ARIZONA WATER BANKING AUTHORITY

WEDNESDAY, NOVEMBER 19, 1997

PLEASE PRINT **ARIZONA DEPARTMENT OF WATER RESOURCES**

1	NAME: TONIA GARRETT REPRESENTING: ELLIS, BAKER & PORTER	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
2	NAME: TOM GRIFFIN REPRESENTING: THE PLANNING GROUP	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
3	NAME: LARRY DOZIER REPRESENTING: CAP	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
4	NAME: DON POPE REPRESENTING: YUMA CO. WATER USER'S ASSN.	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
5	NAME: MIKE BLOCK REPRESENTING: METRO WATER DISTRICT	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
6	NAME: GRANT WARD REPRESENTING: MSIDD	BUSINESS ADDRESS:	TEL: 520-424-3344 FAX: 520-424-3281 E-MAIL:
7	NAME: TIMOTHY L. RECHT REPRESENTING: ROBERT S. LYNCH, ATTY (IEDA)	BUSINESS ADDRESS: 340 E. PALM LN. STE 140 PHOENIX 85004-4526	TEL: 254-5908 FAX: 257-9542 E-MAIL: RSLYNCHATY@AOL.COM

ARIZONA WATER BANKING AUTHORITY

WEDNESDAY, NOVEMBER 19, 1997

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8	NAME: DANA WALKER REPRESENTING: PHELPS DODGE CORP.	BUSINESS ADDRESS:	TEL: FAX: E-MAIL:
9	NAME: HAROLD GOODMAN REPRESENTING: CITY OF GLENDALE	BUSINESS ADDRESS::	TEL: FAX: E-MAIL:
10	NAME: HARRY RUZGERIAN REPRESENTING: MWD OF SO. CALIF.	BUSINESS ADDRESS: 350 S. GRAND AVE. LOS ANGELES	TEL: 213-217-6082 FAX: E-MAIL:
11	NAME: KATHY JACOBS REPRESENTING: TUCSON AMA - ADWR	BUSINESS ADDRESS :	TEL: FAX: E-MAIL:
12	NAME: JOHN ALGOTS REPRESENTING: FT. MOHAVE TRIBE	BUSINESS ADDRESS: 500 MERRIMAN AVE. NEEDLES CA 9363	TEL: 520-346-1605 FAX: E-MAIL:
13	NAME: LARRY LINSER JOHN MUNDERLOH REPRESENTING: BOOKMAN-EDMONSTON ENG.	BUSINESS ADDRESS	TEL: FAX: E-MAIL:
14	NAME: SHARON B. MEGDAL REPRESENTING: PIMA CO. FLOOD CONTROL DISTRICT	BUSINESS ADDRESS	TEL: FAX: E-MAIL:

ARIZONA WATER BANKING AUTHORITY

WEDNESDAY, NOVEMBER 19, 1997

PLEASE PRINT **ARIZONA DEPARTMENT OF WATER RESOURCES**

15	NAME: FLOYD MARSU REPRESENTING: CITY OF SCOTTSDALE	BUSINESS ADDRESS	TEL: FAX: E-MAIL:
16	NAME: PAUL ORME REPRESENTING: MSIDD/CAIDD	BUSINESS ADDRESS	TEL: FAX: E-MAIL:
17	NAME: DAN MUCHOW REPRESENTING: QUARLES & BRADY / CONSOLIDATED INDUSTRY	BUSINESS ADDRESS: 1 E. CAMELBACK RD., STE 400 PHOENIX 85012	TEL: 230-5508 FAX: 230-5598 E-MAIL: DLMUCHOW@QUARLES.COM
18	NAME: CYNTHIA STEFANOVIC REPRESENTING: AZ STATE LAND DEPT	BUSINESS ADDRESS: 1616 W. ADAMS PHOENIX 85007	TEL: 542-2669 FAX: 542-4668 E-MAIL:
19	NAME: DOUG C. NELSON REPRESENTING: AZ. RURAL WATER ASSOC.	BUSINESS ADDRESS: 1000 N. 16TH ST., STE. 120-307 PHOENIX AZ 85020	TEL: 395-1612 FAX: 395-1943 E-MAIL:
20	NAME: DENNIS RULE REPRESENTING: TUCSON WATER CO.	BUSINESS ADDRESS	TEL: FAX: E-MAIL:
21	NAME: REPRESENTING:	BUSINESS ADDRESS	TEL: FAX: E-MAIL:

Arizona Water Banking Authority

500 North Third Street, Phoenix, Arizona 85004
Telephone 602-417-2418
Fax 602-417-2401

FINAL AGENDA

Wednesday, November 19, 1997
9:30 a.m.

Arizona Department of Water Resources
Third floor conference room

I. Welcome / Opening Remarks

II. Adoption of Minutes of October 15 Meeting

III. Update of 1997 Plan of Operation and staff activities

IV. Presentation and initial recommendation of the 1998 Annual Plan of Operation

V. Discussion of Central Avra Valley Storage and Recovery Project Agreement

VI. Pinal County Recovery Report

VII. Tucson Regional Plan

VIII. Interim Report of the AWBA Study Commission

IX. Update on Interstate Discussions

X. Call to the Public

XI. Adjournment

Future Meeting Dates:
Wednesday, December 17, 1997
Wednesday, January 21, 1998

Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, by contacting the Arizona Water Banking Authority at (602) 417-2418 or (602) 417-2455 (T.D.). Requests should be made as early as possible to allow time to arrange the accommodation.

SPEAKER OF THE HOUSE
JEFF GROSCOST

CAPITOL PHONE: (602) 542-5735
HOME: (602) 892-5872
FAX: (602) 542-0102
TOLL FREE: 1-800-352-8404

DISTRICT 30

Arizona House of Representatives

Phoenix, Arizona 85007

November 14, 1997

The Honorable Gail Griffin
House of Representatives
1700 West Washington
Phoenix, AZ 85007

Dear Representative Griffin:

I am pleased to inform you that pursuant to A.R.S. 45-2421-2427, I am appointing you to serve as an ex-officio member of the Arizona Water Banking Authority Commission.

The purpose of the Committee is The Authority, acting through its Commission, shall (1) administer the Fund in accordance with statute; (2) coordinate its staffing needs with the Director and CAWCD; (3) coordinate the storage of water and distribution and extinguishment of long-term storage credits with the Director according to statute; (4) coordinate with CAWCD for the purchase, delivery and storage of Colorado River water delivered through the Central Arizona Project according to statute; (5) coordinate and confer with state agencies, municipal corporations, special districts, authorities, other political subdivisions, private entities, Indian communities and the United States on matters within their jurisdiction relating to the policy and purposes of this chapter; (6) determine on an annual basis the quantity of Colorado River water to be stored by the Authority and where that storage will occur; (7) account for, hold and distribute or extinguish long-term storage credits in accordance with statute; (8) comply with all aspects of Chapter 3.1 of Title; The Authority, acting through its Commission, may (1) apply for and hold water storage permits; (2) accrue, exchange and hold long -term storage credits in accordance with statute; (3) make and execute all contracts necessary to accomplish the above (a-d) , as well as to (e) store Colorado River water in Arizona on behalf of appropriately authorized agencies in California and Nevada, (f) cause a decrease in Arizona diversions from the Colorado River, ensuring that Arizona will use less than its full entitlement to Colorado River water in years in which California and Nevada agencies are contractually authorized to call on the water stored on their behalf and (g) distribute long-term storage credits earned by the Authority on behalf of agencies in California and Nevada to Colorado River water users in Arizona to use in place of Colorado River water that would have otherwise been used by those Arizona users; and (2) submit a request each year to the Legislature for a general fund appropriation, accompanied by a budget detailing how the appropriation would be used and justifying the need for the appropriation. The Authority shall also adopt, by January 1 of each year, a plan of operation for that calendar year. The Committee shall submit its report on or before July 1, 1998.

The members of the Committee are:

Senator Conner, Ex-officio member
Representative Griffin, Ex-officio member
Mr. William L. Chase Jr.,
Mr. Grady Gammage Jr., President, Central Arizona Water Conservation District
Mr. Thomas Griffin, Vice Chair, The Planning Group
Ms. Rita Pearson, Representative, Director, Department of Water Resources
Mr. Richard Walden, Farmer's Investment Company

Thank you for your willingness to serve on this Committee.

Best wishes,

Jeff Groscost
Speaker of the House

cc: Brenda Burns, President of the Senate
Molly Greene, Assistant Director of Operations
Art Hamilton, House Minority Leader
John Halikowski, House Research Director

SPEAKER OF THE HOUSE
JEFF GROSCOST

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DISTRICT 30

Arizona House of Representatives

Phoenix, Arizona 85007

November 14, 1997

The Honorable Gail Griffin
House of Representatives
1700 West Washington
Phoenix, AZ 85007

Dear Representative Griffin:

I am pleased to inform you that pursuant to Laws 1996, Chapter 308, Section 27, I am appointing you to serve as a member of the Arizona Water Banking Authority Study Commission. The Committee is in effect April 30, 1996 and is repealed from and after February 1, 1999.

The purpose of the committee is to study the existing powers of the Arizona Water Banking Authority during the first year of operation and make recommendations regarding any necessary changes to its powers and duties; to study the opportunities for additional Authority uses within Arizona and in cooperation with California and Nevada; to identify appropriate mechanisms to enable Indian communities that hold entitlements to Colorado River water to participate in water banking with the Authority; to make recommendations for continuation or modifications of the tax collected pursuant to A.R.S. 48-3715.02 The Committee shall submit its report on or before November 1, 1998.

The members of the Committee are:

Senator Conner
Representative Griffin, Member
Ms. Mary Ann Anton, Tohono O'odham Nation
Ms. Karen Barfoot, City of Chandler
Ms. Cynthia Chandley
Mr. William L. Chase Jr.
Mr. Grady Gammage Jr., President, Central Arizona Water Conservation District
Mr. Thomas Griffin, Vice Chair, The Planning Group
Mr. Gary Hansen, Colorado River Indian Tribes
Mr. Mark Myers
Mr. Paul Orme
Ms. Rita Pearson, Director, Department of Water Resources
Mr. Donald R. Pope, Yuma County Water Users Association
Mr. Lawrence V. Robertson Jr., Munger & Munger, P.L.C.
Mr. John F. Sullivan, Associate General Manager, Salt River Project
Mr. Richard Walden, Farmer's Investment Company

Thank you for your willingness to serve on this Committee.

Best wishes,

Jeff Groscost
Speaker of the House

cc: Brenda Burns, President of the Senate
Molly Greene, Assistant Director of Operations
Art Hamilton, House Minority Leader
John Halikowski, House Research Director

ARIZONA WATER BANKING AUTHORITY
Draft Minutes

October 15, 1997
Arizona Department of Water Resources

Welcome / Opening Remarks
Chairman Pearson opened the Arizona Water Banking Authority meeting. All members of the Authority were present with the exception of Grady Gammage, Jr., Bill Chase, and Senator Conner.

Adoption of Minutes of September 17 Meeting
The September 17 meeting minutes were adopted as submitted with the recommended changes.

Update of 1997 Plan of Operation
Tim Henley stated that the Arizona Water Banking Authority (Bank) continues to recharge water mainly through the in lieu process. The Bank has recharged 275,000 af through September 1997 and expects to increase to 300,000 af by the end of October if the deliveries can be maintained in November and December. The Bank should be at about 350,000 af by the end of 1997.

GRUSP recharged about 5,000 af in September. It is expected that GRUSP will be able to recharge about 10,000 af in October.

Mr. Henley said that this is the time of the year that the Bank goes out to various potential partners for 1998. There will be several meetings over the next few weeks, working towards the development of the 1998 schedule. A table showing the Bank's projected deliveries for the year should be available in November. The table will be available for the November Water Banking Authority meeting for review and comment by the members of the Authority.

Mr. Henley stated that to comply with legislation, the Bank is required to go to the different GUACs to discuss the upcoming plan of operation. Mr. Henley will be attending various GUAC meetings in November and December to give the members an opportunity to comment. At the November Water Banking Authority meeting, Water Banking Authority staff will present the 1998 Plan of Operation to the Authority members for approval.

AWBA/CAP Pricing Subcommittee
Larry Dozier from CAWCD made a presentation on the status of the CAP Pricing Subcommittee. Mr. Dozier stated that there are two committees that are in operation at this time: the Pricing committee, which is in the process of completing a policy on pricing for the CAP on-going rate setting process for all kinds of water and a Water Banking Pricing Committee.

The Pricing Committee has developed the following: (referring to the handouts of the meeting)
¶1.2 - encouraging the use of CAP water
¶1.4 - acknowledges the need for price stability and predictability
¶1.6 - acknowledges that water rate is the major role of CAWCD's board
¶2 - 3 talks about what CAP will do to ensure that a good job is done in measuring cost and doing cost of service studies and make the information public. The CAWCD will comply with all contract requirements

¶5 - acknowledges that there will be excess water. There may be capital charges established separately. Different rates may be used for multiple user categories
¶6 - 7 the process in which prices will be announced annually
¶7 - complies with policy within their repayment contract, and looks at the budget process

Mr. Henley stated that process of 'looking ahead' is very important to the Bank in providing a somewhat firm projection for five years especially as the Bank looks at the Arizona Legislature and general fund appropriations. Having a price that the Bank can describe to Legislature, especially when the Bank is asking for general fund appropriations.

Mr. Dozier commented that excess pricing leads into the second committee, the Water Banking Pricing subcommittee. This committee includes Steve Weatherspoon as the chairman, Karl Polen, Dalton Cole, Tom Griffin and Bill Chase. The committee started to look at the policy questions issues such as less than full cost rates to the Bank.

There was also a discussion about the priority for water, and CAP acknowledged that since the Bank has "lowest priority", the Bank would buy the water that would have otherwise not been sold. If the incentive rates encourage a lot of the M&I subcontractors or others to do recharge on their own, there may not be enough water left over for the Bank.

CAWCD looked at the pumping energy cost subsidy and the Navajo sales contract that is shared with SRP, which lets SRP manage CAP's power resources and in exchange pay CAWCD $22 million a year. When the contract was put together in 1993 - 94 time period, the Bank did not exist and CAWCD could see that they were not going to deliver 1 maf per year, so they started the contract with an energy threshold that they were allowed to use at lower cost rates at about 1 maf in the 1994 - 95 range and grow into about a 1.5 maf in about 2010. Now that CAWCD is well above the range any power that is above the threshold range comes at an incremental cost. There's a fixed way of computing that incremental cost which is basically a natural gas indexer, and that makes the incremental energy CAWCD buys from that contract not at the $19.5 million Navajo rate but closer to a $29 million rate, or a 50% increase.

CAWCD was able to negotiate a much lower rate in 1997. Mr. Dozier does not feel that CAWCD will be able to negotiate a lower rate for 1998, although he believes that they can get it below the $29 million range.

The committee was also asked to look at point of delivery arrangements. CAWCD uses the postage stamp energy rate. Mr. Dozier commented that since the funds come to CAWCD by county and AMAs, CAWCD might look at the cost of delivery.

CAWCD also looked at a capital cost increase. The more recharge water is delivered, it increases the apportioned amount of M&I water versus Indian and ag water, and therefore it increases the amount of the debt that is interest bearing.

Mr. Henley commented that the committee recognizes that they have a fairly large task before them. Mr. Henley stated that he hopes that before the subcommittee makes a recommendation to the full board of CAWCD, the Bank will have the opportunity to meet as a board and discuss the ramifications of what has been done and maybe provide some solutions to address to the committee. The Bank may have other options that they would like to present.

The committee asked the Bank to look at price elasticity from the standpoint of the Bank. If the price is increased by CAWCD, what will that mean to the Bank in terms of recharging water. Mr. Henley provided to the committee two figures: in lieu recharge alternatives and direct recharge. The second figures show direct and in lieu recharge opportunities.

Mr. Henley stated that the Bank could pay a little bit more for water and still fulfill its role, especially in terms of firming the supplies. The Bank would be able to generate enough credits to do that.

Mr. Henley feels that the Pricing Committee should look at some pricing with respect to the delivery cost at CAP.

If the Bank goes to more direct recharge, it would lose the price elasticity fairly quickly and the Bank would be at a level where even firming supplies would be difficult. Mr. Henley stated that the Bank need not 'panic' over the fact that CAWCD is considering increasing prices. The Bank can see what is going to happen, and will be able to evaluate it in terms of the Bank's mission and goals.

Ms. Pearson requested that pricing be added back to the Bank's agenda where it could be discussed more thoroughly and the Bank could take comments from the public.

Third Management Plan Overview

Mark Frank, Area Director for the ADWR Phoenix Active Management Area, and Sheila Ehlers, also of the ADWR Phoenix Active Management Area, gave a presentation of the process with the augmentation and recharge of the Second Management Plan (SMP) and the Third Management Plan (TMP).

Mr. Frank discussed the SMP and TMP that included the following topics:

- Augmentation of renewable sources
  - Alternative renewable sources
  - Augmentation grant program
  - Recharge Program
  - Focus on "secured" renewable supplies
  - Programs to maximize direct use / recharge of renewable supplies
  - Strategies about use / location / timing of renewable resource use
  - More focus on augmentation grants program
  - Reevaluate storage and recovery criteria of SMP with emphasis on areas of greatest need
- TMP program components
  - Conservation
  - Water Quality Assessment
  - Augmentation and Recharge
- TMP proposals / direction
  - Evaluate recovery strategy - maximize hydrologic benefits
  - Replenishment proposal for conservation program difficulties
  - Direct grants program to predetermined priority areas
  - Develop mechanism and strategy for an agency recommendations to the Bank
  - More focused management / assistance in critical areas
- Structure of the TMP Augmentation & Recharge Program to be of greatest benefit to the AMA(s)
  - Without discouraging individual recharge initiatives
  - Maximizing the ability to work in concert with other programs / organizations

Ms. Ehlers discussed the SMP and TMP, which included the following topics:

- TMP Augmentation Activities
  - Internal Subcommittee Meetings
  - Development of Issue Paper(s)
  - Steering Committee Review
  - Technical Advisory Committee Meetings
  - GUAC Meetings
  - Draft Chapter Development

Ms. Ehlers also gave an overview of the following issues:

- Consistency with the management plan and achievement of goal
- SMP storage and recovery siting criteria
- TMP storage and recovery siting criteria
- Safe yield
- Future water management objectives
- AWBA's role in TMP

Update on Mohave County Discussion

Mr. Henley stated that at this time there have not been any formal discussions with regards to the Mohave County proposal. He did state that CAIDD and MSIDD went together in a contract with Bookman-Edmonston to put together some recovery efforts. The Bank has committed to try to put together a recovery plan, but there is not a lot of information available to do that. It would be more of a 'trust us' recovery plan than a factual recovery plan. So the efforts of CAIDD/MSIDD will help the Bank in developing a recovery plan, which Mr. Henley believes is extremely important.

Mr. Henley was given some very positive results of the study that is being put together. He has invited Bookman-Edmonston to come to a future Water Banking meeting to give a presentation on the results and observations of the two districts in the Pinal County area.

The Bank has contacted one of the consultants and has asked for a scope of work to look at the Pima County-Tucson area and Maricopa County-Phoenix area to look at the options for recovery. Options of what can be done and what the cost would be are problems facing the consultants. The scope includes interviews and discussions with entities that hold CAP water that could be involved in recovery through exchanges.

The discussion of the Third Management Plan indicates the need to look more carefully at recovery, especially if recovery is going to be more constrained than when the Bank was originally authorized through the Third Management Plan activities.

Update on the AWBA Study Commission

Mr. Henley stated that a full overview was given at the last Water Banking meeting which included a review of the subcommittee activities and reports. He did state that there was a meeting on October 23, where the full subcommittee met to review the Interim Report and discuss the comments and changes. The subcommittee plans to complete the Interim Report by November 1. At the upcoming Water Banking meeting, Mr. Dishlip will give an overview of the Interim Report.

The Water Bank staff, Mr. Dishlip and Gregg Houtz met recently with the Gila Indian tribe's water rights group to talk about their opportunities to participate with the Bank. He felt that they were open to the possibility.

Ms. Pearson stated that the tribes have reacted favorably to the Study Commission's efforts to communicate with the individual tribes.

Innovations in American Government

Ms. Klaiber of the Water Banking Authority stated that the application to the Ford Foundation Innovations in American Government program, which recognizes excellence and creativity in government programs, has been completed in draft form for review and response.

Update on Interstate Discussions

Ms. Pearson stated that the seven basin states met to get the update from California regarding efforts to develop a "4.4" plan. The meeting went a little bit better than the six states had anticipated. There seemed to be some progress in developing a phase in California's approach in reducing their demand. The plan that was reviewed was actually more specific on how they would reduce demand. They will approach it from basically hard reduction in demand by doing additional conservation activities, like lining the All American canal, lining the Coachella canal, continuing the land fallowing program with Palo Verde Irrigation District and similar types of programs. California included participation in the Arizona Water Bank in their plan. California has not identified a specific amount, nor have they identified which of the six California agencies would be interested in participating in the program.

They are continuing to meet weekly and the six states will wait until the next time that California is prepared to come forward to make another presentation to give more detail as to how they intend to lessen their demand.

In 1998, there will likely be another surplus declaration, so to some extent, there is no immediate urgency for the California plan. The six states have made it quite clear that they will not support additional Secretarial declaration of the surplus until California has developed and committed to a "4.4" reduction plan.

Ms. Pearson gave an overview of the Endangered Species Act and the litigation involving the Southwestern Willow Fly Catcher habitat. Judge Earl Carroll of the federal district court for the district of Arizona, ruled to uphold the biological opinion issued by the U.S. Fish and Wildlife Service. The opinion allowed for mitigation strategies to preserve a habitat for the species of Lake Mead and chose not to accept a proposal to drain Lake Mead to protect the habitat.

The Southwest Center for Biological Diversity has chosen to appeal Judge Carroll's order to the Ninth Circuit, and there is an expedited hearing process for that case. The issue for the seven states is what role the State would have in the appeal process. Judge Carroll had dismissed as moot the State's claim that they were an indispensable party to the action, but under the 11th Amendment, could not be brought into the litigation and therefore the case should not move forward. He ruled that the particular argument was moot and so the issue was not immediately before the Ninth Circuit, unless the seven states go forward to resurrect the claim.

The seven states had actually agreed among the water directors not to move forward, to allow that issue to die quietly at the district court level. California decided to move forward and become a party to the action in the Ninth Circuit and to raise the 11th Amendment argument. Because they are choosing to do so, the other states chose to be parties to the action. It appears that all seven states will move to intervene and will make an 11th Amendment argument to the Ninth Circuit. Ms. Pearson believes that the argument will likely be brought before the Ninth Circuit.

Ms. Pearson asked Deputy Counsel Chuck Cahoy to comment on the notice of appeal that is due on October 23. Mr. Cahoy confirmed the appeal date and stated that the expedited briefing schedule calls for the federal response brief to be filed. The Notice of Appeal would also have to be filed in

response to Judge Carroll's finding that the motion was moot in order to bring that issue in front of the Ninth Circuit. ADWR will file a Notice of Appeal, a Motion to Consolidate that appeal with the Southwest Center's appeal, and an opening brief at the same time.

Call to the Public

Dave Iwanski stated that he would provide any documents that the Bank would need for their application for the Innovations in Government. Ms. Klaiber stated that the essay response would be adequate to submit.

Mr. Henley stated that if anyone from the public has ever submitted an application to the Ford Foundation that their assistance would be welcomed from the Bank.

Chairman Pearson adjourned the meeting at 11:37 a.m.

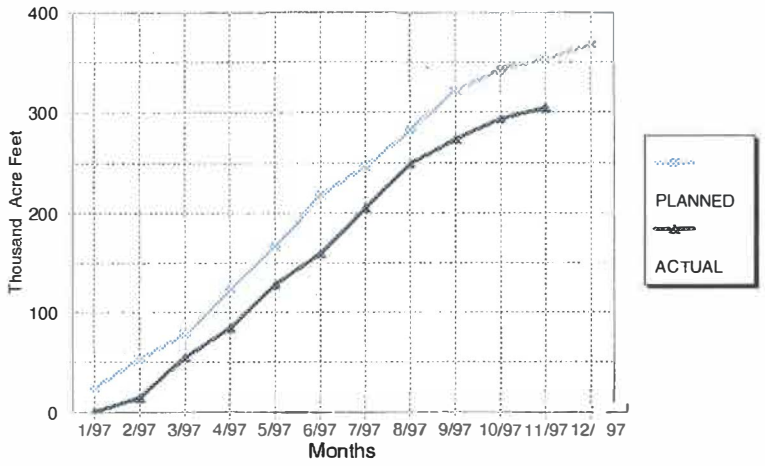
Actual deliveries updated 18-Nov-97

		jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	total	
Phoenix AMA														
	GRUSP	0	0	1,961	0	8,302	727	0	0	4,448	6,021	6,000	27,459	GRUSP
	RWCD	0	0	3,689	8,121	8,326	4,676	8,267	6,164	3,529	4,253	500	47,525	RWCD
	NMIDD	0	3,310	3,490	4,400	2,100	3,700	6,992	15,590	7,618	0	0	47,200	NMIDD
	QCID	0	0	0	0	0	0	3,566	7,263	3,719	1,559	1,000	17,107	QCID
	MWD	0	0	0	0	0	0	578	2,171	904	919	1,432	6,004	MWD
	CHCID	0	0	0	0	0	0	0	0	0	0	0	0	CHCID
Subtotal		0	3,310	9,140	12,521	18,728	9,103	19,403	31,188	20,218	12,752	8,932	145,295	
Pinal AMA														
	CAIDD	0	6,825	19,967	8,208	10,000	0	0	0	0	0	0	45,000	CAIDD
	MSIDD	0	2,446	8,422	5,402	8,923	12,780	10,940	3,838	1,496	5,492	0	59,739	MSIDD
	HIDD	0	1,400	3,300	3,300	5,015	9,575	13,485	9,423	2,667	1,520	2,000	51,685	HIDD
Subtotal		0	10,671	31,689	16,910	23,938	22,355	24,425	13,261	4,163	7,012	2,000	156,424	
Tucson AMA														
	Avra Vally	0	0	0	55	644	743	695	20	0	0	0	2,157	Avra Vally
	CAVSRP	0	0	0	0	0	0	0	0	0	0	0	0	CAVSRP
	Pima Mine	0	0	0	0	0	0	0	0	0	0	0	0	Pima Mine
	Lower Santa Cru	0	0	0	0	0	0	0	0	0	0	0	0	L. Santa Cru
Subtotal		0	0	0	55	644	743	695	20	0	0	0	2,157	
TOTAL		0	13,981	40,829	29,486	43,310	32,201	44,523	44,469	24,381	19,764	10,932	303,876	

1997 PLAN OF OPERATION

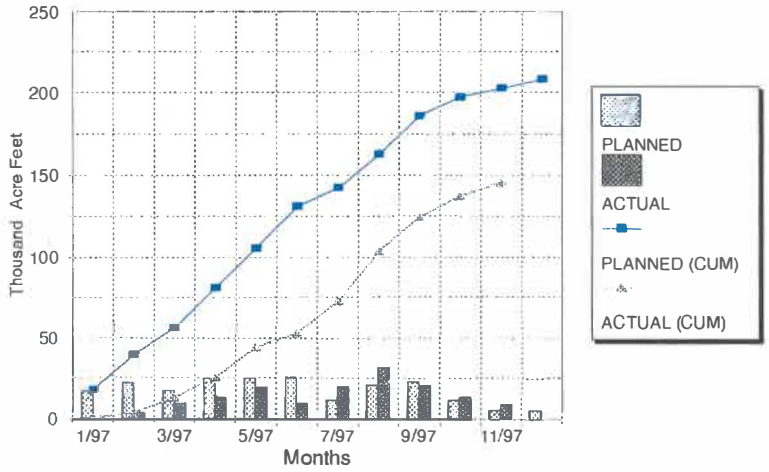
CUMULATIVE DELIVERIES (by Month)

Planned vs. Actual



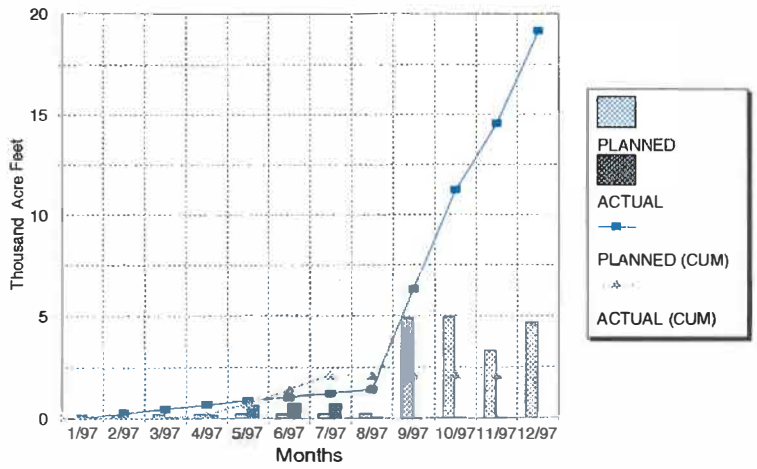
PHOENIX AMA DELIVERIES (by Month)

Planned vs. Actual



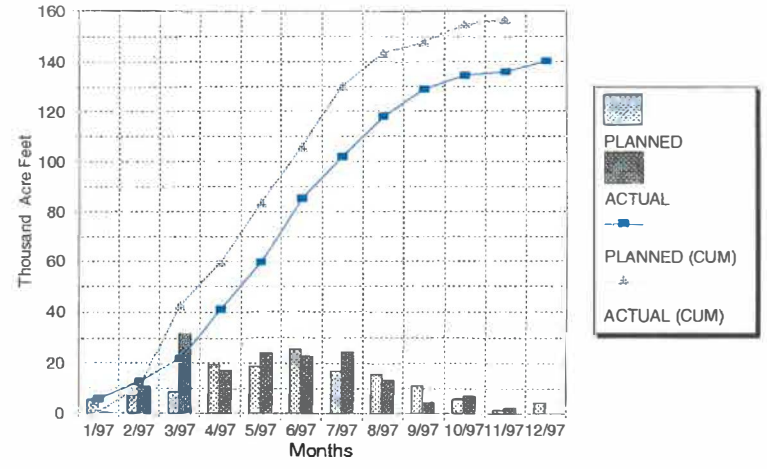
TUCSON AMA DELIVERIES (by Month)

Planned vs. Actual



PINAL AMA DELIVERIES (by Month)

Planned vs. Actual



THE SECRETARY OF THE INTERIOR

WASHINGTON

OCT 14 1997

Honorable Jane Hull
Governor of Arizona
Phoenix, Arizona 85007

Dear Governor Hull:

The Bureau of Reclamation, after consultation at a meeting on July 29, 1997, with representatives of the Colorado River Basin States, the Upper Colorado River Commission, appropriate Federal agencies, Indian tribes, and other interested parties in Colorado River operations, established the 1998 Annual Operating Plan, (AOP) (copy enclosed) for the Colorado River reservoirs. The plan of operation reflects use of the reservoirs for all purposes consistent with the "Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968" (Operating Criteria).

Pursuant to required Secretarial determinations, storage equalization and the avoidance of spills will control the annual releases from Glen Canyon Dam in accordance with Article II(3) of the Operating Criteria, unless the minimum objective release criterion in Article II(2) is controlling. If the equalization criterion is controlling, Glen Canyon Dam will be operated to release sufficient water during water year 1998 to equalize, as nearly as practicable, the active reservoir contents of Lake Powell and Mead on September 30, 1998.

Taking into account (1) the existing water supply conditions in the basin, (2) the most probable near-term water supply conditions in the basin, and (3) that the beneficial consumptive use requirements of Colorado River mainstream users in the Lower Division States are expected to be more than 9,250 MCM (7.5 MAF), the surplus condition is the criterion governing the operation of Lake Mead for calendar year 1998 in accordance with Article III(3)(b) of the Operating Criteria and Article II(2)(B) of the decree in Arizona v. California. This determination is warranted based on the current and projected hydrologic conditions in the Colorado River Basin and water needs in the Lower Division States, utilizing an analysis of future reservoir conditions, Lake Powell releases, and flood control releases. A volume of 2,097 MCM (1.7 MAF) of water will be scheduled for delivery to Mexico during calendar year 1998 in accordance with Article 15 of the 1944 Mexican Treaty and Minute No. 242 of the International Boundary and Water Commission. While there still is no agreed upon long-term strategy for the determination of surplus conditions, the making of this determination, based on flood control and spill avoidance considerations, does not preclude the Secretary from adopting other determination criteria in future years.

Any Lower Division State will be allowed to use water apportioned to, but unused by, another Lower Division State in accordance with Article II(B)(6) of the decree in Arizona v. California.

It is my intention that Glen Canyon Dam will be operated on a long-term basis in conformance with the Record of Decision for the Glen Canyon Dam Final Environmental Impact Statement.

Anticipated increases in the use of Colorado River water dictate that the efficient use of water must be a priority to properly manage the resource. Consultations concerning water conservation measures and operating practices will be carried out under Title 43 CFR 417, Procedural Methods for Implementing Colorado River Water Conservation Measures with Lower Basin Contractors and Others.

Sincerely,

Enclosure

cc: ✓ Ms. Rita Pearson
Director, Arizona Department
Of Water Resources

THE SECRETARY OF THE INTERIOR

WASHINGTON

OCT 14 1997

Honorable Jane Hull
Governor of Arizona
Phoenix, Arizona 85007

Dear Governor Hull:

The Bureau of Reclamation, after consultation at a meeting on July 29, 1997, with representatives of the Colorado River Basin States, the Upper Colorado River Commission, appropriate Federal agencies, Indian tribes, and other interested parties in Colorado River operations, established the 1998 Annual Operating Plan, (AOP) (copy enclosed) for the Colorado River reservoirs. The plan of operation reflects use of the reservoirs for all purposes consistent with the "Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968" (Operating Criteria).

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Sincerely,

Enclosure

cc: ✓ Ms. Rita Pearson
Director, Arizona Department
Of Water Resources

Lower Colorado River Water Supply Report

CURRENT STORAGE	PERCENT CAPACITY	1000 ACRE-FEET	ELEVATION (FEET)
LAKE POWELL - GLEN CANYON DAM	92%	22,355	3687.39
LAKE MEAD - HOOVER DAM	95%	24,561	1211.09
LAKE MOHAVE - DAVIS DAM	81%	1,468	634.32
LAKE HAVASU - PARKER DAM	90%	556	446.74
LOWER COLORADO BASIN CONTENTS	94%	26,586	
TOTAL SYSTEM CONTENTS	91%	55,139	

PROJECTED USE FOR CALENDAR YEAR 1997 as of 11/05/97	1000 ACRE-FEET	
NEVADA	251	
SOUTHERN NEVADA WATER SYSTEM		208
OTHERS		43
BANK		0
CALIFORNIA	5224	
METROPOLITAN WATER DISTRICT OF CALIFORNIA		1,238
IRRIGATION DISTRICTS		3,954
OTHERS		32
BANK		0
ARIZONA	2782	
CENTRAL ARIZONA PROJECT		1,471
OTHERS		1,311
BANK		0
TOTAL LOWER BASIN USE		8,257
DELIVERY TO MEXICO		2,270

CURRENT 7-DAY AVG RELEASE	CUBIC FEET PER SECOND
GLEN CANYON DAM	20,100
HOOVER DAM	11,200
DAVIS DAM	11,900
PARKER DAM	6,900

OTHER SIGNIFICANT INFORMATION

INFLOW ABOVE LAKE POWELL - NOVEMBER FINAL FORECAST	MILLION ACRE-FEET	NOV 10, 1997 PERCENT OF NORMAL
OBSERVED WATER YEAR '97	16.833	144%
OBSERVED APRIL-JULY '97	11.321	146%
OCT OBSERVED INFLOW	1.035	189%
NOV INFLOW FORECAST	0.700	134%

BASIN SNOWPACK AND PRECIP INFORMATION

	PERCENT OF NORMAL
WATER YEAR PRECIP TO DATE	112%
CURRENT BASIN SNOWPACK TO DATE	87%

[TOP OF PAGE | EXT AFFAIRS HOME PAGE | FEEDBACK]

Author: Janie Jo Smith, River Operations Group.

