WESTCAPS

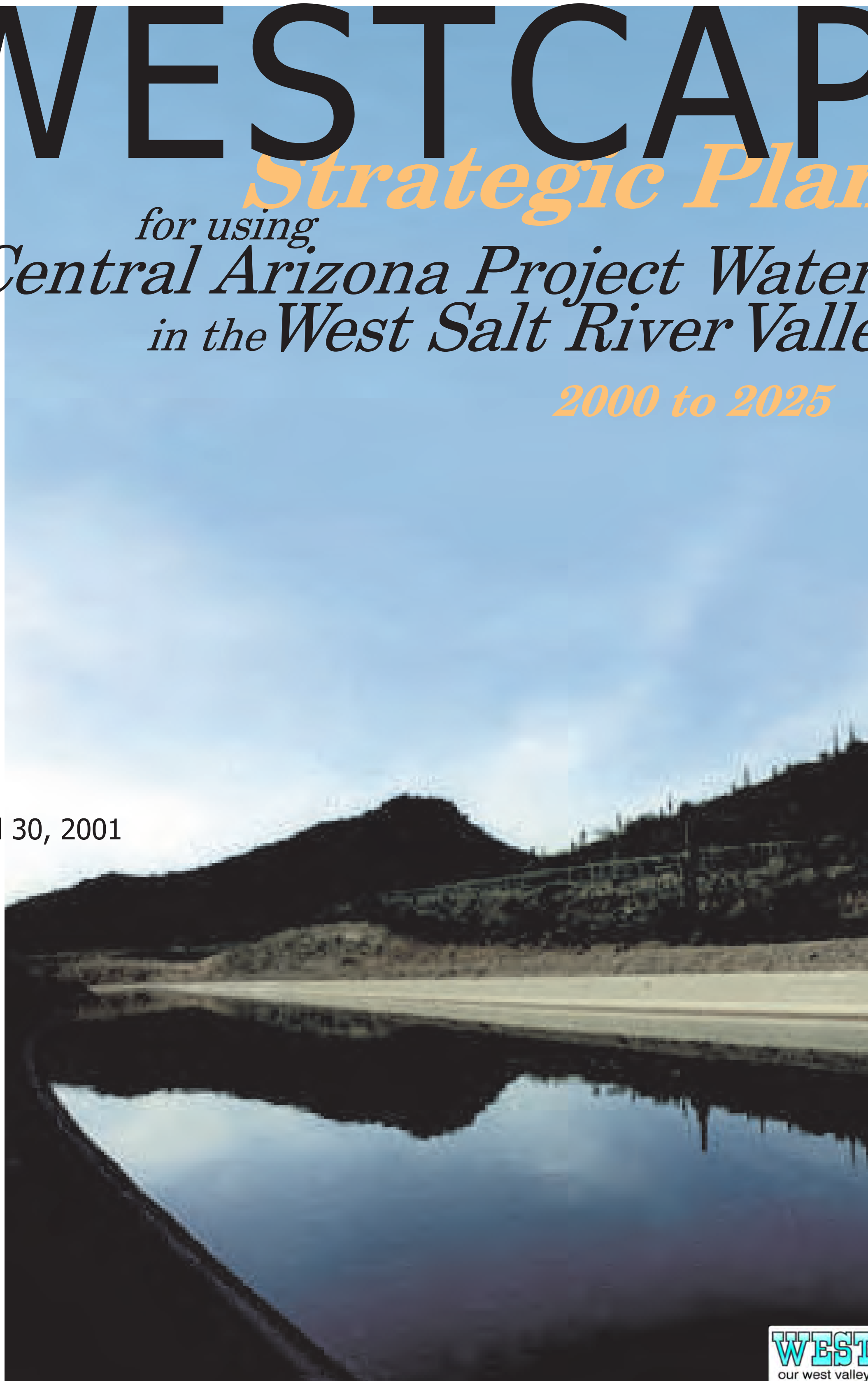
Strategic Plan

for using

Central Arizona Project Water in the West Salt River Valley

2000 to 2025

April 30, 2001



WESTCAPS
our west valley water coalition

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WESTCAPS

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Table of Contents

Table of Contents

Figures Table of Contents

Table of Contents *Figures*

Abbreviations and Acronyms

ACC	Arizona Corporation Commission
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
ac-ft	acre-foot
ac-ft/day	acre-foot per day
ac-ft/yr	acre-foot per year, acre-feet per year
AWBA	Arizona Water Banking Authority
AWS	assured water supply
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CC&N	Certificate of Convenience and Need
cfs	cubic feet per second
CRIT	Colorado River Indian Tribes
D/DBPR	Disinfectant/Disinfection By-Products Rule
DOI	Department of the Interior
EPA	Environmental Protection Agency
ESRV	East Salt River Valley
ESWTR	Enhanced Surface Water Treatment Rule
ft^3/day	cubic feet per day
GRIC	Gila River Indian Community
LAU	lower alluvial unit
MAU	middle alluvial unit
M&I	municipal and industrial
MCL	maximum contaminant level
MF	microfiltration
mg/L	milligrams per liter
mg	million gallons
MGD	million gallons per day
MWD	Maricopa County Municipal Water Conservation District No. 1

Abbreviations and Acronyms

NB-WTP	North Beardsley Water Treatment Plant
NCI	Navigant Consulting, Incorporated
O&M	operation and maintenance
OM&R	operation, maintenance and replacement
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
RID	Roosevelt Irrigation District
RO	reverse osmosis
RUS	Rural Utilities Service
SB-WTP	South Beardsley Water Treatment Plant
SROG	Arizona Municipal Water Users Association Sub-Regional Operating Group
SRP	Salt River Project
SRV	Salt River Valley
TDS	total dissolved solids
THM	trihalomethanes
TOC	total organic carbon
UAU	upper alluvial unit
UF	ultrafiltration
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
WESTCAPS	coalition of West Valley Central Arizona Project Subcontractors
WMC	West Maricopa Combine
WTP	water treatment plant
WSRV	West Salt River Valley
WPA	water planning area

Executive Summary

WESTCAPS Water Delivery Plan

Summary

The West Valley CAP Subcontractors (WESTCAPS) are 10 Central Arizona Project (CAP) subcontractors in the West Salt River Valley (WSRV) who formed a coalition to identify and evaluate options that will allow its members to use CAP water to which they are entitled. WESTCAPS membership consists of: Arizona State Land Department, Arizona Water Company, Town of Buckeye, Citizens Water Resources, City of Glendale, City of Goodyear, City of Peoria, City of Phoenix, City of Surprise, and West Maricopa Combine. WESTCAPS was formed in July 1997 through an intergovernmental agreement among the members. WESTCAPS receives funding through membership dues ($75,000 per year), a grant from the Arizona Department of Water Resources ($75,000 per year), and technical assistance ($400,000 per year) from the Bureau of Reclamation, an agency of the U.S. Department of the Interior.

The WSRV is poised for rapid urbanization that will significantly increase water demand. State law requires new development in the Phoenix metropolitan area to demonstrate a 100-year assured water supply. Full use of CAP water is deemed critical to the continued development and prosperity of the WSRV.

A 1995 study authorized by the Arizona legislature showed that most of the WSRV has experienced significant groundwater decline, resulting in up to 17 feet of land subsidence in portions of the WSRV. Other portions of the West Valley are facing groundwater quality issues that will increase the cost of continued groundwater use. Some municipalities have made the transition and are primarily using renewable water resources; other WSRV water providers are still largely reliant on groundwater.

While Phoenix and Glendale have been using CAP allocations for 15 years, and more recently Peoria by its participation in the Glendale Pyramid Peak Water Treatment Plant, the majority of West Valley water providers are small municipalities and private water companies with limited financial resources and are located some distance away from the CAP canal. WESTCAPS members are concerned that CAP water may continue to be unused if regional solutions are not developed to allow for the treatment, storage, and delivery of CAP water.

WESTCAPS has developed a water delivery plan to shift the communities' reliance from groundwater to renewable water supplies by 2025. Groundwater supplies would be used in a peaking or reserve role. Referring to figure 4, facilities included in this plan are:

- Use of nearly 4 million gallons per day (MGD) of available capacity in the planned Phoenix Lake Pleasant Water Treatment Plant (WTP)
- Expansion of Glendale's Pyramid Peak WTP by approximately 29 MGD
- Two new WTPs with capacities of approximately 58 and 79 MGD
- Use of approximately 16 MGD of capacity in West Maricopa Combine's (WMC) recharge and recovery project

Staff analyzing these facilities envisioned them phased in over time: the first phase completed by year 2005, the second phase by year 2015, and the last phase by year 2025. Adjustments in the timing and location of these facilities are anticipated as this strategy is further developed and the ability and desire of the individual members to participate are determined.

In current dollars, the water delivery infrastructure is estimated to involve approximately $500 million in capital costs over 25 years, with an annual operations, maintenance, and replacement (OM&R) expense of $17 million.

Institutional and financing arrangements for funding infrastructure development were explored and are currently under discussion. Some of the institutional arrangements being considered are: joint powers of authority, simple contractual agreements, privatization, and a water authority.

WESTCAPS analyzed potential recovery mechanisms for the estimated capital costs. Estimated capital cost recovery, in current dollars, is: Impact fees at $2,000 per new residential unit; Bond recovery at $14 per month for each residential unit (existing and new), or $600 per acre-foot of water delivered.

WESTCAPS estimated that approximately 104,000 ac-ft per year of additional renewable water supply would have to be secured by 2025 to implement the proposed water delivery plan. Water cost and availability information was prepared to get a sense of the membership's ability to acquire the necessary supply. It was concluded that there are sufficient renewable supplies available to implement the proposed plan.

Background

The West Valley CAP Subcontractors (10 Central Arizona Project subcontractors in the WSRV) formed a coalition to assess how they can work together to utilize their CAP allocations. WESTCAPS consists of the following agencies: Arizona State Land Department, Arizona Water Company, Town of Buckeye, Citizens Water Resources, City of Glendale, City of Goodyear, City of Peoria, City of Phoenix, City of Surprise, and West Maricopa Combine. WESTCAPS is organized as shown in figure 1.

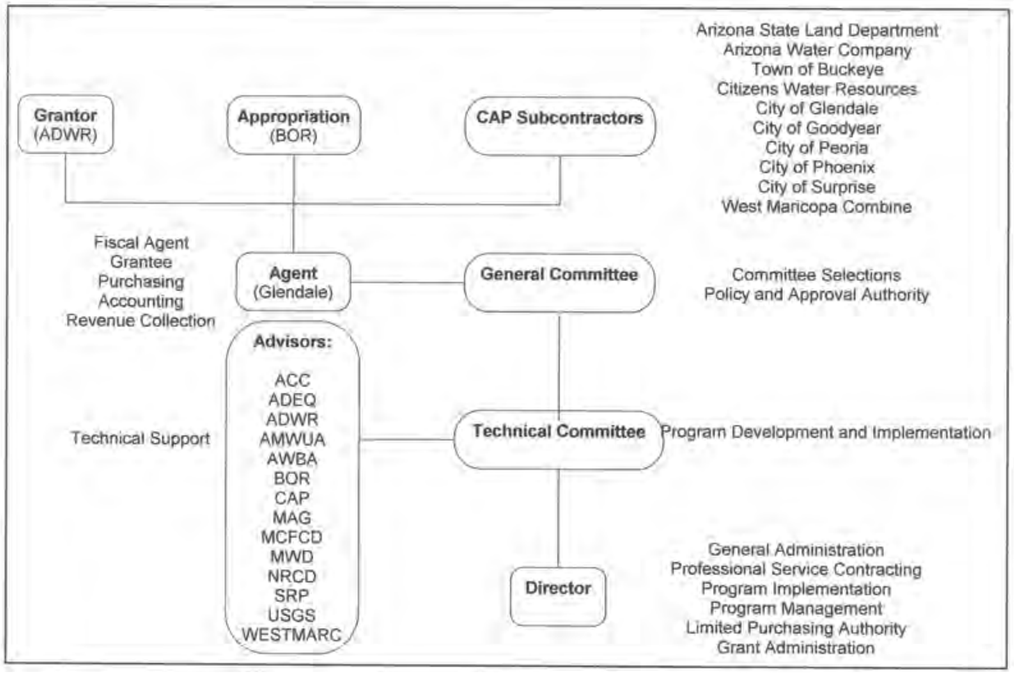


Figure 1.
West Valley CAP Subcontractors

The study area shown in figure 2 represents the geographic boundaries of the WESTCAPS water study area and includes both present and proposed WESTCAPS members' year 2025 service areas.

Problem Statement

Each water provider in the WSRV conducts its own water resources planning and management without much consideration for the plans and actions of neighboring communities. The WSRV communities all share the groundwater aquifer and local surface water supply systems. Water providers in the WSRV must work together to protect, preserve, and develop these shared resources and to respond to issues of increasing regulatory pressure, CAP water utilization, declining groundwater levels, groundwater quality, land subsidence, and managing costs.

If no workable solution is implemented, the WSRV, as a whole, unable to obtain a designation of "Assured Water Supply," as defined by the State of Arizona. Growth and development in the area will become limited. As the aquifer is drawn down, the cost to pump groundwater will increase, water quality will degrade, land subsidence problems will worsen, and the area will not have enough supply to meet future demands.

WESTCAPS Mission and Goals

The following mission and goals were adopted by the WESTCAPS General Committee at its meeting on November 7, 1997.

