

GROUNDWATER STUDY OF THE BIG CHINO VALLEY

TECHNICAL REPORT

SECTION I OF III

PERSPECTIVE

**Ground Water Section - Resource Analysis Branch
Water Resources Section - Surface Water Branch
Earth Sciences Division
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Denver Office
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Denver, Colorado**

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by

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**PRELIMINARY FINDINGS
TECHNICAL REPORT - BIG CHINO INVESTIGATION
SECTION I: PERSPECTIVE**

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1. INTRODUCTION

1.1 Purpose and Goals

This report is the result of an investigation of the Big Chino Valley, Yavapai County, Arizona. The purpose of the investigation was to examine the relationship between the groundwater of the Big Chino Valley and the surface water of the Upper Verde River. The understanding of this relationship will provide the Secretary of Interior with information to support a decision as to the source of water for the Fort McDowell Indian Community Water Rights Settlement.

1.2 Authority

The Fort McDowell Indian Community Water Rights Settlement Act of 1990, (Title IV, Public Law 101-628, SEC. 406.), authorized the Secretary of Interior to acquire land and water rights and to construct diversion, collection, and conveyance facilities to deliver water from the Big Chino Valley to a point near Sullivan Lake in Yavapai County, Arizona. At least 7,000 acre-feet of water would be delivered annually by these facilities for use by the City of Prescott in exchange for 7,000 acre-feet of Prescott's Central Arizona Project water which would be made available to the Fort McDowell Community.

Acquisition of land and water rights, or construction of facilities shall not begin until the Secretary has completed a study of the effects of diversion and delivery of the 7,000 acre-feet of water on the Upper Verde River.

The Bureau of Reclamation (Reclamation) was instructed to complete this study and make available the results by December 31, 1993. To accomplish this task, the Secretary was authorized to enter into an agreement that would advance the Secretary up to \$800,000 from the City of Prescott. Monies up to \$800,000 would be reimbursed to Prescott by the Secretary. A letter dated May 1, 1991 from the Department of Interior to the Mayor of the City of Prescott transmitted a contract of agreement for the advance of funding by Prescott and a statement of work to be completed by Reclamation.

Funds totaling \$800,000 were transferred to Reclamation from Prescott to complete the work necessary to the investigation. These funds were expended in total by Reclamation.

The objective in evaluating the effect of pumping large amounts of groundwater from the valley immediately adjacent to the Verde River is to insure protection of a threatened species of fish in the river. The spokedace (Meda fulgida) is a small stream-dwelling fish endemic to the Gila River in Arizona and New Mexico

(U.S. Fish and Wildlife Service [FWS] 1991). The spokedace was proposed (FWS 1985) and subsequently listed (FWS 1986) as a threatened species under authority of the Endangered Species Act of 1973, as amended. The spokedace is also classified by the State of Arizona as a threatened species (Arizona Game and Fish Department 1988).

The Verde River is a tributary of the Gila River and a segment of the Verde River in Yavapai County supports at least a moderate-sized population of spokedace. The proposed critical habitat segment of the Verde River is approximately 57 kilometers (34 miles) of river extending from approximately 0.8 kilometers (0.5 miles) below the confluence with Sycamore Creek upstream to Sullivan Lake.

Spokedace cannot exist in dewatered places, and populations can be expected to decline or disappear from stream reaches which are intermittent or ephemeral. Permanence of flows of sufficient quantity and quality must be assured to maintain integrity of spokedace populations and their habitats. Also, since Southwestern stream fishes apparently are enhanced relative to non-native species where streams are characterized by a natural hydrograph (Minckley and Meffe 1987); formal agreements that streamflows will not be modified by activities such as damming or diversion that substantially alter natural flow regimes should be an integral part of insuring perennial flows (FWS 1991).

1.3 Previous Investigations

Several important investigations have been conducted earlier and these are noted in the section on References. Most important to this study is the work completed in 1990 by Water Resources Associates, Inc. (WRA). The City of Prescott had retained WRA as a consultant to examine the feasibility of developing a well field in Big Chino Valley. Therefore, much of the technical work completed by WRA was of value to Reclamation. Their report, "Hydrogeology Investigation, Big Chino Valley, Yavapai County, Arizona," provided background and data that considerably shortened the time and effort by Reclamation.

1.4 Organization

The overall responsibility for the study was allotted to the Chairman of the Departmental Implementation Team - Fort McDowell Indian Water Right Settlement in the Office of the Assistant Secretary for Water and Science.

Technical direction and coordination for the study was provided

by the Earth Sciences Division in the Office of the Assistant Commissioner - Resources Management (ACRM).

Coordination for geotechnical work was the responsibility of the Geology Branch in the Office of the Assistant Commissioner - Engineering and Research.

The Arizona Projects Office, Lower Colorado Region provided assistance and guidance for many of the activities in the study.

1.5 Interagency Coordination

Both the United States Geological Survey and the Fish and Wildlife Service assisted in the investigation. Their participation was coordinated through the Earth Sciences Division of ACRM.