ARIZONA WATER BANKING AUTHORITY

1998
ANNUAL PLAN OF OPERATION

Rita P. Pearson, Chairman

January 1, 1998

INTRODUCTION

The Arizona Water Banking Authority (Authority) was created with to store unused Arizona Colorado River entitlement in western, central and/or southern Arizona to develop long-term storage credits to: (1) firm existing water supplies for municipal users during Colorado River shortages or Central Arizona Project (CAP) service interruptions; (2) help meet the water management objectives of the Arizona Groundwater Code; and (3) assist in the settlement of American Indian water rights claims. The Authority is required by statue to approve an annual Plan of Operations by January 1 of each year.

The Plan of Operation is intended to govern the storage of water over the course of the entire calendar year. The Authority recognizes that day-to-day adjustments in the normal operations of the CAP or the individual storage facilities caused by maintenance and fluctuations in the weather may affect the actual monthly deliveries made on behalf of the Authority. However, if the adjustments do not impact the overall annual delivery projections contained in the Plan, those adjustments will not be deemed modifications to the Plan and will be addressed by staff and reported to the Authority on an as-needed basis.

During the course of the year, changing circumstances may present limitations or provide new opportunities not contemplated in the adopted Plan, which could affect the overall projections. In such circumstances, the Authority may choose to modify its adopted Plan. If such modifications are required, the proposed modifications will be discussed and approved by the Authority at a public meeting of the Authority.

1997 PLAN OF OPERATION

In its first year of operations, the Authority recharged approximately 331,000 acre feet of Colorado River water pushing Arizona's total use of Colorado River water close to its normal year entitlement of 2.8 million acre feet (See Figure 1).

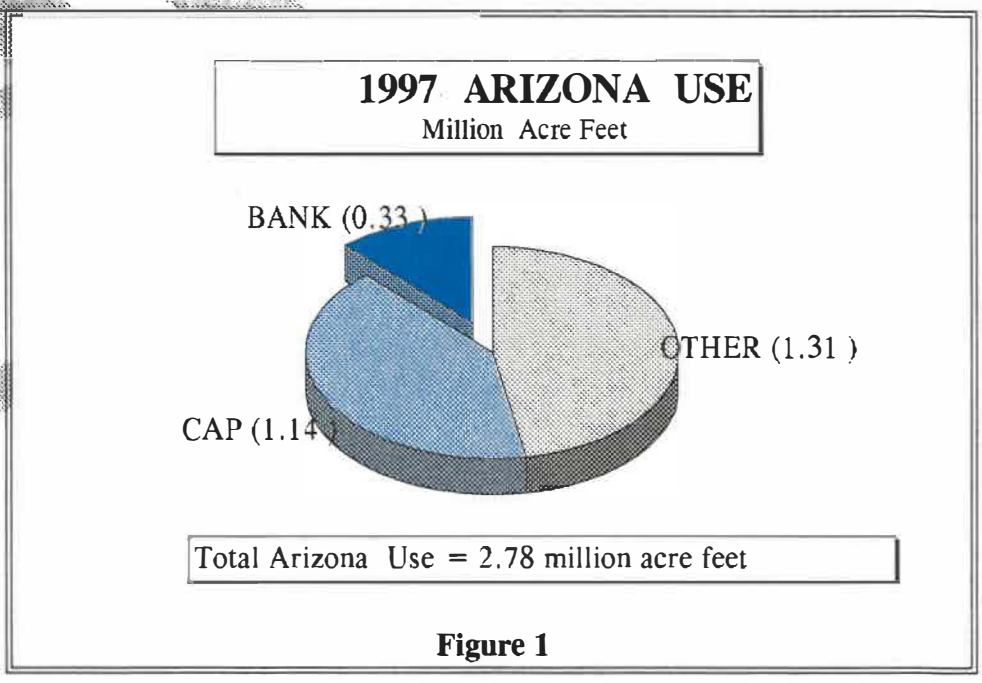


Figure 1

The Authority utilized both Underground Storage Facilities (USF) and Groundwater Saving Facilities (GSF) to store water in 1997. The Authority's recharge partners and the amount stored at each facility are listed in Table 1.

Table 1

AMA	Facility	Type	Annual Capacity	Amount Recharged
Phoenix	GRUSP (SRP)	USF	200,000 af	45,400 af
	Queen Creek ID	GSF	28,000 af	16,000 af
	Chandler Heights ID	GSF	3,000 af	
	New Magma IDD	GSF	54,000 af	47,200 af
	RWCD	GSF	100,000 af	46,500 af
	MWD	GSF	18,000 af	9,500 af
Pinal	MSIDD	GSF	120,000 af	65,000 af
	CAIDD	GSF	110,000 af	45,000 af
	Hohokam ID	GSF	55,000 af	52,800 af
Tucson	Avra Valley (CAP)	USF	8,000 af	2,200 af
	CAVSARP (Tucson)	USF	10,000 af	1,000 af
Total			706,000 af	330,600 af

Because the Secretary of the Interior declared that the Colorado River was in surplus for 1997, the increased use by Arizona did not impact the other Lower Basin States' uses. Total estimated use of Colorado River water in the Lower Basin exceeded 8.2 million acre feet in 1997 (see Figure 2).

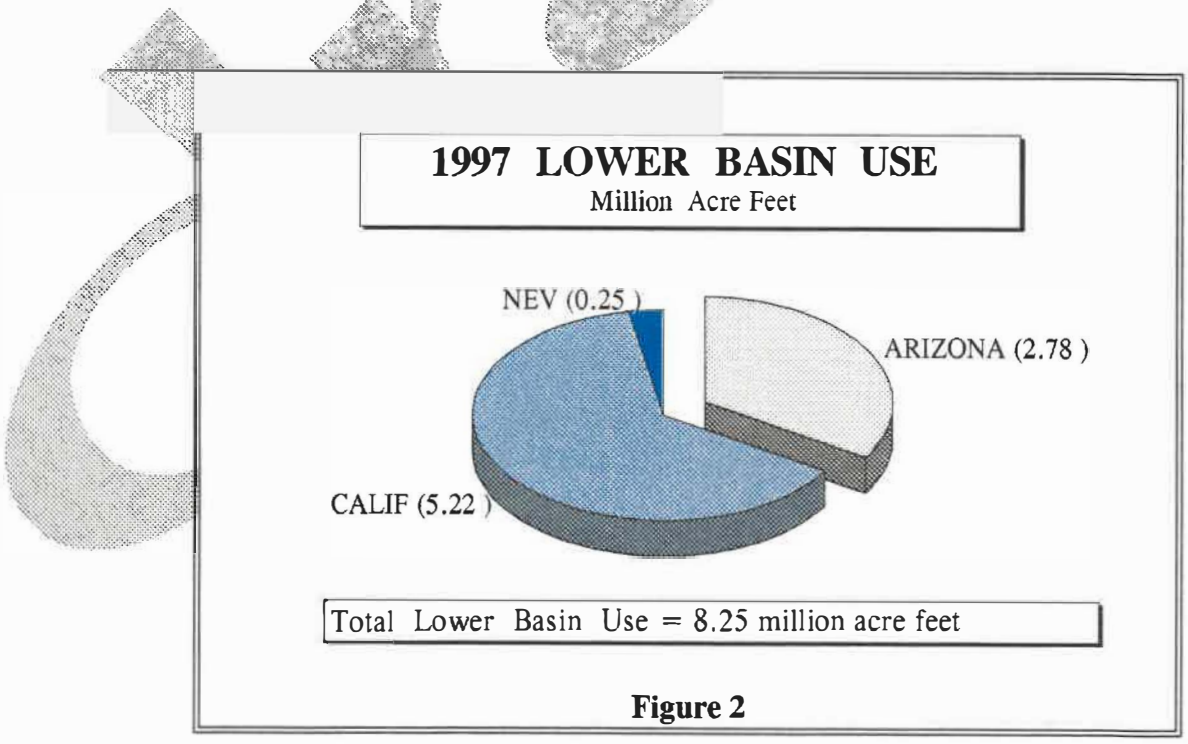


Figure 2

1998 PLAN OF OPERATION

The Secretary of the Interior has declared that the Colorado River is again in a surplus condition and it is expected that uses in the Lower Basin will again exceed 8.2 million acre feet in 1998. Current projected uses in Arizona are less than the 1997 use at 2.68 million acre feet (see Figure 3).

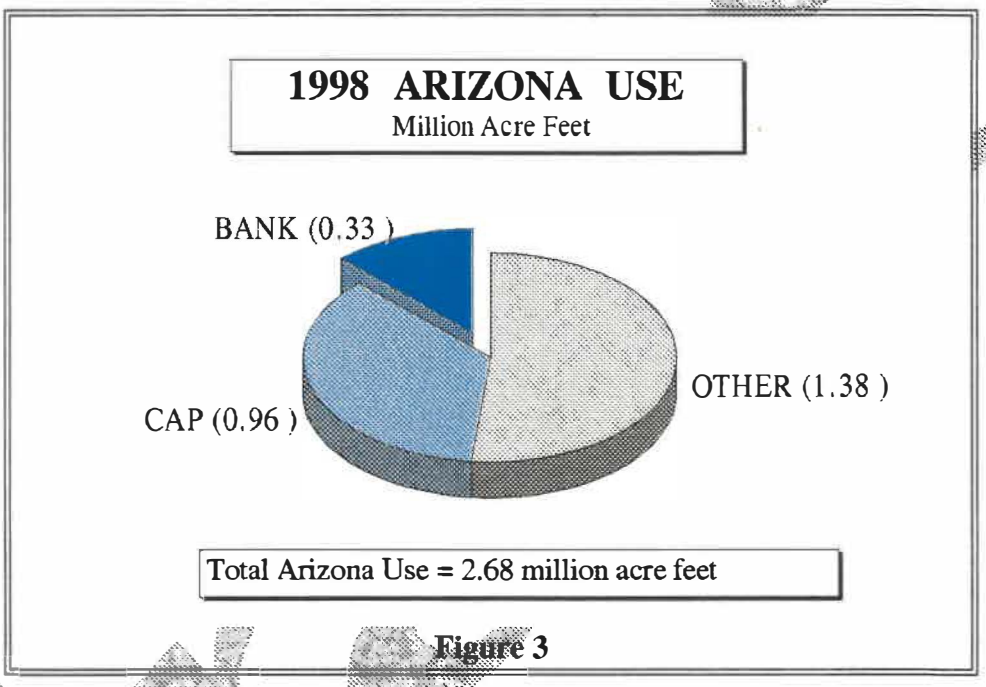


Figure 3

To assist in developing the 1998 Plan, each facility operator submitted an annual delivery schedule to CAP. (CAP scheduled the Authority's deliveries for those GSFs they will be operating.) The CAP staff utilized these schedules to compile an annual schedule for the CAP including M&I, Indian, incentive recharge, agricultural pool, and Authority water. Concurrently, the Authority staff met with the facility operators to discuss their delivery schedules and confirm their continued interest in participating with the Authority. The Plan includes some level of recharge at permitted facilities in Maricopa, Pinal, and Pima counties.

Based on its adopted Plan, the Authority anticipates recharging approximately 330,000 acre feet of Colorado River in 1998. The Plan was developed utilizing facilities that have already been permitted or are anticipated to be permitted in 1998. The Plan attempts to optimize, on a monthly basis, the delivery of Colorado River water to meet the Authority's objectives. However, the Plan remains flexible, and if adequate capacity and funding are available, the Plan can be modified in the future to include additional facilities once those facilities are permitted. Table 2 shows the Authority's 1998 delivery schedule.

Table 2

ARIZONA WATER BANK AUTHORITY

CAP Water Delivery Schedule for AWBA Recharge

Calendar Year 1998

(ACRE-FEET)

				January	February	March	April	May	June	July	August	September	October	November	December	Total
Estimated Total CAP Deliveries + Losses : (M&I, Indian, Ag Pools 1 & 2, Incentive Recharge)				29,000	33,000	91,000	100,000	115,000	147,000	185,000	113,000	56,000	42,000	27,000	26,000	964,000
Available Excess CAP Capacity for AWBA :				42,000	24,000	41,000	29,000	51,000	40,000	10,000	74,000	45,000	26,000	18,000	25,000	425,000
A W B A - Recharge Sites :		Permitted Capacity (AF)	Requested Capacity (AF)													
PHOENIX AMA :																
Direct >	GRUSP	200,000	50,000	2,500	3,500	4,000	5,250	5,250	5,250	5,250	5,250	5,250	4,000	2,500	2,000	50,000
	AGUA FRIA	100,000	12,000	0	0	0	0	0	0	0	0	3,000	3,000	3,000	3,000	12,000
Indirect >	CHCID	3,000	500	0	0	0	50	50	50	50	50	100	100	50	0	500
	MWD	18,000	20,000	0	588	2,471	2,471	2,588	2,588	2,588	2,470	1,412	1,412	1,412	0	20,000
	NEW MAGMA	52,000	40,000	1,975	1,625	3,200	2,300	2,100	2,100	3,700	9,700	9,600	1,700	700	1,300	40,000
	QUEEN CREEK	28,000	20,015	0	0	0	0	0	0	4,252	7,263	3,000	2,000	1,500	2,000	20,015
	RWCD	10,000	24,000	0	0	0	0	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	24,000
	TONOPAH ID	15,000														
PINAL AMA :																
Indirect >	CAIDD	110,000	35,000	0	0	0	0	0	0	0	21,241	9,384	1,145	504	2,726	35,000
	HOHOKAM	55,000	50,440	1,500	2,400	8,500	6,000	8,900	6,890	1,600	10,300	2,000	700	250	1,400	50,440
	MSIDD	120,000	52,780	2,070	3,420	9,630	8,280	7,660	9,350	6,110	1,760	620	730	1,240	1,910	52,780
TUCSON AMA																
Direct >	AVRA VALLEY	10,000	5,420	0	200	360	540	540	540	540	540	540	540	540	540	5,420
	CAVSARP	10,000	5,040	460	460	460	460	460	460	0	460	460	460	460	440	5,040
	PIMA MINE RD	10,000	6,600	0	100	200	700	700	700	700	700	700	700	700	700	6,600
	L. SANTA CRUZ	30,000	5,000	0	0	0	0	0	0	0	0	0	1,500	1,500	2,000	5,000
TOTAL (Direct + Indirect) :				8,505	12,293	28,821	26,051	31,248	30,928	27,790	62,734	39,066	20,987	17,356	21,016	326,795
Remaining CAP Capacity :				33,495	11,707	12,179	2,949	19,752	9,072	(17,790)	11,266	5,934	5,013	644	3,984	98,205

The values in Table 2 reflect the delivery amounts at the CAP turnout and do not account for losses incurred between the turnout and the actual point of use. Those losses must be calculated and deducted from the deliveries to determine the actual credits earned by the Authority.

No recovery is anticipated in 1998. The Authority intends to develop recovery concepts during 1998 to ensure that the benefit of the credits developed will be realized by the area in which the funds are collected.

PRICING

For 1997 and 1998, the CAP Board adopted a delivery rate for Authority water based on the cost of pumping energy plus a $5 contribution to the fixed operation and maintenance cost of the CAP. The Authority's policy of recovering $21 from its in-lieu partners will continue for 1998.

Table 3 reflects the water rates the CAP will charge the Authority for the delivery of Colorado River water, the Authority's rate to irrigation districts for use of in-lieu water, and the various rates the Authority will be charged to utilize the different direct recharge facilities.

Table 3

1998 Water Rates	
CAP delivery rate to AWBA	$41 per acre foot
AWBA rate to In-Lieu User	$21 per acre foot
Direct Recharge Facility rate paid by AWBA	
GRUSP (SRP)	$14 per acre foot
Agua Fria (CAP)	$10 per acre foot (estimate)
Avra Valley (CAP)	$22.50 per acre foot
Pima Mine Road (CAP/Tucson Water)	$10 per acre foot (estimate)
Central Avra Valley (Tucson Water)	$16 per acre foot (estimate)
Lower Santa Cruz (CAP/Pima County)	$20 per acre foot (estimate)

The CAP has established a subcommittee to review the existing delivery rate for the Authority's water. Two members of the Authority sit on this subcommittee. The subcommittee hopes to make a recommendation on a long-term delivery rate for inclusion in CAP 1999 pricing decisions.

The estimated total cost of the Authority's 1998 Plan of Operation is $9,506,000, which includes the direct facility use fees and the CAP delivery rate minus cost recovery from the in-lieu user.

ACCOUNTING

The Authority's enabling legislation requires the development of an accounting system that allows the tracking of all long-term storage credits accrued by the Authority and the funding sources from which they were developed. The Arizona Department of Water Resources has established accounts that allow for the tracking of both credits and funds.

Table 4 provides estimates of the funds available and expended and the credits that will accrue to those accounts based on the 1998 Plan of Operation.

Table 4

1998 Plan of Operation

	Funding		Credits[1]	
	Available	Expended	Amount	Location
Withdrawal Fee				
Phoenix AMA	$2,000,000			
Tucson AMA	$725,000			
Pinal AMA	$775,000	$775,000	35,000 af	
Four Cent Tax				
Maricopa County	$6,221,000	$5,452,000	151,000 af	Phoenix AMA
Pima County	$2,020,000	$1,290,000	20,000 af	Pima AMA
Pinal County	$240,000	$240,000	11,000 af	Pinal AMA
Other				
General Fund	$1,760,000	$1,749,000	79,000 af	
Phoenix AMA				
Tucson AMA				
Pinal AMA		*$1,749,000*	*79,000 af*	*Pinal AMA*
California	(not applicable)			
Nevada	(not applicable)			
Total	$13,741,000	**$9,506,000**	**296,,000 af**	

[1] Estimate based on annual deliveries (annual delivery - 5% losses - 5% cut to the aquifer)

Table 5 provides an estimate of the funds available and expended and the credits that will accrue to those accounts based on the Authority's recharge activities to date.

Table 5

Cumulative Totals

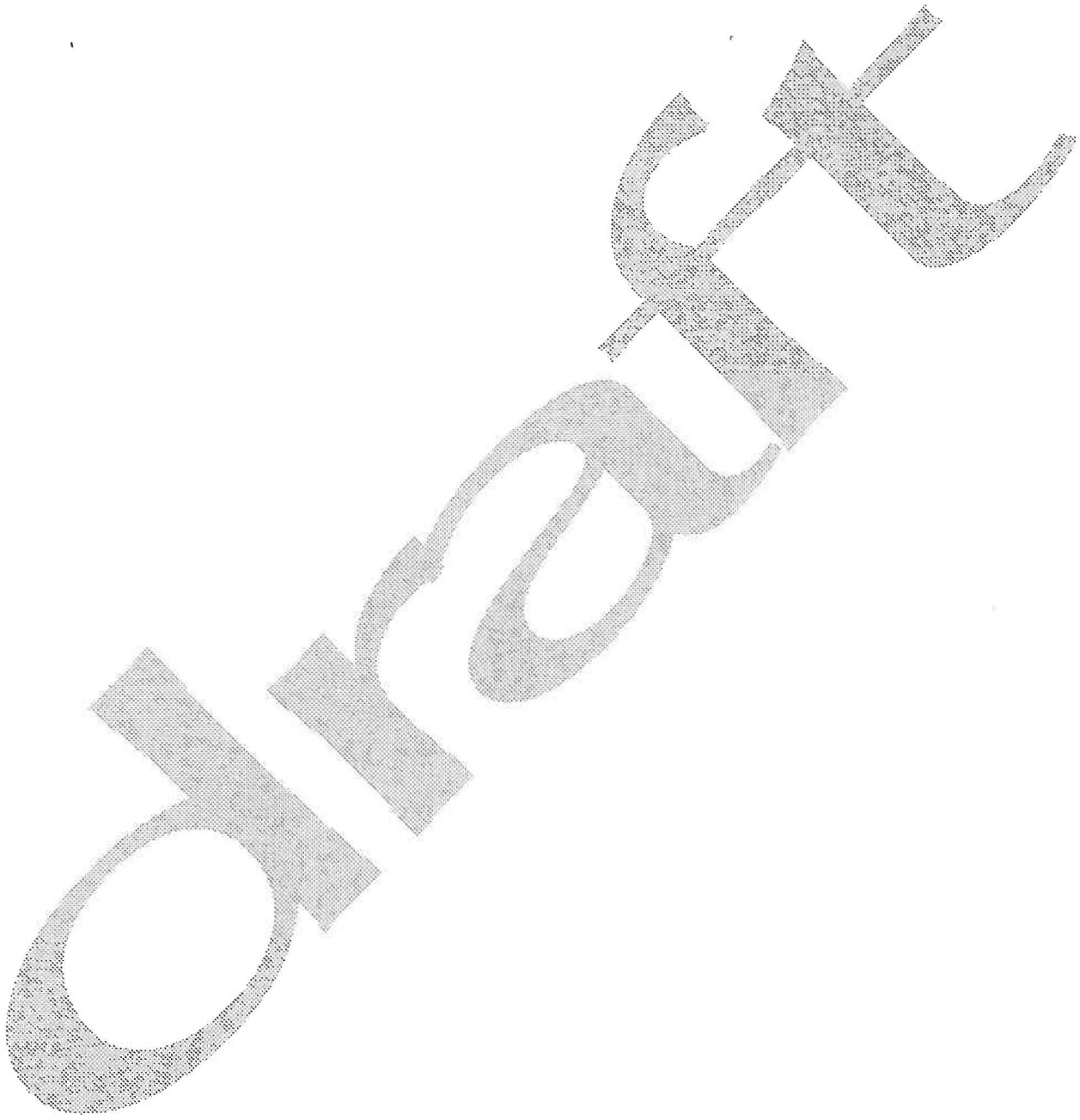
(1997)

	Funding		Credits[1]	
	Available	Expended	Amount	Location
Withdrawal Fee				
Phoenix AMA				
Tucson AMA				
Pinal AMA				
Four Cent Tax				
Maricopa County	$4,895,000	$3,744,000	133,000 af	Phoenix AMA
Pima County	$1,079,000	$175,000	3,000 af	Pima AMA
Pinal County	$226,000	$225,000	14,000 af	Pinal AMA
Other				
General Fund	$2,550,000	$2,490,000	150,000 af	
Phoenix AMA		*$270,000*	*16,000 af*	*Phoexix AMA*
Tucson AMA				
Pinal AMA		*$2,220,000*	*134,000 af*	*Pinal AMA*
California	(not applicable)			
Nevada	(not applicable)			
Total		**$6,634,000**	**300,000 af**	

[1] Estimate based on annual deliveries (annual delivery - 5% losses - 5% cut to the aquifer)

Public Review and Comment

(Note: To be written after meetings with GUACs)



Augmentation and Recharge - SMP

- Alternative renewable sources

  - CAP
  - effluent
  - weather modification
  - watershed management

- Augmentation grant program

  - purpose
  - direction
  - funding criteria

- Recharge Program

  - purpose
  - siting criteria for storage and recovery

Augmentation and Recharge - TMP

- Focus on "secured" renewable supplies
- Programs to maximize direct use / recharge of renewable supplies
- Strategies (water management perspective) about use / location / timing of renewable resource use.
- More focus in augmentation grants program

  - recharge program needs
  - • new methods/technologies
  - • critical decline areas
  - • less funding - AWB

- Reevaluate storage and recovery criteria of SMP with emphasis on areas of greatest need.

TMP Program Components

- Conservation

  - Agriculture
  - Industry
  - Municipal

- Water Quality Assessment

- Augmentation and Recharge

TMP Proposals / Direction

- Evaluate recovery strategy - maximize hydrologic benefits
- Replenishment proposal for conservation program difficulties.
- Direct grants program to predetermined priority areas
- Develop mechanism and strategy for a agency recommendations to Az. Water Bank

  - storage facilities
  - recovery criteria
  - credit extinguishment

- More focused management / assistance in critical areas.

How Can We Structure Our TMP Augmentation & Recharge Program To Be Of Greatest Benefit To The AMA(s):

- Without discouraging individual recharge initiatives
- Maximizing our ability to work in concert with other programs/organizations

  - AWB
  - CAWCD
  - ADEQ

TMP Augmentation Activities

- Internal Subcommittee Meetings
- Development of Issue Paper(s)
- Steering Committee Review
- Technical Advisory Committee Meetings
- GUAC Meetings
- Draft Chapter Development

Consistency with the Management Plan and Achievement of Goal

SMP Storage and Recovery Siting Criteria

TMP Storage and Recovery Siting Criteria

Safe Yield

Future Water Management Objectives

- Alleviate current and projected drawdown
- Alleviate current subsidence
- Protect AMA against future subsidence and earth fissures
- Mitigate water quality problems
- Enhance physical availability of supplies where needed.

AWBA's Role in TMP

TMP Recommendations to the Water Bank

- Whether add'l water storage in AMA would help achieve goal
- Where add'l water storage would be most useful to achieve goal
- Whether extinguishment of LTS credits accrued or to be accrued by the AWBA would help to achieve goal.

RECOVERY ASSESSMENT FOR BANKED WATER
-Summary Report-

CENTRAL ARIZONA
and
MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICTS

November, 1997	*Bookman-Edmonston Engineering*	

INTRODUCTION

The Maricopa-Stanfield and Central Arizona Irrigation and Drainage Districts (MSIDD and CAIDD, or the Districts) are located in Pinal County, Arizona and are currently irrigating with a conjunctive source of Central Arizona Project (CAP) water and groundwater. In 1992, the Districts began participating in the indirect groundwater savings program by receiving a quantity of CAP water in lieu of pumping groundwater. Each acre-foot of groundwater saved through the in-lieu method is counted as a stored water credit. This report presents an analysis of the Districts' potential to recover stored water credits. Included in the analysis are assessments of the physical water supply and conveyance systems, alternative water supply and delivery conditions when recovery may be required, expected water uses of the potential recipients of recovered water, and impacts to the groundwater system.

BACKGROUND

RECHARGE PROGRAM

From 1992 through 1994, the Central Arizona Water Conservation District (CAWCD) and the Districts participated in the groundwater savings program whereby CAWCD delivered a total of approximately 386,000 acre-feet of CAP water to the Districts in exchange for the accrued groundwater recharge credits.

The Arizona Water Banking Authority (AWBA) was established in 1996 under ARS Title 45 - Chapter 14. One objective of the AWBA is to recharge otherwise unused CAP water. The AWBA and the Districts have established a goal to recharge 103,690 acre-feet of CAP water in 1997 under the groundwater savings program. As of October 14, 1997, a total of 101,947 acre-feet had been recharged for the AWBA in 1997. In addition, CAWCD currently offers the Districts CAP water ("pool" water) which is not associated with a formal groundwater recharge program and no credits are accrued.

In general, the groundwater credits accrued under groundwater savings programs are equivalent to groundwater credits accrued under direct recharge programs. The water recharged maintains its legal character and can be 100 percent recovered. The water can be recovered within the same groundwater basin or within the same Active Management Area (AMA). Therefore, the groundwater credits stored by the Districts through the in-lieu programs are considered to be CAP water and may be recovered anywhere within the Pinal AMA.

RECOVERY PROGRAM

Recovery of stored groundwater is generally expected to occur under one of two conditions: 1) a shortage of Colorado River water has been declared, CAP deliveries have been reduced, and recovery from long-term groundwater storage accounts is required to meet demands of CAP M&I subcontractors; or 2) out-of-state or other Colorado River water users who have participated in the groundwater banking program request to recapture water from storage accounts. In this case, the recovery may occur during normal water supply conditions on the Colorado River. In fact, out-of-state participants may be precluded from recovery during conditions of shortage.

Recovery during CAP shortages may be accomplished by pumping groundwater for delivery either directly or through an exchange to high priority CAP contractors, such as the Ak-Chin Indian Community, in-lieu of their uses of CAP water. The CAP water that otherwise would have been used is then available for use from CAP facilities by the recovering entity. If recovery of stored water is made during normal water supply conditions, the same process may be followed. Additionally, if the Districts are receiving CAP water for their own use as expected, then the Districts would simply forgo using CAP water and replace it with groundwater. The unused CAP water then becomes available in the Colorado River pursuant to agreements to forebear its use by CAWCD. Of course, other contractual arrangements will be necessary with the Arizona Department of Water Resources (ADWR), the AWBA, and the Secretary of the Interior.

OTHER ISSUES

The Districts' farming and recovery operations will also be influenced by other conditions and regulations. These include the Pinal AMA's Third and future Management Plans, Assured Water Supply Rules, groundwater pumping restrictions near the boundaries of Indian Communities which are placed on the Districts through federal agreements, contracts for power available to the Districts, and existing groundwater credits in the Pinal AMA. In particular, the Assured Water Supply Rules for the Pinal AMA have established a baseline groundwater level of 1,000 feet below ground surface beyond which pumping for agricultural purposes will not be allowed.

Agreements between the Districts and the United States Bureau of Reclamation (USBR) limit overall pumping by the Districts. CAIDD is restricted to pumping 240,000 acre-feet per year and MSIDD is restricted to 250,000 acre-feet per year. Additionally the Districts' pumping is limited near the boundaries of the Gila River and the Tohono O'Odham Indian Communities. However, the agreements specifically provide that the recovery of groundwater recharge credits held by CAWCD and future stored credits do not count as pumped water within these pumping limits.

ASSUMPTIONS

Significant assumptions made in this evaluation are as follows:

- The Districts will continue to actively maintain and improve the existing wells and add new or replacement wells in the system to assure the capability to satisfy demands.
- The Districts will remain economically viable.
- The Districts' operations will not be impacted by recovery operations. The Districts' projected irrigation levels correspond to full pumping capability during peak use months.

- The recipients of the recovered water can use CAP water to meet their own peak demands. This assumption allows the recovered water to be delivered during off-peak periods of Districts' demand.

RECOVERY RECIPIENTS

Recovery recipients are defined as having an existing CAP contract or entitlement, being located in a way that physical delivery of recovered groundwater is possible, and having a future demand that could likely be at least partially satisfied by recovered groundwater.

While a number of potential recovery recipients are possible, they are screened down to eight potential recovery recipients who are identified (see Table 1) based on a substantial capability to recover while limiting capital cost expenditures on system modifications. The screened list of recovery recipients is summarized in Table 1.

A majority of the potential recovery recipients were contacted in order to obtain their level of interest in a potential recovery program including the Ak-Chin Indian Community, the Tohono O'Odham San Lucy Farms, San Carlos Irrigation and Drainage District (SCIDD), the City of Eloy and the Arizona Water Company. Although all those contacted expressed interest in the recovery program, the remaining potential recovery recipients' level of interest is unknown. Most significant is the Gila River Indian Community (GRIC). If the GRIC is not interested in participating in the recovery program, the potential for recovery would be reduced.

TABLE 1
POTENTIAL USERS AND DELIVERY MECHANISMS
FOR RECOVERED WATER - CAIDD and MSIDD

POTENTIAL RECIPIENT	DELIVERY MECHANISM/CONVEYANCE STRUCTURE	CAP CONTRACT (AF/yr)
Ak-Chin Indian Community	• Direct delivery in Santa Rosa Canal - currently connected. • Construct additional conveyance laterals for direct delivery to southeast portion of Reservation (East Main Canal and E9 Lateral extensions) . • Direct delivery from wells currently on-Community	65,000[1]
City of Eloy	• Direct delivery from existing City of Eloy wells and conveyance systems.	2,171
Arizona Water Company - Casa Grande and Coolidge Systems	• Direct delivery from existing Arizona Water Company wells and conveyance systems.	10,884
Tohono O'Odham - San Lucy Farms	• Direct delivery in Central Main Canal - currently connected. • Requires conveyance of Indian Priority CAP contracts from the Tohono O'Odham Nation.	8,000, 10,800 or 18,800 [2]
SCIDD	• Construct additional canal to deliver to Casa Grande Canal (NB and NC Lateral extensions) • Requires an exchange agreement with the GRIC for Gila River water.	Exchange with Gila River Indian Community
CAP Aqueduct - Pima County CAP Contracts	• Direct delivery to CAP Aqueduct by reversing flow direction of portions of the Central Main and Santa Rosa Canals.	>200,000
GRIC	• Construct additional conveyance laterals for direct delivery to southwest portion of Community (WR, E12 and E13 lateral extensions) . • Direct delivery of CAP water to SCIDD and for exchange Gila River water to GRIC.	173,100

[1] Value does not include 10,000 acre-foot allocation being leased to Del Webb Corporation.
[2] 8,000 acre-feet = Tohono O'Odham Chuichu allocation, 10,800 acre-feet = Tohono O'Odham-Schuk Toak CAP allocation, 18,800 acre-feet = combined allocations.

ESTIMATION OF RECOVERY POTENTIAL

The recovery potential was determined using a detailed analysis of wells and their ability to be used to recover water, an example of which is shown in Figure 1. The first step was to eliminate well pumping capability which would be needed to meet the Districts' demands. A demand curve for the Districts, their pumping capacities, and the amount estimated in excess of their demands is shown in Figure 1. It should be noted that the Districts' demand curve used in this analysis is based on recent cropping patterns and farming practices. Specifically, the 1996 demand curve serves as a base and is reduced such that the maximum demand could be entirely served by District wells.

