro (assemblers)
1979 *An Archaeological Survey of the Cholla-Saguaro Transmission Line Corridor.* Arizona State Museum Archaeological Series No. 135. University of Arizona, Tucson.

Van West, Carla R., and Jeffrey H. Altschul
1994 Agricultural Productivity and Carrying Capacity in the Tonto Basin. In *The Roosevelt Rural Sites Study: Changing Land Use in the Tonto Basin*, edited by Richard Ciolek-Torrello and John R. Welch, pp. 361-436. Statistical Research Technical Series No. 28, Vol. 3. Tucson

Vickrey, Irene
1939 Besh-ba-gowa. *The Kiva* 4:19-22.

1945 Inspiration 1. *The Kiva* 10:22-28.

Welch, John R.
1994 Environmental Influences on Tonto Basin Agricultural Productivity and Sustainability. In *The Roosevelt Rural Sites Study: Changing Land Use in the Tonto Basin*, edited by Richard Ciolek-Torrello and John R. Welch, pp. 19-40. Statistical Research Technical Series No. 28, Vol. 3. Tucson.

Wells, Wesley
1971 Prehistoric Settlement Patterns of Lower Cherry Creek. Ms. on file, Department of Anthropology, Arizona State University, Tempe.

Wheat, Joe Ben
1955 *Mogollon Culture Prior to A.D. 1000.* Memoirs of the Society for American Archaeology No. 10. Society for American Archaeology, Salt Lake City.

Whittlesey, Stephanie M., and J. Jefferson Reid
1982 Cholla Project Perspectives on Salado. In *Cholla Project Archaeology: Introduction,* edited by J. Jefferson Reid, pp. 63-80. Arizona State Museum Archaeological Series No. 161, Vol. 1. University of Arizona, Tucson.

Windmiller, Ric
1971 *A Partial Archaeological Survey of the Castle Dome-Pinto Creek Project Area, near Miami, Arizona.* Arizona State Museum Archaeological Series No. 5. University of Arizona, Tucson.

1973 *An Archaeological Survey of the Castle Dome-Pinto Creek Project Area, near Miami, Arizona: Final Report.* Arizona State Museum Archaeological Series No. 22. University of Arizona, Tucson.

Wood, J. Scott
1980 The Gentry Timber Sale: Behavioral Patterning and Predictability in the Upper Cherry Creek Area, Central Arizona. *The Kiva* 16(1-2):99-119.

1985 The Northeastern Periphery. In *Proceedings of the 1983 Hohokam Symposium,* edited by Alfred E. Dittert, Jr., and Donald E. Dove, pp. 239-262. Arizona Archaeological Society Occasional Paper No. 2, Part 1. Phoenix.

1986 Vale of Tiers: Tonto Basin in the 14th Century. Paper presented at the 59th Annual Pecos Conference, Shoofly Village Ruin, Payson, Arizona.

1989 *Vale of Tiers, Too: Late Classic Period Salado Settlement Patterns and Organizational Models for Tonto Basin.* Tonto National Forest Cultural Resources Inventory Report No. 89-12-280. USDA Forest Service, TNF, Phoenix.

Wood, J. Scott, Martin E. McAllister, Brent L. Woodward, and Dorothy M. Goddard
1981 *Salado: An Introduction to the Archaeology of the Tonto National Forest, Arizona.* Tonto National Forest Cultural Resources Inventory Report No. 80-99. USDA Forest Service, TNF, Phoenix.

Wood, J. Scott, and Linda B. Kelley
1987 *Ruined Cities: Archaeological Investigations in Tonto Basin by Adolph Bandelier, 1883.* Tonto National Forest Cultural Resources Inventory Report No. 87-69. USDA Forest Service, TNF, Phoenix.

Arizona Stream Navigability Study
for the
Salt River:
Granite Reef Dam to the Confluence of the White and Black Rivers

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Section 3

HISTORICAL OVERVIEW OF THE UPPER SALT RIVER, ARIZONA

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HISTORICAL OVERVIEW OF THE UPPER SALT RIVER

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INTRODUCTION

Historical accounts of the upper Salt River provide abundant evidence about the flow regime of the river, uses of the river, diversions from the river, impediments to boating on the river, examples of boating and floating logs down the river, types of vessels used on the river, and customary modes of transportation in the region. Although Spanish accounts of the river may date as early as A.D. 1540, most historical accounts of the river and the surrounding region date to the nineteenth and twentieth centuries.