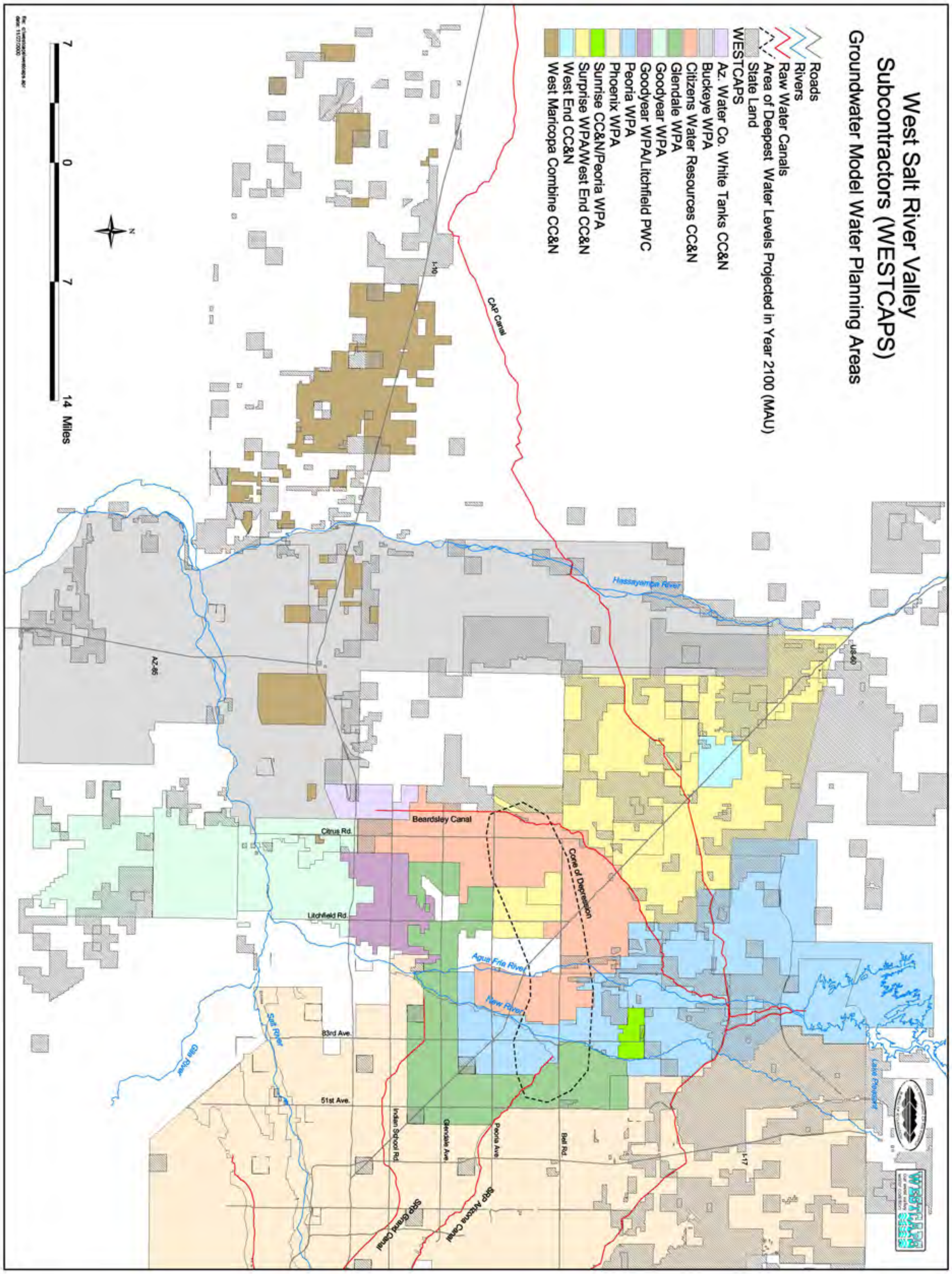


Figure 2. WESTCAPS water supply study area.

"WESTCAPS is a coalition of CAP subcontractors most of whom serve drinking water to communities in the west SRV. WESTCAPS' mission is to develop workable alternatives for its members to provide their customers with a cost effective, sustainable, reliable, and high quality water supply through partnerships and cooperative efforts in regional water resource planning and management, emphasizing CAP utilization."

The primary goal of the planning process is to increase the efficient use of CAP water by WSRV entities possessing municipal and industrial subcontracts. In addition to this goal, WESTCAPS members expressed desired outcomes for both the planning process and what the process implementation. They are:

- Develop a plan that each WESTCAPS member can support
- Develop a common base of understanding of the issues and options
- Develop a mission statement and define the tenets for member involvement
- Protect, preserve, and enhance CAP allocations
- Maximize efficient use of CAP and other renewable resources available to the west SRV
- Understand and influence water policy in Arizona related to water and wastewater management in the WSRV (Arizona Department of Environmental Quality [ADEQ], Arizona Department of Water Resources, Central Arizona Water Conservation District, and the Arizona Corporation Commission)
- Develop long-term, sustainable regional water resource management, infrastructure, and implementation strategies

Originally, the planning process was expected to take 4 to 5 years to complete. WESTCAPS now expects to complete the planning process within 4 years.

Strategic Research

The intent of the Strategic Research phase of the planning process is to identify and describe the factors that drive change by assessing the current situation facing water providers in the WSRV, considering potential future outcomes, and summarizing the key strategic issues. For this planning effort, a strategic issue is a driving factor for change that will, or may, influence WESTCAPS' ability to use its CAP allocations. Strategic research helped WESTCAPS members develop a common understanding of the existing situation for each member and the region as a whole. The outcome from doing strategic research was: (1) a common basis for understanding, (2) an identification of key strategic issues, and (3) development of strategic priorities.

After the strategic research was completed and consensus was developed on the strategic issues, the next step of the planning process was for WESTCAPS to review the list of strategic issues and identify the issues of highest priority. This reduced list of strategic issues then became WESTCAPS' strategic priorities. WESTCAPS strategic priorities are:

1. Insufficient water infrastructure
2. Lack of financing capability
3. Insufficient renewable resources
4. Opportunity to promote recharge in the WSRV
5. Arizona Corporation Commission policy and direction

From this point forward in the planning process, WESTCAPS work efforts were focused on addressing these five strategic priorities.

Strategic Modeling

WESTCAPS identified all of its available options for using CAP and other renewable water supplies in the west Salt River Valley. From these options, WESTCAPS developed six potential infrastructure strategies. A groundwater model analysis was completed for each strategy. In addition, a present worth analysis was also developed for each strategy. It was the intent of WESTCAPS to select one of these strategies as its collective vision of the water infrastructure that should be in place by 2025 to meet projected water demands.

On June 30, 2000, the WESTCAPS General Committee met to consider a recommendation proposed by its Technical Committee to adopt a direct delivery strategy, known as the "WESTCAPS strategy," as the best plan to fulfill WESTCAPS goals (see figure 3).

The proposed WESTCAPS strategy is that by the year 2025, WESTCAPS members would rely on renewable supplies to meet customer demands. Surface WTPs and related infrastructure would be in place by 2025 to meet projected demands, and groundwater supplies would be used in a peaking or reserve role. Buckeye and WMC would rely on recharge and recovery projects. Facilities included in this strategy are:

- Use of 13.21 MGD of available capacity in the planned Phoenix Lake Pleasant WTP
- Expansion of Glendale's Pyramid Peak WTP by 29.45 MGD
- Two new WTPs, located on Maricopa Water District's Beardsley Canal, with capacities of 53.52 and 77.17 MGD
- Use of 15.84 MGD of capacity in WMC's Pipeline to The Future

Staff analyzing these facilities envisioned them implemented in two phases. The first phase by 2010 and the second phase by 2020. Adjustments in the timing and location of these facilities are anticipated as this strategy is further developed and the ability and desire of the individual members to participate are determined.

The interim strategy for CAP utilization would be for each WESTCAPS member, either individually or cooperatively with others, to consider the following options:

- Existing water treatment plants
- Recharge and recovery in existing and future groundwater savings facilities
- Recharge and recovery in existing and future underground storage and recovery projects

In addition, the Central Arizona Groundwater Replenishment District and Arizona Water Banking Authority should be encouraged to recharge as much water as possible in the

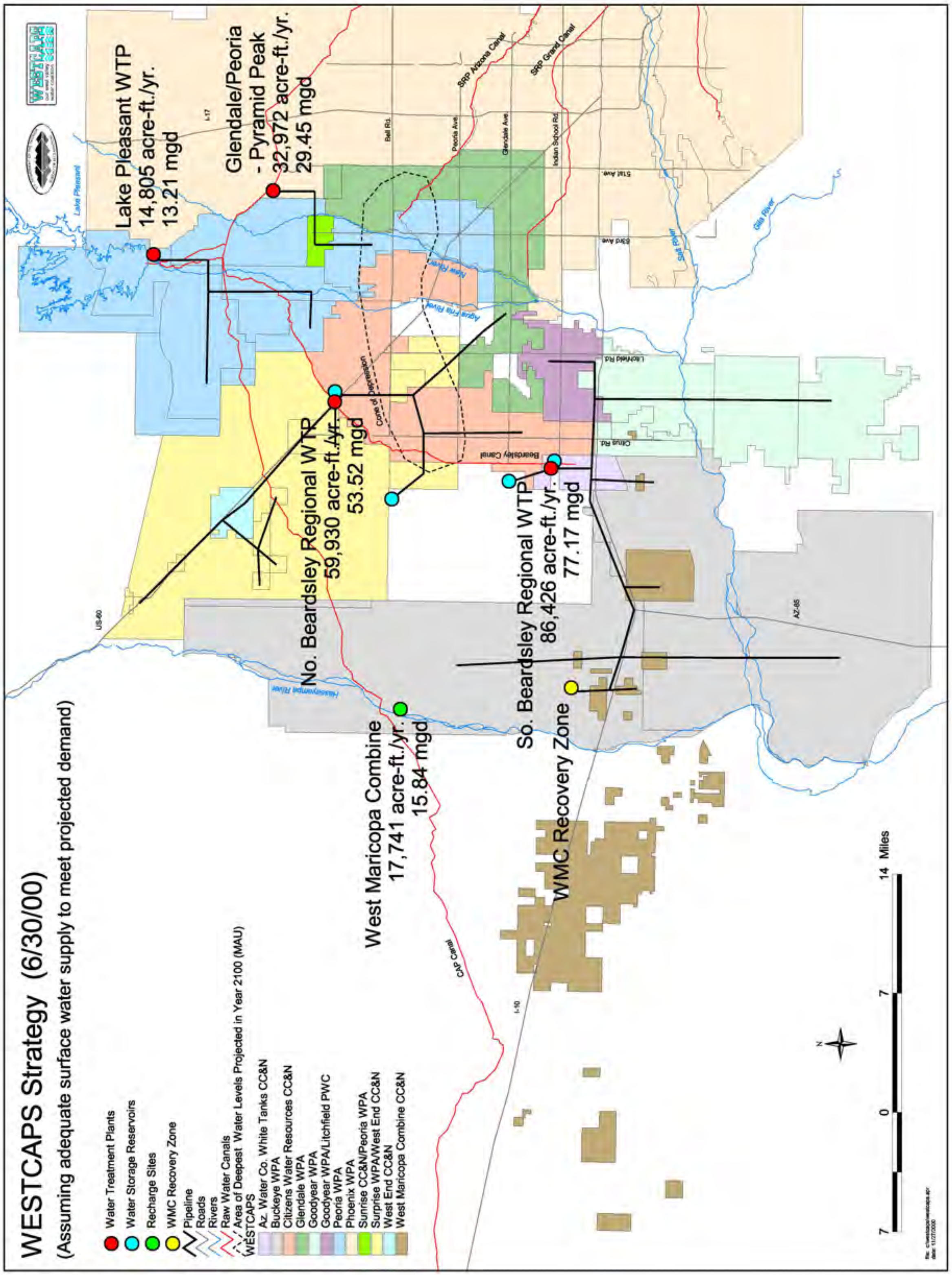


Figure 3. WESTCAPS Strategy, adopted June 30, 2000.

WSRV. Existing and future underground storage and recovery projects include:

- West Maricopa Combine Pipeline to The Future
- Central Arizona Project Agua Fria Recharge Project
- Surprise's McMicken Dam Recharge Project
- Goodyear's Beardsley Canal Recharge Project
- Maricopa County Flood Control District New River Watercourse master planned area
- Salt River Project's Proposed Underground Storage and Recovery Project in the WSRV
- Subregional Operating Group's Agua Fria Recharge Project
- Avondale's Crystal Lakes Project

The WESTCAPS General Committee decided to adopt, on a preliminary basis, the proposed strategy, but requested the Technical Committee make additional refinements to the strategy in the following areas:

- Evaluate potential institutional and financial mechanisms

- Develop regional and subregional alternative plant configurations including transmission and distribution infrastructure

Gap Analysis

The final phase of WESTCAPS planning process, the Gap Analysis, addressed: (1) possible refinements to the WESTCAPS infrastructure strategy selected on June 30, 2000, (2) cost estimates and cashflow for financing the WESTCAPS strategy, (3) potential institutional and financing arrangements, and (4) sources of additional renewable water supply to meet projected supply deficits.

Refinement of the WESTCAPS Strategy

The current proposal before the General Committee is to revise the WESTCAPS strategy by relocating the proposed new WTPs on the Maricopa Water District is Beardsley Canal as follows: (1) move the north Beardsley WTP to the CAP Canal and (2) move the south Beardsley WTP north to a location on the Beardsley Canal (somewhere between Cactus and Bell Road). In addition, a portion of the City of Surprise water planning area would remain on wells, and some of the City of Peoria's projected water demand would be shifted from the planned Phoenix Lake Pleasant WTP to the proposed CAP WTP. The resulting WESTCAPS strategy, revised on September 15, 2000, is shown in figure 4. On a regional basis, there is no significant difference in capital cost between the two strategies. However, there is a significant OM&R savings. By relocating the plants, the elevation will increase between the WTPs and the respective water service areas. The increased elevation, or head, will allow for the pipelines to be adequately pressurized without booster pumps and will result in a power savings. In addition, by locating the new WTPs on two different canal systems, and by interconnecting the distribution systems from the plants, overall system reliability is improved.