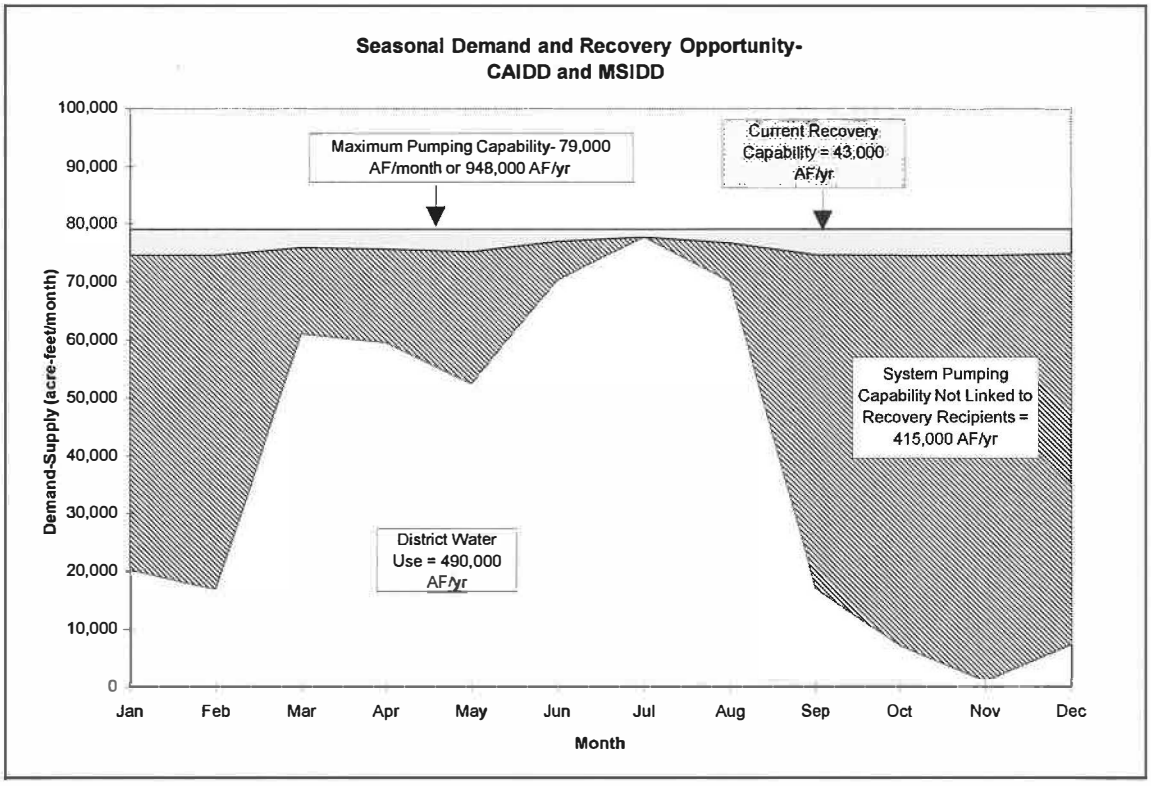


Figure 1

The remaining pumping capability in excess of District demands was examined to determine if the remaining capability is physically useful for recovery. Figure 2 illustrates the physical pumping capability which is useful or not useful for recovery. For example, the excess pumping capability has to be conveyed through a canal that is linked to the

recipient. The linked canal, in turn, must be supplied from a well which is linked to that canal. Finally, only the portion of physically available water which is able to meet the recipient's water requirements is considered useful for recovery. Figure 3 shows an example of a recipient's monthly demand (the Ak-Chin Indian Community) and the amount of demand potentially satisfied by the Districts' recovered water.

Figure 4 summarizes the method of estimating the recovery potential of the current system. Figure 5 is a map showing the Districts' distribution systems and the estimated recoverable annual volumes potentially delivered to recipients (13,000 AF/yr to the Ak-Chin Indian Community and 10,800 AF/yr to the San Lucy Farm).

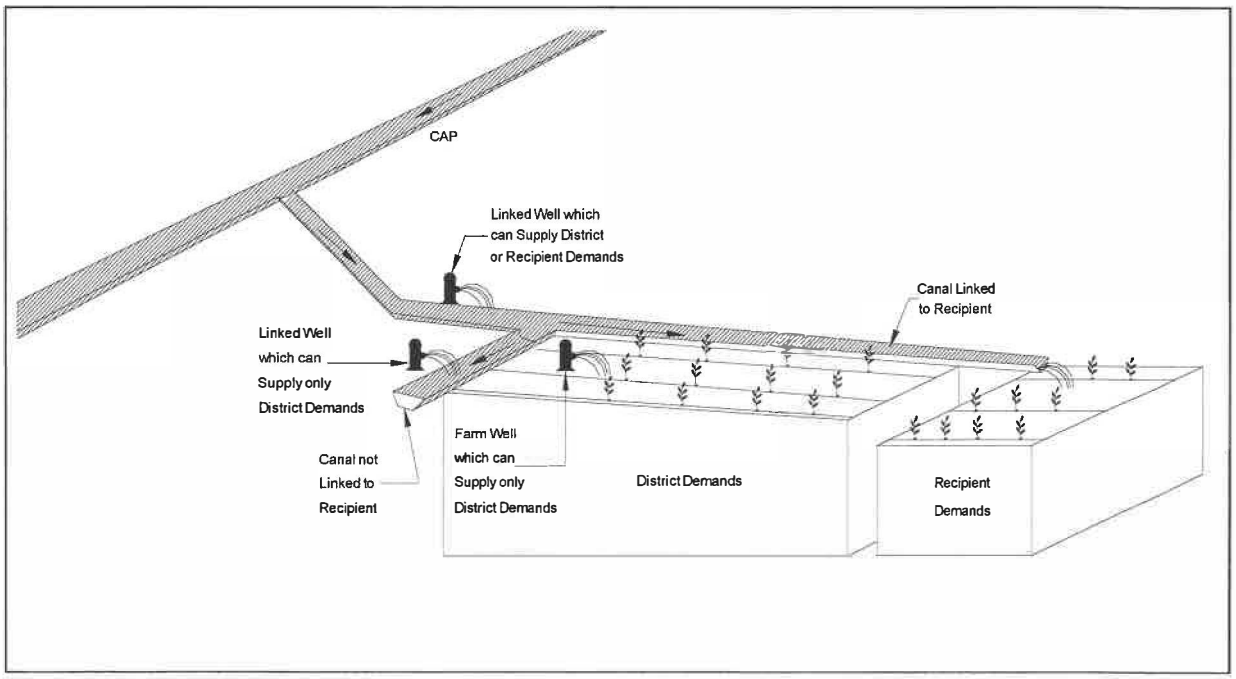


Figure 2

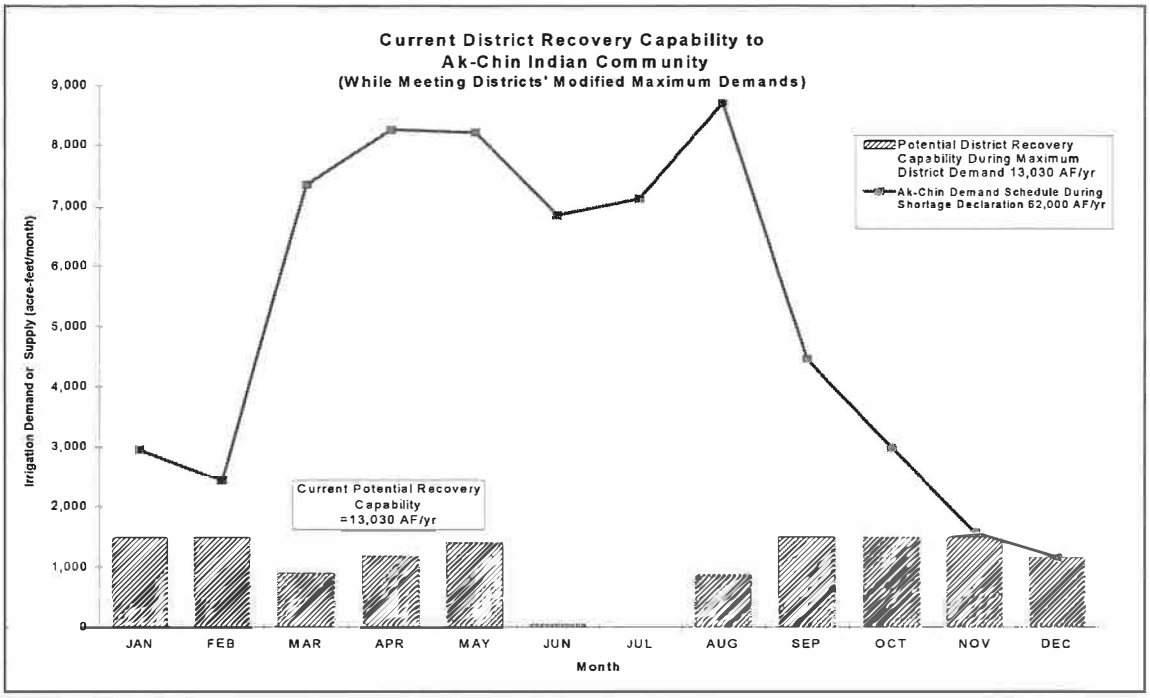
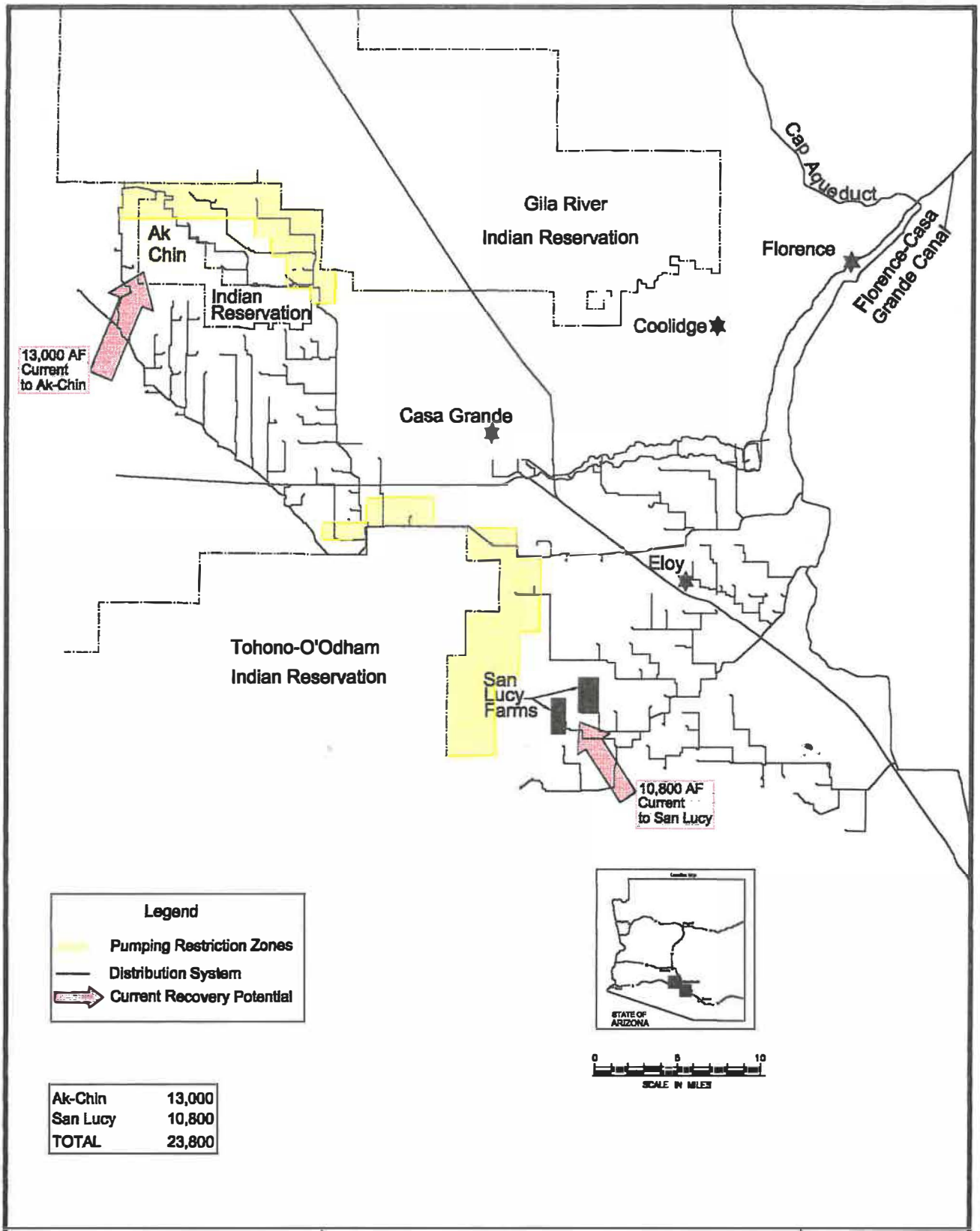

Current District Recovery Capability to
Ak-Chin Indian Community
(While Meeting Districts' Modified Maximum Demands)
Irrigation Demand or Supply (acre-feet/month)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Month
Potential District Recovery Capability During Maximum District Demand 13,030 AF/yr
Ak-Chin Demand Schedule During Shortage Declaration 62,000 AF/yr
Current Potential Recovery Capability =13,030 AF/yr

Figure 3

Estimation of Recovery Potential
MSIDD and CAIDD - Current System

	Total Pumping Capability		948,000 AF
minus	Districts' Water Use	—	490,000 AF
minus	Pumping Capability which cannot be Delivered to a Recipient due to Physical System Constraints	—	415,000 AF
minus	Delivery Capability in Excess of Recipient's Monthly Demands	—	19,000 AF
equals	Recovery Potential	=	24,000 AF

Figure 4



Bookman-Edmonston Engineering	Estimated Annual Recovery Potential-Current System (While Meeting Districts' Maximum Demand)	Figure 5

Figures 6 through 10 depict a similar analysis incorporating reasonable modifications to the Districts' systems. Modifications primarily include extending lateral to connect existing well fields with the recipients. This type of modification is represented pictorially in Figure 7. Other types of modifications include reversing the flow direction of portions of the Santa Rosa and Central Main Canals so that recovered water can be conveyed into the CAP Main Aqueduct for delivery to Pima County users. The operation of the "reverse flow" canals would occur during non-peak demand periods. Finally, other modifications are contractual and will allow certain recipients to operate their own wells to recover water. These recipients include the Arizona Water Company operating wells in Casa Grande and Coolidge, the City of Eloy, and the Ak-Chin Indian Community. The geographic location of the proposed modifications is shown in Figure 10.

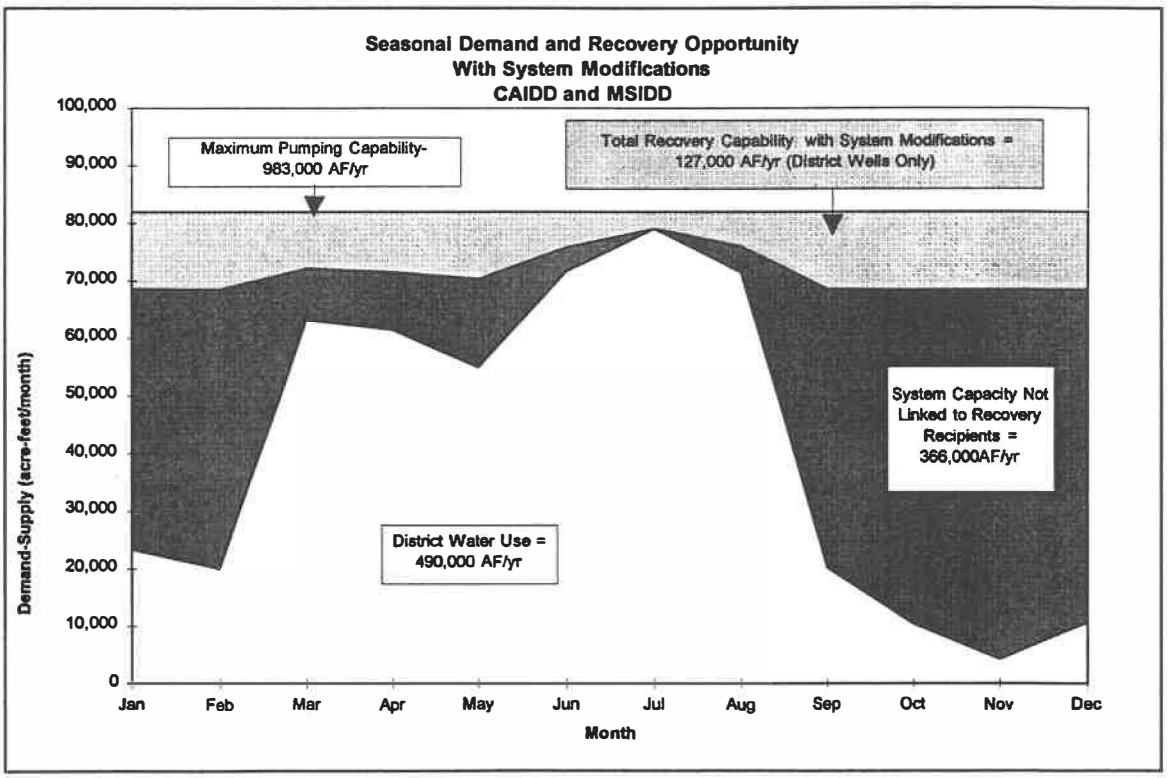


Figure 6

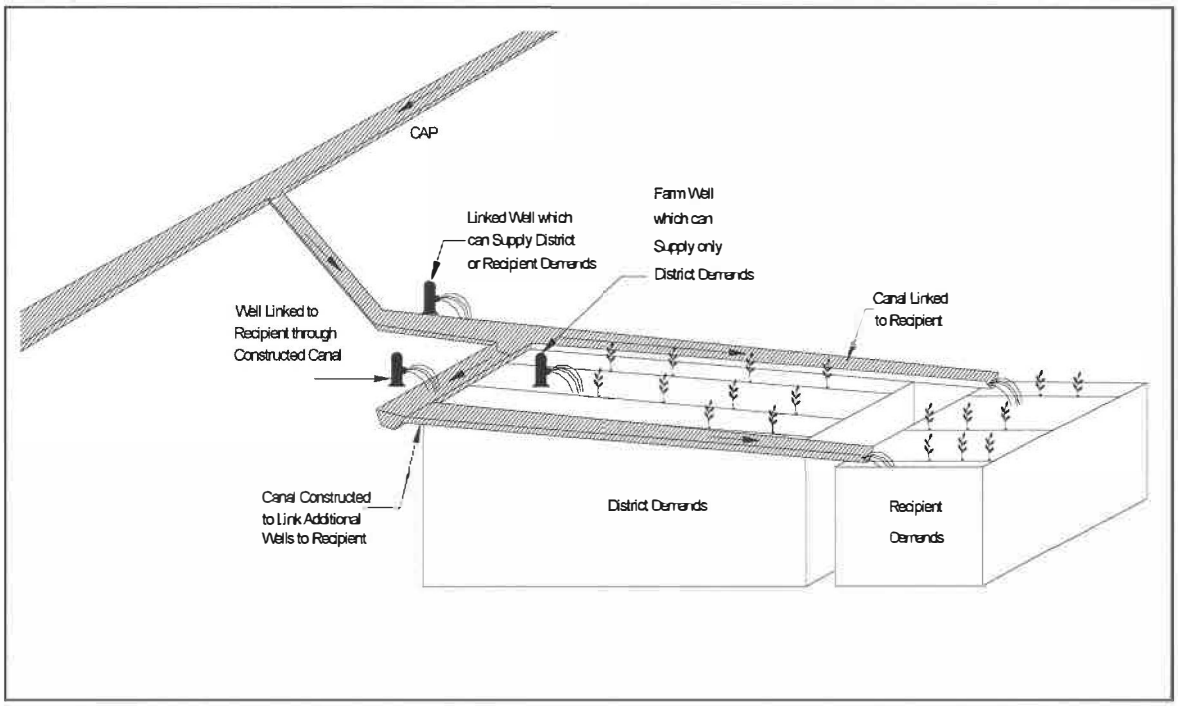


Figure 7

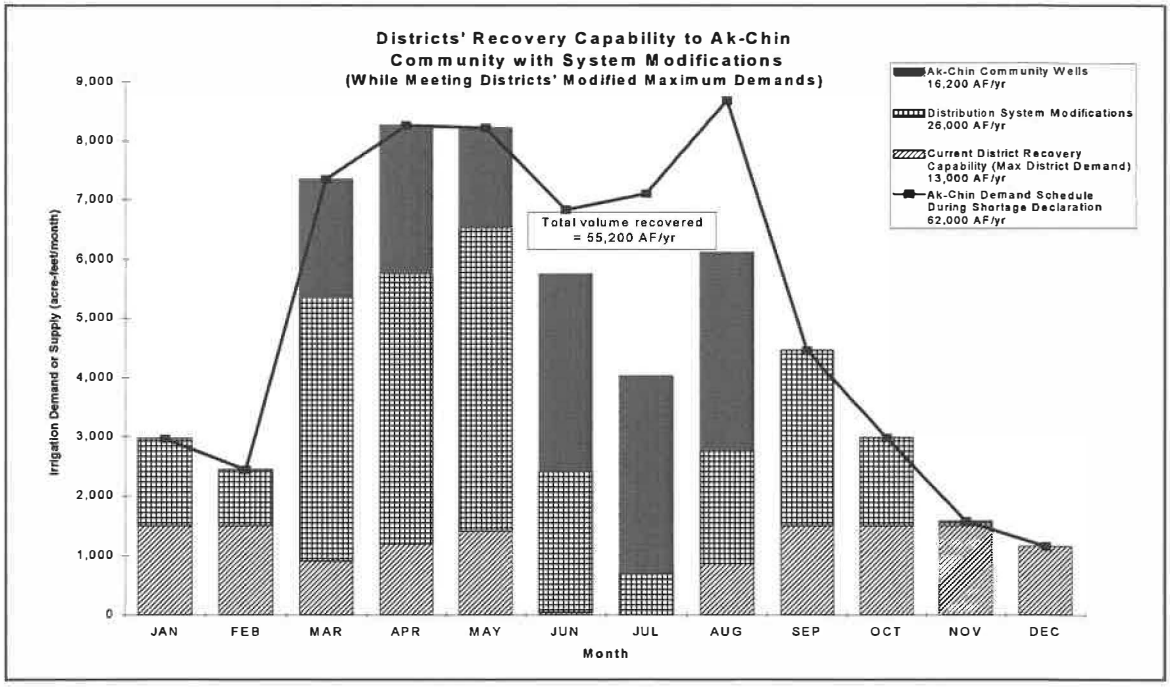
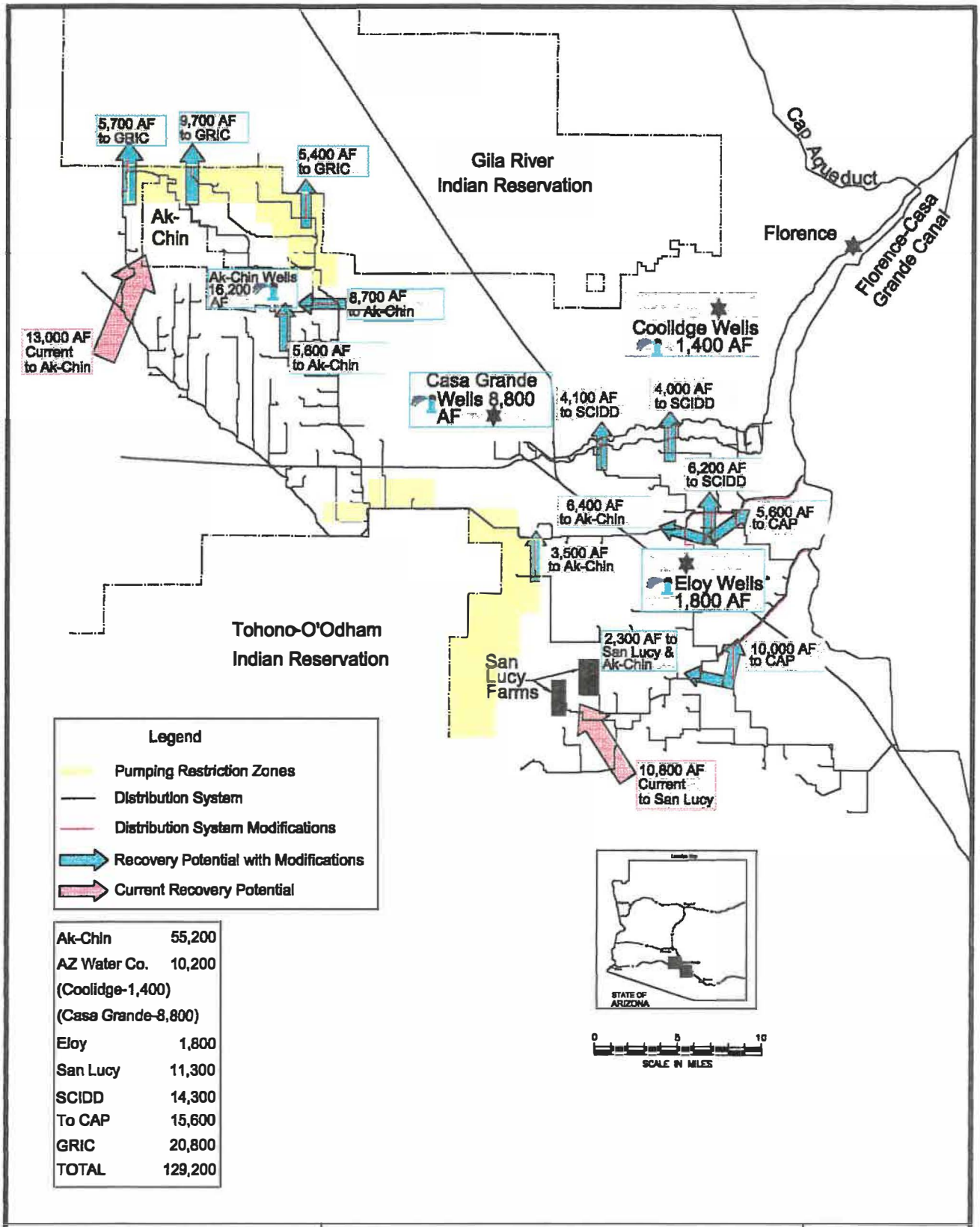


Figure 8

Estimation of Recovery Potential
MSIDD and CAIDD - System with Modifications

			District Wells		Non-District Wells
	Total Pumping Capability with System Modifications		983,000 AF		52,000 AF
minus	Districts' Water Use	−	490,000 AF	−	0 AF
minus	Pumping Capability which cannot be Delivered to a Recipient due to Physical System Constraints	−	366,000 AF	−	0 AF
minus	Delivery Capability in Excess of Recipient's Monthly Demands	−	26,000 AF	−	24,000 AF
		=	101,000 AF	+	28,000 AF
equals	Recovery Potential	=	129,000 AF		

Figure 9



Ak-Chin	55,200
AZ Water Co.	10,200
(Coolidge-1,400)	
(Casa Grande-8,800)	
Eloy	1,800
San Lucy	11,300
SCIDD	14,300
To CAP	15,600
GRIC	20,800
TOTAL	129,200

Bookman-Edmonston Engineering	Estimated Annual Recovery Potential-System with Modifications (While Meeting Districts' Maximum Demand)	Figure 10

As shown in Figure 11, the estimated recovery potential with system modifications increases to 129,200 AF/yr. A graph depicting the estimated costs and recovery volume yields of these modifications is shown in Figure 12. Table 2 itemizes the cost and recovery volume information portrayed in Figure 12.

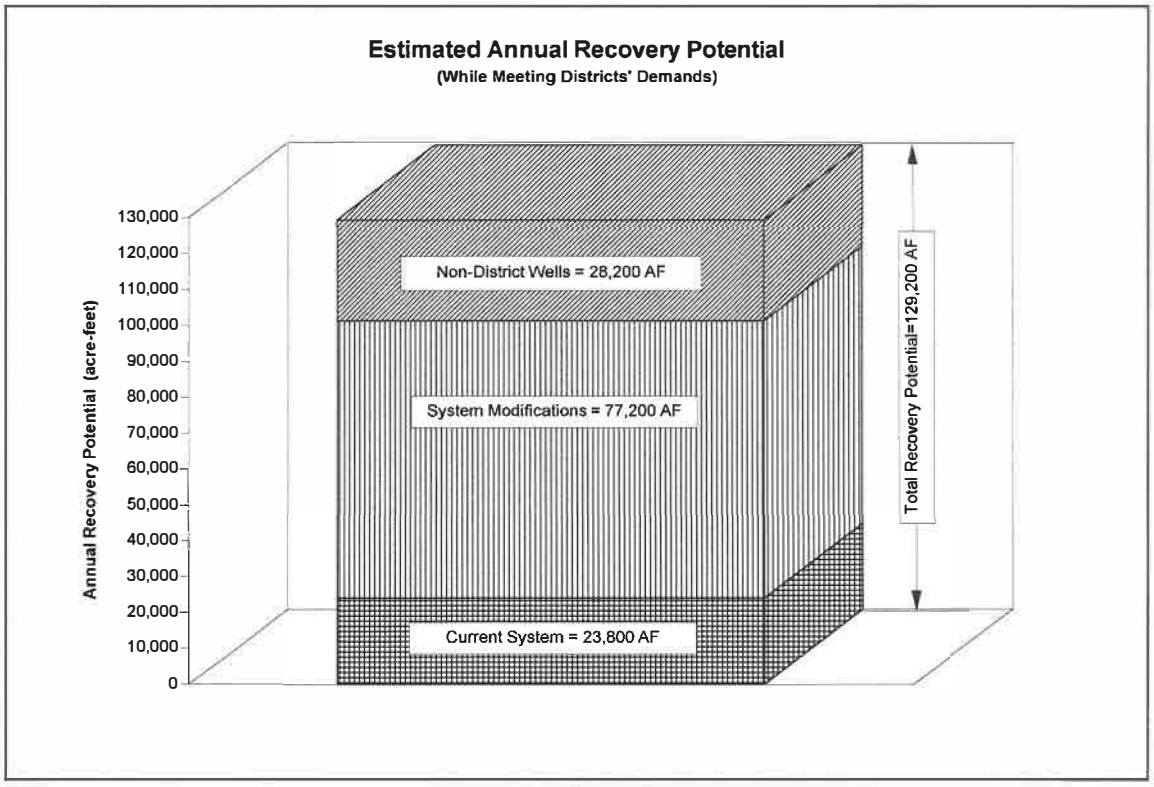


Figure 11

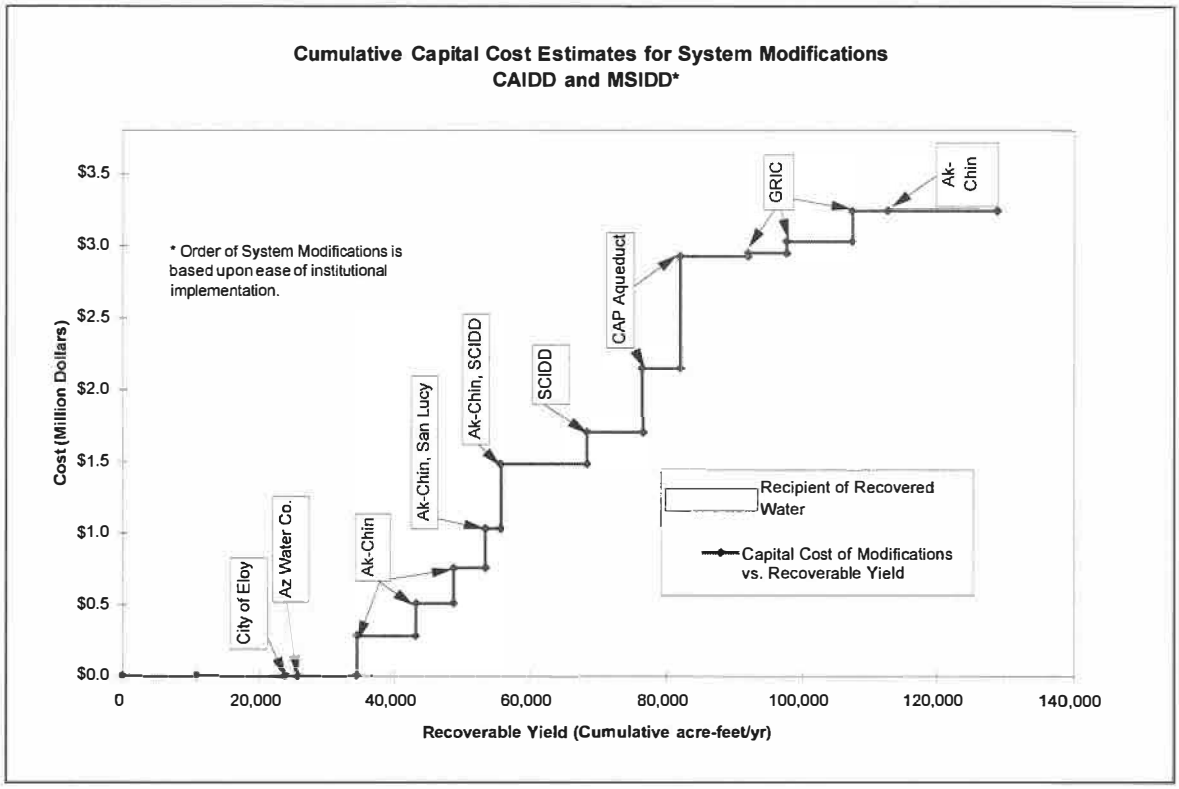


Figure 12

TABLE 2

Recipient Name	Description of Modification	Cost of Modifications (in $)	Cumulative Cost of Modif. (in Million $)	Total Yield (AF/yr)	Cumulative Yield (AF/yr)
San Lucy Farms	Current Recovery	0	0.00	10,800	10,800
Ak-Chin IC	Current Recovery-west side	0	0.00	13,000	23,800
City of Eloy	Existing Wells	0	0.00	1,800	25,600
Arizona Water Co.	Existing Wells	0	0.00	10,200	35,800
Ak-Chin IC	EM4 to east side Ak-Chin	283800	0.28	8,700	44,500
Ak-Chin IC	E9 Lateral to east side Ak-Chin	228200	0.51	5,600	50,100
Ak-Chin IC	CG Lateral to Santa Rosa	247400	0.76	3,500	53,600
Ak-Chin, San Lucy	SB to Central Main	274800	1.03	2,300	55,900
Ak-Chin,SCIDD	CD & CA Laterals to Santa Rosa	446700	1.48	12,600	68,500
SCIDD	SCIDD w/ NB and NC extension	219400	1.70	8,100	76,600
CAP	Reverse Flow in Santa Rosa	452300	2.15	5,600	82,200
CAP	Reverse Flow in Central Main	773000	2.93	10,000	92,200
GRIC	WR extension to GRIC	28300	2.95	5,700	97,900
GRIC	E12 extension to GRIC	77400	3.03	5,400	103,300
GRIC	E13 extension to GRIC	210100	3.24	9,700	113,000
Ak-Chin IC	Existing Wells	0	3.24	16,200	129,200

COST FOR RECOVERING GROUNDWATER

The costs associated with recovering groundwater include the cost of energy, other variable maintenance costs, the cost of well ownership, and administrative costs. Because the Districts typically meet water demands by first operating the least expensive pumps, energy costs increase as the overall demand for water increases. The current energy cost for pumping in each District is illustrated in Figures 13 and 14. The "cumulative average cost of energy" curve represents the blended energy cost for all pumps required to meet the total water demands and is based on 1997 costs and depths to water. The "energy cost of the last increment of water" curve represents the energy cost of the last pump that must be turned on in order to meet water demands. The incremental energy cost for recovering groundwater in 1997 was estimated for several of the identified recovery recipients and is displayed in Table 3.

For illustrative purposes, Table 4 provides estimated fixed costs of ownership and the variable cost of maintenance for a well and pump in Pinal County. Some of these costs would also be factored into recovery pricing, however, no policy is in place regarding how the Districts would price recovered water. Based on the current cost to pump water, it appears that the range for recovery cost will be about $35 to $50 per acre-foot, exclusive of costs for system modifications.

It should be noted that the cost estimates presented in this report, including capital cost of modifications, energy costs, and cost of well ownership and maintenance (Tables 2 - 4) are in 1997 dollars. The actual cost of recovery at some future time will depend upon many factors outside the scope of this report, including energy, maintenance, replacement, and administration costs as defined in the pricing policies yet to be negotiated with the Districts.