State water and land records and assistance were provided to ACRM through the Arizona Department of Water Resources and the Arizona Land Department.

2. STUDY AREA DESCRIPTION

2.1 Location

The study area of the Big Chino Investigation generally encompasses the drainage of the upper Verde River above its confluence with Sycamore Creek. It includes the main tributaries of Big Chino Wash which are: Williamson Wash, Walnut Creek, Pine Creek, and Partridge Creek. Excluded from the study is the drainage area in Aubrey Valley (north of Interstate 40), which is a closed basin and does not contribute water to the Verde River.

The general study area was then more closely defined by each of the disciplines involved in the investigation. The Geologic Framework Investigation will have a somewhat different boundary than the boundary described in the chapter on Surface Water. This is due in part to the attempt to identify gain-loss reaches of the upper Verde River which were beyond the scope of the geologic/geophysical investigation as identified in the plan of study.

Boundaries for the groundwater modeling area are slightly different due to the limited availability of data for a model. These boundaries were adjusted where needed in an attempt to conform to those of surface water boundaries for water budget analyses.

A general map of the study area is provided in Figure 1.

2.2 Geology

Big Chino Valley is located north of Prescott, Arizona, near Paulden. The Basin is within the Transition Zone, a physiographic and tectonic transition between the Colorado Plateau province to the northeast and the Basin and Range province to the southwest. The valley forms an elongated basin extending northwest from the headwaters of the Verde River in the southeastern corner of the valley. Big Chino Valley is one of several basins within the Transition Zone filled with mid- to late Cenozoic sedimentary and volcanic deposits.

The valley area is surrounded by structurally higher blocks of Proterozoic rocks capped by a sequence of Paleozoic rocks composed mostly of limestones. With the exception of the southeastern corner of the valley, the Proterozoic rocks provide structural closure around the valley. The headwaters of the Verde River are located at the southeastern edge of the valley at