A groundwater model analysis, comparing the projected hydrological impacts between the initial WESTCAPS strategy (June 30, 2000)

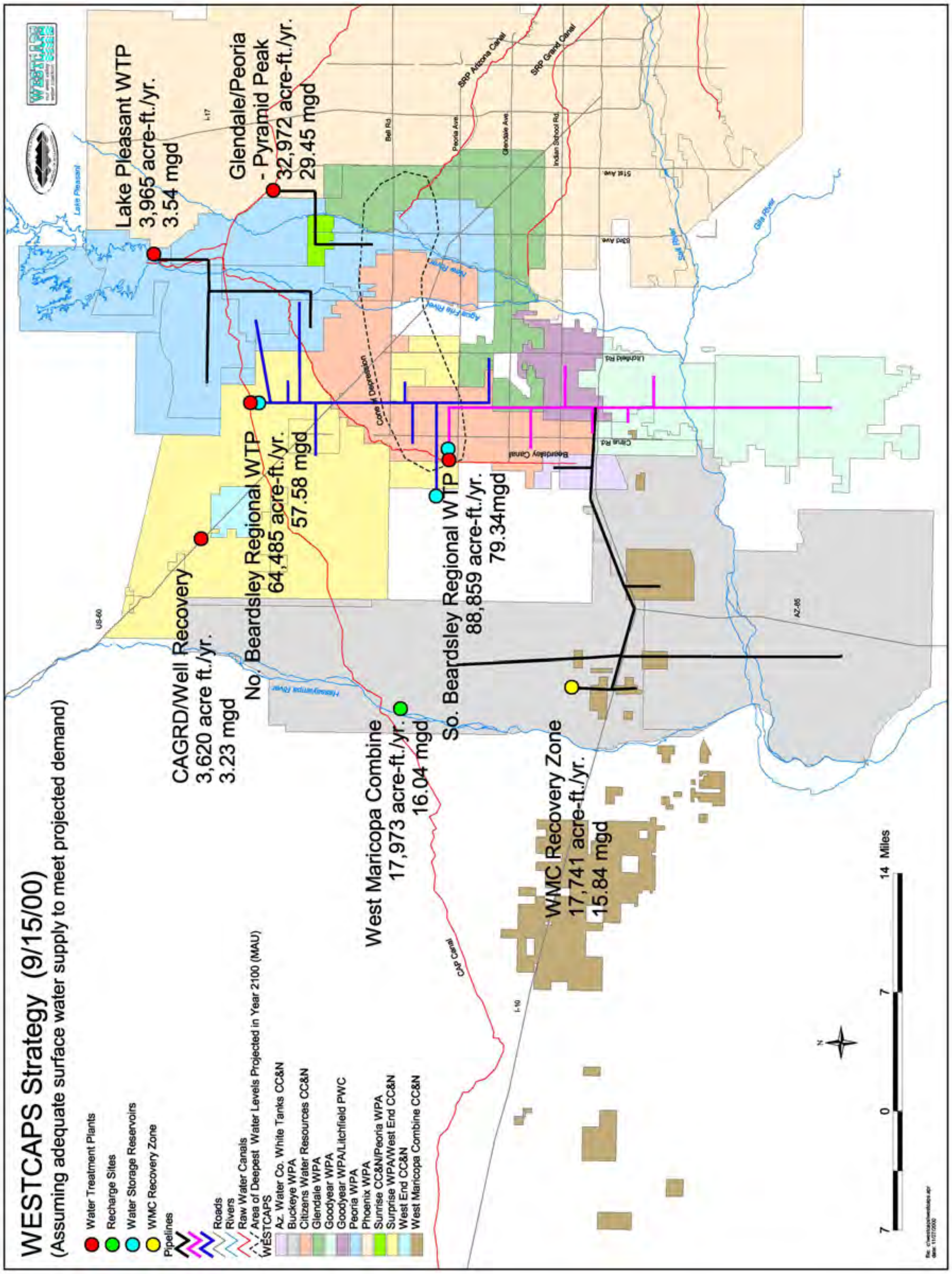


Figure 4. Revised WESTCAPS strategy, dated September 15, 2000.

and the revised WESTCAPS strategy showed no significant difference between the two strategies. However, long-term groundwater drawdown projections showed the revised WESTCAPS strategy (September 15, 2000) markedly reduces the projected water level declines in the northwest valley.

Project Phasing, Cost, and Financing

The two new regional WTPs in the WESTCAPS strategy would be phased in three increments, occurring in the years 2005, 2015, and 2025.

The WESTCAPS strategy (September 15, 2000) is estimated to cost, in year 2000 dollars, approximately $500 million in capital costs over 25 years, with an annual OM&R expense of $17 million. The difference in the regional cost between the initial strategy and the revised strategy was a decrease in total capital costs of $1.7 million and an annual OM&R cost reduction of $2.5 million.

Institutional and financial arrangements for funding infrastructure development were explored and are currently under discussion. Some of the institutional arrangements considered are: joint powers of authority, simple contractual agreements, privatization, and a water authority.

WESTCAPS analyzed potential recovery mechanisms for the estimated capital costs. Estimated capital cost recovery, in the year 2000 dollars, is: Impact fees at $2,000 per new residential unit, or Bond recovery at $14 per month for each residential unit (existing and new), or $600 per acre-foot of water delivered.

Sources of Additional Renewable Supply

Water availability to meet the 2025 demand and cost information were gathered to ascertain the membership's opportunity and ability to acquire the necessary supply. WESTCAPS concluded that there are sufficient renewable supplies available within Arizona to implement the revised WESTCAPS strategy (the proposed strategy). The renewable water supply requirement, currently available surface water supplies, and potential sources for additional renewable supplies are shown in Figure 5.

Demand.—By the year 2025, it is projected that an additional 211,874 acre-feet per year (ac-ft/yr) of renewable supply will be needed to meet projected demands. However, incidental recharge to the aquifer in that year is expected to be 8,475 ac-ft/yr. The projected net regional water supply demand, after adjustment for incidental recharge, is 203,399 ac-ft/yr.

Supply.—Available renewable water supplies in the year 2025 are expected to come from the following water supplies:

- Unused CAP water allocations
- Reallocated CAP water
- Maricopa Water District surface water supplies
- Gila River Indian Community (GRIC) long-term water leases

The total estimated available renewable water supply is 99,487 ac-ft/yr.

Deficit.—The estimated water supply deficit in the year 2025 regional water budget is 103,912 ac-ft/yr. Potential water supplies that could be considered to offset the projected year 2025 groundwater pumping include:

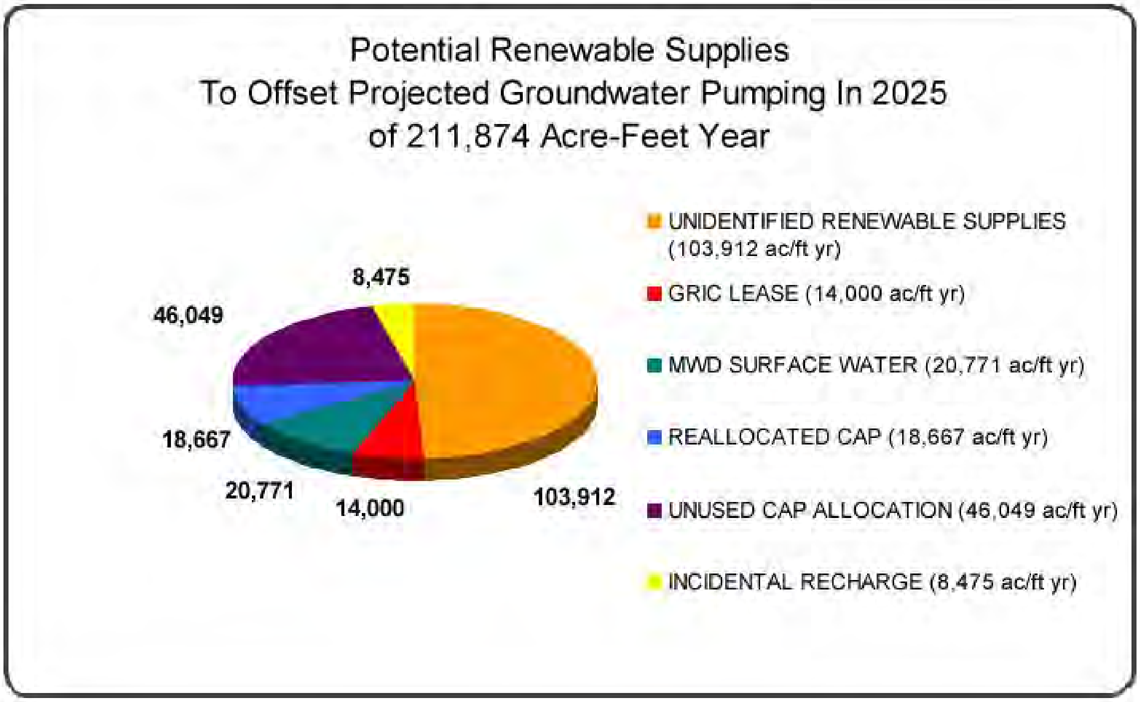


Figure 5. Potential renewable supplies.

- Potential Indian water leases from GRIC, Colorado Indian Tribes, Ak-Chin Indian Community, Ft. McDowell Indian Community, and San Carlos Apache Tribe
- CAP agriculture priority water
- Groundwater from waterlogged areas
- Reclaimed water
- Butler Valley groundwater

Recommended Next Steps

WESTCAPS has determined that the proposed WESTCAPS strategy has enough technical merit to warrant the development of regional facilities and to initiate discussion with policymakers in the WSRV. On a regional basis, the proposed WESTCAPS strategy would provide the following benefits:

- Be less costly than if each of the WESTCAPS members sought to plan and manage their water resource needs alone
- Mitigate groundwater decline in the northwest Salt River Valley
- Improve water system reliability
- Enable water providers to more easily address current and future water quality regulations

Therefore, the next step in the planning process is to discuss the proposed WESTCAPS strategy with decision makers in the WSRV to determine the most acceptable arrangement for its implementation and financing.

Chapter I

Introduction

Background

The West Valley CAP Subcontractors (WESTCAPS) are 10 Central Arizona Project (CAP) subcontractors in the West Salt River Valley (WSRV) who formed a coalition to assess how they can work together to utilize their CAP allocations. WESTCAPS consists of the following agencies: Arizona State Land Department, Arizona Water Company, Town of Buckeye, Citizens Water Resources, City of Glendale, City of Goodyear, City of Peoria, City of Phoenix, City of Surprise, and West Maricopa Combine. WESTCAPS is organized as illustrated in figure I-1 below.

The study area shown in figure I-2 represents the geographic boundaries of the WESTCAPS water study area and includes both present and proposed WESTCAPS members' year 2025 service areas.

Problem Statement

Each water provider in the WSRV conducts its own water resources planning and management without much consideration for the plans and actions of neighboring communities. The ground water aquifer and local surface water supply systems are a resource that is shared by all the communities in the WSRV. West Salt River Valley water

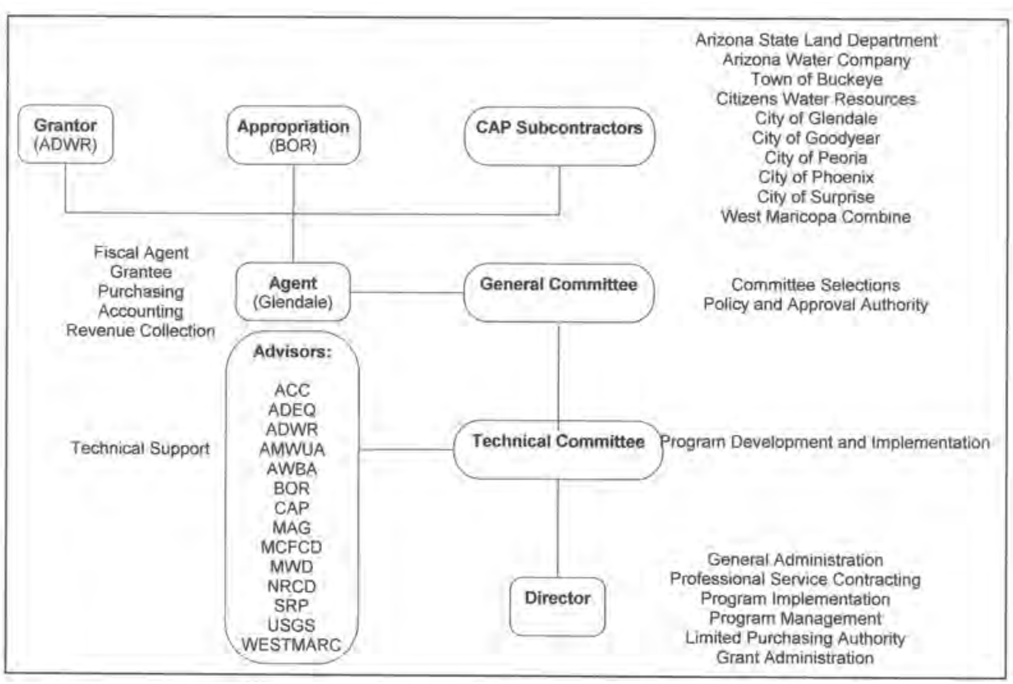


Figure I-1. West Valley Central Arizona Project Subcontractors.