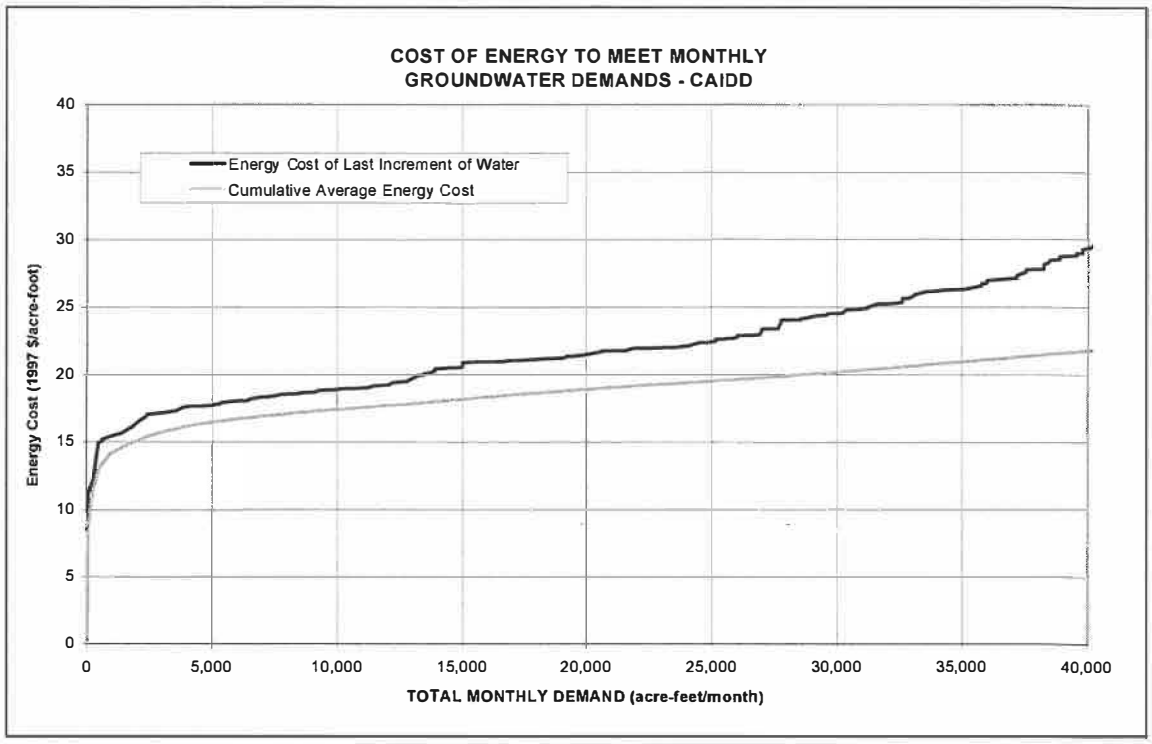


Figure 13

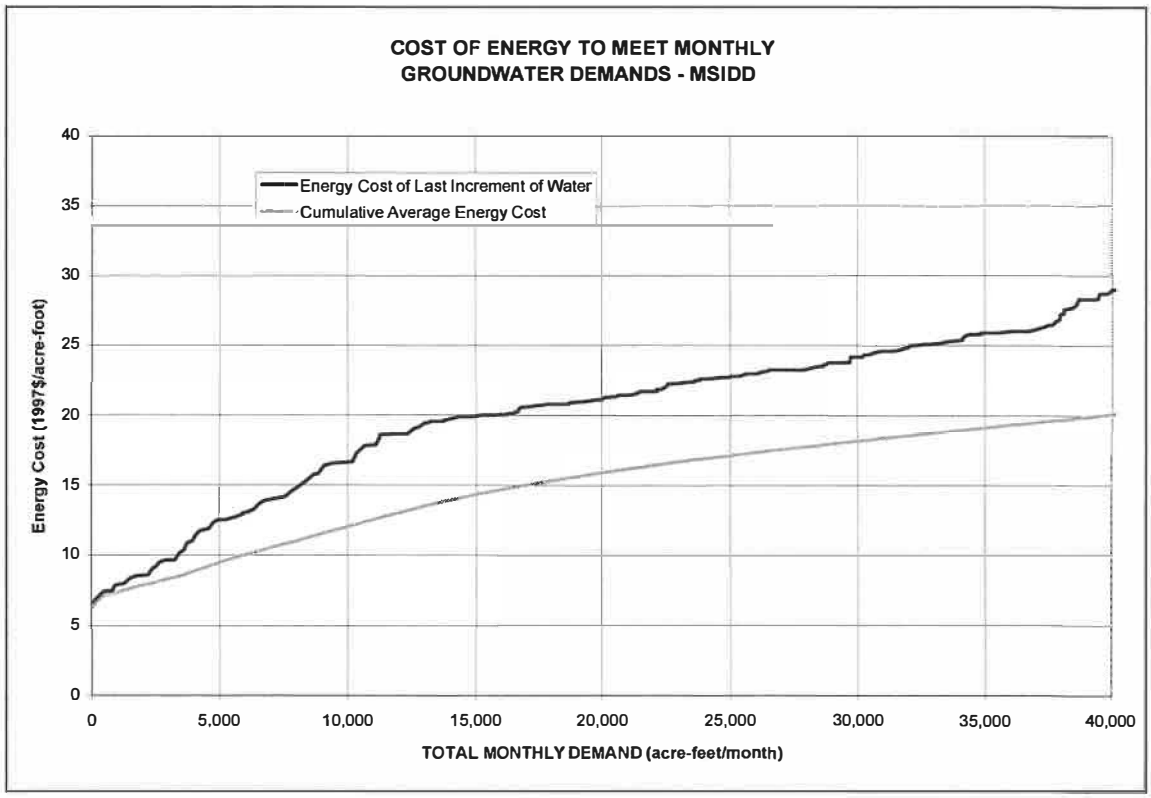


Figure 14

TABLE 3

ESTIMATED ENERGY COST OF SOME EXAMPLE RECOVERY SCENARIOS (in 1997 Dollars and Pumping Depths)

Recipient of Recovered Groundwater	Volume Recovered AF/yr	Cost Range of Last Increment $/AF/month[1]	Weighted Average Cost of Last Increment ($/AF) [2]
Ak-Chin with current system	13,030	$12.50 to $27.75	$23.80
San Lucy Farms with current system	10,820	$15.00 to $29.50	$25.30
Ak-Chin with modified system	39,080	$12.50 to $29.50	$26.00
San Carlos Irrigation and Drainage District	14,280	$15.00 to $29.50	$26.10

[1]Range is based upon the low and high months of demand.
[2]Weighted average is based upon the total volume of demand for each month.

TABLE 4

ADDITIONAL COSTS ASSOCIATED WITH PUMPING GROUNDWATER*

Location of Well	Total Well Cost ($)	Annual Ownership Cost ($/yr)	Cost of Repairs ($/AF)
Eloy	$181,107	$20,473	$7.45
Stanfield	$178,682	$20,912	$7.69
Maricopa	$154,179	$18,570	$5.94

*(Electric Pumping Plants, data from Arizona Field Crop Budgets, South Central Arizona, Pima and Pinal Counties, 1993-94)

IMPACTS TO GROUNDWATER

A groundwater impact analysis was performed to demonstrate that the stored groundwater within the aquifer will be physically available when recovery is necessary. Numerous assumptions regarding future water use conditions must be made in order to analyze the future groundwater levels. The following assumptions represent a high level of groundwater use by the Districts under reasonable and probable future conditions. This produces a conservative analysis of groundwater levels and the physical availability of recharged water in the future. In other words, the projected conditions used in the analysis are worse than the anticipated conditions in terms of negative impact to the groundwater level and may not be consistent with conditions portrayed for estimating recovery capability.

Assumptions made regarding the impacts of recovery to groundwater included assumptions concerning CAP availability, the timing and rates of recharge and recovery, the amount of irrigated agriculture, aquifer parameters, and other groundwater uses. Assumptions concerning availability of CAP water for the Districts include:

- The only CAP pool water available after 2003 is from pool 1 as defined by CAWCD.
- The total volume of pool 1 CAP water available as identified by CAWD is 200,000 AF/yr. The Districts' share of this supply is assumed to be 110,000 AF/yr.

Assumptions concerning recharge and recovery include:

- In-lieu recharge water is not available after 2016, the legislated sunset of the AWBA.
- In-lieu recharge water continues to be available through 2016 at the rate of 50,000 AF/yr to MSIDD and 50,000 AF/yr for CAIDD (these in-lieu rates were also assumed for 1997).
- Recovery occurs at a constant rate of 50,000 AF/yr for MSIDD and CAIDD combined until the credits are exhausted.

- The previously banked credits of CAWCD (386,000 AF, not including 1997 banked credits of AWBA) are included in the recovery effort.

Assumptions concerning irrigated agriculture include:

- Farmed acreage does not drop below 57,000 acres for MSIDD and 54,000 acres for CAIDD (1996 irrigated acreage is approximately 70,000 acres for MSIDD and 63,000 acres for CAIDD).
- Groundwater pumping will continue to be economically viable as an irrigation water source.

Estimated aquifer parameters:

- The average 1997 depth to groundwater is 425 feet for MSIDD and 275 feet for CAIDD. It should be noted that the actual static depths for pumping are not as great as the average depth to groundwater due to selective use of wells.
- Aquifer parameters are taken from the ADWR *Pinal AMA Regional Groundwater Flow Model - Modeling Report No. 2, 1990.*

Figure 15 illustrates the water supplies available to the Districts given these assumptions. The groundwater impacts of the in-lieu program, including recovery, are compared to the groundwater impacts without in-lieu recharge on Figure 16.

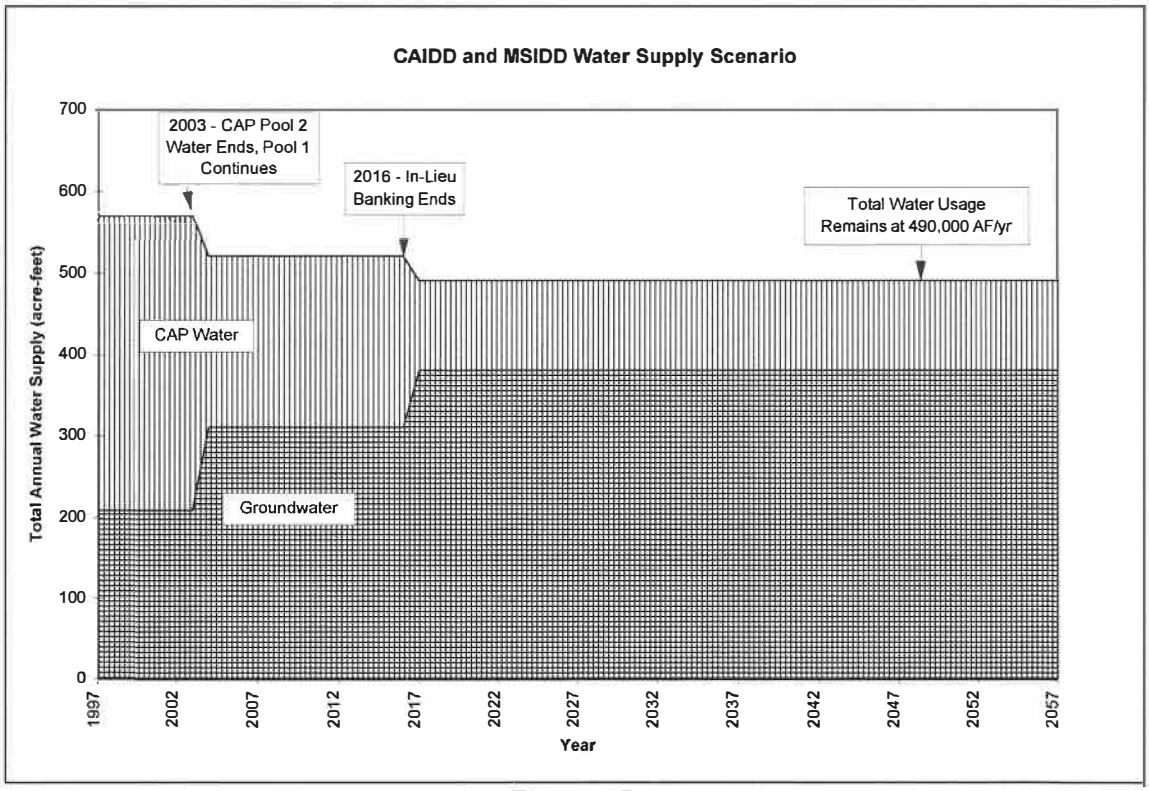


Figure 15

Figure 16 displays the estimated groundwater levels in MSIDD and CAIDD, respectively, with and without the in-lieu recharge and recovery program. The groundwater savings program will result in increased water levels for the period of time that the water remains banked. Both Districts are also able to recover all the water stored through the groundwater savings program without approaching the 1,000-foot level set aside for the municipal and industrial Assured Water Supply in the Pinal AMA.

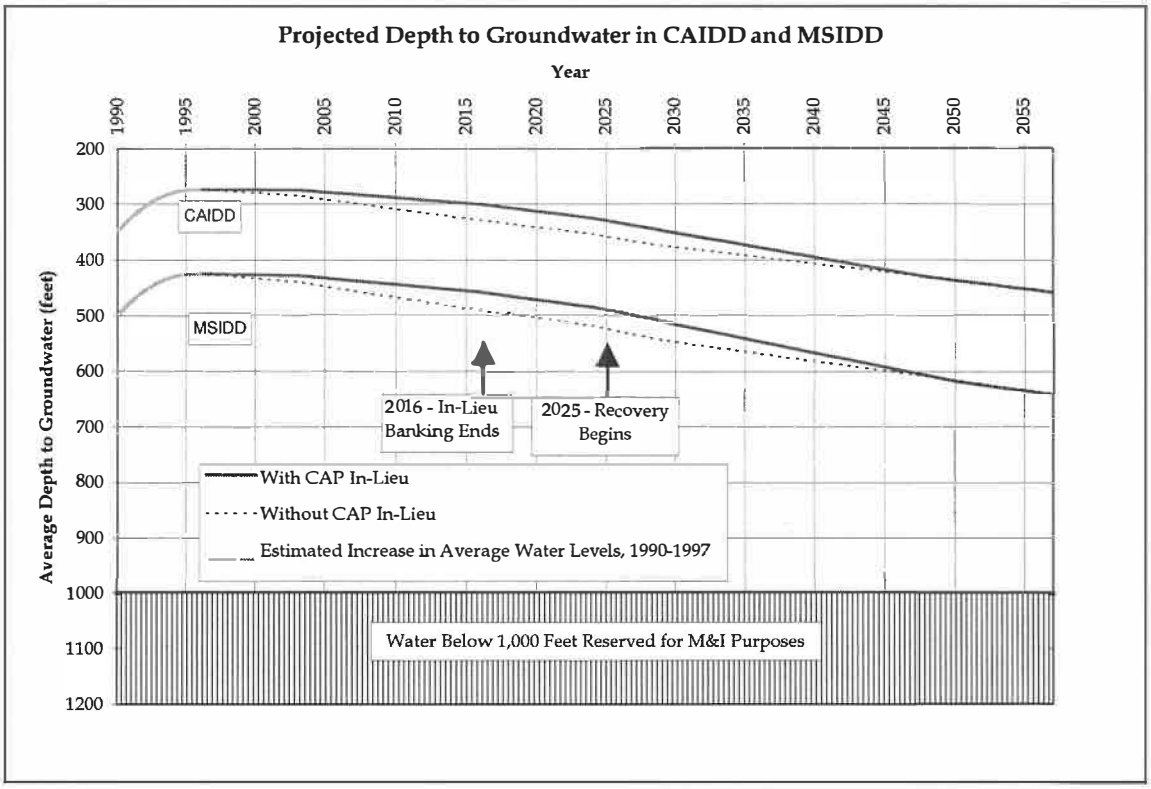


Figure 16

FINDINGS

If all identified recipient entities participate in the recovery program, the potential recovery capability of the Districts is greater than 100,000 AF/yr with the system modifications identified. The cost to construct these identified modifications is estimated to be approximately $3 million. Without the identified modifications, the Districts can recover approximately 24,000 AF/yr. With system modifications to deliver increased quantities to the Ak-Chin Indian Community and San Lucy Farms, approximately 48,000 AF/yr can be recovered at a construction cost of approximately $1.2 million. This water is estimated to be physically and legally recoverable without impacting the Assured Water Supply criteria for the Pinal AMA or the Districts' capability to meet their own irrigation demands.

REPORT TO THE ARIZONA WATER BANKING AUTHORITY

TUCSON ACTIVE MANAGEMENT AREA
REGIONAL RECHARGE PLAN
INSTITUTIONAL AND POLICY ADVISORY GROUP

Arizona Department of Water Resources
Tucson Active Management Area

November 19, 1997

REPORT TO THE ARIZONA WATER BANKING AUTHORITY

TUCSON ACTIVE MANAGEMENT AREA
REGIONAL RECHARGE PLAN
INSTITUTIONAL AND POLICY ADVISORY GROUP

EXECUTIVE SUMMARY

This report presents the findings and recommendations of the Tucson AMA Regional Recharge Planning Process (RRP Process) for incorporation into the Arizona Water Banking Authority (AWBA) plan for additional recharge facilities in the Tucson AMA. The AWBA was required to develop a plan for additional storage facilities in the Tucson AMA after finding that sufficient storage facilities do not exist in the Tucson AMA to meet the needs of the AWBA for the next ten years. The AWBA has requested input from the RRP Process to help meet its requirement to develop a plan for additional storage facilities in the Tucson AMA.

The Tucson AMA RRP Process is a collaborative planning effort initiated by the Arizona Department of Water Resources' Tucson Active Management Area office and Groundwater Users Advisory Council. Two voluntary committees were formed to carry out the process, the Regional Recharge Committee, made up of technical experts in fields related to recharge, and the Institutional Policy Advisory Group (IPAG), which was composed of policy-oriented representatives. The goal of the RRP Process is to develop a coordinated approach to recharge activities in the Tucson AMA. Cooperation in developing the Regional Recharge Plan (RRP) helps build regional partnerships essential to ensure full participation of Tucson AMA water users in state water banking activities.

IPAG recommends that the AWBA adopt the recharge facilities listed in this report as its list of feasible recharge sites for the Tucson AMA. For 1998, AWBA efforts should focus at least initially on facilities currently operating and facilities which are projected to be operating in 1998. The IPAG has concluded that in the short term, the goal of the Regional Recharge Plan is to maximize the total amount of CAP delivered to the basin each year. Over the longer term, it is imperative that achieving water management goals become the primary consideration in siting new facilities. Following this logic in the short term means utilizing existing facilities and facilities that can be developed relatively inexpensively, which are likely to be near the CAP canal. Over time, greater investments will need to be made to ensure that the water is recharged in a location where it directly benefits users and/or addresses subsidence, water quality or other environmental concerns. It may be important for the AWBA to work on developing facilities within the Tucson AMA that might not otherwise have been built, or at least focus on facilities within the AMA with capacity that is not currently spoken for, to avoid the possibility of competing for capacity.

The Tucson AMA has identified three geographic areas where additional storage may substantially increase the likelihood of attaining groundwater management objectives: 1) the Central Tucson wellfield where historic groundwater declines and risk of subsidence could possibly be mitigated; 2) the Cañada del Oro basin where groundwater levels are relatively stable but significant increases in water demand are projected; and, 3) the CAP terminus near Green Valley where water levels are declining, increases in water demand are projected, and there are significant concerns associated with protecting the water supplies on the San Xavier District.

The greatest uncertainty regarding the need for additional recharge capacity stems from the lack of community consensus regarding the City of Tucson's CAP water use. One of the projects listed in the plan is the City of Tucson's Central Avra Valley Storage and Recovery Project (CAVSARP). Tucson Water is the largest water user and holds the largest CAP subcontract in the basin. CAVSARP is planned to recharge 60,000 AF annually before the year 2005, although full build-out will be dependent on the results of pilot studies. The project was designed to replace Central Wellfield pumping, as mandated by the Water Consumer Protection Act (Proposition 200 of 1995). However, use of other options for CAP utilization may significantly reduce the City's need for recharge at the facility, possibly adding to capacity available for other storers, including the AWBA.

There is a high level of agreement among IPAG members that direct recharge in underground storage facilities (USF's) has greater benefits than in-lieu recharge in groundwater storage facilities (GSF's). Despite the strong support for direct recharge, the IPAG feels that in-lieu recharge will be necessary in the Tucson AMA in order to meet the short term goal of maximizing CAP delivery. The assumption that all agricultural users are unwilling to pay the AWBA price (even if some farmers pay more than others) should be more carefully evaluated. There is also a possibility that other users in the basin would be willing to negotiate a price that is closer to the AWBA price. Finally, there may be justification for the AWBA to charge a different price for in-lieu water in the Tucson AMA, given the shortage of facilities and other considerations.

The RRC did not include any recharge projects that involved well injection in the list of projects evaluated. The primary reason for this was the fact that Proposition 200 precludes the use of CAP water for well injection unless it meets the Avra Valley groundwater quality standard and is free of disinfection by-products. In retrospect, it appears that well injection should not have been eliminated from consideration. Well injection is unquestionably a superior method from the perspective of mitigating subsidence. It also has major advantages in that it utilizes existing infrastructure. The concerns about disinfection by-products do not appear to be justified based on the experiences of multiple other states. However, the Tucson AMA is initiating an evaluation of the fate of disinfection byproducts and organic precursors and the potential for harm associated with treatment of recharged CAP water after recovery.

The ability to recover stored water should be a factor in selecting AWBA facilities. If the

objective of storage is to firm municipal supplies, the specific needs of those providers for "wet water" during times of shortage should be considered. If other management objectives are to be pursued, different recovery criteria will apply.

In conclusion, it appears that there are substantial opportunities to pursue recharge projects in the Tucson AMA. The AWBA is encouraged to continue to work with the IPAG in the development of its facilities plan and operating plans. The status of projects changes very quickly, and the relative merits of various facilities may change over time. The Regional Recharge Plan is very much a work in progress, and there are obvious benefits to both parties in keeping in close communication.

REPORT TO THE ARIZONA WATER BANKING AUTHORITY

TUCSON ACTIVE MANAGEMENT AREA
REGIONAL RECHARGE PLAN
INSTITUTIONAL AND POLICY ADVISORY GROUP

I. INTRODUCTION

A. The Arizona Water Banking Authority and Recharge Facility Needs in the Tucson Active Management Area

The Arizona Water Banking Authority (AWBA) was created in 1996 to store currently unused portions of Arizona's allotment of Colorado River water. Four specific legislative sub-goals were identified for the AWBA, including 1) enhancing the reliability of municipal CAP deliveries; 2) helping meet local water management objectives; 3) facilitating Indian water rights settlements; and 4) providing for interstate water banking with Nevada and California. The Authority's other objectives may take on more importance in the future, but its current activities focus on storing excess CAP water for the protection of municipal and industrial water users from future shortages.

The AWBA was required by its enabling legislation to develop a Storage Facility Inventory of all existing storage facilities by March 1, 1997 (A.R.S. §45-2452.A). The inventory assessed whether storage facilities exist to meet the water storage needs of the AWBA for the following ten years (A.R.S. §45-2452.D) in the Phoenix, Pinal, and Tucson Active Management Areas (AMAs), and for areas outside of these AMAs. The Authority must update the inventory at least once every five years (A.R.S. §45-2452.F).

The Facility Inventory indicated a need for between 35,000 and 42,000 acre-feet (AF) of storage capacity for the AWBA in the Tucson AMA. This estimate was based on $1.4 million in revenues from the $0.04 per $100 property tax and $0.7 million from withdrawal fees, divided by a cost of $50-$60 per AF. The inventory found that sufficient storage facilities do not exist in the Tucson AMA to meet the needs of the AWBA for the next ten years. This finding triggered the requirement of A.R.S. §45-2453 that the AWBA develop a plan for additional storage facilities that specifies the type, location, date needed and capacity of storage facilities necessary to meet the needs of the AWBA. The AWBA is directed to seek the advice of the Arizona Department of Water Resources (ADWR) regarding where water storage would most contribute to meeting the water management objectives of the AMA (A.R.S. §45-2453.B.2). The AWBA has requested input from the regional recharge planning process being completed in the Tucson AMA. This document incorporates the findings and recommendations of the regional recharge planning process with special emphasis on the needs of the AWBA.

B. Objectives of the Department of Water Resources

As mentioned above, the AWBA is directed to seek the advice of the Arizona Department of Water Resources (ADWR) regarding where water storage would most contribute to meeting the water management objectives of the AMA (A.R.S. §45-2453.B.2). In general, recharge can help meet the water management objectives of the groundwater code by facilitating the use of renewable water supplies in lieu of mined groundwater and reducing groundwater level declines within the AMA. Almost half of the water currently used in the AMA comes from mined ground water. Increased storage of renewable supplies can help in meeting the AMA's safe yield goal as well as in demonstrating an Assured Water Supply (AWS) for water providers within the AMA. Other water management goals in the Tucson AMA include ensuring reliability of water supply, mitigating potential for subsidence, reducing rates of groundwater decline, and environmental goals such as protecting riparian habitat and providing recreational opportunities. Water quality goals include preventing migration of existing contamination plumes and protecting existing groundwater supplies from long-term degradation.

A more detailed statement and analysis of these water management goals has been incorporated into the Tucson AMA Regional Recharge Planning Process through identification of specific criteria used to evaluate possible recharge sites. This process explicitly incorporated the water management goals identified by ADWR.

C. The Tucson AMA Regional Recharge Planning Process

The Tucson AMA Regional Recharge Planning Process (RRP Process) is a collaborative planning effort initiated by the Arizona Department of Water Resources' Tucson Active Management Area office and Groundwater Users Advisory Council. The goal is to develop a coordinated approach to recharge activities in the Tucson AMA and incorporate these goals into a Regional Recharge Plan (RRP) which will help guide the process. The Plan addresses a number of needs identified by area water users, including 100-year assured water supply demonstrations, reliability of CAP delivery, and increasing the use of renewable water supplies, principally CAP allocations and effluent. Recharge will play an important role in meeting these needs, but recharge projects are costly. Collaborative groundwater recharge planning will enhance the region's ability to take advantage of incentives, secure outside support, and improve the cost-effectiveness of regional recharge projects. The newly created AWBA is recharging some excess CAP water in the Tucson AMA in 1997 and is planning to increase its recharge activities in 1998. Cooperation in developing the RRP helps to build the regional partnerships essential to ensure full participation of Tucson AMA water users in state water banking opportunities.

D. Overview

This report presents the findings and recommendations of the Tucson AMA RRP Process for incorporation into the AWBA plan for additional recharge facilities in the Tucson AMA. Section

II gives some background information and a summary of steps involved in the RRP Process. Section III identifies potential recharge project participants. Section IV examines the existing demand for recharge and the factors that affect recharge demand. Section V presents a scenario analysis of future demand for recharge. Section VI identifies the potential types and sources of water for recharge projects. Entities holding possible source water and the volumes available are also outlined. Section VII contains an assessment of existing and proposed recharge facilities in the Tucson AMA and an analysis of the projects' potential capacity. Section VIII contains implementation issues and recommendations of the planning process.

II. BACKGROUND/SUMMARY OF THE ACTIVITIES OF THE TUCSON AMA REGIONAL RECHARGE PLANNING PROCESS

In September 1995, with support from the Groundwater Users Advisory Council, the Tucson AMA initiated a regional cooperative process for recharge planning. The RRP Process depended on the voluntary participation of two committees of representatives from a broad spectrum of interests. The RRC, or the Regional Recharge Committee, was made up entirely of technical experts in fields related to recharge. They represented a wide variety of interests, including state, local, Federal and Indian government agencies, the University of Arizona, and the private sector. IPAG, or the Institutional and Policy Advisory Group, is composed of policy-oriented representatives whose job is to establish the principles and goals, develop the regional plan, and be instrumental in communicating the results to their respective publics.

The process began with the formation of the technical committee, to ensure that the regional recharge planning effort would be based on sound information. The Tucson AMA initially invited 18 hydrologists, engineers and hydrogeologists from government, water providers, the University of Arizona and consulting firms to sit on the RRC. The original list was expanded to 22 because of interest and enthusiasm in the community. All participants donated their time to the process.

The RRC met regularly from January through July of 1996. Their objectives were to 1) achieve an understanding of the physical and institutional setting for recharge in the Tucson AMA, 2) respond to specific issues in the community, 3) develop siting criteria, 4) apply the siting criteria to potential recharge sites around the Tucson AMA, and 5) prepare a report on their results including the identification of needs for further research and information.

Their first task was to define the physical and institutional issues in need of clarification within the committee and in the community at large. The RRC identified eight such issues. When consensus was reached on each issue, conclusions were included in the committee's report. All the findings published in the RRC report were reviewed and approved by the entire RRC.

The RRC then developed criteria for siting recharge facilities. The criteria were based on physical, regulatory and other institutional constraints. The RRC created a list of possible recharge sites that included existing, planned, investigated, and completely conceptual projects. A subcommittee screened the list to eliminate from further consideration those projects judged unlikely to be implemented within the next 5 years, then described the remaining sites in terms of the established criteria. Of the 34 projects on the initial list, 16 were chosen to be evaluated in greater detail and included in the Committee's report: 11 underground storage facilities (USFs) , and 5 groundwater savings facilities (GSFs).

A joint meeting of the RRC and IPAG was held on August 22, 1996, to create a smooth transition from the technical phase to the policy phase of the process. By this time, a final draft

of the RRC report had been completed and sent to all members of both committees. The RRC's findings were published in a report which was distributed in September 1996, with an executive summary to inform institutional participants and elected officials.

The first task the IPAG undertook was to define the objectives and principles of the regional recharge plan. The following specific objectives were identified for the RRP Process:

- Provide a forum for regional cooperation regarding recharge activities
- Maximize the use of renewable water supplies in the Tucson AMA
- Optimize sharing of recharge, pumping and transmission facilities
- Expedite selection, testing and construction of groundwater recharge facilities
- Facilitate equitable access to recharge capacity
- Provide a background document for the facilities plan that will be required by the Arizona Water Banking Authority

In accordance with these objectives and principles, the IPAG wanted to base their planning activities on an inclusive assessment of recharge-related needs. The group requested that the TAMA staff prepare a questionnaire and personally interview all parties interested in recharge. IPAG members suggested a list of entities to be interviewed for the needs assessment and emphasized that the focus of questions should be to reveal common goals and highlight points of contention so that they could be resolved.

Information for the needs assessment came primarily from these survey interviews, which were conducted from November 1996 through January 1997. The needs assessment survey was designed to elicit information about goals, concerns, operating constraints, recharge project involvement and interest, and assessments of the relevant issues associated with recharge. An attempt was made to interview representatives from all entities likely to participate in recharge in the Tucson AMA, and most of the entities initially identified as likely participants provided some information in response to the survey.

Besides the discussion of issues, the main products of the needs assessment were lists of goals and concerns about the risks of recharge. The goals and concerns of potential participants formed the basis for developing criteria on which individual projects and the Regional Recharge Plan could be evaluated.

The next step was to evaluate the projects identified by the RRC using these criteria. This allowed projects to be evaluated on their suitability for achieving objectives. The 16 projects evaluated by the RRC were chosen to undergo the first round of evaluation and ranking based on

the regional objectives. Information from the RRC's project evaluations was used to identify the extent to which the project met each criterion. The evaluations were up-dated as new information became available and all evaluations were reviewed by the IPAG members and their technical advisors. One project (the Tangerine Road basins at I-10 and Tangerine Road) was deleted from the original list of 16 projects; two projects (in-lieu recharge at Picacho and basins on the Pascua Yaqui reservation) were added. Another project, (BKW Farms at Milewide Road) was added to the list, but not evaluated.

Methods for scoring and ranking projects on the basis of these evaluations were discussed. IPAG members expressed preference for grouping the projects in qualitative categories rather than using numerical ranking. As a result of these discussions, simpler, broader criteria were developed that embodied a regional perspective.

A subcommittee was formed to take the next step towards a plan, which employed a first-order screening of projects that focused on getting the largest amount of water into storage as quickly as possible. Identified sponsors and institutional endorsements were used as indicators that projects were likely to be brought into operation quickly.

With respect to water management objectives, the subcommittee considered groundwater level decline and subsidence maps to identify areas threatened by continued or increased pumpage without recharge. In addition, they considered relative (qualitative) rankings based on a group of criteria derived from environmental and water quality objectives.

A draft of the resulting plan was circulated in August of 1997. Comments were received for two months, followed by some changes to the language of the plan and the relative groupings of projects. Presentations of the initial finding were made to the Tucson Groundwater Users Advisory Council and the AWBA.

III. RECHARGE DEMAND: POTENTIAL PROJECT PARTICIPANTS

A. Municipal Providers

Recharge will be an important tool for municipal water providers in the Tucson AMA. The primary motivating factors for municipal providers to recharge water are Arizona's Assured Water Supply (AWS) program and the desire to firm up water supplies during future droughts on the Colorado River system. The AWS program requires that any new subdivision plats within AMAs can only be approved when there is a demonstrated supply of water to meet the needs of the development for 100 years. Part of this water may be groundwater, but the bulk of the supply must be renewable water. Municipal providers distant from the CAP canal or without a CAP allocation or unable for other reasons to deliver CAP water directly to customers can use recharge through various mechanisms to meet AWS requirements. A provider that recharges renewable water in an ADWR permitted facility may earn credits that count as renewable water for AWS purposes. According to AWS rules, providers that join the Central Arizona Groundwater Replenishment District (CAGRD) can rely on the District to recharge for them (see below), but some will choose to recharge for themselves in order to control their costs. In addition, over the next 100 years, it is anticipated that there will be shortages on the Colorado River approximately 35% of the time. Therefore, municipal providers are interested in accruing long term storage credits that may be recovered for delivery during drought years.

Another motivation for municipal providers to recharge is provided by A.R.S. § 45-853.01.B, which allows providers who store water to use long term storage credits to offset GPCD violations occurring before 2000. Municipal providers are required to meet conservation targets based on the average number of gallons used per capita per day (GPCD). If more water is used than allowed by a provider's GPCD target, the provider can be fined. A municipal provider that holds a storage permit in a permitted recharge facility can use credits to offset the groundwater pumping that exceeded its GPCD target.

Some municipal providers hold contracts for CAP water but are unable to use their allocation directly. They must continue to pay the capital charges associated with their contracts as long as they hold them, whether or not they take CAP water. This motivates those municipal providers to find some use for their CAP allocation. Recharge credits are valuable to such a provider for its own AWS and/or GPCD needs, but also have a value as a commodity to be sold to other entities with similar needs. The Groundwater Code allows the assignment of long term storage credits to another entity, subject to certain limitations.

AWS rules and GPCD targets embody the policy goals of sustainable development and conservation. Many municipal providers are motivated by a sense of public responsibility that prompts them to go beyond the minimum required by state law. They will use recharge to bank renewable water now, when it is abundant, in order to have an ample supply in the future and to ensure a reliable supply of water for their customers in times of shortage.