Prior to the 1860s, the upper Salt River area was occupied exclusively by the Yavapai and Apache. Fort McDowell, on the Verde River 7 miles above its confluence with the Salt, was established in 1865, and farms quickly sprang up around it to supply the soldiers. Camp Ord (Fort Apache) was established in 1870. Crook's campaign of 1872-1873 subdued the Apaches of the Tonto Basin and opened the area to white settlement. Mining south of the Salt River led to development of the salt works on the river at the mouth of Salt River Draw (below the mouth of Cibecue Creek). Ranching and limited farming were practiced throughout the Tonto Basin, and a few small communities (including Armer, Livingston, Cline, and Catalpa) were established along the Salt. In 1885 the Arizona Diversion Dam, located approximately three-quarters of a mile downstream from the confluence of the Verde and the Salt rivers, was completed and began to supply water to fields in the Salt River valley on the north side of the river. Between about 1903 and 1911, Roosevelt Dam was constructed just below the confluence of Tonto Creek and the Salt River. In 1905 floods damaged the Arizona Dam, and in 1908 it was replaced by Granite Reef Dam 3 miles below the Salt-Verde confluence. In the 1920s and 1930s, three additional dams (Mormon Flat, Horse Mesa, and Stewart Mountain) were completed along the Salt River.

Historic accounts of the upper Salt River describe it as flowing year-round, although fluctuating seasonally. Many early writers emphasized the almost impenetrable canyons of the Salt River, which opened up in only a few places, such as the Tonto Basin, Mormon Flat, and the mouth of the Verde River.

Historical accounts also provide evidence for boating on the river, both commercial and recreational. The Boy Scouts of America and the Sierra Club initiated modern recreational rafting on the upper Salt River in the late 1950s.

HISTORICAL OVERVIEW/CHRONOLOGY

Historical documentation of the upper Salt River began with the Spanish, who provided brief descriptions that are often vague about the exact locations being discussed. During the Mexican period (1821 to 1848), the upper Salt River was described by trappers from the United States, whose accounts are also vague. With the establishment of Fort McDowell on the lower Verde River in 1865, the U.S. Army began to subdue the Indian occupants of the region, in the process providing more detailed information on the upper Salt. A chronology of the principal historical events along the upper Salt River can be found at the end of this report. Historical maps showing the principal localities mentioned in the text are in Appendix A.

Historic Indian Use

Historically, the upper Salt River was the homeland of the Yavapai and the Western Apache. Although the Yavapai and Apache spoke different languages, the two groups had similar cultures, with a subsistence pattern based on hunting, gathering wild plants, and limited farming and a settlement pattern of scattered, extended-family rancherías. They were thus often confused with each other by early explorers, military expeditions, and colonists.

The Yavapai are upland Yuman speakers, probably descended from the Cerbat archaeological culture that occupied southern California and northwestern Arizona south of the Colorado River from about A.D. 700 to 1850 (Khera and Mariella 1983). From about A.D. 1300 to 1850, the Cerbat apparently evolved into the historic Pai (Hualapai, Havasupai, and Yavapai). Ferg (1992) argues that the Yavapai controlled the Tonto Basin until about A.D. 1750. In the mid-nineteenth century, a band of Yavapai lived along the Salt River below the Tonto Basin. Most members of this band were massacred by the U.S. Army at Skeleton Cave in 1872. Their way of life prior to the massacre was described by Mike Burns, a Yavapai who at age seven was captured shortly before the battle and raised by Captain James Burns (Corbusier 1971:49-85). Mike Burns wrote that in the winter his family camped in cave houses in the box canyon of the Salt River farther downstream, near the mouth of Fish Creek (Corbusier 1971:62). Their summer camp was "just below the present site of the Roosevelt Dam...[in a] place that no enemy would dare to enter as we could kill every one" (Corbusier 1971:61, 65). An Apache leader named Del-che "camped on the rocky banks of the Salt River about 6 miles away" (Corbusier 1971:62).