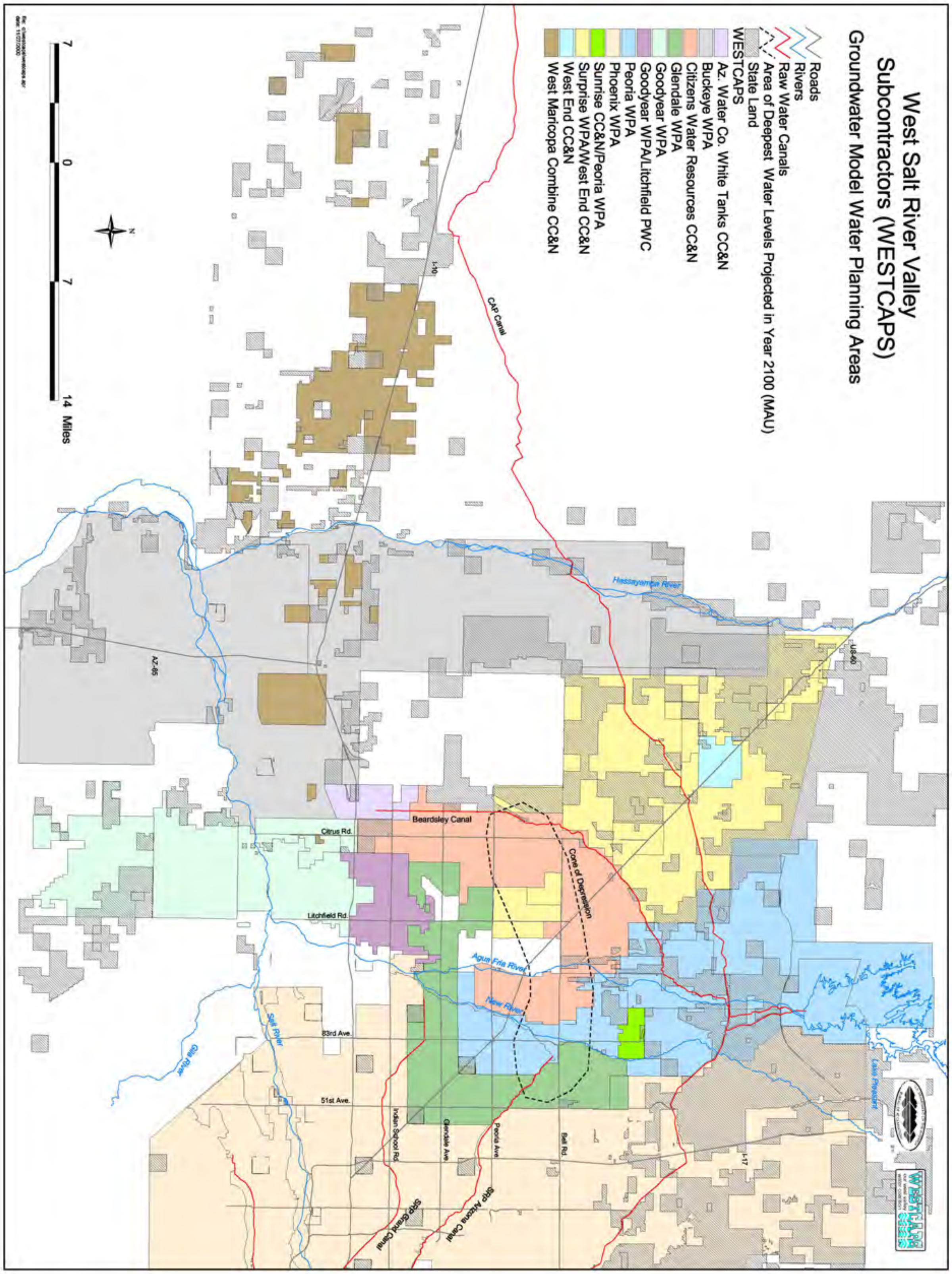


Figure I-2. WESTCAPS water supply study area.

providers must work together to protect, preserve and develop these shared resources and to respond to issues of increasing regulatory pressure; CAP water utilization; declining groundwater levels; groundwater quality; land subsidence; and managing costs.

The Null-Alternative

If no workable solution is implemented, the WSRV, as a whole, will not have an assured water supply (AWS). Growth and development in the area will become limited. As the aquifer is drawn down, the cost to pump groundwater will increase, water quality will degrade, land subsidence problems will worsen, and the area will not have enough supply to meet demand.

Mission Formulation.— The mission, goals, measurement criteria, planning process, and work plan were adopted by WESTCAPS' General Committee at its meeting on November 7, 1997.

Mission Statement

WESTCAPS is a coalition of CAP subcontractors most of whom serve drinking water to communities in the WSRV. It is WESTCAPS' mission to develop workable alternatives for its members to provide their customers with a cost effective, sustainable, reliable, and high quality water supply through partnerships and cooperative efforts in regional water resource planning and management, emphasizing CAP utilization.

Goals

The primary goal of the planning process is to increase the efficient use of CAP water by WSRV entities possessing municipal and industrial subcontracts. In addition to this goal, WESTCAPS membership expressed desired outcomes for both the planning process and what the process produces. Considering those desired outcomes, the following goals were established:

Process Goals

- Develop a plan that each WESTCAPS member can support
- Develop a common base of understanding of the issues and options
- Develop a mission statement and define the tenets for members involvement

Outcome Goals

- Protect, preserve, and enhance CAP allocations

- Maximize efficient use of CAP and other renewable resources available to the WSRV

- Understand and influence water policy in Arizona related to water and wastewater management in the WSRV (ADEQ, Arizona Department of Water Resources, Central Arizona Water Conservation District, and the Arizona Corporation Commission)

- Develop long-term, sustainable regional water resource management, infrastructure, and implementation strategies

Measurement Criteria

The following criteria were set for measuring WESTCAPS progress towards meeting its goals:

- Number of members who have been provided with workable solutions for addressing their water resources needs
- The degree to which renewable water supplies are increased
- The degree to which the efficient use of existing CAP allocations are maximized
- The level of member and public acceptance

Planning Process

The planning process diagram (illustrated in figure I-3) shows the major program elements described in the work plan. It was understood that the work plan is a general guideline and may be revised as WESTCAPS works through the planning process. Originally, the planning process was expected to take 4 to 5 years to complete. WESTCAPS now expects to complete the planning process within 4 years.

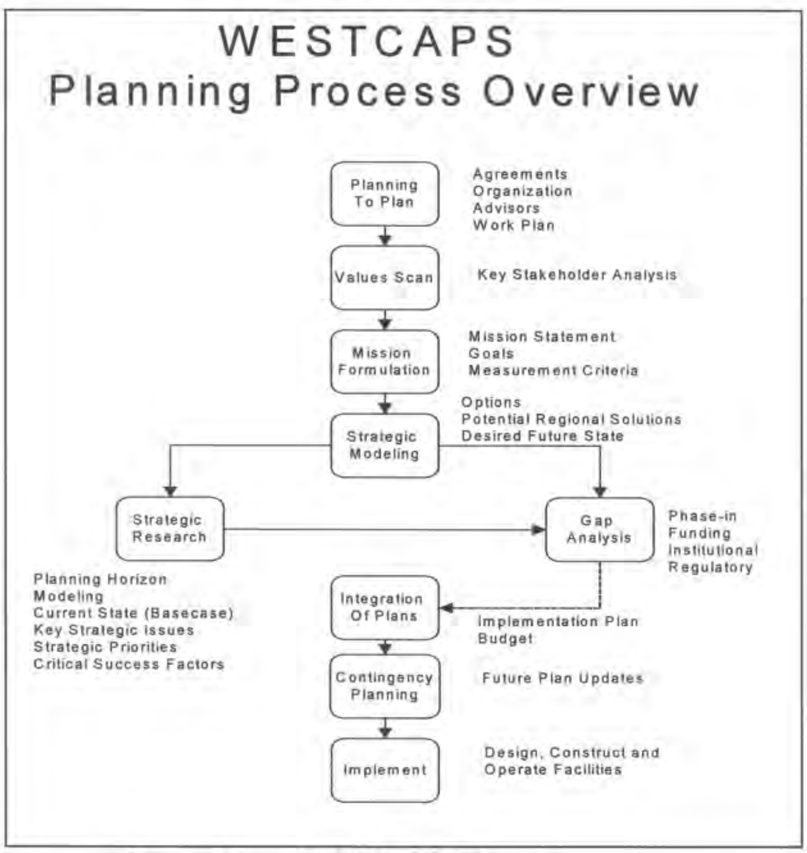


Figure I-3. WESTCAPS planning process.

Strategic Research.—The intent of Strategic Research is to identify and describe the factors that drive change by assessing the current situation facing water providers in the WSRV, considering potential future outcomes, and summarizing the key strategic issues. For this planning effort, a strategic issue is a driving factor for change that will, or may, influence WESTCAPS' ability to use its CAP allocations. Strategic research helped WESTCAPS members develop a common understanding of the existing situation for each member and the region as a whole. The outcome from doing strategic research was: (1) a common basis for understanding, (2) an identification of key strategic issues, and (3) development of strategic priorities.

After the strategic research was completed and consensus was developed on the strategic issues, the next step of the planning process was for WESTCAPS to review the list of strategic issues and identifying the issues of highest priority. This reduced list of strategic issues then became WESTCAPS' strategic priorities.

Strategic Issues

After completing strategic research, the following key strategic issues were developed and refined after extensive discussion by WESTCAPS and its advisors:

State/Federal Negotiations (Negotiations).—The Secretary of the Interior may decide to use a significant amount of CAP water currently earmarked for the WSRV and other surface water resources to resolve Indian water right and Colorado River (California and Nevada) issues. This action could limit available renewable water supplies to WESTCAPS participants and increase competition between participants for remaining surface water supplies. The opportunity also exists for WESTCAPS members to negotiate additional supply.

Reallocation of Additional Supply (Reallocation).—Reallocation of CAP supplies from subcontracts that were either declined or terminated has not been completed. WESTCAPS participants currently do not have enough renewable water supplies to meet forecasted water demands.

Flexible State and Federal Laws and Regulations.—Water quantity (ADWR) and quality (ADEQ) regulation will continue to become more stringent, limit the ability of WESTCAPS participants to use groundwater or recovered effluent in the WSRV and potentially curtail urban development. WESTCAPS may want to influence the regulatory process to develop more flexible policy to facilitate practical water management decisions.

Arizona Corporation Commission (ACC) Policy and Direction.—ACC approval is critical to private water company participation in a regional solution. The uncertainty of cost recovery for CAP water may force private water companies to relinquish their CAP allocations, and those allocations would be reassigned to other water providers or lost in the CAP/Department of the Interior (DOI) litigation.

Insufficient Institutional Infrastructure.—The institutional framework may not be in place to allow WESTCAPS participants to implement the most efficient water management solution.

Opportunity to Promote Recharge in WSRV.—The potential exists to encourage the Arizona Water Banking Authority (AWBA) and the Central Arizona Groundwater Replenishment District (CAGRD) to store renewable supplies in the WSRV. WESTCAPS participants do not have enough renewable water supplies to mitigate declining groundwater levels.

Declining Groundwater Levels.—Groundwater mining by municipal, industrial, and agricultural users in the WSRV has significantly reduced groundwater levels and caused associated impacts in the northwest Salt River Valley. These declines are expected to continue.

Poor Quality Groundwater.—Poor quality groundwater throughout the WSRV in general and, more specifically, in the mid-to-southern WSRV limits the use of untreated groundwater for potable water uses.

Insufficient Renewable Resources.— Current modeling indicates that WESTCAPS participants do not have enough CAP (or other) renewable water supplies to meet forecasted water demands or mitigate declining groundwater levels. Additional renewable resources will be needed.

Insufficient Water Infrastructure.— Additional water conveyance, treatment, and storage infrastructure will be needed in the WSRV to meet anticipated future demands with renewable supplies and to mitigate declining groundwater levels.

Lack of Financing Capability.—Currently, the cost of obtaining additional renewable resources and constructing new water infrastructure places a large financial burden on individual WESTCAPS participants.

Strategic Priorities

WESTCAPS discussed and ranked the key strategic issues. Consensus was developed that the top five strategic priorities are:

- Insufficient water infrastructure
- Lack of financing capability
- Insufficient renewable resources
- Opportunity to promote recharge in WSRV
- Arizona Corporation Commission policy and direction

From this point forward in the planning process, WESTCAPS work efforts were focused on addressing these five strategic priorities.

Strategic Modeling.—WESTCAPS identified all of its available options to it for using CAP water and other renewable water supplies in the WSRV. From these options, WESTCAPS developed six potential infrastructure strategies (see figure I-4). A groundwater model analysis was completed for each strategy. In addition, a present worth analysis was also performed for each strategy. It was the intent of WESTCAPS to select one of these strategies as its collective vision of the water infrastructure that should be in place by 2025 to meet projected water demands. In reviewing the potential strategies and how they performed in the analysis, some points to consider are:

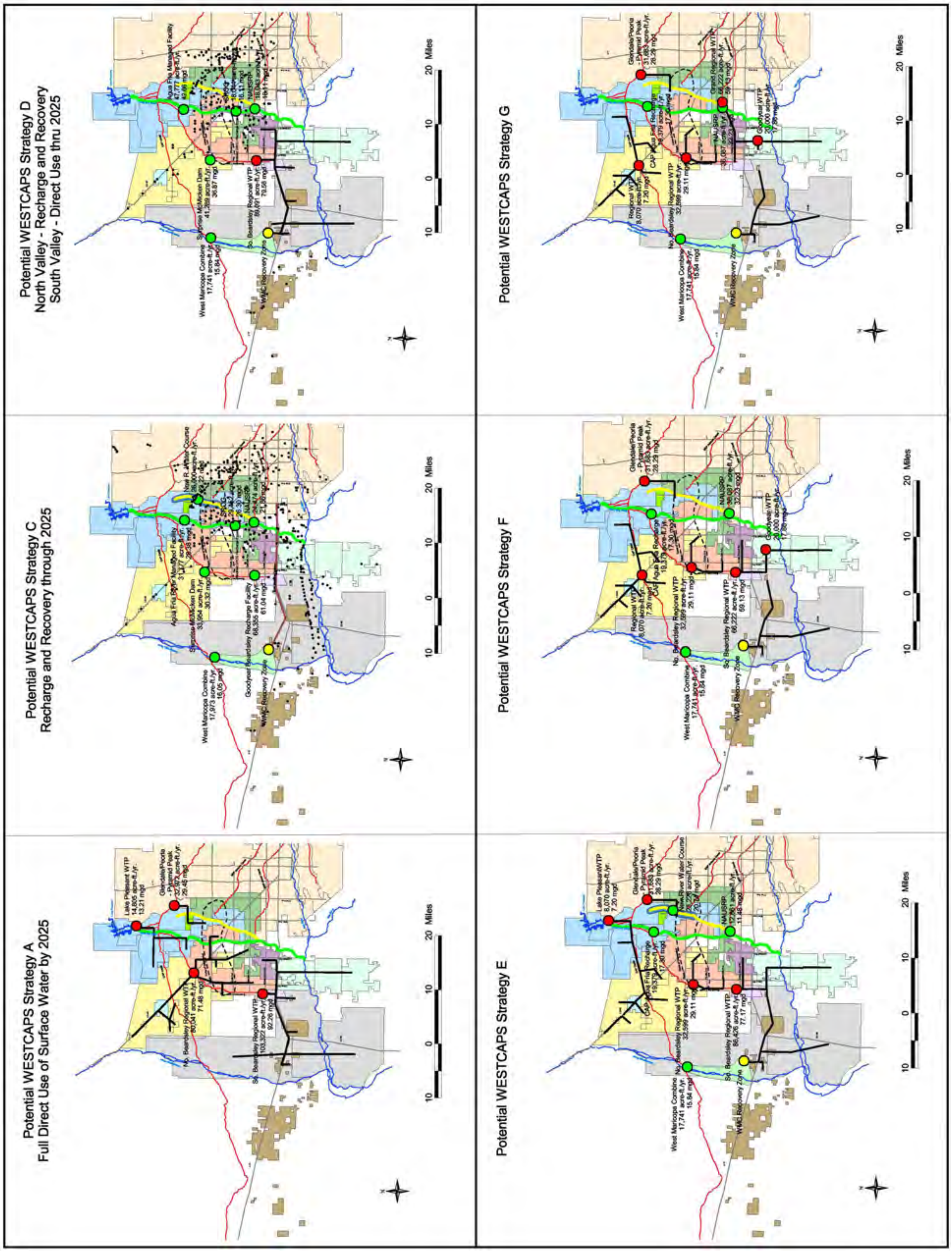


Figure I-4. Alternative WESTCAPS strategies.