B. CAGRD

The Central Arizona Groundwater Replenishment District (CAGRD) was created by the Arizona State Legislature in 1993 to develop recharge projects and recharge on behalf of municipal providers and real estate developments. Membership in the CAGRD assists in providing a demonstration of Assured Water Supply. The details for calculating a member's replenishment obligation are different for the two different kinds of members (designated water providers vs. member lands covered by certificates of AWS), but for both kinds of members the minimum amount of water that must be recharged is very small in the early years and grows larger over time.

The CAGRD is an arm of the Central Arizona Water Conservation District (CAWCD), which is the agency responsible for operating the CAP. During its first twenty years of operations, the CAGRD's primary source of water for replenishment will be excess CAP water, although it may use other surface water and effluent, as well. The CAGRD is required by state law to replenish for its members within their AMA, and it probably will use recharge projects built by CAWCD with State Demonstration Project funds, at least in the early years. The CAWCD has accrued long-term storage credits which, by law, it may convey to the CAGRD.

C. CAWCD

The Central Arizona Water Conservation District (CAWCD, also called the CAP) operates the CAP canal and is responsible for repayment of the construction debt to the federal government. It subcontracts with entities that have been allocated CAP water by the Secretary of the Interior, including municipal providers, to deliver water. It also sells water in excess of the amount ordered by subcontractors. In the years since the canal was completed, the supply of CAP water has greatly exceeded the amount taken by subcontractors, and the CAWCD has used incentive pricing to induce more entities to take CAP water. Incentive pricing makes recharge more attractive to entities that can take advantage of low water prices now in order to avoid paying higher prices in later years; however, incentive priced CAP water is only available to M&I subcontractors.

The CAWCD has an obligation to deliver CAP water to subcontractors each year according to a schedule of priorities established in the Federal Register, which gives first priority to Indian and municipal uses. The supply of CAP water available in any year may be reduced by drought. The CAWCD strives to protect its municipal subcontractors from such shortages through a number of mechanisms, including storing water. It is authorized to construct and operate recharge projects and hold ADWR recharge facility and storage permits for this purpose. In addition, it received funding for State Demonstration recharge projects from an ad valorem tax collected in Pima and Maricopa counties from 1991 to 1996. There are three recharge projects in the Tucson AMA that are funded by State Demonstration Project Funds: Avra Valley Airport Recharge Project, Pima Mine Road, and Lower Santa Cruz. With the creation of the AWBA, much of the funding and responsibility for storing water for drought protection passed from the CAWCD to the AWBA.

D. AWBA

The Arizona Water Banking Authority (AWBA) was created by the State Legislature in 1996 to encourage full utilization of Arizona's Colorado River entitlement. According to statute, it stands last in line for CAP water, after Indian settlement water, subcontractors and all other purchasers of excess and incentive priced water, including other entities using CAP water for recharge.

The AWBA purchases water for drought storage with funding from a tax on property (four cents per $100 assessed valuation) in counties served by the CAP, which must be spent for the benefit of the county in which it was collected. Funding also comes from a pump tax on groundwater users of $2.50/AF, and general fund appropriations. The AWBA must develop an annual operating plan that shows how much water will be recharged and where the recharge will occur. Although the Bank is not obliged to recharge water in the county or AMA from which tax funds were collected, interpretation of the phrase "for the benefit of" makes local recharge a major focus for the AWBA.

The AWBA has estimated that it will recharge between 35,000 and 42,000 acre-feet annually in the Tucson AMA in the next few years. In the AWBA's September 25, 1997 CAP/AWBA Pricing Analysis, the AWBA estimated that a total of 750,000 AF needs to be stored in the AMA to firm up the supplies of municipal CAP contractors in the area. Lack of facilities has made it difficult for the Bank to find adequate recharge capacity in the AMA. The AWBA's Facilities Plan, published in March of 1997, indicated that the recharge facilities in the Tucson AMA were inadequate. As a result, the AWBA is developing a facilities plan which could include working with local entities to develop additional capacity. The Bank's involvement cannot include constructing, owning or operating recharge facilities, but it may, for example, enter into partnerships to provide a revenue stream for recharge services that enables its partners to finance the construction of projects.

The AWBA legislation requires its activities to be coordinated with local water management efforts, thereby influencing what sites the Bank will use for recharge. This document is intended to provide guidance on the effect of facility siting on water management goals. In this context, issues of subsidence, groundwater level declines, and resource management may figure into AWBA decisions.

In its first year of operation, the AWBA devoted most of its attention to recharging water for reliability purposes. In the future, assisting with Indian water settlements and interstate banking are likely to become important components of the AWBA program. The Bank's interstate water banking responsibilities may present an opportunity for storage of Colorado River water for Nevada or California in the Tucson AMA, provided storage capacity exists. This program could be a major factor in funding new facilities in the area.

E. Indian Nations

Portions of the Tohono O'odham Nation's reservation (San Xavier District and Schuk Toak District) are located south and west of the City of Tucson, in the Tucson AMA. Within the Tucson AMA, the Nation is allocated 37,800 AF of CAP water annually. Under the terms of the Southern Arizona Water Rights Settlement Act (SAWRSA), the Secretary of the Interior must supply an additional amount of water in exchange for 28,200 AF of effluent from Pima County wastewater treatment facilities. Some of the SAWRSA water supplies are expected to be used for farming on the reservation, but the Districts have been exploring opportunities for recharge to restore higher groundwater levels, riparian vegetation and wildlife habitat.

Both the Tohono O'odham and the Pascua Yaqui also have expressed some interest in recharging non-Indian water in reservation projects in exchange for storage credits. Very preliminary discussions about the need for an Inter-Governmental Agreement (IGA) with the State of Arizona have occurred. Prior to allowing transfer of credits earned on the reservation to elsewhere in the AMA, the State would have to evaluate the Nation's plans for regulating and monitoring recharge projects. The Nation is concerned about the location of recovery of such recharge credits, principally to ensure that recovery not occur where it would affect water levels on the Reservation.

The Pascua Yaqui Tribe, which has a reservation and several smaller communities in the Tucson AMA, is allocated 500 AF of CAP water annually, from which it is hoping to derive benefit. The tribe is looking into the possibility of developing a recharge project on its reservation to recharge its allocation as well as other non-Indian water. As part of a broader water resources plan to be integrated into its economic development planning, the Pascua Yaquis are investigating the recharge project as a source of revenue and employment.

F. Irrigated Agriculture

Irrigated agriculture in the Tucson AMA used 97,900 AF of water in 1994, over 30 percent of the total water use in the AMA during that year. Although there has been a recent increase in water use, agricultural water use has declined fairly steadily since 1984. Agricultural water use was expected to continue shrinking to around 55,000 AF in 2025. In the next few years, however, irrigated agriculture will play an important role in recharge as Groundwater Savings Facilities (GSF). Farms and irrigation districts that would otherwise pump groundwater but instead agree to use a renewable source can be permitted as GSFs. Typically a municipal provider buys CAP water from CAWCD, either through a subcontract or as excess incentive-priced water, and resells it at a lower price to a farm or district for irrigation. In exchange, the provider earns storage credits for the amount of groundwater "saved" when the farmers turn off their pumps and use CAP water instead. The cost of conveyance systems needed to carry water from the CAP canal is borne singly or shared by participants. The increased use of water for agriculture in recent years has prompted an evaluation of the use of in-lieu water at GSFs. These facilities are required to use renewable supplies strictly in place of groundwater that would have otherwise

been pumped. In theory, GSFs should not result in an increase in agricultural water use.

G. Mines

In the Tucson AMA, copper and molybdenum mines are major industrial water users that operate exclusively on groundwater. They declined their CAP subcontracts primarily because of economic considerations. Sentiment in the Tucson area, however, favors CAP use by the mines as a preferred alternative to their continued groundwater pumping. A recent study of potential CAP water use in mining suggests that the relative price of CAP water being supplied to GSFs would not preclude its use at the mines if costs were highly subsidized by municipal users through GSF arrangements. The mines are concerned about the difference between CAP and ground water chemistry, effects on metal production, the reliability of their water supply, and keeping costs to a minimum. They will look closely at any GSF proposals with these concerns in mind.

H. Other Potential Participants

1. Pima County

The potential for mutual gains may make participation in recharge projects attractive. Although Pima County is only authorized to hold recharge project permits as a component of flood control projects, the County may be a non-permit holding participant in projects and is interested in recharge for several reasons. The County operates the regional wastewater treatment facilities that produced over 68,000 AF of effluent in 1996. Under current arrangements, Pima County controls ten percent of that effluent, from which it would like to derive benefit. A cooperative, basin-wide Regional Effluent Utilization Task Force is meeting through the auspices of the Tucson Regional Water Council (TRWC) to plan for effluent use in the area. For this reason, the Regional Recharge Plan has focussed primarily on CAP water recharge.

Pima County uses water to irrigate county parks and golf courses and these uses are subject to ADWR's conservation regulations. The County, therefore, has an interest in storage credits that allow it to recover water for irrigation purposes. In addition, it may be interested in the possibility of acting as a broker for others. For example, it may want to help golf course developers who are required to find renewable water to replace groundwater for turf irrigation. In addition, Pima County may participate in multiple-use recharge projects for environmental and recreational benefits.

2. United States Bureau of Reclamation

The U.S. Bureau of Reclamation has responsibility for identifying and developing mechanisms to exchange the Secretary of Interior's SAWRSA effluent for water to be supplied to the Tohono O'odham. Recharge is one of the options the Bureau has identified. The Bureau has been

involved in construction of the San Xavier District's arroyos project, and in permitting activities for in-channel recharge along the Santa Cruz River.

3. Arizona State Land Department

The Arizona State Land Department (ASLD) holds in trust large amounts of land, some of which may be useful for USF or GSF recharge. The ASLD is required by the Arizona constitution to manage these lands in order to maximize benefits to the citizens of Arizona, which has been interpreted to mean maximizing the value of and income from the land. The ASLD develops land use plans for the land it controls and evaluates proposals for the use of the land on the basis of these plans. It works with local entities when developing the plans and depends on such entities to implement them.

The ASLD has a CAP allocation for the Tucson AMA of 14,000 AF annually. Its allocation is assigned to state trust lands and can be transferred to the lessee or purchaser of that land. A recent statutory change allows the ASLD to store a portion of its allocation when it contracts with an entity willing to pay all CAWCD "operation, maintenance and replacement charges" (ARS 37-106.01.F). The ASLD and its partner may share the storage credits based on the proportion of the total costs each pays, and the ASLD may sell its credits at their appraised market value.

4. Others

Individual entrepreneurs, interested water resources professionals and community activists have participated in recharge projects by finding, studying and bringing recharge sites to the attention of decision-makers. Because recharge is perceived as a tool with many uses, many people are interested in putting the tool to use for the benefit of the community. Multi-purpose projects which include recreational activities are gaining substantial public support.

IV. Range Of Potential Recharge Facility Needs

A. Circumstances That Will Affect Demand

1. Proposition 200 - The Water Consumer Protection Act

On November 6, 1995, the citizens of Tucson approved Proposition 200, the Water Consumer Protection Act, which limits the ways in which the City's CAP allocation can be used. The proposition prohibits delivery of CAP to potable water customers, unless the CAP water is treated to the same quality as Avra Valley groundwater for hardness, salinity and dissolved organic material. This can only be accomplished through advanced treatment, such as reverse osmosis. Because such techniques have never been applied at this scale, extensive engineering studies and pilot plant operation would be required prior to operation of an advanced treatment plant, should such a plant prove to be the community's choice. The Proposition was reaffirmed by the voters on November 4, 1997, when an alternative initiative controlling CAP water deliveries failed.

While advanced treatment studies are being conducted, the City is pursuing a recharge strategy that would allow it to comply with the provisions of Proposition 200 and meet its various water supply goals. This strategy would replace pumpage from the City's Central Wellfield with water recovered from the Central Avra Valley Storage and Recovery Project (CAVSARP), a large recharge project under development in the central Avra Valley. If Tucson ceases pumping the Central Wellfield altogether, it will have to recharge and recover approximately 60,000 to 70,000 AF annually at CAVSARP. If the City also wants to bank water in long-term storage accounts, it will have to find additional capacity at CAVSARP or elsewhere.

Tucson Water delivers an average of 120,000 AF annually to customers, and its deliveries are expected to increase to almost 170,000 AF by the year 2025. If it does not deliver CAP water directly to customers, then it will need to recharge substantial amounts of water. On the other hand, if Tucson Water returns to direct delivery of CAP water, its demand for recharge capacity will be much lower. In that situation, recharge would be used primarily to protect against shortages, raise groundwater levels and prevent subsidence.

Other municipal providers also may choose to develop treatment facilities for direct delivery to customers in the future. Their need for recharge capacity would depend on this choice.

2. Use Of Groundwater Allowances

Under AWS rules, designated municipal providers and certificated subdivisions are granted limited groundwater allowances that they may use as they choose. For example, they may use up their groundwater allowance in the first years of operating under the rules, as they develop renewable supplies. Alternatively, they may save their groundwater allowance for future contingencies by using only renewable water. Even assuming that their renewable supplies will be primarily CAP water recharged at facilities near the canal (currently the least expensive option), uncertainty about how providers will choose to use their groundwater allowance

introduces uncertainty into recharge demand estimates. Providers are not required to report how they plan to use their groundwater allowance, so credible predictions are difficult.

3. Price of Water

The prices of alternative supplies of water will have an effect on the demand for recharge. As long as the cost of pumping groundwater is lower than the costs for obtaining other water supplies, there will be an incentive to use groundwater. The cost of pumping groundwater depends on several variables, including price of energy, lift (depth to water), aquifer characteristics (transmissivity), and pump characteristics (capacity and efficiency). Energy costs vary with the user; the lowest (subsidized) rates are available to some irrigation districts and the highest rates are paid by individuals. In the northwestern portion of the Tucson AMA, irrigation districts charge farmers in the range of $30.00 to $45.00 per acre-foot of groundwater. This charge includes operation, maintenance and repair (OM&R) costs. The average cost for pumping groundwater at the Kai Farm at Picacho ($20.00 to $25.00/AF) probably represents the low end for such costs. The costs for groundwater estimated for the ASARCO (Mission) and Cypress (Sierrita/Twin Buttes) mines at the southern end on the AMA were $84.00 and $166.00, respectively, which probably represents the high end.

The CAWCD sets prices for CAP water. M&I subcontractors are required to pay capital charges on their full allocation regardless of deliveries, fixed OM&R charges and pumping energy costs for subcontract water that is delivered, and fixed OM&R charges for subcontract water that is ordered but not delivered. In 1997, the capital charge was $39/AF, the fixed O&M charge was $36/AF, and the pumping energy cost was $31/AF for a total of $106/AF. The capital charge is projected to rise to $54/AF by 2001, while the energy and fixed O&M costs will be determined annually. Excess CAP water is the volume remaining after all subcontract water is scheduled. Subcontractors may purchase specially priced excess CAP water under the incentive program if that water will be used to accrue long term storage credits. Through 1999, incentive priced water is set at $36/AF. M&I users who are not subcontractors may also purchase available excess water for $106 in 1997 to a projected cost of $145/AF in 2001.

The demand for recharge storage credits is creating a category of water available to certain agricultural users at an even lower cost. Municipal providers are buying incentive-priced water and reselling it to groundwater saving facilities (GSFs) at reduced prices, as low as $5.00 per acre-foot, in exchange for storage credits. The cost per credit to the municipal providers in these arrangements is lower than other currently available recharge alternatives.

Total cost of reclaimed water produced by the City of Tucson's Sweetwater facility is $650 to $750 per acre-foot, of which $100 - $150 is the cost of production (the remaining $600 pays for capital costs). Reclaimed water is sold to most customers at a price of $462 per acre-foot, making it an economically feasible alternative primarily for those customers whose current supply is potable water. The price for potable water is generally substantially higher.

B. Other Recharge "Demands"

1. AWBA

The AWBA estimates that in 1998 it will receive approximately $1.4 million from the 4-cent tax in Pima County and an additional $700,000 from groundwater withdrawal fees. For planning purposes, it assumes that the total funds from Pima County will remain approximately the same for its 10-year planning horizon at $2.1 million per year. And, since there was much less AWBA storage in Pima County in 1997 than anticipated, there will be some unspent money from 1997 rolled forward for use in 1998.

The Bank further assumes that CAP water will be available for it to purchase for recharge in Pima County. In 1997, the Bank paid $36/AF to the CAWCD for CAP water and received $21/AF from farms and irrigation districts for in-lieu water at GSFs in the Phoenix and Pinal AMAs. The Bank paid $13/AF, plus the water cost, to recharge directly at the Granite Reef Underground Storage Project (GRUSP) in the Phoenix AMA. Due to the lower cost, given a particular amount of funds, the Bank is able to buy much more water for GSF recharge than for direct recharge.

In the Tucson AMA, other storers are offering CAP water to GSFs for $5 to $17/AF, a range much lower than the AWBA's $21/AF. As long as the Bank adheres to its current pricing policy, GSF recharge in the Tucson AMA may not be feasible for the Bank. This situation needs to be re-evaluated if the Bank intends to meet its own recharge goals. The amount of water that the Bank can recharge in the AMA using locally derived funds depends on how much it will cost them to use the direct recharge facilities being developed here. In its Storage Facilities Inventory, the AWBA used an average cost range of $50 to $60/AF to estimate its annual need for recharge capacity. The AWBA paid $58.50/AF ($22.50/AF for facility costs and $36/AF for water) to recharge in the Avra Valley Recharge Project in 1997. The CAWCD is also likely to raise the AWBA price for water in the near future to cover more of the actual costs associated with delivering CAP water. Therefore, an estimated range of $50 to $70/AF may be more appropriate for the average cost of recharge to the Bank in the Tucson AMA. Using this range, the AWBA would need approximately 30,000 to 42,000 AF of annual recharge capacity in the Tucson AMA in years which rollover funds from previous years are not available. However, additional capacity will be needed to catch up with the previous years' recharge needs.

In addition, preliminary discussions have been held with Nevada about banking water in Arizona. It is possible that some Colorado River water recharge, paid for by Nevada and/or California, could occur in the Tucson AMA. This can only occur after the Director of ADWR approves rules for interstate banking.

2. Indian Water

ADWR planners project 10,800 AF of annual water demand for Indian agriculture on the Schuk Toak District in the Tucson AMA in the year 2025. Assuming this demand would be met by CAP water deliveries, 27,000 AF of Indian CAP allocation water would remain, some or all of

which could be used for recharge. (This does not include any additional CAP water provided through SAWRSA.) The San Xavier District was given a Water Protection Fund grant to study the environmental impacts of CAP use, including recharge. The results of that study may guide decisions about recharge on the reservation. Although the San Xavier District and the Tohono O'odham Nation have been investigating options, they have not indicated their likely course of action. It is unlikely that they will decide to utilize capacity in off-reservation projects. On the other hand, the development of on-reservation capacity for non-Indians may reduce the demand for off-reservation capacity.

3. SAWRSA Effluent

By the terms of the SAWRSA Settlement, the Secretary of the Interior controls 28,200 AF of effluent to be exchanged for water for the San Xavier and Schuk Toak Districts of the Tohono O'odham Nation. The Settlement is also expected to limit the amount of groundwater they are entitled to pump. An option that may be available to the Secretary for exchange is recharge of effluent to create credits that can be sold to pay for CAP or other water of acceptable quality. Other arrangements are possible that involve delivery to agriculture. This means that the Secretary's effluent adds from 0 to 28,200 AF of demand for recharge capacity.

V. DEVELOPMENT OF ALTERNATIVE DEMAND PLANS -- SCENARIO ANALYSIS

Implications For Recharge Needs And Site Selection

Three scenarios were developed using the target years 2000 and 2007: 1) low demand, 2) medium demand, and 3) high demand for recharge capacity. Calendar year 2007 represents the last year of the AWBA's ten year planning period for its Storage Facilities Inventory. Projections of recharge demand were based on information, including population projections, used to monitor the ADWR Assured Water Supply program. The following components of recharge demand were used to develop the scenarios.

Categories/Users of Recharge Capacity
The scenarios described below are not anticipated utilization patterns. They are used in this report for illustrative purposes only and are meant to frame the possible low-end and high-end conditions that may define future recharge demand.

1. City of Tucson: Options were selected to represent the range of alternative ways to meet water supply needs and compliance with Assured Water Supply requirements: a) deliver CAP water directly without recharge; b) blend CAP water with groundwater; and c) recharge CAP water to offset groundwater pumping.

2. Other Designated Municipal Providers: Selected options for recharge demand include: a) CAGRD minimum replenishment; and b) phased in use of annual storage and recovery.

3. Long-Term Storage Credits: Options were selected for each eligible party regarding whether to accrue long-term storage credits during this time period: a) low; b) medium; and c) high.

4. Arizona Water Banking Authority: Scenarios were developed using the current AWBA budget, but increasing the cost of CAP water to the AWBA.

It was assumed that some recharge facilities would be expanded relative to the level of demand. For example, in the low demand scenario, the City of Tucson would deliver treated CAP water directly to customers and would not use a strategy of annual storage and recovery. In the high demand scenario, the City of Tucson recharges the majority of its CAP, and would have to expand the volume of its facilities. Developed recharge capacity for each of the three scenarios was adjusted to demonstrate how projects in the plan could respond flexibly to different demand conditions.

The demand scenarios are listed below. See Table 1 for estimated demand and supply volumes for each of the following scenarios.

Scenario 1: Low Recharge Demand

City of Tucson: Tucson Water directly delivers CAP water to most of its potable customers. Customers in the outlying portions of the service area and who are not connected to the contiguous distribution system may not receive CAP water. Therefore, they are served groundwater only (5% of total potable demand). In addition, northwest area entities CAP use reduces Tucson Water's available CAP supply by 8,000 AF annually. Tucson Water recharges the remainder of their 140,000 AF CAP water allocation.

140,000 - ((Potable Demand - (Potable Demand * 5%)) + 8,000)

Other Municipal: Subdivisions with certificates of Assured Water Supply (AWS) and designated providers (other than Tucson Water) rely exclusively on the CAGRD to replenish their pumped groundwater. The CAGRD stores the minimum required by contract for all of its members.

Long Term Storage Credits: Tucson Water stores water of a sufficient volume to earn credits at the rate of 10% of its potable water demand minus incidental recharge. No other providers accrue credits.

((Total Demand - (Effluent Demand + Incidental Recharge)) * 10%

AWBA: The AWBA purchases CAP water and storage capacity in the AMA with a budget of $2.1 M. The average price for AWBA recharge is $70/AF. This price includes the following costs: CAP water, use of any conveyance infrastructure necessary beyond the CAP canal, and the negotiated cost for using the recharge facilities.

Scenario 2: Medium Recharge Demand

City of Tucson: Tucson Water delivers a blend containing 40% CAP water and 60% groundwater to its potable water customers. Customers in the outlying portions of the service area and who are not connected to the contiguous distribution system may not receive CAP water. Therefore, they are served groundwater only (5% of total potable demand). Tucson Water stores enough water to replace 100% of its groundwater demand minus incidental recharge.

((((Potable Demand - (Potable Demand * 5%)) * 60%) + (Potable Demand * 5%)) - Incidental Recharge) * 100%

Other Municipal: Designated providers other than Tucson Water phase in recharge as Annual Storage and Recovery (ASR) beginning in 2000 by storing a volume of water equal to 10% of their groundwater demand minus incidental recharge and increasing by 5% each year thereafter. They choose to debit their groundwater allocations for the remainder of the groundwater. Subdivisions with certificates of AWS rely exclusively on the CAGRD. The CAGRD stores the minimum required by contract for all of its members.

(((Total Demand - Incidental Recharge) * X) + Minimum GRD Replenishment Obligation for Certificates). Note: in 2000 X= 10% and in 2007 X=45%

Long Term Storage Credits: Tucson Water earns credits at the rate of 15% of its potable water demand minus incidental recharge. Other designated providers accrue credits at the rate of 10% of their potable water demand minus incidental recharge.

(((Total Demand - (Effluent Demand + Incidental Recharge)) * X). Note: for Tucson Water X=15% and for all other designated providers X=10%.

AWBA: The AWBA purchases CAP water and storage capacity in the AMA with a budget of $2.1 M. The average price for AWBA recharge is $60/AF. This price includes the following costs: CAP water, use of any conveyance infrastructure necessary beyond the CAP canal, and the negotiated cost for using the recharge facilities.

Scenario 3: High Recharge Demand

City of Tucson: Tucson Water directly delivers no CAP water to its potable customers. It stores as ASR enough water to replace 80% of its potable demand minus incidental recharge. It chooses to debit its groundwater allocation for the remaining groundwater.

(Potable Water Demand * 80%) - Incidental Recharge

Other Municipal: Designated providers, other than Tucson Water, store as ASR enough water to replace 75% of their groundwater demand minus incidental recharge. Subdivisions with certificates of AWS rely exclusively on the CAGRD. The CAGRD stores the minimum required by contract for all of its members.

((Total Demand - Incidental Recharge) * 75%) + Minimum GRD Replenishment Obligation for Certificates

Long Term Storage Credits: Tucson Water earns credits at the rate of 20% of its potable demand minus incidental recharge. Other designated providers earn credits at the rate of 15% of their potable demand minus incidental recharge.

(((Total Demand - (Effluent Demand + Incidental Recharge)) * X)
Note: for Tucson Water X=20% and for all others X = 15%.

AWBA: The AWBA purchases CAP water and storage capacity in the AMA with a budget of $2.1 M. The average price for AWBA recharge is $50/AF. This price includes the following costs: CAP water, use of any conveyance infrastructure necessary beyond the CAP canal, and the negotiated cost for using the recharge facilities.

Table 1

RECHARGE DEMAND SCENARIOS		
Scenario 1: Low Demand	**2000**	**2007**
Tucson Water	28,300	18,000
Other Municipal	1,400	7,800
LTSC	10,400	11,500
AWBA	30,000	30,000
Total	70,100	67,300
Scenario 2: Medium Demand	**2000**	**2007**
Tucson Water	62,900	69,000
Other Municipal	1,800	10,300
LTSC	17,000	18,900
AWBA	35,000	35,000
Total	116,700	133,200
Scenario 3: High Demand	**2000**	**2007**
Tucson Water	82,500	90,600
Other Municipal	10,600	15,400
LTSC	22,900	25,500
AWBA	42,000	42,000
Total	158,000	173,500

VI. SOURCES OF RECHARGE WATER

There are substantial quantities of renewable water supplies available to the Tucson AMA. A summary table is included as Table 2 on page VI-3.

A. CAP

The primary source water for recharge in the Tucson AMA is the Central Arizona Project (CAP). The City of Tucson's CAP allocation is the largest Municipal and Industrial allocation in the state: 148,420 AF. This allocation was intended to cover the demand of Tucson and several other water providers in the region and allow for increasing demand associated with population growth. Allocations to other municipal providers, Indian Tribes, and the State Land Department within the AMA bring the total amount of CAP allocated to entities in the AMA to 215,333 AF.

Tucson's location at the end of the CAP pipeline makes it especially vulnerable to canal outages and water shortages. The risks associated with this vulnerability will have to be accounted for in the siting and design of recharge projects. As described above (II.C.1), direct municipal use takes priority over all others in times of shortages, except Indian water rights. Municipal and Indian uses have the highest water delivery priority on an annual basis. Except when a shortage is declared, the CAWCD will deliver all the water ordered by municipal subcontractors in the calendar year it was ordered. However, according to current CAWCD policy, on a daily basis, subcontract water ordered for agricultural use will take priority over that ordered for municipal recharge. Thus, scheduled deliveries to recharge projects may be curtailed, especially during the growing season. However, all subcontract water has priority over excess water. Municipal providers are concerned about the implications of this policy on accrual of storage credits and compliance with AWS requirements. They are also concerned that direct recharge projects may have to be over-designed to compensate for unscheduled dry periods, thus increasing the cost of construction.

B. Effluent

The supply of effluent grows with population: as more water is used, more flows into the wastewater system. ADWR planners project that there will be about 75,000 AF of effluent produced in the Tucson AMA in the year 2000, and about 120,000 AF in 2025. They also project that direct municipal, industrial and agricultural use of effluent will double from about 15,000 AF in the year 2000 to nearly 30,000 AF in 2025. These projections leave 60,000 AF of effluent potentially available for recharge in the year 2000.

From a basin-wide water budget perspective, more water is saved by allowing the effluent to recharge naturally after discharge from wastewater treatment plants into the Santa Cruz than by recharging the effluent in projects which result in groundwater credits. The ADWR includes the natural recharge of effluent (called "incidental" recharge) in its water budget calculations for the Tucson AMA, and it is a significant factor in determining whether the region achieves its goal of

safe yield by 2025. When effluent is recharged in a managed USF for the purpose of earning credits to pump groundwater, the recharging entity receives long term storage credits from ADWR for 50 percent of the water recharged. The other 50 percent is considered the "cut to the aquifer". However, if effluent is stored at a constructed USF, there is no cut to the aquifer.

Recharge of effluent can serve some specific water management needs, because the "incidental" recharge of effluent in the Santa Cruz does not necessarily recharge at the time or place where it is most needed. For example, the annual storage and recovery project at Tucson's Sweetwater facility stores effluent underground in the winter months when demand is low, so that it will be available for delivery through the reclaimed water system in the summer months when demand is high. A project would address water management needs if it recharged effluent in an area of declining groundwater levels and high subsidence threat if that effluent otherwise would have been discharged in an area with stable or rising groundwater levels.

Regardless of the basin-wide implications, wastewater is now viewed primarily as a resource rather than a problem. The right to recharge effluent for groundwater storage credits exists in Arizona law, and owners of effluent have an incentive to exercise this right to their benefit. Under the terms of a 1979 IGA, the City of Tucson controls 90 percent of the effluent produced at Pima County's wastewater treatment facilities, and the County controls the remaining 10 percent. (The Secretary of the Interior is entitled to 28,200 AF, taken off the top, annually, by the terms of SAWRSA, see above.) The IGA has been a source of conflict between the City and the County in recent years as the value of effluent as a resource has become apparent.

In addition, communities outside the City of Tucson are looking for ways to utilize the resource for their own benefit. One concept that is gaining popularity is the operation of satellite treatment facilities in these communities and reuse and/or recharge of the effluent for the benefit of the community. Like Tucson's Sweetwater facility, these projects may be planned to include wetlands that both treat the effluent to meet water quality requirements and produce environmental, recreational and wildlife benefits. The on-going Regional Effluent Utilization Study will examine this and other concepts, proposals and issues.

C. Other

In past years, storm water retention has been studied as a method of increasing recharge from rain storms and mountain-front runoff. The City of Tucson is considering small-scale multiple-use projects incorporating storm water recharge. No other participants have expressed interest in pursuing such projects at this time; therefore, consideration of artificial storm water recharge was not specifically included in this plan. In order to accrue recharge credits from storm water, storers have to prove that the water would otherwise have left the AMA.

Table 2
SOURCES OF WATER FOR RECHARGE IN THE TUCSON AMA
Total amounts in year 2000 in Acre-feet.

Entity	CAP	Effluent	Other	Comments
Bureau of Reclamation		28,200		Secretary of Interior's SAWRSA exchange
CAWCD/CAGRD	1,500 Excess CAP			projected minimum replenishment obligation
State Land Department	14,000			for TAMA
AWBA	42,000 Excess CAP			purchased by estimated $2.1M revenue from Pima Co. at $50/AF
San Xavier District of TON	27,000		23,000	allocation and SAWRSA exchange from Secretary's effluent
Schuk Toak District of TON	10,800		5,200	allocation and SAWRSA exchange from Secretary's effluent
Pascua Yaqui Tribe	500			allocation
Pima County		4,680		1979 IGA
City of Tucson	148,420	42,120		allocation and 1979 IGA
Town of Oro Valley	1,652			allocation
Del Lago WC	786			allocation
Spanish Trail WC	3,037			allocation
Commun WC - Green Valley/New Pueblo WC	1,337			allocation
Green Valley WC	1,900			allocation and
Cortaro WUA	47			allocation
Flowing Wells ID	4,354			allocation expected to be exchanged
Midvale Farms	1,500			allocation expected to be available to City of Tucson
TOTAL	258,830	75,000	28,200	

VII. RECHARGE PROJECT SITE ASSESSMENT AND CAPACITY ANALYSIS

The Regional Recharge Committee (RRC) evaluated potential and existing recharge projects in detail. It selected 16 recharge projects for further evaluation. Evaluations were based on technical and economic criteria, and the projects' regional benefits were described. These 16 projects were used as a preliminary list of potential project sites to be assessed to determine the extent to which they met Regional Recharge Plan objectives. It was determined by IPAG that the Tangerine Road at I-10 (basins) site would be eliminated from consideration and that the Kai at Picacho (indirect) and Pascua Yaqui (basins) sites would be included. BKW at Milewide (indirect) was added to the list, but not evaluated. A map of planned recharge projects is included as Figure 1.

A. Review Criteria

Assessment criteria were developed based on objectives. They reflect the objectives of potential recharge participants, including the AWBA, as identified through the interview process. They also incorporate the discussions of the IPAG on distinguishing short-term from long-term objectives. Each of the 17 projects evaluated was described in terms of the assessment criteria using information provided in the RRC Report and supplemental information provided by the projects' sponsors, when needed. The criteria used in these project descriptions are listed below.

Required criteria for all projects:

Hydrologic Feasibility. The project site and design meet the technical criteria as described in the RRC Report.

Regulatory Compliance. The project has obtained or is likely to qualify for all applicable permits and can comply with all applicable laws and regulations including the Endangered Species Act.

Contaminant Isolation. The project will not mobilize contaminants or exacerbate groundwater contamination.