The Apaches are Southern Athapaskan speakers descended from Athapaskans who began migrating south from the western subarctic approximately 1000 years ago (Wilcox 1981). Anthropologists recognize seven groups of Southern Athapaskan speakers: the Navajo; the Western, Chiricahua, Mescalero, Jicarilla, and Lipan Apache; and the Kiowa-Apache. Scholars have not yet settled the debate about when the Southern Athapaskans arrived in the Southwest. Some have argued for an early arrival date, circa A.D. 1000. Gunnerson's (1956, 1974) reconstruction suggests that the Southern Athapaskans arrived on the southern Great Plains about A.D. 1525 and spread into the Southwest between about A.D. 1540 and 1582. According to Gunnerson, when Coronado passed through the Southwest in 1540-1542 (see below), he did not describe any groups that historians can identify as Apacheans. When he explored the Southern Great Plains in 1541, however, he observed a group of nomadic bison hunters who lived in conical skin tents that they transported on dog travois. Coronado's Pueblo Indian guides said that this group had arrived on the southern Great Plains about 15 years before. Gunnerson thought that these nomadic bison hunters were the Southern Athapaskans. In 1582 the Espejo expedition reported a group of nomadic peoples in the vicinity of Acoma Pueblo in western New Mexico. Gunnerson interpreted this group as Southern Athapaskan, possibly ancestors of the modern Navajo. Based on these accounts and her interpretation of them, Gunnerson argued that the Southern Athapaskans had reached the Southern Plains by about A.D. 1525 but had not yet entered the Southwest in 1540, although they were living in the region by A.D. 1582.

Historically, the Southern Athapaskans practiced both hunting and gathering and farming, although the emphasis was different in each group. Raiding and warfare were also significant components of the Southern Athapaskan subsistence pattern. Southern Athapaskan mobility was largely a function of the degree of emphasis on hunting and gathering, farming, and raiding. The mobility of the Southern Athapaskans resulted in indistinct boundaries between bands and rendered each of the different Southern Athapaskan languages mutually intelligible into the historic period. Spanish colonists began to distinguish differences among the Southern Athapaskans as early as 1598 (Gunnerson 1974:57) but used a large number of different terms for the Apaches (Opler [1983:387-392] lists many of these.) Only after the conquest of the Apaches in the late nineteenth century did the loosely organized Apachean groups crystallize into formal bands and tribes.

Basso (1983) divides the Western Apache into five bands: Northern Tonto Apache, Southern Tonto Apache, Cibecue Apache, White Mountain Apache, and San Carlos Apache. The San Carlos Apache are further divided into numerous local groups, including the Aravaipas, Pinaleños, and Coyoteros, among others (Thrapp 1967:viii). Hohmann and Rink (1990:57) state that "the upper Salt River was home to the 'Coyotero' Apaches." They add that the Cibecue bands resided in the vicinity of upper Cibecue Creek, the Pinaleño lived in and around the Pinal Mountains, and the southern Tonto bands lived within the Tonto Basin. Granger (1960:111)

says that the Pinal Mountains were occupied by the "Pinal Coyoteros, a tribe of Apaches, who were also referred to as the Pinaleños." "Yavapai people migrated from the lower Colorado River Basin and intermarried with the southern Tonto Apache" (Hohmann and Rink 1990:57). Hohmann and Rink describe how the Apache followed a seasonal round of food gathering, growing, and hunting. In late spring, they moved to farming sites along the White River, Carrizo Creek, and Cibecue Creek, where they planted corn, beans, and pumpkins. Young, old, and disabled people stayed with the crops to protect them from destructive birds and animals while others hunted or gathered wild plants such as cactus fruits, mesquite beans, yucca, and acorns. In the fall, they harvested their fields and gathered pinon nuts and juniper berries. During the winter, when food was scarce, some groups resorted to raiding [Hohmann and Rink 1990:57].