- Potential Strategy A represented a regional strategy whereby all future water demands are met solely through the use of WTPs.

- Potential Strategy C represented a regional strategy whereby all future water demands are met solely through the use of recharge and recovery projects.

- Potential Strategy D represented two subregional strategies. The northwest SRV future water demands would be met through recharge and recovery projects. The southwest SRV future water demands would be met through water treatment plants. Except for Buckeye, whose demands would be met using WMC's recharge and recovery project.

- Potential Strategy E represented a strategy whereby future water demands are met through the use of Phoenix's Lake Pleasant WTP, an expansion of Glendale's Pyramid Peak WTP, a new WTP located on MWD's Beardsley Canal, and large recharge and recovery projects strategically located near the groundwater cone of depression in the northwest SRV. Buckeye would be served by WMC's recharge and recovery project.

- Potential Strategies F and G represented strategies whereby future water demands are met through the use of either Phoenix's Lake Pleasant WTP or a new WTP off the CAP Canal, an expansion of Glendale's Pyramid Peak WTP, a new WTP located on MWD's Beardsley Canal, a pump and treat facility located in Goodyear, and large recharge and recovery projects strategically located near the cone of depression. Buckeye would be served by WMC's recharge and recovery project.

- In potential Strategies F and G, another member of WESTCAPS would cost share in the pump and treat facility, be charged by the ADWR for a portion of the groundwater pumping at the facility, and, in exchange, would receive a portion of Goodyear's CAP allocation.

- Direct use of surface water supplies WTPs and groundwater savings facilities have the most immediate positive effect towards reducing groundwater decline (wells are turned off).

- Recharge projects in the area of hydrologic impact would be the next best strategy towards reducing groundwater decline. The location, timing, and amount of recovery through the use of wells will reduce the effectiveness of recharge projects in mitigating groundwater decline.

On June 30, 2000, the WESTCAPS General Committee met to consider a recommendation proposed by its Technical Committee to adopt a direct delivery strategy, known as the "WESTCAPS strategy," as the best plan to fulfill WESTCAPS goals (see figure I-5). The General Committee decided to adopt, on a preliminary basis, the proposed strategy, but requested the Technical Committee make additional refinements to the WESTCAPS strategy in the following areas:

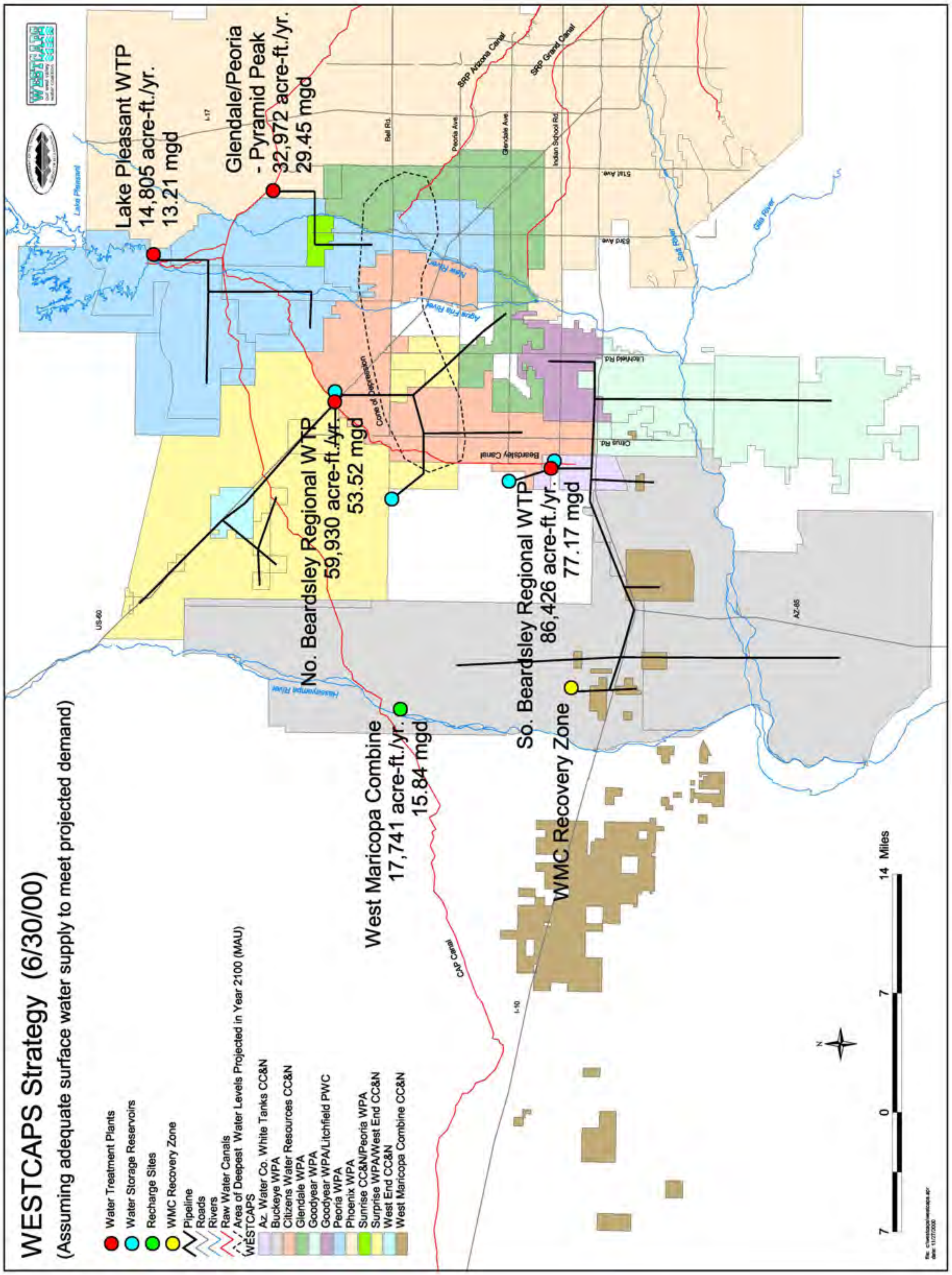


Figure I-5. WESTCAPS strategy, adopted on June 30, 2000.

- Evaluate potential institutional and financial mechanisms

- Develop regional and subregional alternative plant configurations including transmission and distribution infrastructure.

Gap Analysis

The Gap Analysis analyzed: (1) possible refinements to the WESTCAPS infrastructure strategy selected on June 30, 2000, (2) cost estimates and cashflow for financing the WESTCAPS strategy, (3) potential institutional and financing arrangements, and (4) sources of additional renewable water supply to meet projected supply deficits. This report discusses the Gap analysis.

Chapter II

Refinement of the WESTCAPS Strategy

The WESTCAPS strategy, agreed upon by the WESTCAPS General Committee on June 30, 2000, applies to most WESTCAPS members, with the exception of Buckeye and WMC. The WESTCAPS strategy involves using renewable water as the primary water supply (to be in place by the year 2025).

The WESTCAPS strategy calls for constructing water treatment plants and related infrastructure to augment the use of existing groundwater supplies in order to supply peak demand and provide short- and long-term reliability. Proposed facilities required to meet these needs include the:

- Interim use of 13.21 million gallons per day (MGD) of water capacity available from Phoenix's planned Lake Pleasant WTP
- Expansion of Glendale's Pyramid Peak WTP by 29.45 MGD
- 15.84 MGD capacity available from the WMC's Pipeline to the Future
- Use of two new WTPs located on MWD's Beardsley Canal with capacities of 53.52 and 77.17 MGD

This chapter discusses the Lake Pleasant, Pyramid Peak, and WMC Pipeline to The Future portions of the WESTCAPS strategy. Chapter 3 discusses the refinement of the WESTCAPS strategy regarding placement of the two new WTPs.

These facilities will be completed and put into operation in two phases (Phase 1 in the year 2010 and Phase 2 in the year 2020). As the plan is developed further and participation by various individual WESTCAPS members is determined, changes to the WESTCAPS strategy will be necessary for scheduling implementation and facility configuration and location.

The General Committee requested the WESTCAPS strategy be refined by developing configuration plans for a regional and subregional alternative WTP. The WTP will include infrastructure details for transmission and distribution pipelines. The configuration plan alternatives will be coordinated with the individual needs of member water providers. This refinement of the WESTCAPS strategy will include water treatment plant location sitings, preliminary engineering, and transmission and distribution pipelines routing analyses. Additionally, a study of financing alternatives, organizational structure, and public and political acceptance is needed to implement the selected alternative (see figure II-1).

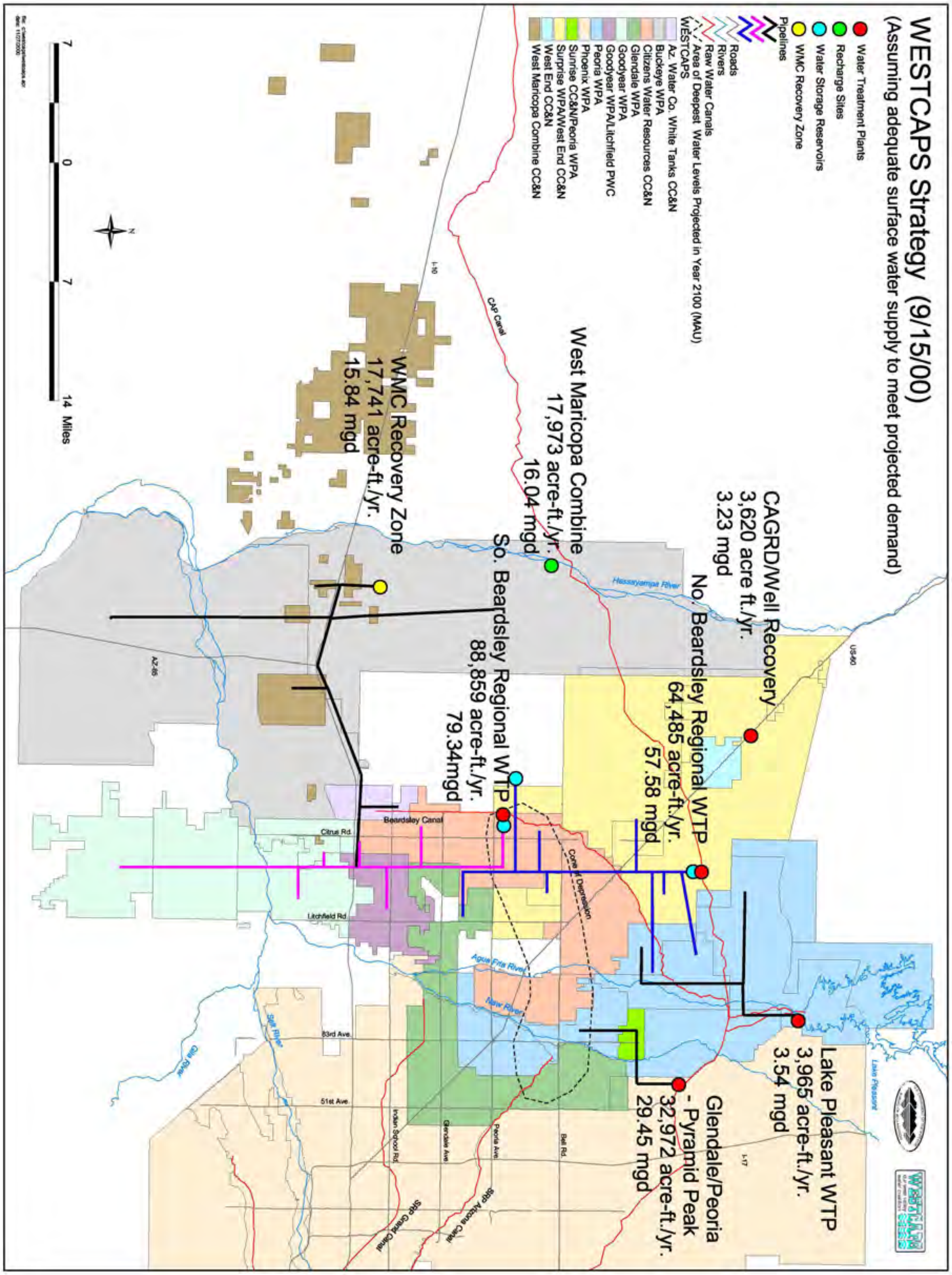


Figure II-1 Revised WESTCAPS strategy, dated September 15, 2000.

Background

As the WESTCAPS strategy was developed, several interrelated water resource issues were-considered. Since the amount of CAP water anticipated to be available will not meet projected demand, the balance will be supplemented with groundwater and other surface supplies. The disadvantage in using a multisource supply system is that multiple systems must be maintained. However, the advantage that it offers substantial operational benefits because, if problems arise, a backup is in place and ready to take over. The total projected demands for water resources are shown in table I-1 of Chapter I . Graphic representation of the table data is shown on figure II-2.

Concerns over whether CAP water will be available in the long-term, including shortages of Colorado River water, and whether CAP and outages of direct delivery system maintenance occur in the short term, might make it beneficial to keep well water systems operational. Making the well system an integral part of the supply ensures that wells are maintained and operational. Wells that are periodically operated should function much more efficiently and reliably over an extended period of time.

To meet the water supply needs of WESTCAPS' members, it was suggested that five water supply facilities be analyzed to help develop a strategy leading to a final conceptual plan.