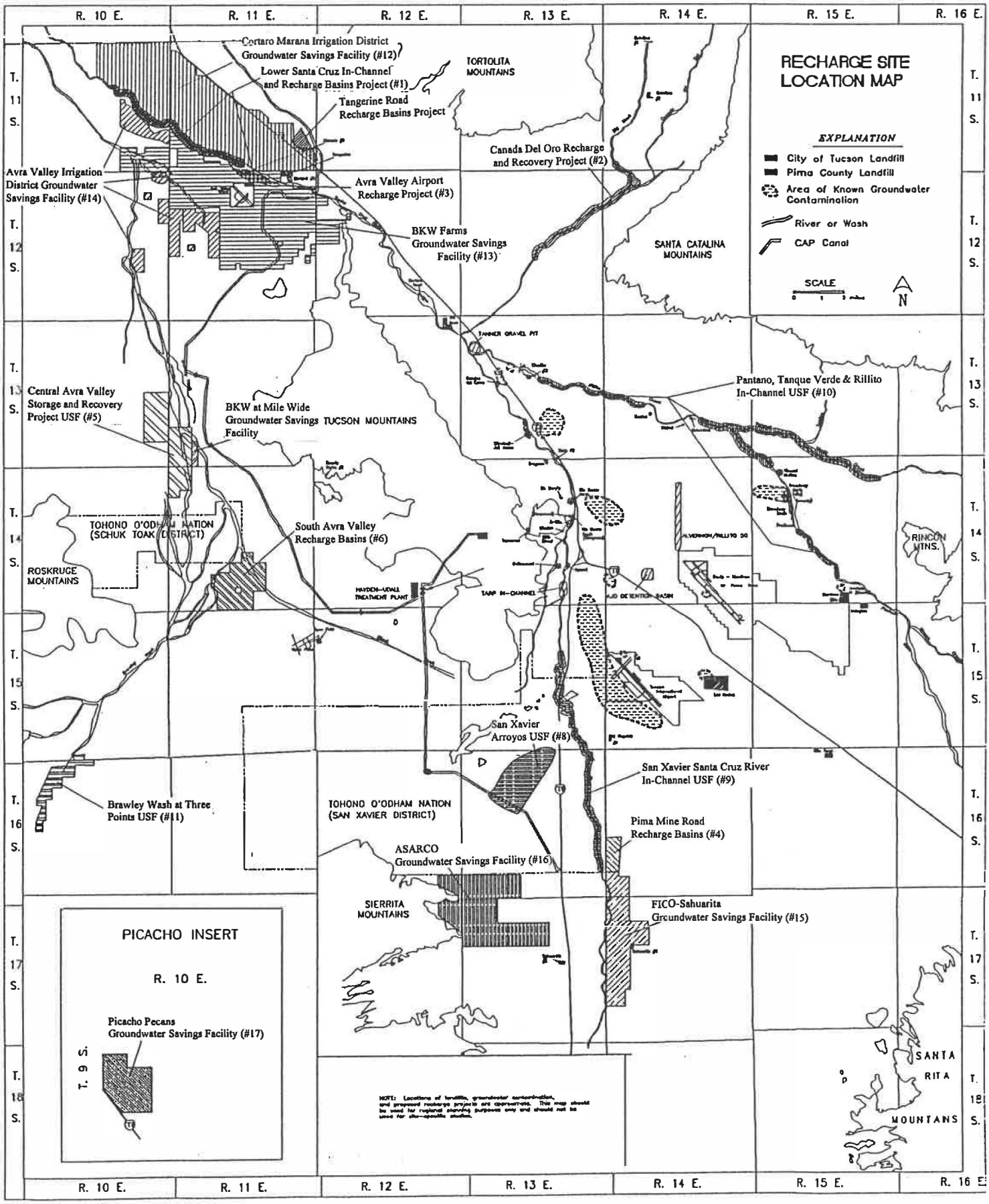
Acceptability. The project has been approved or is likely to be approved by the governing bodies with jurisdiction over land in the project's area of impact. Local organizations and enterprises are unlikely to object to the project or the project is likely to mitigate local objections.

The following criteria were separated into short and long-term categories:

Speed. The project can be brought into operation within the next three years. (Short-term)

Water Storage Capacity. The project stores a large quantity of water relative to the short-term

Figure 1. Tucson AMA Regional Recharge Site Location Map



storage goal; the storage capacity exceeds the minimum, short-term requirements of its sponsors. (Short-term)

Low Cost. The project provides the most economical means to meet its sponsor(s)'s objectives. (Short-term)

Water Supply. The project stores water in the vicinity of future wellfields; the project stores a large quantity of water relative to the long-term storage goal; the project storage capacity exceeds the minimum, long-term requirements of its sponsors. (Long-term)

Storage Credits. The project generates storage credits that can be transferred, recovered or extinguished by the credit owner. Water stored at the project has a high probability of generating credits. (Long-term)

Environmental Enhancement. The project stores water in the vicinity of a riparian/environmental amenity so as to enhance the amenity; the project is designed for riparian/environmental enhancement; the project is accessible to the general public for recreation. (Long-term)

Water Quality Management. The project design provides mitigation/containment of plumes, per a specific remediation plan. The project minimizes any long-term negative water quality impacts of recharge on the aquifer and water customers. (Long-term)

Reduced Overdraft/Cones of Depression and Subsidence Prevention/Mitigation. The project stores water in the vicinity of overdraft and subsidence; the project is designed to mitigate subsidence effects. (Long-term)

Multiple Parties/Multiple Benefits. The project has the support of multiple cooperating sponsors; the project provides multiple benefits to identifiable beneficiaries. (Long-term)

Benefit/Cost. The project costs are appropriate relative to the benefits it provides, including intangible benefits. (Long-term)

B. Categorization of Projects

Rather than rank projects numerically on the basis of the assessments, the IPAG elected to categorize projects qualitatively. In order to develop categories of projects, the IPAG needed to be able to prioritize the criteria and condense the information in the assessments. These tasks were accomplished by combining individual criteria into three groups: feasibility, capacity, and water management and related benefits. The components of these three groups are displayed below.

FEASIBILITY

Operational and regulatory risk
- Status of project
- Conditions imposed by applicable regulations and policies

Acceptability
- Equal access
- Sponsorship potential
- Community support

Contaminant isolation

Hydrologic feasibility
- Storage potential (Depth to water & groundwater flow)
- Soil, subsoil, & aquifer characteristics

Cost
- Dollars per acre-foot of water recharged ($/AF)

CAPACITY

Total planned capacity

Phase-in of capacity

Capacity in excess of amount likely to be committed to identified sponsors

WATER MANAGEMENT AND RELATED BENEFITS

Groundwater level (GWL) change & cone of depression
- Historical GWL decline
- Recent GWL change
- Potential future GWL declines

Subsidence
- Calculated subsidence potential
- Potential impact on infrastructure

Recreational Access

Special needs of location (e.g., trees on Tanque Verde)

Riparian habitat

Multiple purposes/multiple beneficiaries

Shared facilities

Water quality benefits

Long-term water balance

The group of "feasibility" criteria was intended to allow the relative ordering of projects based on how certain the IPAG could be that they would be built. "Capacity" criteria included total planned capacity and capacity in excess of the projected short-term and long-term needs of the sponsors. "Water management and related benefits" comprised the long-term, location-specific objectives and additional benefits of multiple-use projects. "Cost" was considered as a possible criteria category but was omitted as a separate category since economic factors influence feasibility and were included in the feasibility criteria category. It was extremely difficult to

develop comparable cost figures for each project, since some projects are still conceptual. In addition, recovery costs are not always easily separated from storage costs.

The resulting categorization of projects follows:

Feasibility Criterion

Category IV - Projects that have demonstrated their feasibility and are operating.

Avra Valley Airport Recharge Project
BKW Farms Groundwater Savings Project
CMID Groundwater Savings Project
Kai Farms Groundwater Savings Projects at Picacho

Category III - Projects with good evidence of feasibility that are permitted (at least for large pilot operation) or are expected to be permitted in the near future.

AVID Groundwater Savings Project
Lower Santa Cruz Replenishment Project
Pima Mine Road Recharge Project
Central Avra Valley Storage and Recovery Project
San Xavier District Arroyos In-channel Recharge Project

Category II - Projects with sponsorship and substantial momentum but also substantial uncertainties regarding their operation as regional recharge facilities.

CDO Recharge and Recovery Project
Santa Cruz River In-channel Recharge Project at San Xavier District
FICO Groundwater Savings Project
Pascua Yaqui Recharge Project

Category I - Projects that lack sponsors or have been assigned lower priority than other projects by potential sponsors.

Pantano, Rillito and Tanque Verde In-channel Recharge Project
ASARCO Groundwater Savings Project
South Avra Valley Recharge Project
Brawley Wash Recharge Project

Capacity Criterion

Category III - Projects with the potential to recharge over 20,000 AF of water annually within ten years.

CDO Recharge and Recovery Project
Lower Santa Cruz Replenishment Project
Central Avra Valley Storage and Recovery Project
South Avra Valley Recharge Project
Brawley Wash Recharge Project
FICO Groundwater Savings Project

Category II - Projects with the potential to recharge more than 10,000 to 20,000 AF of water annually within ten years.

Pima Mine Road Recharge Project
BKW Farms Groundwater Savings Project
CMID Groundwater Savings Project
AVID Groundwater Savings Project
Kai Farms Groundwater Savings Projects at Picacho

Category I - Projects with the potential to recharge up to 10,000 AF of water annually within the next 10 years.

Avra Valley Airport Recharge Project
San Xavier District Arroyos In-channel Recharge Project
Santa Cruz River In-channel Recharge Project at San Xavier District
Pantano, Rillito and Tanque Verde Recharge Project
ASARCO Groundwater Savings Project
Pascua Yaqui Recharge Project

Water Management and Related Benefits Criterion

Category IV - Projects contributing substantially to a majority of the listed water management and related benefits.

CDO Recharge and Recovery Project
Pantano, Rillito and Tanque Verde Recharge Project
Central Avra Valley Storage and Recovery Project

Category III - Projects contributing to several listed water management and related benefits.

Pima Mine Road Recharge Project
San Xavier District Arroyos In-channel Recharge Project
Santa Cruz River In-channel Recharge Project at San Xavier District
FICO Groundwater Savings Project
ASARCO Groundwater Savings Project

Category II - Projects contributing to one or more listed water management and related benefits.

Avra Valley Airport Recharge Project
Lower Santa Cruz Replenishment Project
BKW Farms Groundwater Savings Project
AVID Groundwater Savings Project
South Avra Valley Recharge Project
Pascua Yaqui Recharge Project
CMID Groundwater Savings Project

Category I - Projects with limited regional benefits beyond accrual of storage credits.

Kai Farms Groundwater Savings Projects at Picacho
Brawley Wash Recharge Project

Each facility in a given category was given the same score. The scoring process and outcome is illustrated in the following charts. (The highest ranking is "IV" for Feasibility and for Water Management; "III" is the highest category for Capacity).

C. Project Capacity Analysis

This phase of the Regional Recharge Plan includes all projects listed in feasibility categories IV, III and II. All of these projects have sponsorship commitment and were not disqualified on the basis of the IPAG's selection criteria. All have the potential to contribute needed recharge capacity to the AMA, as well as to provide other recharge-related benefits. While the future demand for recharge capacity is uncertain, more CAP water is currently available for recharge than will be available in the future. This Plan is intended to support the on-going efforts of sponsoring entities to build sufficient recharge projects to allow storage of currently available water supply while building appropriate capacity for long-term storage needs.

In the Table 4 below, projects in Feasibility Category IV are assumed to be recharging by the year 2000 at their full projected capacity. Recharge in projects in feasibility categories II and III is estimated for the years 2000 and 2007 based on what is known about the projects' phase-in time lines. Projects located on Indian reservations are summed separately because, in the absence of an IGA governing storage credits, recharge in these projects can not be used to meet the demand of municipal water providers.

The table below shows the amount of CAP water projected by IPAG to be recharged in the years 2000 and 2007 by planned projects. These projections were used as the basis of the "Recharge Capacity" analysis that follows.

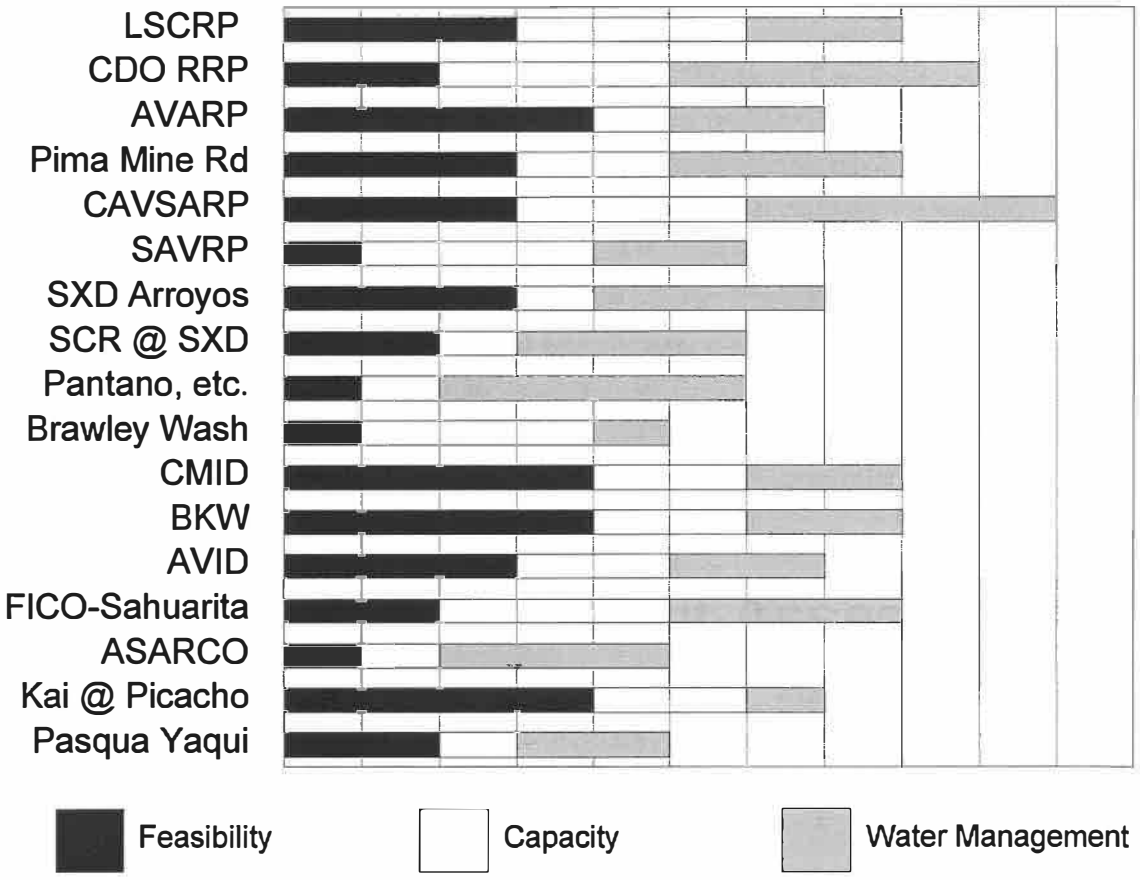
Table 3

SITE ASSESSMENT CATEGORIZATION			
PROJECTS	Feasibility	Capacity	Water Mgmt
Avra Valley Airport	IV	I	II
BKW	IV	II	II
CMID	IV	II	II
Kai @ Picacho	IV	II	I
AVID	III	II	II
CDO - Big Wash	II	III	IV
Lower Santa Cruz	III	III	II
Pima Mine Road	III	II	III
CAVSARP	III	III	IV
FICO-Sahuarita	II	III	III
SXD Arroyos	III	I	III
Santa Cruz @ SXD	II	I	III
Pascua Yaqui	II	I	II
Pantano, etc.	I	I	IV
ASARCO	I	I	III
SAVRP	I	III	II
Brawley Wash	I	III	I

Figure 2

Recharge Project Assessment

(as of November 1997*)



Projects were selected from a longer list of 35 and are considered most likely to meet regional objectives.

*Project assessments are expected to change in absolute and relative terms over time as projects develop.

Table 4. IPAG PROJECTIONS OF DEVELOPABLE RECHARGE CAPACITY BASED ON CURRENT ASSUMPTIONS/INFORMATION		
GSF	2000	2007
BKW Farms (RRC #13)	15,000	15,000
CMID (RRC #12)	16,000	16,000
Kai @ Picacho (RRC #17)	11,000	11,000
BKW @ Mile Wide Road **** (RRC #19)	750	750
AVID (RRC #14)	10,000	10,000
FICO (RRC #15)	20,000	20,000
ASARCO (RRC #16)	0	10,000
TOTAL GSF	**72,750**	**82,750**
Direct	2000	2007
Avra Valley Airport (basins) (RRC #3)	7,000	7,000
Lower Santa Cruz (basins) ** (RRC #1)	15,000	30,000
Pima Mine Road (basins) (RRC #4)	10,000	30,000
CAVSARP (basins) (RRC #5)	30,000	30,000
CDO - Big Wash (in-channel) *** (RRC #2)	0	25,000
Pantano, Rillito and Tanque Verde (in-channel) (RRC #10)	0	10,000
TOTAL DIRECT	**62,000**	**132,000**
TOTAL NON-INDIAN	**134,750**	**214,750**
Indian Water Recharge*	2000	2007
SXD (basins) *****	0	15,000
SXD Arroyos (in-channel) (RRC #8)	9,000	9,000
SXD Santa Cruz (in-channel) (RRC #9)	7,000	7,000
Pascua Yaqui (basins) (RRC # 18)	10,000	10,000
TOTAL INDIAN	**26,000**	**41,000**
TOTAL RECHARGE	**160,750**	**255,750**

* ADWR permits not required on Indian lands. IGA needed to allow storage credit recovery by non-Indians.
** May be expanded to include managed in-channel component.
*** Design includes spreading basins as well as managed in-channel.
**** Not evaluated in recharge site assessment, but included here to match recharge capacity to CAP supply.

D. Ability to Meet Recharge Needs

As is shown in Table 4, it is only possible to utilize all of the CAP water available if virtually all of the projects are contructed, including those on Indian reservations. This would require massive capital investment, and it is probably overly optimistic to assume it could be done by 2007. The "high end" recharge scenario presents a more probable maximum developable capacity of 173,500 AF by 2007 (see Table 1).

VIII. IMPLEMENTATION ISSUES AND RECOMMENDATIONS

Table 6 shows amounts delivered to recharge projects in the Tucson AMA from 1995 and 1996, with projections of the total for 1997. As is shown, the amount of water stored in the Tucson AMA is projected to triple compared to 1995 levels by the end of 1997. Water storage capacity will continue to grow with several projects scheduled to expand or begin storage in 1998.

Table 6
WATER DELIVERED TO RECHARGE PROJECTS IN THE TAMA

Recharge Facility	1995	1996	1997 (Estimate)
Avra Valley Pilot (CAP)	0 AF	2,794.1 AF	5,506 AF
CAVSARP Pilot (CAP)	0 AF	153.6 AF	3,000 AF
CMID GSF (CAP)	5,902.0 AF	9,581.0 AF	10,000 AF
BKW GSF (CAP)	4,235.0 AF	7,080.0 AF	8,800 AF
Kai Picacho GSF (CAP)	0 AF	0 AF	6,000 AF
Sweetwater Annual Storage and Recovery (Effluent)	2,654.1 AF	2,572.0 AF	4,000 AF
TOTAL	**12,791.1 AF**	**22,180.7 AF**	**37,306 AF**

However, given the fact that the Tucson AMA has up to 250,000 acre-feet of CAP water available and direct delivery appears unlikely in the near future, it is clear that the area has a long way to go in developing sufficient recharge capacity. Substantial new infrastructure will be required. It would be extremely advantageous if the AWBA could assist in funding one or more new facilities by providing a guaranteed revenue stream.

Although there is substantial uncertainty regarding the total recharge demand as described in section III, it is abundantly clear that additional facilities are required. The range of capacity required in the year 2000 given the assumptions used in scenario development is 70,100 to 158,000 AF. By 2007, the range is 67,300 to 173,500 AF. Table 7 lists all recharge projects and discusses potential for AWBA participation. As uncertainties are resolved regarding recharge demand in the Tucson AMA, then longer-term planning may become more reliable.

Recommendations:

- The IPAG has concluded that in the short term, the goal of the Regional Recharge Plan is to maximize the total amount of CAP delivered to the basin each year. However, over the longer term, it is imperative that achieving water management goals become the primary

Table 7. Tucson AMA Recharge Project Descriptions and Opportunities for Water Bank Participation

Project Description	Project Status	Funding (Feasibility or Construction)	Facility or Storage Permit Holder	Opportunity for Water Bank Participation
Lower Santa Cruz USF proposes to store CAP water in off-channel constructed shallow spreading basins for 20 years. This facility is located south of the Santa Cruz River between Sanders Road and Avra Valley Road. (RRC #1)	Permit application for full project is complete and correct. An objection was received on 9/26/97. Planned Phase I capacity is 12,000 to 13,000 AF. Full scale design capacity is 30,000 AF per year (AFA). It is projected that up to 4,500 AF will be stored in 1998. Phase I is fully funded by CAWCD and PCFCD. Expansion to full scale is not funded.	PCFCD CAWCD (State Demo Project) Marana ADWR* BOR*		Capacity available to the AWBA could range from 0 to 4,500 AF in 1998. It is expected that most of the capacity of Phase I basins would be available to the AWBA thereafter, as well as additional capacity developed in Phase II. This project does not rank as high as others in potential for addressing water management concerns, but is an excellent location for AWBA storage, at least in the short-term.
Cañada Del Oro USF proposes to store CAP water using spreading basins and managed in-channel recharge. This project is one element of the Northwest Tucson Active Management Area Replenishment Program (NWRP). CAP water would be pumped to a reservoir near Tangerine Road and La Cañada Boulevard, and then to two recharge areas and for direct use by golf courses. (RRC #2)	This facility is being investigated, but there is no permit application. Full scale capacity estimated at 30,000 AFA. Alternative pilot testing options under discussion. Feasibility studies are funded, but construction is not funded.	Oro Valley* Metro* ADWR* BOR* Marana* PCFCD - land		The project involves significant capital investment and there may be opportunities for the AWBA to participate in funding this project. The project ranks highly for water management objectives.
Avra Valley Airport USF stores CAP water in off-channel constructed shallow spreading basins. This facility is located to the northeast of the Airport, less than one mile south of Tangerine Road and about one mile east of Sanders Road. (RRC #3)	The pilot for this facility was permitted for storage of 8,300 AF over two years ending 6/30/98. Application for 11,000 AFA full scale project has been submitted. Facility is fully funded.	CAWCD (State Demo Project) Metro	CAWCD - facility, storage AWBA - storage Metro - storage	Up to 5,340 AF of capacity could be available to the AWBA in 1998. This project does not rank as high as others in potential for addressing water management concerns, but is an excellent location for AWBA storage, at least in the short-term.
Pima Mine Road USF will store CAP water in off-channel constructed shallow spreading basins. This facility is located to the north of Pima Mine Road, along the Old Nogales Highway. (RRC #4)	Currently permitted to store 10,000 AF over 2 years in a pilot project. Storage is projected to begin in early 1998. Full scale capacity is projected to be 30,000 AFA. Facility is fully funded.	Tucson CAWCD (State DemoProject)	CAWCD - facility, storage Tucson - storage	Potential capacity available to the AWBA from the current pilot ranges from 0 to 5,000 AF over 2 years. The project rated in the second highest grouping for water management objectives.
Central Avra Valley Storage and Recovery Project (CAVSARP) USF stores CAP water in off-channel shallow spreading basins. Located north of Mile Wide Road and a mile west of Sanders Road. The first pilot-scale facility permit was issued on August 1, 1996. (RRC #5)	The expanded pilot phase of this facility is permitted for storage of 10,000 AF over two years. Storage began in October 1997. Full scale capacity is projected to be 60,000 AFA. Facility is fully funded.	Tucson	Tucson - facility, storage	Up to 5,000 AF of capacity is projected to be available to the AWBA in 1998. This project rated in the highest grouping for ability to meet water management objectives.
South Avra Valley USF proposes to store CAP water using spreading basins north of Snyder Hill Road and south of Garcia Ranch Road on either side of Sandario Road. (RRC #6)	This facility is not being actively investigated. The proposed capacity for this facility is 43,800 AFA.			This facility is not being actively investigated.
San Xavier Arroyos USF stores CAP water by recharging through arroyos to the west of I-10 and the main channel of the Santa Cruz River. (RRC #8)	A short-term pilot is on-going at this facility. Capacity is estimated at 9,000 AFA for the 4 basins. The project is partially funded in that Tucson has supplied treated CAP water and CAWCD prepared blowouts.	SXD* - Water Protection Fund grant funded study CAWCD, Tucson, BOR - prepared blowouts		Potential water management benefit from this project is ranked in the second highest grouping. However, potential capacity is rated in the lowest grouping. An IGA would be required for the State to recognize water stored on the reservation. Potential for participation in SAWRSA settlement.
San Xavier Santa Cruz River USF proposes recharge of CAP water in the main channel of the Santa Cruz River where it crosses Pima Mine Road, extending north to Valencia Road. (RRC #9)	This proposed facility is has a possible capacity of 8,500 AFA. The San Xavier District Council has considered and approved this project, but the Tohono O'odham Nation has not formally considered this project or endorsed it. Facility is not funded.	Tucson - paid for outlet structure		Potential water management benefit from this project is ranked in the highest grouping. However, potential capacity is rated in the lowest grouping. An IGA would be required for the State to recognize water stored on the reservation. Potential for participation in SAWRSA settlement.
Pantano, Tanque Verde & Rillito USF proposes recharge of CAP water in Pantano, Tanque Verde & Rillito stream channels using the City's reclaimed water system for distribution. (RRC #10)	This facility is not being actively investigated. The proposed capacity is 17,000 AFA.			This facility is not being actively investigated.
Brawley Wash at Three Points USF proposes recharge of CAP water using spreading basins located 1.5 miles southwest of Robles Junction in floodplain eastof Brawley Wash. (RRC #11)	This facility is not being actively investigated. The proposed capacity is 40,000 AFA.			This facility is not being actively investigated.
Cortaro Marana Irrigation District (CMID) GSF receives CAP water in lieu of pumping groundwater. This facility is roughly located from Tangerine Road north to the Pima/Pinal county border and southwest of I-10 to one mile west of Trico Road. (RRC #12)	This facility is currently operating and is permitted to store 10,000 AFA. An application to expand to 20,000 AFA has been received. Facility is fully funded.	CMID CAWCD Tucson	CAWCD - facility, storage Spanish Trail WC - storage Green Valley - storage Tucson - storage	Unless current AWBA water pricing policy is changed, this is not a likely candidate for long-term AWBA storage. Contribution of this site to groundwater management objectives is not as high as others.
BKW Farms GSF receives CAP water in-lieu of pumping groundwater. This facility is roughly located south of the Santa Cruz River to Emigh Road between Trico Road and Silverbell Road. (RRC #13)	The facility is currently operating and is permited to store 8,800 AFA. Application for expansion to 16,614 AFA has been submitted. Facility is fully funded.	BKW Tucson (ADWR Augmentation Grant) for conveyance	CAWCD - facility, storage Metro - storage Tucson - storage Green Valley - storage	Unless current AWBA water pricing policy is changed, this is not a likely candidate for long-term AWBA storage. Contribution of this site to groundwater management objectives is not as high as others.
Avra Valley Irrigation District (AVID) GSF proposes to store CAP water in-lieu of using groundwater between Trico and Sanders Roads, on either side of Avra Valley Road west of the Santa Cruz River. (RRC #14)	The application to permit 10,642 AFA of storage has been submitted. Facility is fully funded.	Herb Kai		Unless current AWBA water pricing policy is changed, this is not a likely candidate for long-term AWBA storage. Contribution of this site to groundwater management objectives is not as high as others.
Farmers Investment Company (FICO) - Sahuarita GSF proposes recharging CAP water in lieu of pumping groundwater at the FICO-Sahuarita farm located west of the CAP terminus at Pima Mine Road. (RRC #15)	This project to store 20,00 AFA is currently under investigation through ADWR contract. Regional interests are participating in investigations through a technical advisory committee. Facility is not funded.	ADWR*		May be a candidate for AWBA participation. The project ranks in the second highest grouping for water management benefits, with potential to positively impact groundwater declines and share conveyance facilities with Pima Mine Road project, and possibly others.
ASARCO GSF proposes delivery of CAP water to the ASARCO water recycling pond at Pima Mine Road in-lieu of pumping groundwater. (RRC #16)	This project to store 10,000 AFA is currently under investigation through an ADWR contract. Previously reviewed as part of ADWR study on CAP water use in mines. Facility is not funded.	ADWR*		Due to economic considerations (high pumping costs, etc.), this is not a likely candidate for AWBA storage.
Picacho Pecans GSF receives CAP water in lieu of pumping groundwater. This facility is located in Pinal County, east of the Town of Red Rock, south of Neuman Peak to Park Link Road and between I-10 and Pecan Road. (RRC #17)	This facility is operating and is permitted to store 11,231 AFA through 12/31/06. Facility is fully funded.	Herb Kai	Metro - storage CAWCD- storage Spanish Trail WC - storage Oro Valley - storage Green Valley - storage Tucson - storage	Unless current AWBA water pricing policy is changed, this is not a likely candidate for long-term AWBA storage. Contribution of this site to groundwater management objectives is low.
Pascua Yaqui USF proposes to store CAP water west of the CAP canal alignment in the western portion of the Pascua Yaqui Reservation using spreading basins. (RRC #18)	The proposed capacity of this facility is 10,000 AFA. Facility is not funded.			There is some potential for AWBA participation in this facility, however this project is still purely conceptual at this time.
BKW at Mile Wide GSF proposes to store CAP water in-lieu of groundwater west of the CAP canal between Ft. Lowell and Mile Wide Roads.	The proposed capacity of this facility is 627.2 AFA. An application has been received and is currently incomplete and incorrect. Facility is fully funded.	BKW		Unless current AWBA water pricing policy is changed, this is not a likely candidate for long-term AWBA storage. Contribution of this site to groundwater management objectives does not rank as high as others.

* denotes funding for feasibility study

consideration in siting new facilities. Following this logic in the short term means utilizing existing facilities and facilities that can be developed relatively inexpensively, which are likely to be near the CAP canal. **Over time, greater investments will need to be made to ensure that the water is recharged in a location where it directly benefits users and/or addresses subsidence, water quality or other environmental concerns.**

- The Tucson AMA has identified three geographic areas where additional storage may substantially increase the likelihood of attaining groundwater management objectives: 1) the Central Tucson wellfield where historic groundwater declines and risk of subsidence could possibly be mitigated; 2) the Cañada del Oro basin where groundwater levels are relatively stable but significant increases in water demand are projected; and, 3) the CAP terminus near Green Valley where water levels are declining, increases in water demand are projected, and there are significant concerns associated with protecting the water supplies on the San Xavier District.

  Although the most serious water management concerns are associated with Tucson's Central Wellfield, it is anticipated that a combination of a reduction in pumping and the development of the CAVSARP storage and recovery facility will address these concerns. This is probably not a likely location for AWBA activity, due to distance from the canal and political and jurisdictional considerations.

  The AWBA could positively impact water management objectives in the Cañada del Oro basin. There have been ongoing investigations of the possibilities for direct recharge in this area, primarily because of projected increases in demand. At this time, the groundwater table is largely stable, except in the lower reaches of the watershed. Bringing "wet water" to the region is a top priority for Metro Water District and the Town of Oro Valley. Current investigations involve both CAP and effluent (reclaimed water) deliveries; both require significant capital investment since pumping stations and up to 16 miles of pipelines may be required.

  In the Green Valley/Sahuarita area, potential in-lieu and direct storage facilities (in addition to the Pima Mine Road project) are currently being evaluated pursuant to a contract with the Tucson AMA office. There is a major advantage to recharge in this area, since it is generally up-gradient from the majority of the pumpers in the AMA. In addition, there has been substantial damage to lands on the San Xavier District due to dewatering. Representatives of the District and the Tohono O'odham Nation have indicated interest in recharge on or near the reservation to raise the groundwater level, restore riparian habitat, and possibly to generate credits that could be transferred off of the Reservation for use elsewhere in the AMA. **There may be significant potential for Water Bank activities in this location.**

- The greatest uncertainty regarding the need for additional recharge capacity stems from the lack of community consensus regarding the City of Tucson's CAP water use. One of

the projects listed in the plan is the City of Tucson's Central Avra Valley Storage and Recovery Project (CAVSARP). Tucson Water is the largest water user and holds the largest CAP subcontract in the basin. CAVSARP is planned to recharge 60,000 AF annually before the year 2005, although full build-out will be dependent on the results of pilot studies. The project was designed to replace Central Wellfield pumping, as mandated by the Water Consumer Protection Act (Proposition 200 of 1995). However, use of other options for CAP utilization may significantly reduce the City's need for recharge at the facility, possibly adding to capacity available for other storers, including the AWBA.

- There is a high level of agreement among IPAG members that **direct recharge in underground storage facilities (USF's) has greater benefits than in-lieu recharge in groundwater storage facilities (GSF's).** This is because in-lieu recharge means that groundwater mining will occur in the future, causing long-term declines. The nature of in-lieu recharge means that the groundwater underneath an existing agricultural or industrial user will be preserved. It is much more likely that the industrial user or farm will physically use that groundwater in the future, rather than the municipal user who paid for the CAP water. Although direct recharge may also take place near where other users may withdraw the water saved, the IPAG feels that there are greater benefits to direct recharge if it is sited properly. It was noted that the relative benefits of individual projects must be evaluated on a site by site basis.

  Since in-lieu recharge is not legally authorized to continue past 2025 and there are issues to be considered regarding the length of time that agricultural or industrial users will continue to be in business, any major capital investments associated with in-lieu projects should be evaluated to ensure that there are other long-term benefits of the infrastructure to be constructed.

  Despite the strong support for direct recharge, the IPAG feels that **in-lieu recharge will be necessary in the Tucson AMA in order to meet the short term goal of maximizing CAP delivery.** The AWBA will need to recharge substantial quantities of water in the next few years (30,000 to 60,000 acre-feet per year) in order to utilize the 1997 funds that have been rolled over. The AWBA has historically assumed that in-lieu recharge will not be possible in the Tucson AMA because existing arrangements within the TAMA involve paying less money for the in-lieu water than the AWBA charges in other AMAs. **The assumption that all agricultural users are unwilling to pay the AWBA price (even if some farmers pay more than others) should definitely be more carefully evaluated. There is also a possibility that other users in the basin would be willing to negotiate a price that is closer to the AWBA price. Finally, there may be justification for the AWBA to charge a different price for in-lieu water in the Tucson AMA, given the shortage of facilities and other considerations.**

- Some important water management objectives of recharge are specific to locations

dispersed throughout the basin. One or two large recharge facilities might provide equal capacity at a lower price than many smaller projects, but they would be unlikely to address the location-specific objectives. The objectives of equity and local acceptability also may direct recharge planning toward decentralization.

- The IPAG does not anticipate the need to identify and study additional recharge sites beyond those identified in this report *for the sole purpose of increasing recharge capacity*. An analysis of the recharge capacity that would be provided by projects with identified sponsors showed that sufficient capacity through 2007 would be available if all these projects were constructed. However, several of the identified projects are only in the conceptual phase and substantial additional work will be required to evaluate these projects further and confirm whether the sponsors are willing to move forward. Also, if projects on the Indian reservations do not move forward, more capacity will have to be developed off of the reservations.

- Probably the most significant area of concern in the Tucson AMA from a water management perspective is the City of Tucson's Central Wellfield. It is clear that the most effective way to stabilize the water levels across the basin and reduce the threat of subsidence is to stop pumping the wells in the area. Although there is one project in the Central Wellfield included in the RRC evaluation, it is the conclusion of the technical committee that very little water can be recharged through streambeds (about 17,000 acre-feet per year). The RRC concluded that although the surficial materials in the streambeds have a high infiltration rate, the water is likely to mound when it hits the less permeable materials in the aquifer. In addition, there are so many landfills along stream channels in the central Tucson basin that many reaches are unavailable for recharge.

  The CAVSARP, if fully operational, would permit the City to reduce and perhaps eliminate Central Wellfield pumping except during peak periods. If pumping were reduced significantly, the need for recharge would be less urgent, but some artificial recharge still would be desirable. Among the 16 projects described in detail in the RRC Report, only the Pantano, Rillito and Tanque Verde In-channel Recharge Project would recharge water in the vicinity of the Central Wellfield, and this project was not being developed as of November 1997. It is possible that portions of this project will be developed using reclaimed water as the source.