Fort Apache was established in 1870 as Camp Ord to protect the Euroamerican settlers from Indian raids (Granger 1960:233; Walker and Bufkin 1986:37). The San Carlos and Fort Apache (or White Mountain) Indian reservations were established by Executive Order in 1872 (Thrapp 1967:111). In the late fall of 1872, General George Crook launched his campaign against the Apaches of the Tonto Basin and by the following spring had rounded up most of the Apaches (Thrapp 1967). In 1875, 1600 White Mountain Apache were relocated to San Carlos (Nelson 1990:58).

By 1906 the Apaches on the nearby reservations constituted, in the eyes of Euroamericans, a large work force and were enlisted for construction of Roosevelt Dam. Their work camps and their role in this extraordinary engineering feat are described by Ayres et al. (1994), Rogge, Keane, and McWatters (1994), and Rogge et al. (1996).

Spanish Exploration

In February of 1540, Francisco Vázquez de Coronado set out from Compostela, Mexico, leading an expedition of over 230 mounted men, 62 foot soldiers, and over 800 Indian allies to explore what is now the southwestern United States (Winship 1892-3, 1990). The expedition's route has been variously reconstructed (for a summary see National Park Service 1991), some scholars suggesting that they crossed the Salt River in the vicinity of the study reach, others that they traveled somewhere along the Arizona-New Mexico border. Byrkit (1984:223) suggests that the Salt River was the river Coronado crossed using rafts, the Rio de las Balsas of Captain Juan Jaramillo (one of the chroniclers of the Coronado Expedition). Haak (1991:107-108) agrees with this interpretation, but most reconstructions of Coronado's route place this crossing to the east of the study area.

Once the Spanish began to missionize southern Arizona in 1691, they reached the lower Salt River on a number of occasions but apparently never ventured above the confluence of the Salt and the Verde. The Spanish recognized the Salt (or Salado), the Verde, and the Rio de la Asunción (the Salt River below the confluence of the Salt and the Verde), but they also applied other names to these rivers.

On March 1, 1699, Father Eusebio Kino climbed to the top of the Estrella Mountains, south of present-day Phoenix, where guides pointed out the major rivers of the region. Kino called the Gila the Río de los Apóstoles and named branches of the Gila after the four evangelists (Bolton 1936:422; Coues 1900:136n), including the Salt, which he named for Matthew (Bolton 1936:422). By 1701, however, Kino was referring to the Salt River as the Río Azúl (Coues 1900:137n).

Padre Luís Velarde's 1716 description of the Pimería Alta states that the major rivers of the region were the Gila and the Colorado but also mentions "two others, called the Salado and the Verde, the first because it is salty, and the latter perhaps because it runs among greenish shapes or rocks. And these rivers run, the Salado from the east to the west and to the south from Moqui [Hopi]; and the Green or Verde from the northeast of the said province to where they are joined, as has been said" (Wyllys 1931:116).

According to Granger (1960:115), "In 1736 or 1737, Padre Ignacio Xavier Keller viewed the Verde and Salado Rivers and apparently named their union point and the stream below there, the Asunción ("Assumption")."

Father Jacobo Sedelmayr, who reached the Salt in 1744, called it the Rio de la Asunción (Granger 1960:115). According to Sedelmayr, at the confluence of the Salt and Gila "a very pleasant country surrounds this fork of the rivers. Here the eye is regaled with creeks, marshes, fields of reed grass and an abundant growth of alders and cottonwood" (Dunne 1955:24).

Father Ignaz Pfefferkorn mentioned the Salt River in 1763 (Pfefferkorn 1949), noting that the Gila unites with the large Río de la Asunción, which flows from north to south-west, and into whose great volume pour two little streams, the Río Salado (salty river) and the Río Verde (green river), some miles before the Río de la Asunción joins the Gila [Pfefferkorn 1949:28].