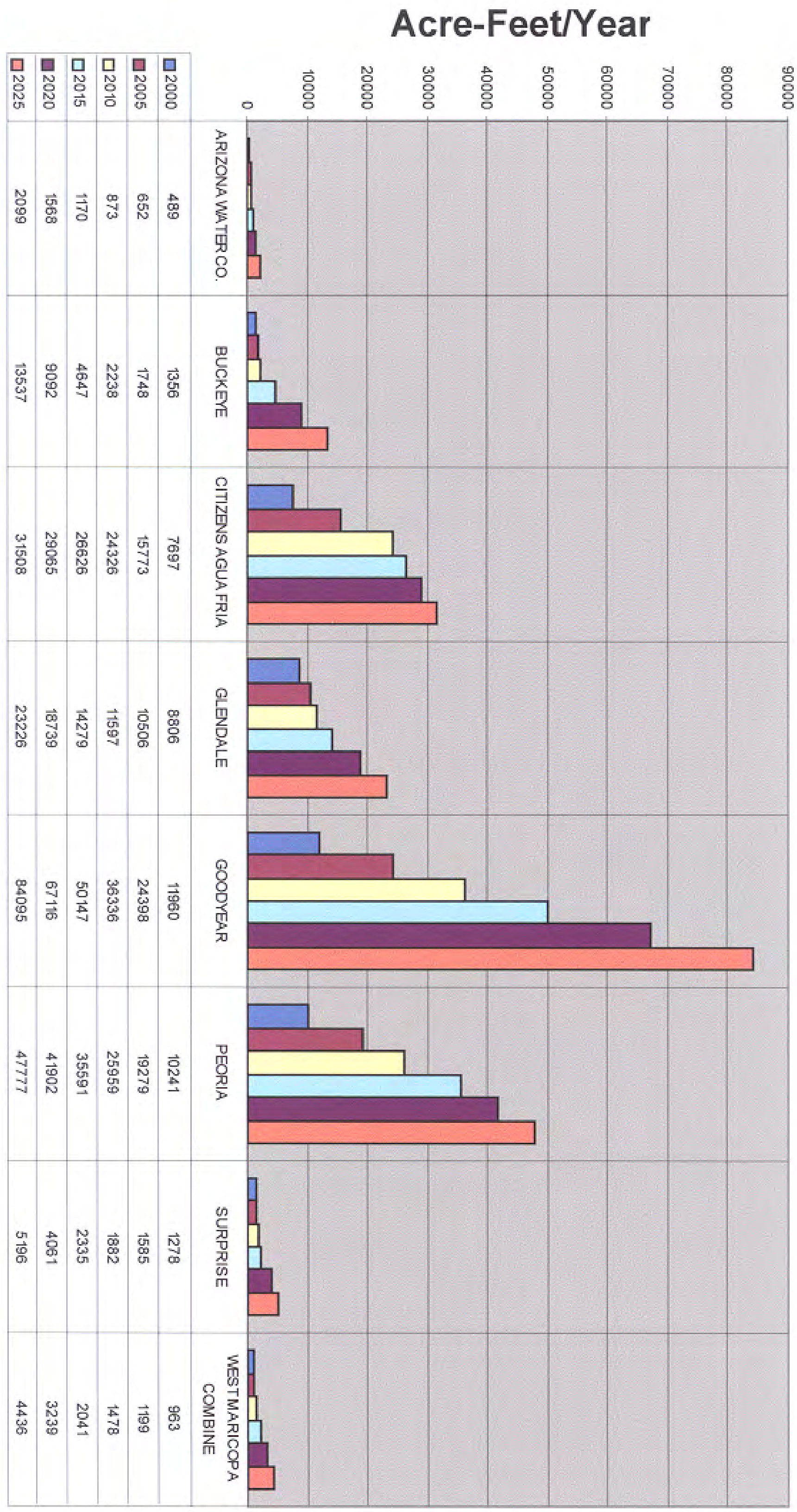
Lake Peasant and Pyramid Peak WTPs and the WMC Recharge/Recovery Facility, are either existing facilities or are in the final design stage. Study of these facilities was limited to augmenting previously collected data, verifying earlier cost estimates, and assuring that water quantities and quality parameters can be met. The three facilities are expected to provide about 58.5 MGD of the 189.19 MGD total demand for the year 2025.

The two remaining proposed facilities will be newly constructed WTPs. designed to meet the balance of the year 2025 demand of 130.69 MGD. It was proposed that the new WTPs be located along the Beardsley Canal or the CAP Canal.

As the WESTCAPS strategy was refined, a conceptual design for the facilities, with the appropriate distribution network, was developed. During the refining of the WESTCAPS strategy, it was determined that an analysis of both single and multiple WTPs would be required. A north Beardsley Water Treatment Plant (NB-WTP) was identified as a "one plant solution." The NB-WTP would be located in the northwest valley, with distribution networks to member service areas not intended to be served by the existing/planned facilities described above.

A multiple WTP alternative would consist of a smaller NB-WTP and a south Beardsley Water Treatment Plant (SB-WTP). A second multi-WTP alternative was considered, consisting of a WTP on the CAP Canal and a WTP located on the Beardsley Canal. This configuration was selected as best meeting WESTCAP member needs.

The analysis considered construction in stages for each alternative plant.



	ARIZONA WATER CO.	BUCKEYE	CITIZENS AGUA FRIA	GLENDALE	GOODYEAR	PEORIA	SURPRISE	WEST MARICOPA COMBINE
2000	489	1356	7697	8806	11960	10241	1278	963
2005	652	1748	15773	10506	24398	19279	1585	1199
2010	873	2238	24326	11597	36336	25959	1882	1478
2015	1170	4647	26626	14279	50147	35591	2335	2041
2020	1568	9092	29065	18739	67116	41902	4061	3239
2025	2099	13537	31508	23226	84095	47777	5196	4436

Figure II-2. WESTCAPS projected groundwater pumping.

General Description of Facilities in the Study Area

At the present time, some WESTCAPS' members located in the study area have not made full use of their existing CAP allocations. Groundwater wells supplying water in the study area are owned and operated by individual providers. Regional interconnections between the systems are minimal. The future of the groundwater supplies and regulatory considerations, such as treatment to remove arsenic, are two primary issues prompting an evaluation of water resource management. Water providers are evaluating the use of renewable water supplies, such as CAP water, or additional treatment of well water. Currently, there is no region-wide renewable water supply use plan and no WTPs west of the Agua Fria River on either the CAP or Beardsley Canal (see figure II-3).

Facilities and Projects Under Development

As previously mentioned, there are three water facilities in the WSRV area currently in operation, being designed, or under construction. Two of these are CAP WTPs and one is a recharge and recovery facility located to the west, on the Hassayampa River channel. It should be noted that two of these facilities are located east of the Agua Fria River, and the other is located to the west of the White Tank Mountains. These facilities represent one water service area to the east of the Agua Fria River, and one to the west of the White Tank Mountains. The subsequent analysis in this study will determine options for the area bounded by these two generic service areas and the interrelation to each other.

Lake Pleasant WTP

The City of Phoenix's Lake Pleasant WTP is located approximately 1.5 miles southeast of Lake Pleasant, along the CAP Waddell Canal. Phoenix purchased 225 acres for the plant site from the Arizona State Land Department. The project schedule identifies plans to construct and deliver the first 80 MGD plant module in the year 2006. The site will allow for three additional future expansions of 80 MGD each, for a total build-out capacity of 320 MGD for the plants. Treated water will be conveyed to Phoenix through a planned, 78-inch-diameter pipeline along the Carefree Highway alignment. Phoenix is currently evaluating the water treatment process using a pilot test, program. Results are expected by December 2000.

The majority of the water supply capacity is dedicated to the City of Phoenix service area to the east of the Lake Pleasant WTP. No other water users are anticipated for this service area, except possibly the City of Peoria, where discussions are currently taking place. Any arrangements made with WESTCAPS members would be based on a limited-term, wholesale water sales agreement. Phoenix will maintain full ownership of the WTP. The City of Phoenix estimates that approximately 20 MGD of water might be available for use. The Lake Pleasant WTP unit price for wholesale water delivery is currently unknown.

In the interim, the City of Peoria intends to acquire a limited amount of treatment capacity for water that will be delivered to service areas to the south and west of the Lake Pleasant WTP. The amount of water to be used and the length of time Peoria intends to use the limited treatment capacity, has not been determined. The installation of the Peoria distribution lines from this plant would be temporary, but

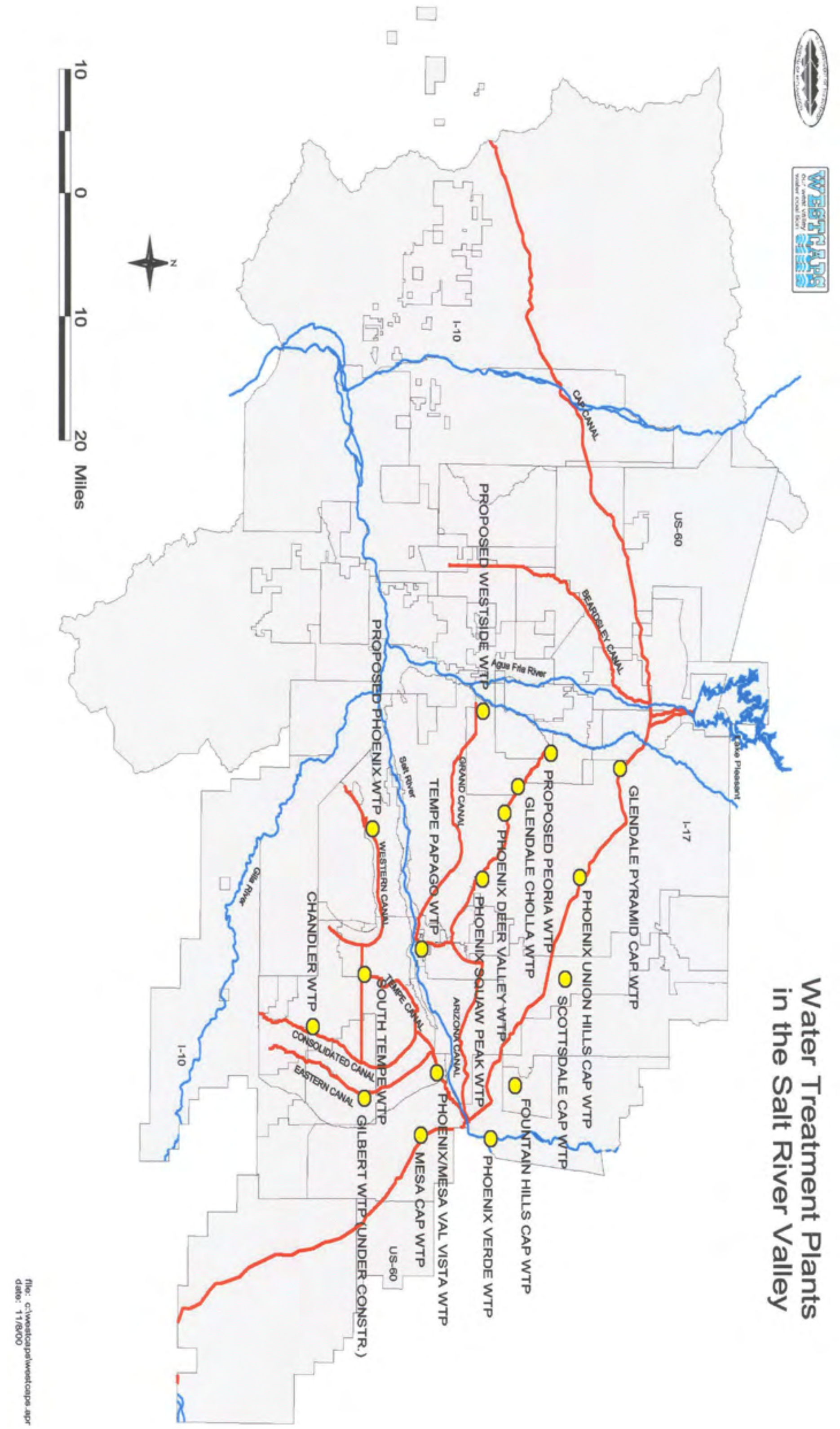


Figure II-3. Water treatment plants in the Salt River Valley.

may provide a portion of the future Peoria distribution network. Emergency water supply, system reliability, and interconnected pipelines with Phoenix could benefit Peoria. Development of Peoria as distribution lines may be hampered by the lack of a firm water supply from the Phoenix plant, but may be justified until a new Peoria CAP WTP or WESTCAPS north regional WTP can be constructed.

WESTCAPS members will receive valuable water treatment methods information and operational data from the City of Phoenix's various WTPs that receive water from both the Salt and Verde Rivers, from the CAP, and from the pilot tests being conducted on the new Lake Pleasant WTP.

Pyramid Peak WTP

Built in 1986, the WTP is located adjacent to the CAP Canal, at the intersection of 63rd Avenue and Dynamite Boulevard. The source of water is primarily Colorado River water carried through the CAP system. It is possible to combine Colorado and Agua Fria River water at Lake Pleasant, but this combination is dependent on CAP operations. Currently, the Pyramid Peak WTP uses a conventional chlorine treatment process. The plant size was increased in 1998 to a total design capacity of 26 MGD with a hydraulic overload capacity of 39 MGD. There is a 10-milligram (mg) potable water reservoir onsite to allow for the necessary chlorine contact time. The plant can be expanded to a 56 MGD capacity with an additional 10-mg potable water reservoir on the current land site. Future additional land acquisitions could increase the ultimate capacity to 86 MGD.

The Pyramid Peak WTP primarily provides water to the Glendale service area. Peoria purchased 6 MGD of the plant capacity for delivery to their service area, using a pipe junction at 67th Avenue and Jomax Road. Currently, the capacity of the WTP, reservoir, and transmission system is fully utilized. Since, all the storage capacity is being used, none can be leased to other entities. City of Glendale officials are willing to discuss expansion of the Pyramid Peak WTP to make water available for delivery to WESTCAPS members.

Estimated expansion cost:

$54.00 ac-ft	CAP pump energy
$48.00 ac-ft	capital cost for CAP
$36.83 ac-ft	WTP operation and maintenance (O&M) costs
$31.83 ac-ft average	WTP capital cost (for Peoria)
$169.83 ac-ft	overall average cost to Peoria

WMC Recharge/Recovery Facility Pipeline to the Future

The WMC service areas are located a great distance from the CAP Canal. As a long-term solution, the WMC has elected to install a recharge and recovery project to economically serve their water needs. The CAP water allocation would be recharged south of the CAP on the Hassayampa River, with recovery downstream in the service area.