  The RRC did not include any recharge projects that involved well injection in the list of projects evaluated. The primary reason for this was the fact that Proposition 200 precludes the use of CAP water for well injection unless it meets the Avra Valley groundwater quality standard and is free of disinfection by-products. In retrospect, it appears that well injection should not have been eliminated from consideration. Well injection is unquestionably a superior method from the perspective of mitigating subsidence. It also has major advantages in that it utilizes existing infrastructure. The City's two well injection pilot projects in the Central Wellfield were quite successful for

the short period of time that the projects were active, while CAP delivery was under way. The concerns about disinfection by-products do not appear to be justified based on the experiences of multiple other states. However, the Tucson AMA is initiating an evaluation of the fate of disinfection byproducts and organic precursors and the potential for harm associated with treatment of recharged CAP water after recovery.

- If all of the projects listed in the RRP are implemented in the near term (a rather unlikely outcome), there could be between 85,000 and 90,000 AF of developed capacity *in excess* of local demand in the year 2000 and between 115,000 and 120,000 AF in the year 2007. This would result in sufficient capacity for the AWBA. Approximately 40 to 45 percent of the total developed capacity would be provided by GSFs and would be unavailable to the AWBA if its pricing policies are not reconsidered. In addition, 10 percent or more of the total developed capacity will be on Indian Reservation land. An IGA would be necessary before the AWBA could use any of this capacity for non-Indian storage.

- One issue that is difficult to address is the degree to which existing users in the basin will utilize existing recharge capacity. At this time it is clear that the demand for capacity far exceeds the supply, yet local interests are so anxious to facilitate the activities of the AWBA that they have stepped aside to provide capacity. Since the Bank is intended to recharge water that would not otherwise have been recharged, this is somewhat problematic. **It may be important for the AWBA to work on developing facilities within the Tucson AMA that might not otherwise have been built, or at least focus on facilities within the AMA with capacity that is not currently spoken for, to avoid the possibility of competing for capacity.**

- The ability to recover stored water should be a factor in selecting AWBA facilities. If the objective of storage is to firm municipal supplies, the specific needs of those providers for "wet water" during times of shortage should be considered. If other management objectives are to be pursued, different recovery criteria will apply.

- The IPAG recommends that the AWBA adopt the listed recharge facilities as its list of feasible recharge sites for the Tucson AMA. Further study of the suitability of recharge sites for AWBA purposes should focus at least initially on these facilities. For 1998, AWBA efforts should be directed toward recharge facilities currently operating and facilities which are projected to be operating in 1998. The direct facilities include Pima Mine Road, Avra Valley Airport, Lower Santa Cruz, and CAVSARP. In-lieu facilities (GSF's) that will be available include: Cortaro-Marana, BKW, Picacho Pecans and Avra Valley Irrigation District. The capacity at Avra Valley Irrigation District will be new in 1998, whereas the other three GSFs were operating in 1997.

In conclusion, it appears that there are substantial opportunities to pursue recharge projects in the Tucson AMA. The AWBA is encouraged to continue to work with the IPAG in the development of its facilities plan and operating plans. The status of projects changes very quickly, and the

relative merits of various facilities may change over time. The Regional Recharge Plan is very much a work in progress, and there are obvious benefits to both parties in keeping in close communication.

Arizona Water Banking Authority Study Commission
Interim Report
Summary

Introduction

The Arizona Water Banking Authority Study Commission was created by the Arizona Legislature in 1996 through the enactment of House Bill 2494. The Study Commission is ancillary to the Arizona Water Banking Authority (AWBA), which was created by the same legislation. The Study Commission's role is to assist the AWBA and the Legislature in evaluating the effectiveness of the powers and duties that were authorized by the enabling legislation, and then to suggest additions or modifications if appropriate. The Study Commission held its first meeting in September 1996 and must complete its work by November 1998. The Legislature asked the Study Commission to prepare and file this interim report of its activities by November 1, 1997. Its final findings and recommendations will be documented in a final report due by November 1, 1998.

This Interim Report is composed of a summary report and four subcommittee reports. This report was prepared by the Arizona Department of Water Resources (ADWR) with the AWBA staff's assistance.

Purpose of the Arizona Water Banking Authority Study Commission

The Legislature charged the Study Commission with performance of the following tasks:

(1) Study the existing powers and duties of the AWBA during its first year of operation and make recommendations regarding any necessary changes to the existing powers and duties.
(2) Study the opportunities for additional water banking authority uses within Arizona and in cooperation with California and Nevada.
(3) Identify appropriate mechanisms that will enable Indian communities that hold entitlements to Colorado River water to participate in water banking with the AWBA.
(4) Make recommendations for continuation or modification of the tax collected pursuant to Arizona Revised Statutes section 48-3751.02 (*ad valorem* tax levied by the Central Arizona Water Conservation District (CAWCD) in Maricopa, Pinal, and Pima Counties that may be used for water banking purposes).

The Study Commission prioritized its efforts for its first year toward issues associated with tasks 1, 2 and 3. Issues associated with the fourth task were deferred until the second year of the the study process.

Study Commission Members

The AWBA Study Commission is comprised of fourteen members. Five of the members represent the AWBA board members and the other nine were appointed by Rita Pearson, the Director of the ADWR. The appointed members represent municipal and industrial water (M&I) users, agricultural water users including those that do not use the Central Arizona Project (CAP)

facilities, persons interested in CAP issues, persons interested in Colorado River issues, persons from Indian communities and persons affiliated with environmental interests. All appointed members must be knowledgeable in water resources management in Arizona.

The following individuals serve on the Study Commission:

- Rita Pearson, Chairman: Ms. Pearson is the Director of ADWR and Chairman of the AWBA.
- Mary Ann Antone: Ms. Antone is an elected representative from the Sif Oidak District to the Tohono O'odham Tribal Council Legislative Branch.
- Karen Barfoot: Ms. Barfoot is the Water Resources Advisor to the City of Chandler and is a member of the Arizona Water Resources Advisory Board.
- Cynthia Chandley, Esq.: Ms. Chandley is senior counsel and manager of land and water resources for the Phelps Dodge Corporation.
- Bill Chase: Mr. Chase serves on the board of the AWBA and is also the Water Resources Advisor for the City of Phoenix.
- Larry Dozier: Mr. Dozier is the Deputy General Manager of the CAWCD. Mr. Dozier serves on the Study Commission on behalf of Grady Gammage, Jr., Esq., who is the President of the CAWCD Board and a member of the AWBA.
- Tom Griffin: Mr. Griffin serves on the AWBA and is also the Chairman of the Mohave County Water Augmentation Authority.
- Gary Hansen: Mr. Hansen is the Water Resources Director for the Colorado River Indian Tribes.
- Mark Myers: Mr. Myers operates a private consulting practice in Tucson which focuses on multiple purpose projects related to land use, natural resources, water policy, and environmental policy.
- Paul Orme, Esq.: Mr. Orme is an attorney specializing in water and agricultural law issues. He is also a member of the Arizona Water Protection Fund Commission.
- Donald Pope: Mr. Pope is the manager of the Yuma County Water Users Association.
- Lawrence Robertson, Esq.: Mr. Robertson is an attorney in private practice in Tucson who specializes in water, energy, municipal and public utility law.
- John Sullivan: Mr. Sullivan is an associate general manager for the Water Group at the Salt River Project (SRP) and is also a member of the Arizona Water Resources Advisory Board.
- Richard Walden: Mr. Walden serves on the AWBA and also operates farms in Arizona.

The ADWR and the AWBA provide staff support for the Study Commission.

Organization and Meetings

The Study Commission began in September 1996 with an organizational meeting. The Study Commission decided that it would spend the first few months reviewing and discussing background information so that all members could work from a common knowledge base. Presentations were made concerning:

- Current powers and duties of the AWBA
- Arizona's uses of Colorado River water
- Interest by Southern Nevada Water Authority (SNWA) and California water users in water banking with the AWBA
- Laws governing the Colorado River
- Colorado River operations
- Colorado River water supplies and demands
- Priorities to Colorado River water within Arizona
- Interstate banking provisions
- Water banking activities and organizations in other states

Following this phase, the Study Commission established subcommittees to study and discuss the several critical issue areas. The subcommittees met frequently to identify issues, review studies and prepare recommendations. Each subcommittee prepared an interim report which was reviewed by the full Study Commission at meetings in September and October 1997.

The four subcommittees and their members are listed below.

Planning and Modeling Assumptions
Larry Dozier (Chairman), Karen Barfoot, Bill Chase, Mark Myers, Rita Pearson, Don Pope, and John Sullivan

Interstate and Intrastate Banking and Marketing Issues
Mark Myers (Chairman), Larry Dozier, Gary Hansen, Paul Orme, Larry Robertson, Tom Griffin, Cynthia Chandley, Don Pope, Bill Chase, and Karen Barfoot

Water Banking Benefits Outside of the CAP Service Area
Tom Griffin (Chairman), Larry Dozier, Gary Hansen, Don Pope, Cynthia Chandley, and Bill Chase

Indian Issues
Mary Ann Antone (Co-chairman), Gary Hansen (Co-chairman), John Sullivan, Karen Barfoot, Cynthia Chandley, and Larry Robertson

The following table lists the meetings held by the Study Commission and the subcommittees through October 1997.

Date	*Type of Meeting*
September 11, 1996	Full Study Commission
October 31, 1996	Full Study Commission
November 18,1996	Full Study Commission
December 16, 1996	Full Study Commission
January 23, 1997	Full Study Commission
February 26, 1997	Indian Issues
February 27, 1997	Full Study Commission
March 26, 1997	Indian Issues - All Tribes
March 27, 1997	Full Study Commission
March 28, 1997	Indian Issues
April 15, 1997	Planning/Modeling Assumptions
April 16, 1997	Benefits Outside CAP Service Area
April 21, 1997	Indian Issues - Tohono O'odham
April 24, 1997	Interstate & Intrastate Banking & Marketing
April 24, 1997	Indian Issues
May 15, 1997	Planning/Modeling Assumptions
May 21, 1997	Benefits Outside CAP Service Area
May 22, 1997	Indian Issues
May 22, 1997	Interstate & Intrastate Banking & Marketing
May 30, 1997	Indian Issues - Fort McDowell
June 4, 1997	Planning/Modeling Assumptions
June 16, 1994	Indian Issues - Col. River Tribes
June 26, 1997	Interstate & Intrastate Banking & Marketing
June 26, 1997	Indian Issues
June 30, 1997	Benefits Outside CAP Service Area
July 14, 1997	Indian Issues - Yavapai-Apache
August 19, 1997	Benefits Outside CAP Service Area
August 27, 1997	Interstate & Intrastate Banking & Marketing
August 27, 1997	Indian Issues
August 28, 1997	Planning/Modeling Assumptions
September 6, 1997	Indian Issues - Hualapai Tribe
September 10, 1997	Planning/Modeling Assumptions
September 12, 1997	Indian Issues - Gila River
September 25, 1997	Full Study Commission
October 23, 1997	Full Study Commission

Subcommittee Findings and Recommendations

Each subcommittee identified and evaluated a series of issues related to its primary area of study. In several instances, the issues overlapped between subcommittees. For example, water marketing and land fallowing options were identified as issues by more than one subcommittee. When this happened, the subcommittees attempted to provide a different perspective on the issue to avoid duplication of effort.

1. Planning and Modeling Assumptions Subcommittee

The Study Commission determined that it needs to develop a consistent set of water planning assumptions to evaluate the availability of water supply to meet demands. These assumptions were used in the Colorado River System Simulation (CRSSez) computer model to quantify the potential future water shortages that may occur for existing municipal and industrial CAP subcontractors and others. The potential shortages represent the amount of water that will need to be banked to firm long-term water supplies. The output from the model also quantifies the potential amount of water that is excess to the projected annual demands and is consequently available for banking purposes. The subcommittee organized its work into two issue areas.

Issue 1

What assumptions should the Arizona Water Banking Authority Study Commission make with respect to planning and modeling the Colorado River operations?

The future availability of water from the Colorado River for Arizona is dependent on several key variables. These key variables are summarized as follows:

- Upper Colorado River Basin water demand build-up
- Lake Mead protection levels or shortage strategies
- Surplus declaration strategies
- Water demand reduction - shortage distribution strategy
- Yuma desalter operations

The subcommittee studied numerous iterations of model runs to determine the sensitivity of the key variables to water banking and marketing decisions. Based on the analysis of these studies, the subcommittee recommends that for planning purposes, the Study Commission should use the following assumptions:

- For the Study Commission's planning purposes, the Upper Colorado Basin water demand build-up is recommended to be a maximum of 4.8 million acre feet (maf) without losses. The

projected build-up which the Upper Basin terms "anticipated" is listed as 4.6 maf without losses, and the remainder is termed "potential." The 4.8 maf amount allows for some projected build-up beyond the "anticipated" amount.

- Lake Mead should be operated assuming that a shortage is declared to protect, with an 80% probability, the current SNWA intake level of 1050 feet. It should also be assumed that the lake level will never be allowed to drop below the level of the planned SNWA intake of 1000 feet.
- Assume a surplus strategy of spill avoidance based upon a presumed inflow from the Upper Basin of approximately 17 maf (70th percentile level of historic runoff).
- Assume a strategy of reducing the shortage year deliveries to the CAP and other Priority 4 water users to no more than 1 maf.
- Assume that the Yuma Desalting Plant will be operated, but also investigate the impact to Arizona if the Yuma Desalting Plant is not run.

The recommended assumptions are appropriate for the intended purposes of the Study Commission. These assumptions are not, however, necessarily appropriate for other purposes, such as determining Colorado River long-term reservoir operating criteria. Adoption of these assumptions for study purposes should not be interpreted as an official position by the State of Arizona or the ADWR regarding policies on reservoir operating criteria, development or use of water supplies by any other basin state, or operations of the Yuma Desalting Plant.

Issue 2

How much water should be stored by the Arizona Water Bank to protect against projected shortages?

One of the purposes of the AWBA is to store water brought into Arizona through the CAP to protect Arizona M&I water users against future water shortages on the Colorado River and disruptions of operations of the CAP. The AWBA may distribute long-term storage credits earned by the AWBA to make water available to M&I users of Colorado River water in Arizona that are inside or outside of the CAWCD service area, in accordance with Arizona law.

The subcommittee discussed the potential need for a backup water supply during times of a CAP shortage. The subcommittee considered several options for the amount of water for the M&I users of Colorado River water that should be protected. For those M&I water users inside of the CAWCD service area, the protected amount might be one of three options.

CATEGORY	AMOUNTS
M&I allocations with adjustments by Indian water rights settlements and Cliff Dam replacement water	676 kaf/yr
M&I allocations plus 113 kaf of water which can be potentially leased from the Indian Communities	789 kaf/yr
Projected M&I demand for CAP water in 2040	838 kaf/yr

If the AWBA provides shortage protection for an annual demand of 676,000 af, an estimated 3,029,000 af of recharge credits must be stored to meet the shortages to the CAP M&I through the year 2100. The Colorado River water users not in the CAWCD service area would need up to 575,000 af. The projected Indian shortages are estimated at 1,403,000 af.

If the AWBA provides shortage protection for an annual demand of 789,000 af, then an estimated 3,527,000 af of recharge credits must be stored to meet the shortages to the CAP M&I through the year 2100. The water users outside the CAWCD service area still need 575,000 af. The projected Indian shortages for non-leased water are estimated to be 923,000 af.

If the AWBA provides shortage protection for an annual demand of 838,000 af, then an estimated 4,296,000 af of recharge credits need to be stored to meet the shortages to the CAP M&I through the year 2100. The water users outside the CAWCD service area still need 575,000 AF. The projected Indian shortages are estimated to be 948,000 af.

2. Interstate and Intrastate Water Banking and Marketing Issues Subcommittee

The Study Commission determined that a number of opportunities may exist for the AWBA to perform additional services that could assist water users in Arizona in meeting their needs for a reliable water supply. It also recognized that the program for banking water for interstate purposes could potentially be expanded in a variety of ways. In order to address this category of issues, the Interstate and Intrastate Water Banking and Marketing Issues Subcommittee was formed. The subcommittee identified three primary issue areas.

Issue 1

Arizona and the United States Bureau of Reclamation should develop a policy and process for transferring entitlements between parties in Arizona (including transfers with Indian nations) and for leasing Colorado River water supply for more than one year. The policy should consider temporary and permanent agricultural land fallowing and marketing of water that is made available through Indian water rights and contracts.

Water transfer issues, especially transfers from rural areas to urban areas, have been controversial in Arizona. In the 1980s, several urban municipal providers sought to augment their water supplies by purchasing rights to groundwater in rural basins. After several years of discussion and debate over the issues, the Arizona legislature enacted laws that prohibited future groundwater transfers from most of the state's basins.

While many of the same issues that arose in the groundwater transfer controversy may also exist with transfers of entitlements to Colorado River water, several transfers and leases have been completed in recent years. Water transfers and leases are directly overseen by the United States Bureau of Reclamation (USBR) through its responsibility to administer water contracts for Colorado River water on behalf of the Secretary of the Interior. Historically, the USBR has looked to the state, acting through the ADWR, to provide policy advice on whether the proposed transfer is in the public interest.

ADWR has developed policy statements for the transfer of CAP water from exchange contractors and for the relinquishment and transfer of CAP contracts within the CAP service area. ADWR has not developed a policy on the general transfer of Colorado River water entitlements for multiple years. Though not directly required by statute, an ADWR policy on transfers and leases of Colorado River water under Indian contracts or rights would help establish the terms under which such a transaction would be viewed favorably by the state.

The subcommittee has identified a number of opportunities for the AWBA to provide assistance in meeting the future water needs of water users within Arizona. Possibilities also exist to further assist California and Nevada. Because much of the demand for water is in central Arizona, and most of the higher priority water rights are located along the Colorado River, transferring and transporting non-CAP water may be an important component in solving future water supply problems. In recognition of this circumstance, the subcommittee believes a policy for transporting non-CAP water through the CAP aqueduct system should, therefore, be developed concurrently. The ADWR, USBR, and CAWCD should coordinate their efforts to create such a policy.

The subcommittee recommends that those agencies establish a priority for the development of such policies and procedures so transfer activity may proceed in a timely manner. Once the policies are established, the AWBA's role with respect to water marketing activities will be clearer. The subcommittee recommends that the government agencies initiate an open public process to obtain input in developing the policy.

Issue 2

Should the benefits and services provided by the AWBA be expanded? If so, which services are most appropriate?

The AWBA is currently authorized to provide four primary services: 1) Protect M&I uses of Colorado River water against droughts or other shortages by providing a backup supply; 2) enhance water management objectives of the state; 3) assist in the settlement of Indian water rights claims; and 4) assist water users in California and Nevada in meeting their future water supply needs. If authorized, the AWBA may be able to provide several more benefits and services.

The subcommittee identified and discussed the following types of services:

- Short term or interim supply services
  - Drought and shortage protection beyond current authority
  - Nonpermanent uses
  - Interim Supplies

- Long-term or 100-year assured water supply services
  - Long term credit averaging
  - Water supply supplementation
  - Water transfers and CAP allocations

The subcommittee recommends that all of the concepts identified to date be retained for further study and analysis by the Study Commission. Before the subcommittee recommends statutory AWBA authorization to provide these additional services, it must evaluate the feasibility and need for these services.

Issue 3

Should the AWBA be authorized to meet future needs for water supply by using techniques other than the long-term storage credit system?

The AWBA is currently authorized to provide a variety of services by recharging excess Colorado River water that can be delivered through the CAP. Clearly, this banking approach must be considered a high priority considering the current availability of unused CAP water and the capacity of the CAP aqueduct system to deliver this water. The use of excess water results in a viable way to supplement Arizona's long-term supplies. Water banks in other states provide a variety of other examples of other banking techniques. The subcommittee has identified four additional banking mechanisms that may have potential use in Arizona, including:

- Storage of supplies other than excess Colorado River water
- Water storage in surface reservoirs
- Land fallowing of senior rights
- Return flow credit development

The subcommittee recommends that the Study Commission continue to evaluate the identified measures as well as others that may be suggested by the public over the course of the next year. While these additional measures may all have benefits to water banking, none appears to be superior to Arizona's currently authorized approach of storing excess Colorado River water using artificial groundwater recharge methods. As studies progress involving the water augmentation needs within Arizona or in association with California and Nevada, the benefits and economic feasibility of employing additional water banking techniques will be better understood.

3. Water Banking Benefits Outside of the CAP Service Area Subcommittee

The Study Commission determined that it intends to place special emphasis on identifying opportunities for the AWBA to provide benefits on a statewide basis. The existing powers and duties of the Authority extend to providing shortage protection for M&I users of Colorado River water who are located outside of the CAP service area. The Study Commission formed a subcommittee to provide further information on these existing authorities and also determine if there are feasible opportunities to expand the AWBA to provide additional benefits.

The Water Banking Benefits Outside the CAP Service Area Subcommittee identified seven primary issue areas.

Issue 1

Determine the frequency and magnitude of potential shortages to those municipal and industrial water users of Colorado River water who are not Central Arizona Project subcontractors.

The subcommittee reviewed computer modeling studies performed by ADWR staff that identified potential shortages through the year 2100. These studies also identified a number of uncertainties on the method which may be employed to distribute shortages among various water users. Depending on the shortage sharing methods, the 100-year cumulative shortage to Colorado River area M&I water users could be as low as only 21,000 af or as high as 779,000 af.

The subcommittee believes that providing adequate shortage protection for Colorado River M&I water users outside of the CAP service area is critical. Water providers located along the Colorado River corridor usually lack a backup supply because water withdrawn from wells within the floodplain area is generally considered to be river water rather than groundwater. Therefore, when

shortage conditions exist, these providers may be faced with extremely damaging water supply reductions. The subcommittee concluded that predicting the frequency and magnitude of these potential shortages is very difficult at the present time but recommends using a conservative approach for planning purposes.

Issue 2

Should the AWBA be empowered to obtain and make available water supplies to new water providers or to supplement the supplies and allocations of existing providers in areas located outside of the CAP service area?

Water providers along the Colorado River have expressed concerns that their current level of water allocation will be inadequate to accommodate all of the anticipated growth. The Mohave County Water Augmentation Authority was formed to address the need for supplemental water supplies.

Quantifying the need for supplemental supplies is difficult and subject to a variety of assumptions. One common method includes use of census figures to project future population. Those figures are then multiplied by a gallons per person per day rate. Other methods factor in land use patterns and zoning to estimate an ultimate water need.

ADWR developed information regarding current allocations and projected future needs for water providers located along the Colorado River. The ADWR study indicates that only Lake Havasu City, of the large municipal providers, is likely to exceed its contract amounts by the year 2040, although many may be using a large portion of their allocations. ADWR acknowledges that the data base used for these estimates needs additional information and is in the process of updating its estimates.

The subcommittee believes that M&I water supply augmentation for the fast growing areas along the Colorado River corridor may be an appropriate additional role for the AWBA. Because of the location of the communities, most, if not all, water withdrawn or diverted will be considered Colorado River water. Priority 4 supplies of Colorado River water available for allocation along the Colorado River are limited to 164,652 af, and all but a few thousand acre feet have been allocated. It may, therefore, be difficult for new water providers to be established or for existing providers to obtain additional allocations.

While these problems are recognized, the subcommittee also concluded that it may be inappropriate, or at least premature, to give the AWBA the responsibility for supply augmentation if there will not be a need for such service for a long time. Before making a recommendation on this issue, the subcommittee would like to better determine if there is a need for additional M&I water and if so, if water providers have an interest in using the AWBA to develop those supplies.

Issue 3

Should the AWBA be empowered to store water at recharge sites that do not have direct access to excess water delivered through the Central Arizona Project?

The AWBA's enabling legislation limits the AWBA to obtaining water for storage that can be delivered through the CAP. The legislation does not allow the AWBA to independently own, develop, operate or construct storage facilities. The limitation that water delivered to a storage site must be delivered through the CAP means that all water must be stored either in western Arizona along the aqueduct route or at a facility within the CAP service area. In order to recover the water for the benefit of water users outside of the CAP service area, an exchange and forbearance mechanism must be established with CAP water users. If the AWBA could store water at a site near the Colorado River, it may be possible to deliver water to water users without requiring the exchange and forbearance agreements.

Two proposals were developed for discussion purposes: recharge to increase Colorado River return flows, and recharge and capture. The feasibility of the proposals is dependent upon favorable site-specific hydrogeologic conditions.

Storing water along the Colorado River may have advantages if the recovered water could be delivered without negatively impacting other Arizona water users' rights to divert Colorado River water. If water is stored for too long, that water will be lost to the Colorado River. Water storage must, therefore, either be for short periods of time or should not be initiated until much closer to the time frame when it would need to be recovered. Of the two storage methods identified by the subcommittee, it appears that the recharge and capture method is more practical and thus worthy of further investigation and study. The subcommittee recommends that this issue be investigated further, but only if a practical water recharge site can be identified.

Issue 4

Identify the needs and opportunities for the AWBA to provide assistance for water supply enhancement or drought protection for M&I water users who are neither located within the CAP service area nor located along the Colorado River.

Growth is occurring throughout the state and there is a need for water supply augmentation in certain areas that do not have direct access to the CAP or the Colorado River. Communities that may have ample long-term supplies may find that a local shortage could occur in times of drought. Another potential need for water could result from the ultimate determination of water rights through the adjudication process. The AWBA could be a supply source for obtaining substitute supplies by serving as a statewide water augmentation agency. One critical difficulty in attempting to develop water supplies for users who lack access to the CAP or the Colorado River is the feasibility of implementing water exchanges on in-state river systems.

At present, there are obstacles to getting water to rural municipalities. It is not currently feasible to implement water exchanges on certain in-state river systems. However, this does not mean that rural community problems should not be addressed.

The subcommittee recommends that further consideration be given to this issue during the next year. The following activities should be addressed:

- Study population and growth trends of the rural counties in Arizona. ADWR may be able to provide direct assistance as would other governmental entities.
- Analyze the state to determine which areas would be likely to suffer the greatest impact if drought conditions were to arise. These areas should be categorized and prioritized for further study as to possible exchange scenarios or infrastructure development.
- Continue to work with the USBR and the U. S. Fish and Wildlife Service to examine endangered species impacts with respect to exchanges.

Issue 5

Should the AWBA be empowered to provide water supply enhancement assistance for non-M&I uses within Arizona such as environmental enhancement projects?

As use of water within Arizona increases, the competition for remaining supply also increases. The discussion of using banking mechanisms to supply water for uses other than M&I focused on two examples. First, water may be needed for environmental enhancement or endangered species mitigation programs. The second example was the federal government's need to obtain a replacement supply for the brine stream that is associated with the operation of the Yuma Desalting Plant. The USBR has indicated interest in using the AWBA as a partial solution to issues associated with operating the Yuma Plant.

The subcommittee believes that this issue merits further consideration but does not have a specific recommendation at this time. Future activities should involve further identification of potential environmental projects that could benefit from AWBA services. The USBR should be consulted directly regarding the range of interest that the federal government may have in using the AWBA to meet its short or long term needs.

Issue 6

Study and determine the mechanisms for forbearance and exchange which may be used to deliver Water Bank-developed supplies to water users outside of the CAP service area.

The AWBA is currently authorized to store water on behalf of Colorado River M&I contractors outside of the CAP service area. However, storage of water must occur as a result of deliveries through the CAP. When the stored water is recovered, it must be made available to the

water users located in the Colorado River area. It is highly unlikely that the water will be directly transported from central Arizona groundwater basins back to the Colorado River area communities. An exchange agreement must, therefore, be made. Water users who normally would be receiving Colorado River water through the CAP must be willing to accept the recovered water as a substitute supply. As an alternative to utilizing CAP forbearance as the method for firming those contracts outside the CAP service area, the CAP could agree to indemnify the other post-1968 domestic users. Instead of creating unused water by forbearance, CAP could agree up-front to accept their shortage reduction plus any reductions that would have applied to the other post-1968 domestic water users.

The subcommittee believes this is an important issue to make the AWBA more useful for Colorado River communities. The concepts that the subcommittee has identified for creating forbearance within Arizona appear to have merit, but they require additional study and discussion over the next year.

Issue 7

Should M&I water users located outside of the CAWCD service area who receive credits from the AWBA to offset a water shortage be required to pay to have those credits replaced? Should the reimbursement rate be equal to what the bank originally paid for the credits or should it be at the rate in effect at the time the purchase of replacement water is needed?

Arizona Revised Statutes (A.R.S.) section 45-2457.B establishes the mechanism for M&I users outside of the CAWCD service area to take advantage of the AWBA to firm their supplies against the potential of shortage. First, the statute requires the AWBA to reserve a reasonable number of long-term storage credits accrued with the general fund appropriation for the benefit of those users. The AWBA is then instructed to distribute those credits back to those users only if the water users need the water to offset a shortage. The AWBA collects reimbursement for the cost to the AWBA of replacing the long-term storage credits distributed. (Similar requirements exist for use of general fund credits used for M&I shortages within the CAWCD service area.)

Discussion on this issue in the subcommittee focused on the need to clarify the statutory language to make it clear that the reimbursement of funds would not be needed in the same year water was being withdrawn from the Water Bank to protect against shortages. If a Colorado River shortage was taking place, it would obviously be very difficult, and therefore very expensive for the AWBA to obtain a replacement supply. Mohave County representatives would like the statute clarified to show that the intent of the reimbursement provision is that the AWBA should wait until alternative sources are more readily available before obtaining a replacement.

The subcommittee has concluded that A.R.S. section 4524.57.B is ambiguous and should be amended to clarify that additional sources of water need not be purchased in the same year as when the supplies are withdrawn.

An additional issue is whether the replacement supply of water needs to be continued. The purchaser of water may be required to "pay back" the cost of the water but may not be required to actually replace the water. The subcommittee intends to further examine whether replacement is necessary. Concern was voiced, however, that a Colorado River community that has no backup supply may be extremely vulnerable in the future if the AWBA does not continuously restore drought protection supplies.

4. Indian Issues Subcommittee

The identification of appropriate mechanisms to allow Arizona's Indian communities to participate in water banking activities is one of the primary areas for consideration by the Study Commission. The Study Commission is also very interested in identifying ways the AWBA can assist in the settlement of Indian water rights claims, which is an existing function of the AWBA. The Indian Issues Subcommittee addressed these and other related issues.

The subcommittee adopted an approach of working with individual Indian Communities to identify problems and needs that could be solved with water banking programs. The subcommittee found that meetings with the Tribes were rewarding, and a great deal of information was exchanged.

The Indian Issues Subcommittee organized their work effort around four issue statements.

Issue 1

What are the respective water rights and supplies of the Arizona Indian tribes and how will they interact with the AWBA?

While no two tribes have identical circumstances, the subcommittee concluded that several of the tribes may share common issues or opportunities to interact with the AWBA. The tribes were consequently categorized as follows:

- Tribes with a CAP allocation and an implemented settlement
  - Ak Chin Indian Community, Fort McDowell Indian Community, Salt River Pima-Maricopa Indian Community, and Yavapai-Prescott Indian Tribe.
- Tribes with a CAP allocation and full or partially negotiated settlements not yet implemented
  - San Carlos Apache Tribe and the Tohono O'odham Nation.
- Tribes with CAP allocation but no Indian water rights settlement
  - Gila River Indian Community, Pasqua Yaqui Tribe, Tonto Apache Tribe, and the Yavapai-Apache Nation.
- Tribes with adjudicated water rights but no CAP allocation
  - Cocopah Tribe, Colorado River Indian Tribes, Fort Mohave Indian Tribe, and the Fort Yuma-Quechan Tribe.

- Tribes without adjudicated water rights, settlements or CAP allocations
  - Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab-Paiute Tribe, Navajo Nation, San Juan Southern Paiute Tribe, White Mountain Apache Tribe, and the Pueblo of Zuni.

Issue 2

How can the AWBA assist in achieving implementation of Indian water rights settlements?

The subcommittee discussed this issue extensively and found a number of feasible techniques that the AWBA may employ to assist in implementing water rights settlements. The primary techniques include:

- Provide a partial water supply including:
  - Shortage protection
  - Storage accounts
  - Supplementing other supplies
  - Use of alternate sources of water for use on the reservation
- Mitigate impacts of off-reservation groundwater overdraft
- On-reservation storage techniques

The subcommittee believes that all of the measures relating to water rights settlements identified to date have considerable merit and should be retained for further study. Future studies should expand the concepts by identifying real opportunities for the AWBA to implement these ideas. The cost of implementation, as well as the availability of storage and recovery sites, should be studied. Studies should also attempt to better quantify the practical limits on the volumes of water the AWBA could contribute to settlements and the time frames for implementation of water storage and recovery.

Issue 3

How can the AWBA provide additional water supplies or marketing services to Indian communities?

The subcommittee has identified a number of potential interactions between the AWBA and Indian communities which may be mutually beneficial but are not directly related to an Indian water rights settlement. Generally, these activities involve the AWBA providing water storage services for a tribe or the purchase of water by the AWBA from the tribe. Additional legislative authorization would be needed before these types of activities could be initiated. The four techniques identified are:

- Store unused Indian water for the tribe's benefit at off-reservation locations
- Purchase water from Indian tribes as a supply source for recharge

- Serve as an intermediary or facilitator in marketing Indian water to non-Indian water users
- Arrange land fallowing agreements

The subcommittee believes that the measures relating to water marketing identified to date should continue to be investigated. Many of the ideas described may potentially be accomplished without the AWBA's involvement. It will, therefore, be necessary to determine whether the Indian communities believe that the AWBA could serve a beneficial function in facilitating marketing transactions. The subcommittee also recommends that special emphasis be placed on those concepts that would permit Indian communities to participate with the AWBA in banking activities related to interstate transactions with California and Nevada. These concepts should focus on the opportunities to store interstate water at sites on reservations and to provide a financial benefit to Indian communities as a result of water purchases for interstate purposes.

Issue 4

What are some of the challenges facing Indian community participation in AWBA activities?

The subcommittee discussed a variety of legal, institutional, physical, and cultural challenges which may impede Indian tribes from partnering with the AWBA. Many of these challenges were identified through the fact-finding meetings the subcommittee held with tribal council representatives. These challenges include:

- Lack of delivery infrastructure or exchange capability
- Difficulty for the AWBA to participate in settlement discussions
- Funding limitations
- Legal and policy questions about marketing
- Low demands for short-term water supplies
- Wheeling agreements through the CAP
- Sovereignty, trust, and regulatory issues
- Federal participation

The subcommittee concluded that numerous challenges will confront Indian community participation in water banking activities. The subcommittee recommends that the legal questions about marketing be explored in more detail. The subcommittee fully appreciates that the problems associated with Indian sovereignty, trust, and regulation may be very difficult to overcome. The subcommittee intends to focus on these issues in future discussions with the Indian communities to identify ways that meaningful partnerships may be established.

Arizona Water Banking Authority Study Commission
Interim Report
Summary

Introduction

The Arizona Water Banking Authority Study Commission was created by the Arizona Legislature in 1996 through the enactment of House Bill 2494. The Study Commission is ancillary to the Arizona Water Banking Authority (AWBA), which was created by the same legislation. The Study Commission's role is to assist the AWBA and the Legislature in evaluating the effectiveness of the powers and duties that were authorized by the enabling legislation, and then to suggest additions or modifications if appropriate. The Study Commission held its first meeting in September 1996 and must complete its work by November 1998. The Legislature asked the Study Commission to prepare and file this interim report of its activities by November 1, 1997. Its final findings and recommendations will be documented in a final report due by November 1, 1998.

This Interim Report is composed of a summary report and four subcommittee reports. This report was prepared by the Arizona Department of Water Resources (ADWR) with the AWBA staff's assistance.