Granger (1960:115) says that "the writer of the Rudo Ensayo" ("Rough Essay," an eighteenth century account by an anonymous Jesuit priest) called the section of the Salt below the confluence with the Verde the

Rio Compuesto (Put-Together River). Coues (1900:140n) dates the Rudo Ensayo to 1762 (but see Guiteras [1951], who gives a date of 1763) and quotes page 129 as follows:

> *[T]he Gila...receives the waters of the Assumption River, which, eight or nine leagues farther up to the northwest is formed by two other rivers, taking their rise, according to an account of Father James Sedelmayr [of his travels to the Yumas in 1748], in an extensive ridge of mountains in the land of the Apaches, on the other side of the Gila, farther up towards the east. Of these two branches, one is called Verde, owing to the verdure of the groves which adorn its banks, and the other Salado, because it is salty to such a degree, that after its union with the Verde, and even after joining the Gila, the water for some distance is unpalatable. [Coues 1900:140].*

In November of 1775, Father Francisco Garcés, arriving at the confluence of the Gila and Salt rivers, described the rivers of southern Arizona and mentioned that the Río de la Asumpción [sic] was composed of the Verde and the Salado (Garcés 1900:139). Garcés wrote that the Río de la Asumpción "is much larger than the Gila, which becomes much (*muchisimo*) swollen in the summer by reason of the snows that there are in the sierras in which it rises and through which it flows" (Garcés 1900:110-111). Garcés reiterated that the Gila River "receives the principal volume of its waters from the Rio de la Asumpción, which is very much increased by the melting of the snows of the sierra through which it flows" (Garcés 1900:139-140).

American Trappers

Mexico won its independence from Spain in 1821. Despite Mexico's attempts to discourage incursions into its territories by citizens of the United States, fur trappers began exploring the Southwest while it was still part of Mexico. Contrary to their popular image, the mountain men generally rode horseback through the Southwest and did not normally use boats. James Ohio Pattie canoed the lower Gila in 1827, however, and on at least two occasions (Ewing Young's party in 1826 and James Ohio Pattie's group in 1827), trappers canoed the lower Colorado River.

The mountain men began trapping the Gila and its tributaries in 1826, when James Ohio Pattie and his father Sylvester Pattie made an illegal trip to the Gila. The Patties approached the Gila by way of the Santa Rita copper mines, near what is now Silver City, New Mexico, and returned by the same route. In the summer of 1826, they returned to pick up their caches of furs, but they were gone (Weber 1971:95-97).

Ewing Young and William Wolfskill also organized an expedition to the Gila in the summer of 1826, but Ewing Young became ill, and William Wolfskill led the group of 11 to 16 men (Weber 1971:124). This group went to the Santa Rita mines, then down the Gila to the Salt, where they were attacked by Indians and forced to retreat.

In the fall of 1826, four groups of trappers went to the Gila. William Sherley ("Old Bill") Williams and Ceran St. Vrain led a group of 20 men. A second group, led by John Rowland, consisted of 18 men, Antoine Robidoux led a group of 30 men, including James Ohio Pattie, and Ewing Young led a party of 18 (Weber 1826:119-120). The Robidoux party went to the Santa Rita Mines, then went down the Gila to the Salt River, where Indians killed all the men except for Robidoux, Pattie, and an unnamed French trapper (Weber 1971:123). The survivors joined Ewing Young's party. George C. Yount was with Ewing Young's 1826 group. Like Robidoux's group, Young's party had gone through the Santa Rita Mines on their way to the Gila. They had then gone through San Francisco Hot Springs and trapped up the San Francisco River, returning to the Gila. The combined Young and Robidoux parties next traveled up the Salt, trapping beaver along the way. At the Verde River (which they called the San Francisco River), the party split, and Ewing Young went up the Verde, while Pattie continued up the Salt. Young followed the Verde to its headwaters, then returned to the Salt (Byrkit 1978:34; Davis 1982; Pattie 1831). The entire group then continued on down the Salt and the Gila to the Colorado. Yount wrote:

> *In trapping the Colorado it was found convenient to construct small water-craft, which was done by scooping out logs of Cottonwood, after the method practiced by the Indians--With these canoes our trappers ascended the River till they reached the nation of the Mohavies [Camp 1966:33).]*

The group went upstream to the bend in the Colorado River, then back to the Mohave villages (Camp 1966:38). At the mouth of the Virgin River, the group divided up again (Weber 1971:125). Young and most of the rest of the group may have gone to California in early 1827 before returning to Santa Fe. Pattie and others went east and returned to Santa Fe by traveling down the Rio Grande (Weber 1971:125). George Yount returned to Santa Fe via Zuni Pueblo (Weber 1971:126). Thomas ("Pegleg") Smith, S. Stone, and Alexander Branch may have taken a still different route back to New Mexico; Humphreys (1966:318) says that after they left the main group at the mouth of the Virgin River, they built rafts and crossed the Colorado River.