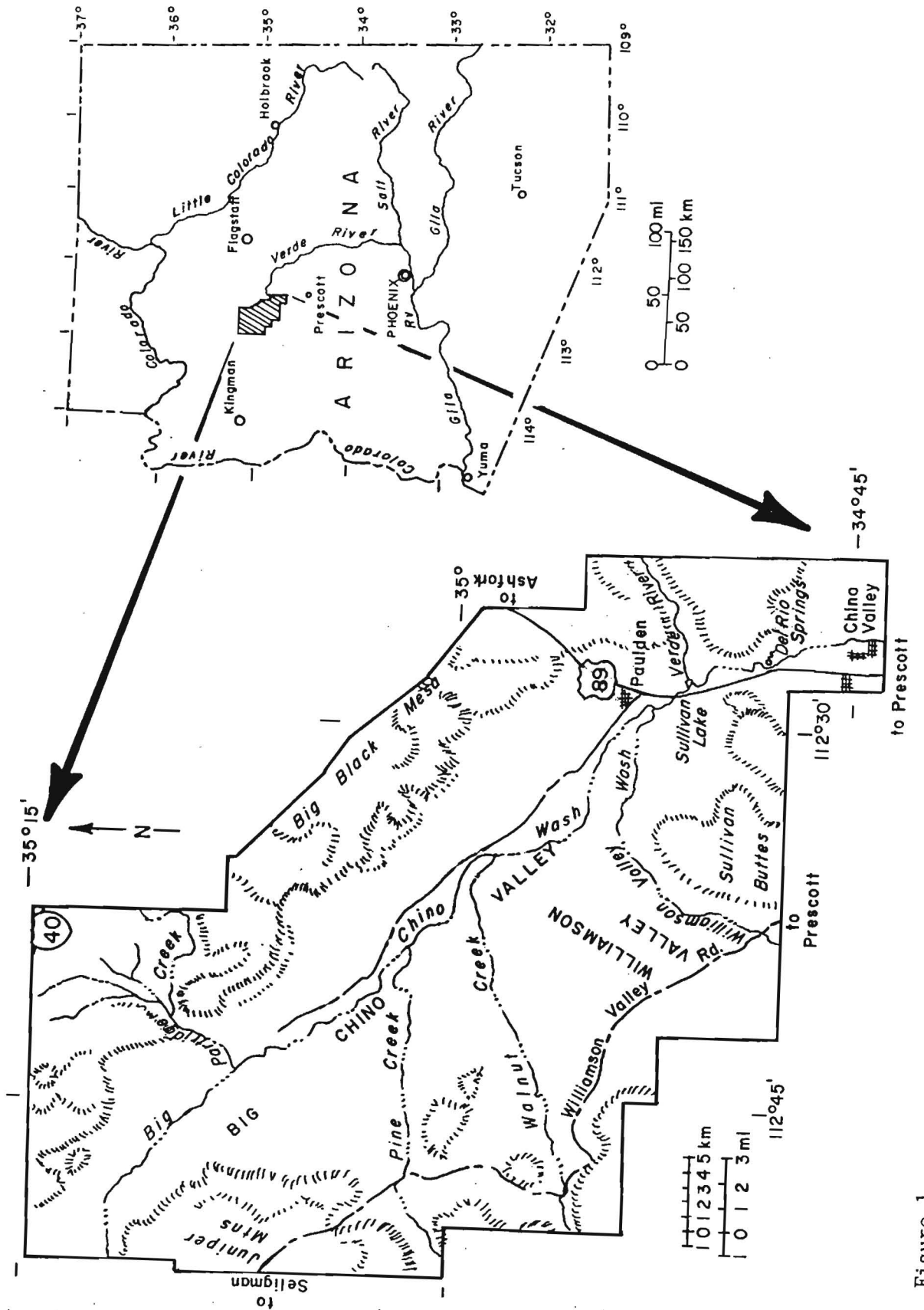


Figure 1

the lowest point in the rim of Proterozoic rocks that surround the basin. Paleozoic Martin Limestone appears to underlie Tertiary basin fill throughout much of the basin except the Williamson Valley area.

The present form of Big Chino Valley is primarily the result of late Cenozoic displacement on the Big Chino fault and other northwest trending faults in the valley. This movement has downdropped the valley and preserved a thick sequence of Cenozoic deposits. Tertiary basalts flowed into the valley from several locations and the accumulation of these basalts at the southeastern end probably blocked drainage from the valley. Blockage of the drainage together with downwarping of the valley along the Big Chino fault led to deposition of fine-grained fill. These basalts underlie fine-grained basin fill throughout the northernmost portion of the valley and also underlie an extensive area at its southern end. The fine-grained basin fill is thickest in a narrow (1-2 miles wide) graben adjacent to the Big Chino fault. The thickness of fill in this graben may exceed 2,500 feet in some locations. The basin fill appears to be more coarse grained along the margins of the valley, such as along Big Black Mesa, and in the southwestern portion. Older, more coarse-grained basin fill probably underlies the fine-grained basin fill and basalt throughout most of the valley.

2.3 Water Use

The waters in the study area have traditionally been used for six primary purposes. While these categories of use may not have changed with time, the amount of use in any given category has changed dramatically over short periods of time. The primary categories are:

- Irrigation
- Recreation
- Industrial
- Livestock
- Domestic
- Riparian habitat

The greatest use of water in the Big Chino Valley today is irrigation. Approximately 870 acres are being actively irrigated in the valley representing a consumptive use of about 1,650 acre-feet annually.

Estimates of the amount of water consumptively used for industrial, domestic, and livestock purposes are 300 acre-feet annually. Riparian vegetation in the study area is estimated to consume over 250 acre-feet per year. Total consumptive use in these six categories therefore is approximately 2,200 acre-feet annually.

3. FINDINGS AND CONCLUSIONS

3.1 Findings

The results of this investigation suggest that groundwater pumping in the upper Big Chino Valley would have an adverse effect on the flow and perhaps the biota of the Verde River. However, the information gathered to date is incomplete as to what effect the diversion of those waters would have on the continued existence of the spikedace (Meda fulgida).

The geologic and geophysical studies by Reclamation confirmed the existence of a large zone of semi-impervious material (clay) in the central part of the valley. This zone of material (in conjunction with some evidence of nearby faulting) has the potential to isolate the upper Big Chino Valley groundwater from the groundwater springs which maintain the constant flow of water in the upper Verde River. However, to effectively isolate the groundwater in the upper valley, the zone would have to be complete and continuous across the central portion of the valley. The geologic and geophysical investigations have not confirmed the extent of this zone especially on the west side of the valley.

The information obtained from the geological and geophysical investigations which are provided in SECTION II Geologic Framework Investigations, and hydrologic information assembled as a result of this study, as well as information available from other known studies and records, were used to develop two groundwater models of the Big Chino Basin. Both of the groundwater models indicate that the groundwater in the Big Chino Basin is hydrologically connected to the upper Verde River. Lack of data and the complex geology of the area may suggest that the modeling efforts cannot provide sufficient proof of the hydrologic connection of the upper Big Chino Valley to the Verde River, however, analysis of the results of the groundwater models infer that there is no continuous impediment to the flow of water from the northern part of the valley to the upper Verde River.

3.2 Conclusions

It is concluded that this investigation will not provide enough evidence to support a recommendation to the Secretary of the Interior to proceed with acquisition of water and land in the Big Chino Valley to effect a full or partial settlement for the Fort McDowell Implementation. This conclusion is the result of findings of the study which do not support a location in the Big

Chino Valley where a large diversion of groundwater out of the valley would not result in a depletion of flows in the upper Verde River.

It is also concluded that due to the extreme complexity of the geology of the area, further investigation with limited resources would most likely not result in a clear, definitive answer. For the purpose of any future investigations, it would be beneficial for this report to provide an estimate of the amount of work which would be necessary to reach a conclusion as to the water resources of the Big Chino Valley. However, the needs of any future investigations would be substantially different than those which directed this study. It would be inappropriate to attempt to predict the direction of future investigations. The technical information gained as a result of this study is substantial and provides more geological, geophysical, and hydrological knowledge of the area than was available prior to this investigation.