Purpose of the Arizona Water Banking Authority Study Commission

The Legislature charged the Study Commission with performance of the following tasks:

(1) Study the existing powers and duties of the AWBA during its first year of operation and make recommendations regarding any necessary changes to the existing powers and duties.
(2) Study the opportunities for additional water banking authority uses within Arizona and in cooperation with California and Nevada.
(3) Identify appropriate mechanisms that will enable Indian communities that hold entitlements to Colorado River water to participate in water banking with the AWBA.
(4) Make recommendations for continuation or modification of the tax collected pursuant to Arizona Revised Statutes section 48-3751.02 (*ad valorem* tax levied by the Central Arizona Water Conservation District (CAWCD) in Maricopa, Pinal, and Pima Counties that may be used for water banking purposes).

The Study Commission prioritized its efforts for its first year toward issues associated with tasks 1, 2 and 3. Issues associated with the fourth task were deferred until the second year of the the study process.

Study Commission Members

The AWBA Study Commission is comprised of fourteen members. Five of the members represent the AWBA board members and the other nine were appointed by Rita Pearson, the Director of the ADWR. The appointed members represent municipal and industrial water (M&I) users, agricultural water users including those that do not use the Central Arizona Project (CAP)

facilities, persons interested in CAP issues, persons interested in Colorado River issues, persons from Indian communities and persons affiliated with environmental interests. All appointed members must be knowledgeable in water resources management in Arizona.

The following individuals serve on the Study Commission:

- Rita Pearson, Chairman: Ms. Pearson is the Director of ADWR and Chairman of the AWBA.
- Mary Ann Antone: Ms. Antone is an elected representative from the Sif Oidak District to the Tohono O'odham Tribal Council Legislative Branch.
- Karen Barfoot: Ms. Barfoot is the Water Resources Advisor to the City of Chandler and is a member of the Arizona Water Resources Advisory Board.
- Cynthia Chandley, Esq.: Ms. Chandley is senior counsel and manager of land and water resources for the Phelps Dodge Corporation.
- Bill Chase: Mr. Chase serves on the board of the AWBA and is also the Water Resources Advisor for the City of Phoenix.
- Larry Dozier: Mr. Dozier is the Deputy General Manager of the CAWCD. Mr. Dozier serves on the Study Commission on behalf of Grady Gammage, Jr., Esq., who is the President of the CAWCD Board and a member of the AWBA.
- Tom Griffin: Mr. Griffin serves on the AWBA and is also the Chairman of the Mohave County Water Augmentation Authority.
- Gary Hansen: Mr. Hansen is the Water Resources Director for the Colorado River Indian Tribes.
- Mark Myers: Mr. Myers operates a private consulting practice in Tucson which focuses on multiple purpose projects related to land use, natural resources, water policy, and environmental policy.
- Paul Orme, Esq.: Mr. Orme is an attorney specializing in water and agricultural law issues. He is also a member of the Arizona Water Protection Fund Commission.
- Donald Pope: Mr. Pope is the manager of the Yuma County Water Users Association.
- Lawrence Robertson, Esq.: Mr. Robertson is an attorney in private practice in Tucson who specializes in water, energy, municipal and public utility law.
- John Sullivan: Mr. Sullivan is an associate general manager for the Water Group at the Salt River Project (SRP) and is also a member of the Arizona Water Resources Advisory Board.
- Richard Walden: Mr. Walden serves on the AWBA and also operates farms in Arizona.

The ADWR and the AWBA provide staff support for the Study Commission.

Organization and Meetings

The Study Commission began in September 1996 with an organizational meeting. The Study Commission decided that it would spend the first few months reviewing and discussing background information so that all members could work from a common knowledge base. Presentations were made concerning:

- Current powers and duties of the AWBA
- Arizona's uses of Colorado River water
- Interest by Southern Nevada Water Authority (SNWA) and California water users in water banking with the AWBA
- Laws governing the Colorado River
- Colorado River operations
- Colorado River water supplies and demands
- Priorities to Colorado River water within Arizona
- Interstate banking provisions
- Water banking activities and organizations in other states

Following this phase, the Study Commission established subcommittees to study and discuss the several critical issue areas. The subcommittees met frequently to identify issues, review studies and prepare recommendations. Each subcommittee prepared an interim report which was reviewed by the full Study Commission at meetings in September and October 1997.

The four subcommittees and their members are listed below.

Planning and Modeling Assumptions
Larry Dozier (Chairman), Karen Barfoot, Bill Chase, Mark Myers, Rita Pearson, Don Pope, and John Sullivan

Interstate and Intrastate Banking and Marketing Issues
Mark Myers (Chairman), Larry Dozier, Gary Hansen, Paul Orme, Larry Robertson, Tom Griffin, Cynthia Chandley, Don Pope, Bill Chase, and Karen Barfoot

Water Banking Benefits Outside of the CAP Service Area
Tom Griffin (Chairman), Larry Dozier, Gary Hansen, Don Pope, Cynthia Chandley, and Bill Chase

Indian Issues
Mary Ann Antone (Co-chairman), Gary Hansen (Co-chairman), John Sullivan, Karen Barfoot, Cynthia Chandley, and Larry Robertson

The following table lists the meetings held by the Study Commission and the subcommittees through October 1997.

Date	*Type of Meeting*
September 11, 1996	Full Study Commission
October 31, 1996	Full Study Commission
November 18,1996	Full Study Commission
December 16, 1996	Full Study Commission
January 23, 1997	Full Study Commission
February 26, 1997	Indian Issues
February 27, 1997	Full Study Commission
March 26, 1997	Indian Issues - All Tribes
March 27, 1997	Full Study Commission
March 28, 1997	Indian Issues
April 15, 1997	Planning/Modeling Assumptions
April 16, 1997	Benefits Outside CAP Service Area
April 21, 1997	Indian Issues - Tohono O'odham
April 24, 1997	Interstate & Intrastate Banking & Marketing
April 24, 1997	Indian Issues
May 15, 1997	Planning/Modeling Assumptions
May 21, 1997	Benefits Outside CAP Service Area
May 22, 1997	Indian Issues
May 22, 1997	Interstate & Intrastate Banking & Marketing
May 30, 1997	Indian Issues - Fort McDowell
June 4, 1997	Planning/Modeling Assumptions
June 16, 1994	Indian Issues - Col. River Tribes
June 26, 1997	Interstate & Intrastate Banking & Marketing
June 26, 1997	Indian Issues
June 30, 1997	Benefits Outside CAP Service Area
July 14, 1997	Indian Issues - Yavapai-Apache
August 19, 1997	Benefits Outside CAP Service Area
August 27, 1997	Interstate & Intrastate Banking & Marketing
August 27, 1997	Indian Issues
August 28, 1997	Planning/Modeling Assumptions
September 6, 1997	Indian Issues - Hualapai Tribe
September 10, 1997	Planning/Modeling Assumptions
September 12, 1997	Indian Issues - Gila River
September 25, 1997	Full Study Commission
October 23, 1997	Full Study Commission

Subcommittee Findings and Recommendations

Each subcommittee identified and evaluated a series of issues related to its primary area of study. In several instances, the issues overlapped between subcommittees. For example, water marketing and land fallowing options were identified as issues by more than one subcommittee. When this happened, the subcommittees attempted to provide a different perspective on the issue to avoid duplication of effort.

1. Planning and Modeling Assumptions Subcommittee

The Study Commission determined that it needs to develop a consistent set of water planning assumptions to evaluate the availability of water supply to meet demands. These assumptions were used in the Colorado River System Simulation (CRSSez) computer model to quantify the potential future water shortages that may occur for existing municipal and industrial CAP subcontractors and others. The potential shortages represent the amount of water that will need to be banked to firm long-term water supplies. The output from the model also quantifies the potential amount of water that is excess to the projected annual demands and is consequently available for banking purposes. The subcommittee organized its work into two issue areas.

Issue 1

What assumptions should the Arizona Water Banking Authority Study Commission make with respect to planning and modeling the Colorado River operations?

The future availability of water from the Colorado River for Arizona is dependent on several key variables. These key variables are summarized as follows:

- Upper Colorado River Basin water demand build-up
- Lake Mead protection levels or shortage strategies
- Surplus declaration strategies
- Water demand reduction - shortage distribution strategy
- Yuma desalter operations

The subcommittee studied numerous iterations of model runs to determine the sensitivity of the key variables to water banking and marketing decisions. Based on the analysis of these studies, the subcommittee recommends that for planning purposes, the Study Commission should use the following assumptions:

- For the Study Commission's planning purposes, the Upper Colorado Basin water demand build-up is recommended to be a maximum of 4.8 million acre feet (maf) without losses. The

projected build-up which the Upper Basin terms "anticipated" is listed as 4.6 maf without losses, and the remainder is termed "potential." The 4.8 maf amount allows for some projected build-up beyond the "anticipated" amount.

- Lake Mead should be operated assuming that a shortage is declared to protect, with an 80% probability, the current SNWA intake level of 1050 feet. It should also be assumed that the lake level will never be allowed to drop below the level of the planned SNWA intake of 1000 feet.
- Assume a surplus strategy of spill avoidance based upon a presumed inflow from the Upper Basin of approximately 17 maf (70th percentile level of historic runoff).
- Assume a strategy of reducing the shortage year deliveries to the CAP and other Priority 4 water users to no more than 1 maf.
- Assume that the Yuma Desalting Plant will be operated, but also investigate the impact to Arizona if the Yuma Desalting Plant is not run.

The recommended assumptions are appropriate for the intended purposes of the Study Commission. These assumptions are not, however, necessarily appropriate for other purposes, such as determining Colorado River long-term reservoir operating criteria. Adoption of these assumptions for study purposes should not be interpreted as an official position by the State of Arizona or the ADWR regarding policies on reservoir operating criteria, development or use of water supplies by any other basin state, or operations of the Yuma Desalting Plant.

Issue 2

How much water should be stored by the Arizona Water Bank to protect against projected shortages?

One of the purposes of the AWBA is to store water brought into Arizona through the CAP to protect Arizona M&I water users against future water shortages on the Colorado River and disruptions of operations of the CAP. The AWBA may distribute long-term storage credits earned by the AWBA to make water available to M&I users of Colorado River water in Arizona that are inside or outside of the CAWCD service area, in accordance with Arizona law.

The subcommittee discussed the potential need for a backup water supply during times of a CAP shortage. The subcommittee considered several options for the amount of water for the M&I users of Colorado River water that should be protected. For those M&I water users inside of the CAWCD service area, the protected amount might be one of three options.

CATEGORY	AMOUNTS
M&I allocations with adjustments by Indian water rights settlements and Cliff Dam replacement water	676 kaf/yr
M&I allocations plus 113 kaf of water which can be potentially leased from the Indian Communities	789 kaf/yr
Projected M&I demand for CAP water in 2040	838 kaf/yr

If the AWBA provides shortage protection for an annual demand of 676,000 af, an estimated 3,029,000 af of recharge credits must be stored to meet the shortages to the CAP M&I through the year 2100. The Colorado River water users not in the CAWCD service area would need up to 575,000 af. The projected Indian shortages are estimated at 1,403,000 af.

If the AWBA provides shortage protection for an annual demand of 789,000 af, then an estimated 3,527,000 af of recharge credits must be stored to meet the shortages to the CAP M&I through the year 2100. The water users outside the CAWCD service area still need 575,000 af. The projected Indian shortages for non-leased water are estimated to be 923,000 af.

If the AWBA provides shortage protection for an annual demand of 838,000 af, then an estimated 4,296,000 af of recharge credits need to be stored to meet the shortages to the CAP M&I through the year 2100. The water users outside the CAWCD service area still need 575,000 AF. The projected Indian shortages are estimated to be 948,000 af.

2. Interstate and Intrastate Water Banking and Marketing Issues Subcommittee

The Study Commission determined that a number of opportunities may exist for the AWBA to perform additional services that could assist water users in Arizona in meeting their needs for a reliable water supply. It also recognized that the program for banking water for interstate purposes could potentially be expanded in a variety of ways. In order to address this category of issues, the Interstate and Intrastate Water Banking and Marketing Issues Subcommittee was formed. The subcommittee identified three primary issue areas.

Issue 1

Arizona and the United States Bureau of Reclamation should develop a policy and process for transferring entitlements between parties in Arizona (including transfers with Indian nations) and for leasing Colorado River water supply for more than one year. The policy should consider temporary and permanent agricultural land fallowing and marketing of water that is made available through Indian water rights and contracts.

Water transfer issues, especially transfers from rural areas to urban areas, have been controversial in Arizona. In the 1980s, several urban municipal providers sought to augment their water supplies by purchasing rights to groundwater in rural basins. After several years of discussion and debate over the issues, the Arizona legislature enacted laws that prohibited future groundwater transfers from most of the state's basins.

While many of the same issues that arose in the groundwater transfer controversy may also exist with transfers of entitlements to Colorado River water, several transfers and leases have been completed in recent years. Water transfers and leases are directly overseen by the United States Bureau of Reclamation (USBR) through its responsibility to administer water contracts for Colorado River water on behalf of the Secretary of the Interior. Historically, the USBR has looked to the state, acting through the ADWR, to provide policy advice on whether the proposed transfer is in the public interest.

ADWR has developed policy statements for the transfer of CAP water from exchange contractors and for the relinquishment and transfer of CAP contracts within the CAP service area. ADWR has not developed a policy on the general transfer of Colorado River water entitlements for multiple years. Though not directly required by statute, an ADWR policy on transfers and leases of Colorado River water under Indian contracts or rights would help establish the terms under which such a transaction would be viewed favorably by the state.

The subcommittee has identified a number of opportunities for the AWBA to provide assistance in meeting the future water needs of water users within Arizona. Possibilities also exist to further assist California and Nevada. Because much of the demand for water is in central Arizona, and most of the higher priority water rights are located along the Colorado River, transferring and transporting non-CAP water may be an important component in solving future water supply problems. In recognition of this circumstance, the subcommittee believes a policy for transporting non-CAP water through the CAP aqueduct system should, therefore, be developed concurrently. The ADWR, USBR, and CAWCD should coordinate their efforts to create such a policy.

The subcommittee recommends that those agencies establish a priority for the development of such policies and procedures so transfer activity may proceed in a timely manner. Once the policies are established, the AWBA's role with respect to water marketing activities will be clearer. The subcommittee recommends that the government agencies initiate an open public process to obtain input in developing the policy.

Issue 2

Should the benefits and services provided by the AWBA be expanded? If so, which services are most appropriate?

The AWBA is currently authorized to provide four primary services: 1) Protect M&I uses of Colorado River water against droughts or other shortages by providing a backup supply; 2) enhance water management objectives of the state; 3) assist in the settlement of Indian water rights claims; and 4) assist water users in California and Nevada in meeting their future water supply needs. If authorized, the AWBA may be able to provide several more benefits and services.

The subcommittee identified and discussed the following types of services:

- Short term or interim supply services
  - Drought and shortage protection beyond current authority
  - Nonpermanent uses
  - Interim Supplies

- Long-term or 100-year assured water supply services
  - Long term credit averaging
  - Water supply supplementation
  - Water transfers and CAP allocations

The subcommittee recommends that all of the concepts identified to date be retained for further study and analysis by the Study Commission. Before the subcommittee recommends statutory AWBA authorization to provide these additional services, it must evaluate the feasibility and need for these services.

Issue 3

Should the AWBA be authorized to meet future needs for water supply by using techniques other than the long-term storage credit system?

The AWBA is currently authorized to provide a variety of services by recharging excess Colorado River water that can be delivered through the CAP. Clearly, this banking approach must be considered a high priority considering the current availability of unused CAP water and the capacity of the CAP aqueduct system to deliver this water. The use of excess water results in a viable way to supplement Arizona's long-term supplies. Water banks in other states provide a variety of other examples of other banking techniques. The subcommittee has identified four additional banking mechanisms that may have potential use in Arizona, including:

- Storage of supplies other than excess Colorado River water
- Water storage in surface reservoirs
- Land fallowing of senior rights
- Return flow credit development

The subcommittee recommends that the Study Commission continue to evaluate the identified measures as well as others that may be suggested by the public over the course of the next year. While these additional measures may all have benefits to water banking, none appears to be superior to Arizona's currently authorized approach of storing excess Colorado River water using artificial groundwater recharge methods. As studies progress involving the water augmentation needs within Arizona or in association with California and Nevada, the benefits and economic feasibility of employing additional water banking techniques will be better understood.

3. Water Banking Benefits Outside of the CAP Service Area Subcommittee

The Study Commission determined that it intends to place special emphasis on identifying opportunities for the AWBA to provide benefits on a statewide basis. The existing powers and duties of the Authority extend to providing shortage protection for M&I users of Colorado River water who are located outside of the CAP service area. The Study Commission formed a subcommittee to provide further information on these existing authorities and also determine if there are feasible opportunities to expand the AWBA to provide additional benefits.

The Water Banking Benefits Outside the CAP Service Area Subcommittee identified seven primary issue areas.

Issue 1

Determine the frequency and magnitude of potential shortages to those municipal and industrial water users of Colorado River water who are not Central Arizona Project subcontractors.

The subcommittee reviewed computer modeling studies performed by ADWR staff that identified potential shortages through the year 2100. These studies also identified a number of uncertainties on the method which may be employed to distribute shortages among various water users. Depending on the shortage sharing methods, the 100-year cumulative shortage to Colorado River area M&I water users could be as low as only 21,000 af or as high as 779,000 af.

The subcommittee believes that providing adequate shortage protection for Colorado River M&I water users outside of the CAP service area is critical. Water providers located along the Colorado River corridor usually lack a backup supply because water withdrawn from wells within the floodplain area is generally considered to be river water rather than groundwater. Therefore, when

shortage conditions exist, these providers may be faced with extremely damaging water supply reductions. The subcommittee concluded that predicting the frequency and magnitude of these potential shortages is very difficult at the present time but recommends using a conservative approach for planning purposes.

Issue 2

Should the AWBA be empowered to obtain and make available water supplies to new water providers or to supplement the supplies and allocations of existing providers in areas located outside of the CAP service area?

Water providers along the Colorado River have expressed concerns that their current level of water allocation will be inadequate to accommodate all of the anticipated growth. The Mohave County Water Augmentation Authority was formed to address the need for supplemental water supplies.

Quantifying the need for supplemental supplies is difficult and subject to a variety of assumptions. One common method includes use of census figures to project future population. Those figures are then multiplied by a gallons per person per day rate. Other methods factor in land use patterns and zoning to estimate an ultimate water need.

ADWR developed information regarding current allocations and projected future needs for water providers located along the Colorado River. The ADWR study indicates that only Lake Havasu City, of the large municipal providers, is likely to exceed its contract amounts by the year 2040, although many may be using a large portion of their allocations. ADWR acknowledges that the data base used for these estimates needs additional information and is in the process of updating its estimates.

The subcommittee believes that M&I water supply augmentation for the fast growing areas along the Colorado River corridor may be an appropriate additional role for the AWBA. Because of the location of the communities, most, if not all, water withdrawn or diverted will be considered Colorado River water. Priority 4 supplies of Colorado River water available for allocation along the Colorado River are limited to 164,652 af, and all but a few thousand acre feet have been allocated. It may, therefore, be difficult for new water providers to be established or for existing providers to obtain additional allocations.

While these problems are recognized, the subcommittee also concluded that it may be inappropriate, or at least premature, to give the AWBA the responsibility for supply augmentation if there will not be a need for such service for a long time. Before making a recommendation on this issue, the subcommittee would like to better determine if there is a need for additional M&I water and if so, if water providers have an interest in using the AWBA to develop those supplies.

Issue 3

Should the AWBA be empowered to store water at recharge sites that do not have direct access to excess water delivered through the Central Arizona Project?

The AWBA's enabling legislation limits the AWBA to obtaining water for storage that can be delivered through the CAP. The legislation does not allow the AWBA to independently own, develop, operate or construct storage facilities. The limitation that water delivered to a storage site must be delivered through the CAP means that all water must be stored either in western Arizona along the aqueduct route or at a facility within the CAP service area. In order to recover the water for the benefit of water users outside of the CAP service area, an exchange and forbearance mechanism must be established with CAP water users. If the AWBA could store water at a site near the Colorado River, it may be possible to deliver water to water users without requiring the exchange and forbearance agreements.

Two proposals were developed for discussion purposes: recharge to increase Colorado River return flows, and recharge and capture. The feasibility of the proposals is dependent upon favorable site-specific hydrogeologic conditions.

Storing water along the Colorado River may have advantages if the recovered water could be delivered without negatively impacting other Arizona water users' rights to divert Colorado River water. If water is stored for too long, that water will be lost to the Colorado River. Water storage must, therefore, either be for short periods of time or should not be initiated until much closer to the time frame when it would need to be recovered. Of the two storage methods identified by the subcommittee, it appears that the recharge and capture method is more practical and thus worthy of further investigation and study. The subcommittee recommends that this issue be investigated further, but only if a practical water recharge site can be identified.

Issue 4

Identify the needs and opportunities for the AWBA to provide assistance for water supply enhancement or drought protection for M&I water users who are neither located within the CAP service area nor located along the Colorado River.

Growth is occurring throughout the state and there is a need for water supply augmentation in certain areas that do not have direct access to the CAP or the Colorado River. Communities that may have ample long-term supplies may find that a local shortage could occur in times of drought. Another potential need for water could result from the ultimate determination of water rights through the adjudication process. The AWBA could be a supply source for obtaining substitute supplies by serving as a statewide water augmentation agency. One critical difficulty in attempting to develop water supplies for users who lack access to the CAP or the Colorado River is the feasibility of implementing water exchanges on in-state river systems.

At present, there are obstacles to getting water to rural municipalities. It is not currently feasible to implement water exchanges on certain in-state river systems. However, this does not mean that rural community problems should not be addressed.

The subcommittee recommends that further consideration be given to this issue during the next year. The following activities should be addressed:

- Study population and growth trends of the rural counties in Arizona. ADWR may be able to provide direct assistance as would other governmental entities.
- Analyze the state to determine which areas would be likely to suffer the greatest impact if drought conditions were to arise. These areas should be categorized and prioritized for further study as to possible exchange scenarios or infrastructure development.
- Continue to work with the USBR and the U. S. Fish and Wildlife Service to examine endangered species impacts with respect to exchanges.

Issue 5

Should the AWBA be empowered to provide water supply enhancement assistance for non-M&I uses within Arizona such as environmental enhancement projects?

As use of water within Arizona increases, the competition for remaining supply also increases. The discussion of using banking mechanisms to supply water for uses other than M&I focused on two examples. First, water may be needed for environmental enhancement or endangered species mitigation programs. The second example was the federal government's need to obtain a replacement supply for the brine stream that is associated with the operation of the Yuma Desalting Plant. The USBR has indicated interest in using the AWBA as a partial solution to issues associated with operating the Yuma Plant.

The subcommittee believes that this issue merits further consideration but does not have a specific recommendation at this time. Future activities should involve further identification of potential environmental projects that could benefit from AWBA services. The USBR should be consulted directly regarding the range of interest that the federal government may have in using the AWBA to meet its short or long term needs.

Issue 6

Study and determine the mechanisms for forbearance and exchange which may be used to deliver Water Bank-developed supplies to water users outside of the CAP service area.

The AWBA is currently authorized to store water on behalf of Colorado River M&I contractors outside of the CAP service area. However, storage of water must occur as a result of deliveries through the CAP. When the stored water is recovered, it must be made available to the

water users located in the Colorado River area. It is highly unlikely that the water will be directly transported from central Arizona groundwater basins back to the Colorado River area communities. An exchange agreement must, therefore, be made. Water users who normally would be receiving Colorado River water through the CAP must be willing to accept the recovered water as a substitute supply. As an alternative to utilizing CAP forbearance as the method for firming those contracts outside the CAP service area, the CAP could agree to indemnify the other post-1968 domestic users. Instead of creating unused water by forbearance, CAP could agree up-front to accept their shortage reduction plus any reductions that would have applied to the other post-1968 domestic water users.

The subcommittee believes this is an important issue to make the AWBA more useful for Colorado River communities. The concepts that the subcommittee has identified for creating forbearance within Arizona appear to have merit, but they require additional study and discussion over the next year.

Issue 7

Should M&I water users located outside of the CAWCD service area who receive credits from the AWBA to offset a water shortage be required to pay to have those credits replaced? Should the reimbursement rate be equal to what the bank originally paid for the credits or should it be at the rate in effect at the time the purchase of replacement water is needed?

Arizona Revised Statutes (A.R.S.) section 45-2457.B establishes the mechanism for M&I users outside of the CAWCD service area to take advantage of the AWBA to firm their supplies against the potential of shortage. First, the statute requires the AWBA to reserve a reasonable number of long-term storage credits accrued with the general fund appropriation for the benefit of those users. The AWBA is then instructed to distribute those credits back to those users only if the water users need the water to offset a shortage. The AWBA collects reimbursement for the cost to the AWBA of replacing the long-term storage credits distributed. (Similar requirements exist for use of general fund credits used for M&I shortages within the CAWCD service area.)

Discussion on this issue in the subcommittee focused on the need to clarify the statutory language to make it clear that the reimbursement of funds would not be needed in the same year water was being withdrawn from the Water Bank to protect against shortages. If a Colorado River shortage was taking place, it would obviously be very difficult, and therefore very expensive for the AWBA to obtain a replacement supply. Mohave County representatives would like the statute clarified to show that the intent of the reimbursement provision is that the AWBA should wait until alternative sources are more readily available before obtaining a replacement.

The subcommittee has concluded that A.R.S. section 4524.57.B is ambiguous and should be amended to clarify that additional sources of water need not be purchased in the same year as when the supplies are withdrawn.

An additional issue is whether the replacement supply of water needs to be continued. The purchaser of water may be required to "pay back" the cost of the water but may not be required to actually replace the water. The subcommittee intends to further examine whether replacement is necessary. Concern was voiced, however, that a Colorado River community that has no backup supply may be extremely vulnerable in the future if the AWBA does not continuously restore drought protection supplies.

4. Indian Issues Subcommittee

The identification of appropriate mechanisms to allow Arizona's Indian communities to participate in water banking activities is one of the primary areas for consideration by the Study Commission. The Study Commission is also very interested in identifying ways the AWBA can assist in the settlement of Indian water rights claims, which is an existing function of the AWBA. The Indian Issues Subcommittee addressed these and other related issues.

The subcommittee adopted an approach of working with individual Indian Communities to identify problems and needs that could be solved with water banking programs. The subcommittee found that meetings with the Tribes were rewarding, and a great deal of information was exchanged.

The Indian Issues Subcommittee organized their work effort around four issue statements.

Issue 1

What are the respective water rights and supplies of the Arizona Indian tribes and how will they interact with the AWBA?

While no two tribes have identical circumstances, the subcommittee concluded that several of the tribes may share common issues or opportunities to interact with the AWBA. The tribes were consequently categorized as follows:

- Tribes with a CAP allocation and an implemented settlement
  - Ak Chin Indian Community, Fort McDowell Indian Community, Salt River Pima-Maricopa Indian Community, and Yavapai-Prescott Indian Tribe.
- Tribes with a CAP allocation and full or partially negotiated settlements not yet implemented
  - San Carlos Apache Tribe and the Tohono O'odham Nation.
- Tribes with CAP allocation but no Indian water rights settlement
  - Gila River Indian Community, Pasqua Yaqui Tribe, Tonto Apache Tribe, and the Yavapai-Apache Nation.
- Tribes with adjudicated water rights but no CAP allocation
  - Cocopah Tribe, Colorado River Indian Tribes, Fort Mohave Indian Tribe, and the Fort Yuma-Quechan Tribe.

- Tribes without adjudicated water rights, settlements or CAP allocations
  - Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab-Paiute Tribe, Navajo Nation, San Juan Southern Paiute Tribe, White Mountain Apache Tribe, and the Pueblo of Zuni.

Issue 2

How can the AWBA assist in achieving implementation of Indian water rights settlements?

The subcommittee discussed this issue extensively and found a number of feasible techniques that the AWBA may employ to assist in implementing water rights settlements. The primary techniques include:

- Provide a partial water supply including:
  - Shortage protection
  - Storage accounts
  - Supplementing other supplies
  - Use of alternate sources of water for use on the reservation
- Mitigate impacts of off-reservation groundwater overdraft
- On-reservation storage techniques

The subcommittee believes that all of the measures relating to water rights settlements identified to date have considerable merit and should be retained for further study. Future studies should expand the concepts by identifying real opportunities for the AWBA to implement these ideas. The cost of implementation, as well as the availability of storage and recovery sites, should be studied. Studies should also attempt to better quantify the practical limits on the volumes of water the AWBA could contribute to settlements and the time frames for implementation of water storage and recovery.

Issue 3

How can the AWBA provide additional water supplies or marketing services to Indian communities?

The subcommittee has identified a number of potential interactions between the AWBA and Indian communities which may be mutually beneficial but are not directly related to an Indian water rights settlement. Generally, these activities involve the AWBA providing water storage services for a tribe or the purchase of water by the AWBA from the tribe. Additional legislative authorization would be needed before these types of activities could be initiated. The four techniques identified are:

- Store unused Indian water for the tribe's benefit at off-reservation locations
- Purchase water from Indian tribes as a supply source for recharge

- Serve as an intermediary or facilitator in marketing Indian water to non-Indian water users
- Arrange land fallowing agreements

The subcommittee believes that the measures relating to water marketing identified to date should continue to be investigated. Many of the ideas described may potentially be accomplished without the AWBA's involvement. It will, therefore, be necessary to determine whether the Indian communities believe that the AWBA could serve a beneficial function in facilitating marketing transactions. The subcommittee also recommends that special emphasis be placed on those concepts that would permit Indian communities to participate with the AWBA in banking activities related to interstate transactions with California and Nevada. These concepts should focus on the opportunities to store interstate water at sites on reservations and to provide a financial benefit to Indian communities as a result of water purchases for interstate purposes.

Issue 4

What are some of the challenges facing Indian community participation in AWBA activities?

The subcommittee discussed a variety of legal, institutional, physical, and cultural challenges which may impede Indian tribes from partnering with the AWBA. Many of these challenges were identified through the fact-finding meetings the subcommittee held with tribal council representatives. These challenges include:

- Lack of delivery infrastructure or exchange capability
- Difficulty for the AWBA to participate in settlement discussions
- Funding limitations
- Legal and policy questions about marketing
- Low demands for short-term water supplies
- Wheeling agreements through the CAP
- Sovereignty, trust, and regulatory issues
- Federal participation

The subcommittee concluded that numerous challenges will confront Indian community participation in water banking activities. The subcommittee recommends that the legal questions about marketing be explored in more detail. The subcommittee fully appreciates that the problems associated with Indian sovereignty, trust, and regulation may be very difficult to overcome. The subcommittee intends to focus on these issues in future discussions with the Indian communities to identify ways that meaningful partnerships may be established.

ARIZONA
WATER
BANKING
AUTHORITY
STUDY
COMMISSION

INTERIM REPORT

NOVEMBER 1, 1997

1

Study Commission Purposes

- Study existing powers and duties of the AWBA and recommend necessary changes
- Study opportunities for additional water banking uses
- Identify mechanisms that will enable Indian communities to participate with AWBA
- Review ad valorem tax provision

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Arizona Water Banking Authority Study Commission Members

Rita Pearson - Chairman

Mary Ann Antone	**Karen Barfoot**
Cynthia Chandley	**Bill Chase**
Larry Dozier	**Tom Griffin**
Gary Hansen	**Mark Myers**
Paul Orme	**Donald Pope**
Larry Robertson	**John Sullivan**
Richard Walden	

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Study Commission Schedule

- ✓ Organizational Meeting
  Sept. 96
- ✓ Background Presentations
  Oct. 96 - Mar. 97
- ✓ Subcommittee Meetings
  Apr.97 - Sept. 97
- ✓ Review Interim Findings
  Sept.97 - Oct. 97
- ✓ Interim Report
  Nov. 97
- Additional Subcommittee Meetings
  Nov. 97 - Apr. 98
- Develop Recommendations
  May 98 - Oct. 98
- Final Report Due
  Nov. 98

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Study Commission Subcommittees

- ***Planning and Modeling Issues***
- ***Interstate and Intrastate Banking and Marketing Issues***
- ***Water Banking Benefits Outside of the CAP Service Area***
- ***Indian Issues***

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STUDY COMMISSION ISSUES
Planning Assumptions Subcommittee

What factors affect the long term reliability of Arizona's Colorado River supplies?

- Upper Basin Development
- Reservoir operating strategies
  - Surplus criteria
  - Shortage criteria
- Lower Basin demands
- Yuma Desalter operation

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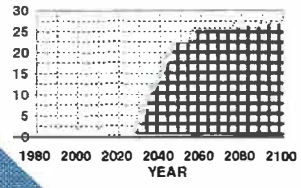
STUDY COMMISSION ISSUES
Planning Assumptions Subcommittee

- What is the probability of a Colorado River shortage in Arizona?
- How much water should be banked to protect against M&I shortages?

Probability of a Colorado River Shortage



100 Year Cumulative Shortages

CAP M&I Demand Level	CAP M&I	River M&I	CAP Indian
676 kaf	3.81 maf	6.73 maf	1.48 maf
739 kaf	3.53 maf	6.58 maf	0.92 maf
832 kaf	4.30 maf	6.50 maf	0.95 maf

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STUDY COMMISSION ISSUES
Banking and Marketing Subcommittee

- Agencies should develop transfer policies
- Additional benefits and services

Short term supplies	Long term supplies
Drought and shortage	*Credit averaging*
Non-permanent uses	*Supply suplementation*
Interim supplies	*Transfers and CAP allocations*

- Additional water supply techniques
  - *Store other supplies*
  - *Surface water reservoirs*
  - *Land fallowing agreements*
  - *Return flow credit development*

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STUDY COMMISSION ISSUES
Outside CAP Service Area Subcommittee

- Banking needs for non-CAP shortage protection
- Water supply augmentation
- Recharge at sites along the Colorado River
- Provide benefits to water users not within the CAP service area or near the River

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STUDY COMMISSION ISSUES
Outside CAP Service Area Subcommittee

- Provide benefits for environmental or other purposes
- Forebearance and exchange mechanisms
- Reimbursement and replacement issues

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STUDY COMMISSION ISSUES
Indian Issues Subcommittee

- Indian rights and settlement status
  - *Tribes with CAP and settlement*
  - *Tribes with CAP and partial settlement*
  - *Tribes with CAP and no settlement*
  - *Tribes without CAP but with adjudicated rights*
  - *Tribes without CAP and no settlement or adjudicated rights*
- Implementation of settlements
  - *Partial water supply*
  - *Mitigate off reservation groundwater pumping*
  - *On-reservation storage*

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STUDY COMMISSION ISSUES
Indian Issues Subcommittee

- Additional supplies or marketing services
  - *Store unused Indian water*
  - *Purchase water from Indians for recharge*
  - *Marketing facilitator*
  - *Land fallowing agreements*
- Challenges
  - *Lack of infrastructure or exchange capability*
  - *AWBA not part of settlement discussions*
  - *Funding limitations*
  - *Legal and policy questions on marketing*
  - *Low demand for short term supplies*
  - *Wheeling through the CAP*
  - *Sovereignty, trust, and regulatory*
  - *Federal participation*

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