In 1827 George Yount led a party of 24 men "including servants and campkeepers" (Camp 1966:43) to the Gila and Colorado rivers, returning by way of the Grand Canyon, Grand Falls, Hopi, and Zuni. Sylvester and James Ohio Pattie were on this trip, as far as the Colorado River, and James described building a canoe and

floating the Gila (Pattie 1831:136). At the Colorado River, the Patties and six others "became insubordinate, and parted from the main body, above the mouth of the Gila, built canoes, and descended the Colorado to try their fortunes alone" (Camp 1966:43). (See Pattie [1831:136-151] for his description of the situation.) The Patties traveled across Baja California to Santa Catalina, where they were arrested for traveling outside the area specified in their permit. Sylvester Pattie died in jail, but James was finally released and returned to Kentucky in 1830 (Weber 1971:139-140). After the Patties left the expedition, the remaining 16 men under Yount went up the Colorado, then headed east, between the Grand Canyon and the San Francisco Peaks, to Zuni and the Rio Grande (Camp 1966).

In his 1850 report on the 1849 Navajo expedition (see below), Lieutenant James H. Simpson (1850:137) reported that in 1827 Richard Campbell led 35 men to San Diego via Zuni Pueblo; a substantial amount of historical research has been done on the route of this group (Camp 1966:x; Maloney 1939; Roberts 1931:12; Simpson 1850:137; Templeton 1965:57, 62; Wallace 1984: 326 n.2; Weber 1971:135-136). Roberts (1931:12) cites Simpson (1850:137) as reporting that this group went down the west bank of the Zuni River, crossed the Zuni east of Twin Buttes, continued southwest, crossed the Little Colorado, and went on to the upper Salt, following an Indian trail. Camp (1966:x) and Weber (1971:135-136) seem to suggest that this expedition went from Zuni to Hopi to the Crossing of the Fathers, then west. Templeton (1965:57, 62) argues convincingly, however, that Campbell was with Ewing Young's 1826-1827 group (described above), a conclusion supported by Wallace (1984:326 n.2).

According to Wallace (1984:332), Ewing Young and Kit Carson were familiar with a trail down the Zuni River from Zuni to the Little Colorado River, thence down the south side of the Little Colorado River to the first creek on the east side of Volcanic Mountain, which was followed to the Mogollon Rim, where the trail descended to the Salt River. In August of 1829, Young led a group of 40 American, Canadian, and French trappers (including Kit Carson on his first trapping expedition) from Taos to Zuni, and then to the head of the Salt River (Carter 1968:42-44). The group followed the Salt River to the mouth of the Verde River, then went up the Verde to its headwaters, where the group split up, some of the men going back to Taos, while Young, Carson, and others went to California (Byrkit 1978:35, 46; Weber 1971:142-143). Young and Carson returned in the fall of 1830, traveling from Los Angeles to the Colorado River, up the Gila to the Santa Rita mines and back to Taos, arriving in Taos in April of 1831.

The trappers and traders of the Mexican Period thus acquired a familiarity with the upper Salt River, but few descriptions of their expeditions were published, and the accounts that did appear in print rarely describe the rivers (as ironic as that may seem, given the importance of the rivers to the fur trade). One exception is Pattie's

description of the Salt River (Pattie 1831). The fragmentary accounts of the trappers do suggest, however, that the Palatkwapi Trail (from Hopi to the Verde Valley, perhaps taken by those members of Young's 1829 expedition who did not go on to California and by Leroux in 1854) (Byrkit 1988) and the Zuni-Salt River Trail followed by Young and Carson in 1829 (and by Lt. Beckwith in 1849) (Carter 1968:42-44; Foreman 1937, 1941a:220; Wallace 1984:332) were both in use during the Mexican Period. Antoine Leroux, who later guided the Sitgreaves and Whipple expeditions along the 35th parallel and returned to Taos via the Salt and Verde in 1854, apparently acquired his knowledge of the area during six or seven years of trapping in the 1830s (although he first arrived in Taos in 1824 [Foreman 1941b; Parkhill 1965, 1966]).