Storage capacity of the managed recharge site is anticipated to be 25,000 ac-ft/yr.

Future deliveries from the recovery areas are anticipated to be between 25,000 and 37,000 acre-feet per year. The use of the Hassayampa River eliminates the need to construct many miles of pipeline to deliver CAP water. The recovery project involves at least 7 wells, which could serve a population of up to 210,000 (calculated at 25,000 ac-ft/yr and 2 families of 4 persons each per ac-ft).

WMC estimates the recovery area has approximately 6 million acre-feet of good quality water above the 1,000-foot-level. The water constituents average values are considered very good, with a total dissolved solids (TDS) level of 170 parts per million (ppm), fluoride of 1 ppm, and arsenic at 0.0065 ppm. Over time, the area of hydrologic impact from the recharge facility will intersect with the recovery area. The ADWR issued a managed Underground Storage Facility Permit on August 7, 1998. It is anticipated the recharge component of the facility will be operational early in the year 2000, with the recovery and delivery components of the facility operational by January 2002.

For non-WMC participants, neither the recharge site nor the recovery site is presently located in an overdraft area. A 48-inch-diameter, 26-mile-long pipeline could be constructed and installed in the WESTCAPS study area. This pipeline would be designed to deliver at least 25,000 acre-feet of potable water per year. This option considers the use of both the recharge and conveyance capabilities by the Arizona Water Company; Cities of Buckeye, Citizens, Goodyear; and WMC.

The initial estimated cost for the recharge component of the project is $13.00 per acre-foot. The estimated cost of delivered water for those participating in the recharge, recovery, and delivery components of the Pipeline to The Future is approximately $1.10 per 1,000 gallons ($358.44 per ac-ft). The total cost (including CAP water, recharge, recovery, and delivery system costs) is estimated at $445.00 per ac-ft.

Estimated additional capital costs for connection and distribution infrastructure are:

Town of Buckeye:	$200,000
Arizona Water Company:	$300,000
City of Goodyear:	$500,000
Citizens Water Resources:	$1,000,000

If ADWR allows WESTCAPS members to use the recharged water to participate in an AWS demonstration project, the cost for implementing this option would replace the CAGRD fee of $188 per ac-ft. The recovery of this basin water may benefit water agencies by eliminating the use of existing wells and the costs of wellhead treatments and recovery and treatment of groundwater. If wellhead treatments can be avoided, the cost of recharge and recovery should be less than direct delivery of CAP water. To provide for peaking water capacities and emergency water supply, a water storage tank will be required.

Possible Raw Water Supplies for Water Treatment Plants – Dropped from Consideration

Salt River Project (SRP) Canals

The SRP system of canals and reservoirs was built over many decades to provide a dependable supply of water to the Salt River Valley and encourage agricultural development. The canals follow the paths of the ancient Hohokam civilization. The construction of Theodore Roosevelt Dam, SRP's first dam, was authorized under Federal legislation set forth in the National Reclamation Act of 1902. The 1902 law provided Government loans "to reclaim the arid lands of the West" using irrigation projects. Theodore Roosevelt Dam and Granite Reef Diversion Dam were built to provide a dependable water supply for the Phoenix valley. In 1917, the Bureau of Reclamation relinquished the SRP dams and canal system operation to the Salt River Water Users Association, which still operates these facilities for the Federal Government (see figure II-4).

The SRP water service area is limited to shareholder lands (lands that were offered a collateral for the construction of Roosevelt Dam). Water supplies are delivered from reservoirs constructed on the Verde and Salt River watersheds and well water located in the SRP service areas. A CAP interconnect turnout is located at the intersection of the CAP and SRP Granite Reef Diversion Dam. The water from the CAP can be delivered to either the Arizona (north) or south transmission canals.

Annually, in the fall and winter, SRP ceases water deliveries for a period of approximately 30 days. This period performed alternately on the north and south transmission canals, is known as canal dryup. During this dryup period, various repairs, cleaning, and construction projects are performed on the SRP system.

SRP's major canals (transmission canals) and laterals (distribution canals) accessible by the WESTCAPS are described below:

Arizona Canal.—The Arizona Canal, representing the northern boundary of the SRP, is 38-miles long and has historically provided water to the far north portion of SRP's member lands. The Arizona Canal starts at Granite Reef Diversion Dam and terminates in the area of 75th Avenue and Paradise Lane at SRP's Lateral 20. The Arizona Canal also supplies water to SRP's Grand Canal through the Crosscut Canal in the area of 64th Street. Along with agricultural and urban water deliveries, three municipal water treatment plants receive water directly off the Arizona Canal: two are owned by the City of Phoenix, and one is owned the City of Glendale. A fourth WTP is under construction by the City of Peoria located in the area of 73rd Avenue. The City of Scottsdale is studying the feasibility of locating a fifth plant along the Arizona Canal in the area of Hayden Road.

The ability of WESTCAPS members to use the Arizona Canal to transport of CAP or other non-SRP water beyond the Crosscut Canal is limited, due to the relatively high demands and capacity constraints now placed on the Arizona Canal by municipal, agricultural, and urban users.

Grand Canal.—The Grand Canal is fed from the Arizona Canal through the Crosscut Canal, located in the area of Indian School and 64th Street. The Grand Canal terminates at the New River through a drain, north of Bethany Home Road. Tempe's municipal WTP takes water off the Crosscut Canal in the McKellips Road area. No other WTPs are located on the Grand Canal. The Grand Canal provides water to SRP member lands that are located north of the Salt River and south of member lands serviced by the Arizona Canal. The Grand Canal also receives return irrigation flows from Arizona Canal laterals. Capacity constraints, lower water quality (due to return flows), and distance from the CAP headworks (water losses) make the Grand Canal a poor candidate for in transporting WESTCAPS' CAP allocations.

The SRP is conducting a canal capacity study of its entire system, with results expected to be available by mid-2001. Based on the results of the SRP study, reconsideration of the SRP system as a raw water supplier to WTPs may be warranted.

Roosevelt Irrigation District (RID) Canal

The RID Canal owned by the RID flows to the west and terminates at the Agua Fria River channel, south of Indian School Road. The capacity of this canal is too small to consider as a supply for a WTP.

Citizens Pipeline, Lake Pleasant Road Water Conveyance System

Lake Pleasant Road Conveyance System will provide 17,000 acre-feet of CAP water to a centrally located water campus at Deer Valley Road, between 107th and 115th Avenues. This water will be untreated and could meet nonpotable water demands directly or be conveyed to a nearby treatment facility to be treated to drinking water standards. This project brings a substantial amount of CAP water to an area experiencing the most severe water level declines in the WSRV. An expanded pipeline could be constructed when the Sun Cities/Youngtown Groundwater Savings Project is constructed (sometime between the years 2002 or 2003).

In this analysis, Citizens Water Resources assumes two water delivery capacities. A 30-inch pipeline would provide an average capacity of 16,900 ac-ft. A 36-inch pipeline would provide an average capacity of 24,245 ac-ft. These volumes include the original capacity (6,651 ac-ft) for the Sun Cities/ Youngtown Groundwater Savings Project and additional capacity (around 5,000 acre-feet) to meet 100 percent of the golf course water demands served by the Sun Cities/Youngtown Groundwater Savings Project.

The average incremental capacities for the pipelines are as follows: 5,339 ac-ft for the 30-inch pipeline and 12,684 ac-ft for the 36-inch pipeline. Estimated project costs are shown below:

Facility	30-inch pipeline	36-inch pipeline
	$1,000	**$1,000**
Transmission pipeline and turnout	$2,148	$3,392
Contingency, engineering, administration, and legal	$1,181	$2,163
Total capital cost	**$3,329**	**$5,555**

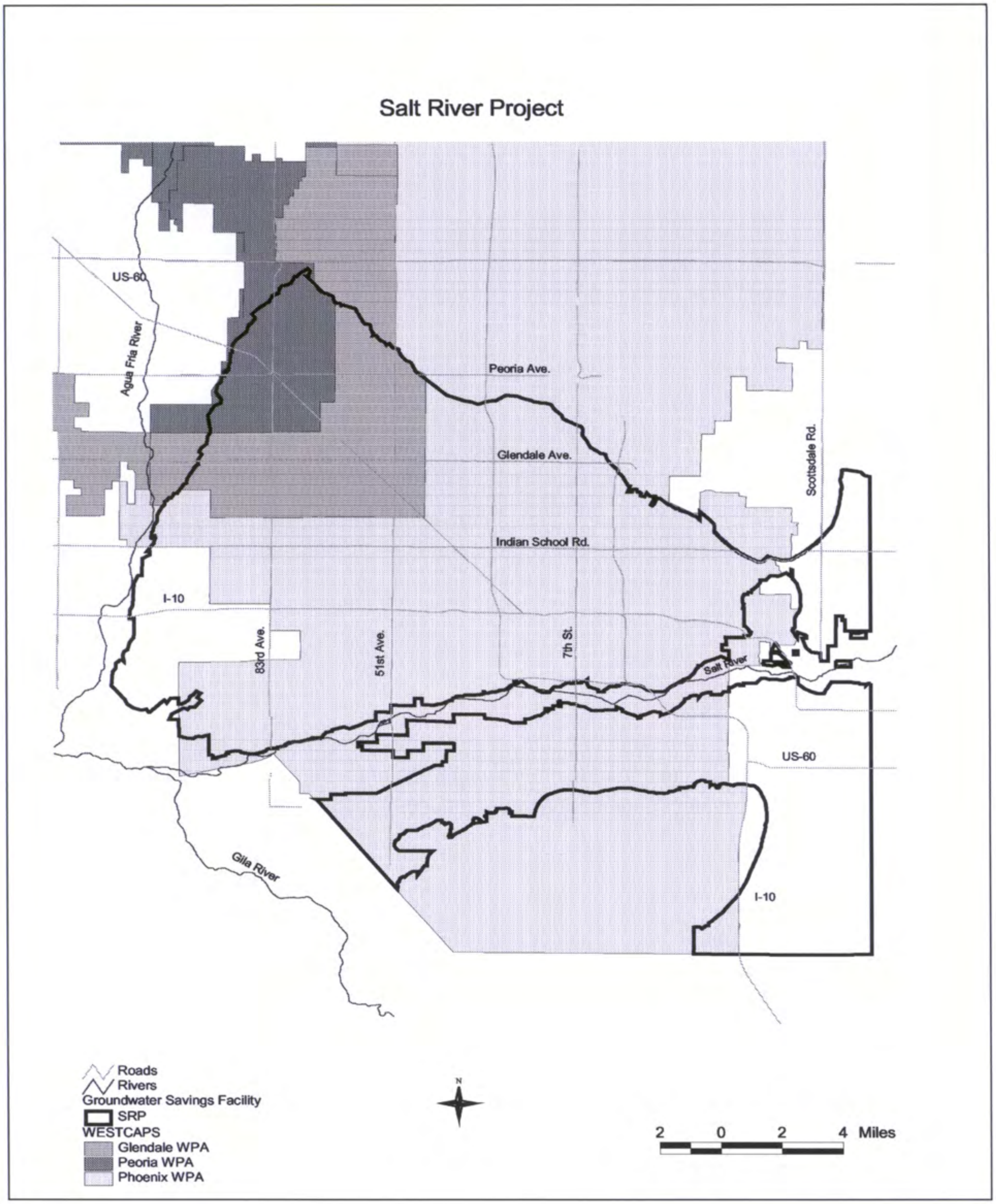


Figure II-4.—Salt River Project water service area

Chapter III

Regional and Subregional Alternative Plant Configuration

WESTCAPS developed some general assumptions regarding the amount of CAP water that would be available for members use. Using those assumptions, WESTCAPS evaluated an alternative for treating and directly delivering CAP water. The exact quantity of CAP water that may be available to the water provider is still undetermined. CAP water available from each of the water providers is assumed to include two base supply options (see table III-1):

- 153,344 ac-ft -
  Assumes water supplies will be acquired to meet the projected demand (unlimited supply scenario).

- 65,681 ac-ft -
  Assumes available water supply will be limited by anticipated water rights allocations.

For each of the water supply options, two WTPs configurations were evaluated (see table III-2). The first configuration involves constructing a single treatment plant located along the CAP system. The second configuration involves constructing two WTPs: one along the CAP system and one along the Beardsley Canal, owned and operated by MWD.

The study evaluated each unlimited supply option configuration and treatment plant staging (constructed in phases to meet the estimated demand for water in the years 2005, 2015, and 2025). A summary of the options, configurations, stages, and corresponding capacities is shown in table III-2.

Cost estimates were developed for the options, configurations, phases, and corresponding capacities that can be compared against other water delivery alternatives.

When evaluating the WESTCAPS strategy, several interrelated water resource issues must be considered. Since the amount of CAP water assumed to be available will not meet projected demand, the balance will be supplemented with groundwater and other surface water supplies. The disadvantage in using this kind of a multisupply system is that multiple systems must be maintained. However, the advantage is that it offers substantial operational benefits because, if problems should arise, a backup is in place and ready to take over.