United States Military Exploration

In 1849 James Collier, the first customs collector of the Port of San Francisco, was guided to California by mountain man John Hatcher (Foreman 1937 cited by Wallace 1984:332). They went down the Zuni River to the Little Colorado, then went on to the upper Salt River by the trail described above. According to Roberts (1931:12), who cites Amiel Weeks Whipple (1851:15) and Sitgreaves (1853:6), Collier was accompanied by a military detachment led by Brevet Captain Herman Thorne, who drowned October 16, 1849, while crossing the Colorado River (Whipple was present, having made the trip from San Diego [Whipple 1851]). At that point, Lieutenant Edward G. Beckwith took command, and later maps of the Military Department of New Mexico (1859, partially revised and corrected in 1867) show Beckwith's trip. (Foreman [1941c:15] also describes this event.) A number of old maps show a route labeled "Beckwith 1849" running west from Zuni, crossing the Little Colorado River west of its confluence with the Zuni River, Silver Creek, and the head of Chevelon Creek, then passing over the Mogollon Rim, skirting the headwaters of the "San Carlos River" (probably Carrizo Creek), passing through the vicinity of present-day Cibecue, and reaching the Salt River between the mouth of what appears to be Canyon Creek and Tonto Creek (which is labeled as such). Based on information from Beckwith and Dr. Randall, another member of the expedition, Whipple described this route through the Salt River canyon, comparing it to the canyon of the Bill Williams River and the Gila Box:

> *The Salinas also, according to the accounts of Lieutenant Beckwith and Dr. Randall, who tried to follow its course, on their way from Zuñi to the Gila, in 1849, treads a chasm of the same nature, and is as impassable with pack-mules as that near Mount Turnbull. They were obliged to leave the stream, and make their way over high and rough mountains [Foreman 1941a:220].*

From July of 1853 to March of 1854, Whipple surveyed a railroad route from Fort Smith, Arkansas, to Los Angeles, California, via the Colorado Plateau to the north of the study area. Upon reaching Los Angeles,

Antoine Leroux (the mountain man who guided the expedition) returned to New Mexico via the Gila and the Verde, a route that became known as Leroux's Trail (Foreman 1941c:13). In their *Report Upon the Indian Tribes*, Whipple, Ewbank, and Turner (1855:14-15) provided an excerpt from Leroux's journal from May 16 through 24, describing Leroux's trip from the mouth of the Salt River to Beaver Creek.

In late summer of 1870, General George Stoneman (Military Commander of the Department of Arizona) and 24 other men (including 1 officer, 1 surgeon, 12 enlisted men, 4 teamsters, 3 servants, 1 cook, and 2 civilians) toured the military posts of Arizona (Marion 1965). Leaving Fort Whipple on August 29, 1870, they went north to the Leroux Valley, then east past Leroux Springs, Cosnino Caves, and Canyon Diablo, arriving at the Little Colorado on September 4 (Marion 1965:18). The group forded the Little Colorado River at Sunset Crossing on September 4 and crossed to the south side again at Leroux Crossing, near the confluence of the Puerco and the Little Colorado, on September 6 (Marion 1965:19). They then traveled up Silver Creek and over the Mogollon Rim to Camp Mogollon. The rest of their trip took them to Camp Goodwin, Camp Bowie, Tucson, Camp Grant, Fort McDowell, and back to Fort Whipple, which they reached on October 5. Traveling south from Camp Mogollon (Fort Apache is on the south side of the East Fork of the White River) to Camp Goodwin, the Stoneman party crossed the Black River and avoided the Salt River entirely.

Hostilities with the Apaches

In the 1860s, the United States military presence in the Southwest was greatly reduced because of the need for manpower to fight the Civil War back east. Until troops were again posted in the area following the war, some settlers took matters into their own hands.

Vigilante Actions

In 1864, King S. Woolsey of Prescott led three vigilante campaigns against the Apaches of the Tonto Basin (Goff 1981:33; Haak 1991:3). In January of 1864, Woolsey led 15 to 60 men from Fort Whipple at Prescott down the Agua Fria, east to the Verde, and into the Tonto Basin (Goff 1981:33). Somewhere in the area, perhaps near Fish Creek, Woolsey and his vigilantes murdered a group of Apaches who had been invited to a council, an event known variously as the Bloody Tanks Massacre or the Pinole Treaty (after the food served to the doomed visitors) (Faulk 1970; Goff 1981:33; Welch and Ciolek-Torrello 1991:57). In March, Woolsey and approximately 100 men "surprised Apache occupants and annihilated a village of 60 wickiups, killing 14 warriors and many women and children" (Ogle 1940:49 cited by Welch and Ciolek-Torrello 1991:57).

According to Welch and Ciolek-Torrello (1991:57), "Woolsey's third expedition failed to locate any Indians, but the group named Tonto Creek after the group of Apaches they had been pursuing." "On June 1, 1864, Woolsey and 93 men left Agua Fria Ranch and traveled down Tonto Creek, finding an abandoned village of 50 Apache wickiups at the mouth of Tonto Creek" (LeCount 1976:2). In his report to Territorial Governor John M. Goodwin, Woolsey described following Sycamore Creek "about twelve miles to its mouth, finding Indian corn and wheat fields all the way. At the mouth of the creek the Salt River flows southward for some miles and then turns to the west" (Goff 1981:45). Woolsey's group then crossed the Salt River and followed the left bank 6 miles to the Salt River Canyon and then went overland to Pinal Creek, where he camped in the Indian wheat fields on June 13 (Granger 1960:111). Woolsey then went down Pinal Creek and camped on the Salt River before returning to Wheatfields on Pinal Creek. Grapevine Spring, on the south side of the Salt River and east of the mouth of Tonto Creek, was named by Woolsey in June of 1864 during his third expedition. His expedition used this spring for water instead of the Salt River, which was too brackish to be potable (Granger 1960:104). In his report to Governor Goodwin, Woolsey wrote, "The road from Grape Vine springs is about fourteen miles S.E. to some springs and tanks, and then turning east for about five miles, where it reaches Pinal creek at our camping ground" (Goff 1981:46). Woolsey led his men to Fort Goodwin on the San Pedro River, then back to the Wheatfields camp in August of 1864, and "found an extensive Indian wheat field ready for harvesting" [Granger 1960:119]), then to Grapevine Spring along the Salt River, then up Tonto Creek to the Verde River, the Agua Fria River, and home, arriving at Prescott 87 days after starting (Goff 1981:47-51).

Some other military records also mention the Salt River. George M. Wheeler's Army survey of the American West began in 1869 and lasted until 1879; Arizona was mapped in 1871 (Bartlett 1962). Granger (1960:115) says that "Capt. George M. Wheeler in 1873 refers to [the Salt River] by two names: The Prieto ("Black") and the Salt River." Army wife and diarist Martha Summerhayes mentioned crossing the Salt River several times, but never described the river (Summerhayes 1911:195, 212). Summerhayes was at Fort Apache from October of 1874 to April of 1875, but she did not describe the Salt River below the camp. In December of 1876, she crossed the Salt on her way to Fort McDowell, and she crossed it again on her trip from Fort McDowell to Fort Lowell in 1878.

Military Presence and Campaigns

In 1865 Camp (later Fort) McDowell was established on the Verde River 8 miles above its confluence with the Salt. Soldiers at Camp McDowell dug an irrigation ditch and put in gardens, "becoming the first Euro-American irrigators of central Arizona" (Rogge, Keane, and McWatters 1994:7). Soon after, civilian farmers settled in the area. In 1867 a site for Camp Reno was selected on Tonto Creek (Haak 1991:4) approximately 15 miles above the confluence of Tonto Creek and the Salt River (Reicker 1879). In 1868 a wagon road running