Table III-1. Alternative plant configuration for the WESTCAPS strategy
(as adopted by the General Committee on June 30, 2000)

Water Facility	System capacities: Assuming adequate surface water supply to meet projected demand (revised September 15, 2000)	System capacities: Limited by amount of anticipated supplies	Notes
Member facilities			
Lake Pleasant WTP	3,965 ac-ft/yr 3.54 MGD	2,688.3 ac-ft/yr 2.4 MGD	Peoria #3, WPA#44
Glendale/Peoria WTP	32,972 ac-ft/yr 29.45 MGD	22,345 ac-ft/yr 19.95 MGD	Peoria WPA # 98, 77, 71, 63, 76
WMC	17,973 ac-ft/yr 16.04 MGD	539 ac-ft/yr 0.48 MGD	WMC + Buckeye - #201
CAGRD/Well Recovery	3,620 ac-ft/yr 3.23 MGD	8,234.2 ac-ft/yr 7.35 MGD	Balance of WMC
Subtotals	58,530 ac-ft/yr 52.26 MGD	33,806.5 ac-ft/yr 30.18 MGD	
WESTCAPS - configuration No. 1, single WTP			
One Regional North WTP	153,344 ac-ft/yr 136.92 MGD 211.8 cfs	65,680.5 ac-ft/yr 58.64 MGD 90.7 cfs	12 WPA turnouts
WESTCAPS - configuration No. 2, two WTPs			
North CAP WTP	64,485 ac-ft/yr 57.58 MGD 89.1 cfs	38,909.7 ac-ft/yr 34.74 MGD 53.7 cfs	6 WPA turnouts
South Beardsley WTP	88,859 ac-ft/yr 79.34 MGD 122.73 cfs	26,770.8 ac-ft/yr 23.9 MGD 36.98 cfs	6 WPA turnouts
Subtotals	153,344 ac-ft/yr 136.92 MGD	65,680.5 ac-ft/yr 58.64 MGD	
Regional total expected demand			
Totals	211,874 ac-ft/yr 189.16 MGD	99,487 ac-ft/yr 88.82 MGD	

Table III-2. Phase -in of configuration alternatives

Option		Capacity (ac-ft/yr)
Unlimited supply capacity		
One WTP (along CAP Canal system):		
Phase 1	Build WTP to estimated demand at year 2005	53,700
Phase 2	Expand WTP to estimated demand at year 2015	98,677
Phase 3	Expand WTP to ultimate demand at year 2025	153,344
Two WTPs (CAP Canal system and Beardsley Canal):		
Phase 1	North WTP to estimated demand at year 2005	0
	South WTP to estimated demand at year 2005	51,329
Phase 2	North WTP to estimated demand at year 2015	45,138
	South WTP to estimated demand at year 2015	53,539
Phase 3	North WTP to estimated demand at year 2025	64,485
	South WTP to estimated demand at year 2025	88,859
Phase 3	Total ultimate demand at year 2025	153,344
Limited supply capacity option		
One WTP (along CAP Canal system)		65,681
Two WTPs (CAP Canal system and Beardsley Canal):		
	North WTP to estimated demand at year 2025	38,910
	South WTP to estimated demand at year 2025	26,771
Total estimated demand at year 2025		65,681

Concerns over whether CAP water will be available in the long term, (including shortages of Colorado River water) and whether CAP and outages of direct delivery system maintenance occur in the short term, might make it beneficial to keep well water systems operational. Making the well system an integral part of the supply ensures that wells are maintained and operational. Wells that are periodically operated should function much more efficiently and reliably over an extended period of time.

Elements Common to the Configurations

Water Treatment Options

All configurations for direct delivery will use conventional water treatment, filtration, and disinfections for cost and water quality evaluations. However, single water quality is vital to customers and water providers, various treatment train options were identified. This will give the public and policy makers a full range of options for evaluating water quality and corresponding cost.

Table III-3 provides a comparison of the available treatment methods. Figure III-1 is a comparison summary of treatment options and filtering abilities.

Conventional Treatment.—This report discusses two treatment trains[1] (direct filtration and conventional filtration). The direct filtration treatment train allows receiving untreated water to be delivered to the filter beds without pretreatment. However, for this to occur, the raw water has to be of very good quality and low turbidity. The conventional filtration treatment train requires some sort of disinfection and particle flocculation treatment before water can be delivered to the filter beds. Since the quality of CAP water varies with location of sampling site and the time of year the sample was taken, conventional filtration is preferred. However, the following discussions refer to direct filtration and, at times offer comparisons with conventional filtration.

[1] "Treatment train" is a term used to briefly list, in order, the primary physical features and processes of various types of WTPs.

Table III-3. Comparison of water treatment processes

Criteria	Conventional treatment	Slows and filtration	Microfiltration/ ultrafiltration (MF/UF)	With reverse osmosis (RO)
Cost	Moderate	Low	Moderate	High
Meets ESWTR[1]	Yes	To be determined[2]	Yes	Yes
Meets D/DBPR[1]	With enhanced coagulation	To be determined	No[3]	Yes
Operational experience on Colorado River water	High	Low	Low	Moderate
Land area requirements	High	Very high	Low	Moderate
Operator training	Moderate	Basic	Advanced	Advanced

[1] Enhanced Surface Water Treatment Rule (ESWTR); Disinfectant/Disinfection By-Products Rule (D/DBPR) B, see appendix Fin "Alternatives for Using Central Arizona Project Water in the Northwest Tucson Area" report for details.
[2] Recommend pilot tests for CAP water, in order to make a determination.
[3] MF/UF with enhanced coagulation to remove sufficient total organic carbon to meet the D/DBPR is presently under development by MF/UF manufacturers.

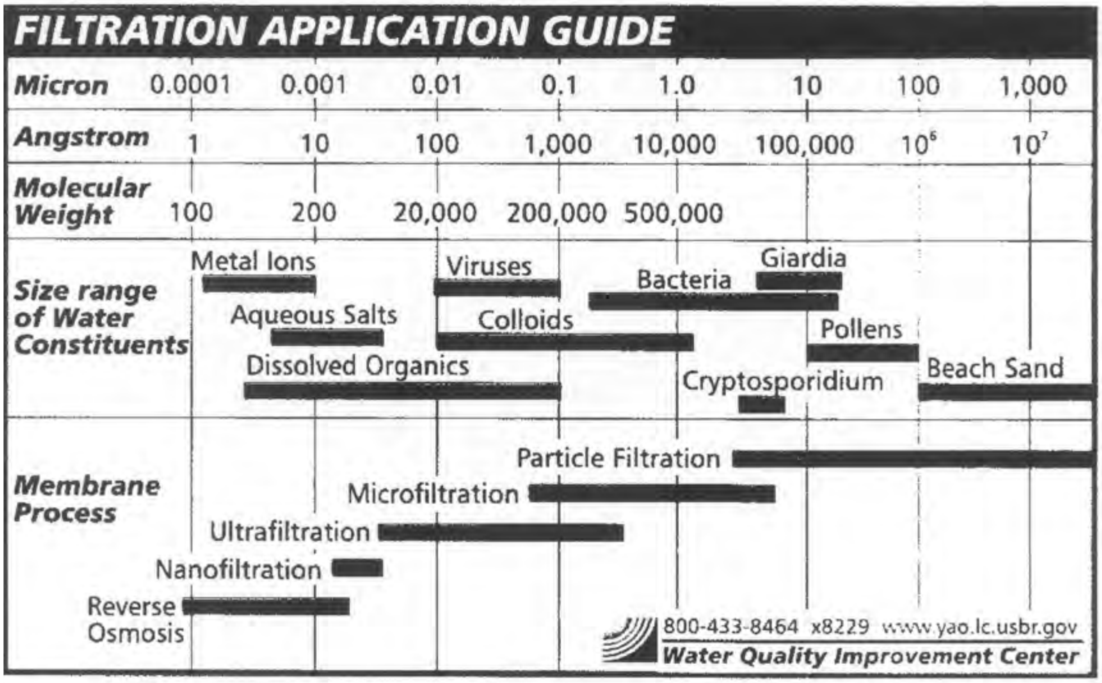


Figure III-1. Treatment options and filtering abilities.
("Particle filtration" is also referred to as "conventional filtration.")

The treatment train preferred in this study includes:

- Untreated (raw) CAP water
- Gravity turnout
- Option for a raw water reservoir
- Low head pump
- Screens
- Aeration
- Ozone
- Chemical pretreatment (disinfectants and coagulants)
- Rapid and/or flash mixers
- Flocculation/sedimentation beds
- Filters
- Post disinfection
- Corrosion control
- Finished water reservoir

In addition, the conventional filtration treatment train will include options to bypass certain processes during those times that CAP water quality is good allowing the plant to be operated very nearly like a direct filtration plant. Photographs typical WTP layouts are shown in figure III-2.

Figure III-2. Two photographs of typical WTPs.

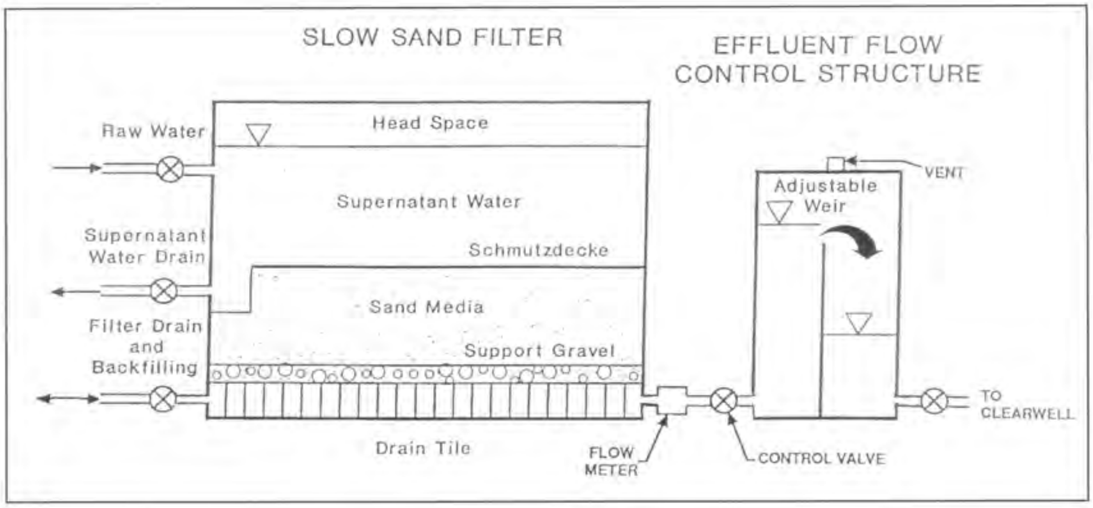


Figure III-3. Basic components of an outlet-controlled slowsand filter. (American Water Works Association, 1993)

Slowsand Filtration.—Slowsand filters are expected to remove biological particles, such as Giardia cysts, *Cryptosporidium oocysts*, algae, bacteria, viruses, and turbidities. Slowsand filtration is attractive for small communities because it is passive (meaning that operator intervention is minimal, resulting in lower operating costs), and it is effective when high-quality water is applied. Slowsand filtration does not require external suppliers or chemical coagulation involving coagulant chemical feeders, rapid mixers, and flocculators, or sedimentation basins with sludge removal equipment. Operation requires only the adjustment of flow to the plant, the monitoring of headloss and turbidity, and the scraping of the filter *schmutzdecke* (top thin layer).

The slowsand filter system may be constructed of reinforced concrete, ferro-cement, stone/brick masonry, or earthen berms covered with high-density polyethylene geomembrane liner. The system components consist of the following:

- A supernatant layer of raw water
- A bed of fine sand, usually 1.64 to 3.28 feet (0.5 to 1.0 meters) deep
- A system of supported underdrains
- An inlet and outlet structure
- Filter regulation and control instrumentation and valves

The waterflow into a slowsand filter can be controlled at the filter inlet or outlet. Figure III-3 shows the basic components of an outlet-controlled slowsand filter. The method of control will affect the structure and the control devices.

The water in the filter slowly passes through the porous sandbed. During this passage, the physical and biological quality of raw water improves through a combination of biological assimilation and physical filtration. A thin layer will form on the surface of the sandbed when the bed is mature. This thin layer (*schmutzdecke*) consists of retained organic and inorganic material and a great variety of biologically active microorganisms that break down organic matter. The filter layer eventually clogs. Cleaning the filter, which involves scraping off the top few inches of the sand filter bed, including the retained organic and inorganic material filter skin, can restore the filtration capacity.

Microfiltration and Ultrafiltration.— Microfiltration (MF) and ultrafiltration (UF) are barrier membrane filtration processes. In normal filtration flow operation, the feed water flows through the membrane module. Inside the membrane module, water flows around the hollow membrane fibers. The flow passes through the walls of the membrane fibers (outside-in flow) to the inside of the tubular fiber space. The membrane serves as a barrier that prevents passage of solids larger than the pores in the membrane. For MF, particles greater than about 0.2-micron diameter cannot pass through the pores in the walls of the hollow membrane fiber. Particles smaller than about 0.2 micron, and most of the water, do pass through the hollow membrane fibers to the tubular fiber space inside. This filtered water (filtrate) passes out of the membrane assembly as product water. The unfiltered feed water then carries the solids out of the membrane assembly as wastewater. UF removes even smaller solids down to about 0.01-micron diameter or 10 percent of the size of the particles removed by MF (see figure III-1). In some MF/UF systems, the filters operate without a continuous flush but are periodically backwashed for removal of solids deposited on the membrane surface.

Microfiltration and ultrafiltration operate at relatively low pressures of 5 to 40 pounds per square inch (psi). The transmembrane pressure (pressure between the feedwater side and the filtrate side of the hollow fiber) is typically about 5 to 15 psi with a clean membrane. Pressure increases as filtered particles accumulate on the surface of the membrane. At some point, backwashing is needed to flush the accumulated particle solids to waste. This is usually done automatically, based on pressure drop or the length of time the membrane system is in operation. The backwash water can be recovered and recycled back through the microfilter. The amount of backwash water is no more than that required for conventional filtration backwashing and, in many instances, is less.

An important advantage of MF/UF over conventional filtration is that no filter-aid chemicals are usually required, unless removal of a contaminant (such as iron, manganese, or total organic carbon [TOC]) is needed. Chemicals are used for occasional cleaning. These cleaning chemicals are approved for use in treating drinking water. In most cases, the cleaning chemicals can be discharged to the local sewer. Because MF/UF provides absolute barriers to microorganisms, it serves as a "physical disinfectant" by removing protozoa (Giardia and *Cryptosporidium)* cysts, bacteria, and viruses (see figure III-1). MF/UF is very effective as pretreatment to remove particulate material from water that may foul or plug the downstream RO treatment process. Because of the very low particulate levels of MF/UF filtrate, a downstream RO plant can operate without particulate fouling at high flux rates.

Treatment Option Cost Summary.—Table III-4 shows a summary of costs for various treatment types in dollars per thousand gallons, capital and O&M, (Reclamation, August 2000, Southern Arizona Regional Water Management Study).

Water Treatment Overview.—The operation for configurations involving both the Beardsley and CAP Canals will be similar. Water delivery begins with a canal side gravity turnout, which must be constructed and integrated into the canal side slope. From the turnout, water will then pass through a metering vault before delivery to an optional raw water reservoir and then the WTP. Treated water is stored

Treatment type	Cost ($ per 1,000 gallons)
Conventional treatment	0.57
Slowsand filtration	0.13
Microfiltration/ultrafiltration	0.57

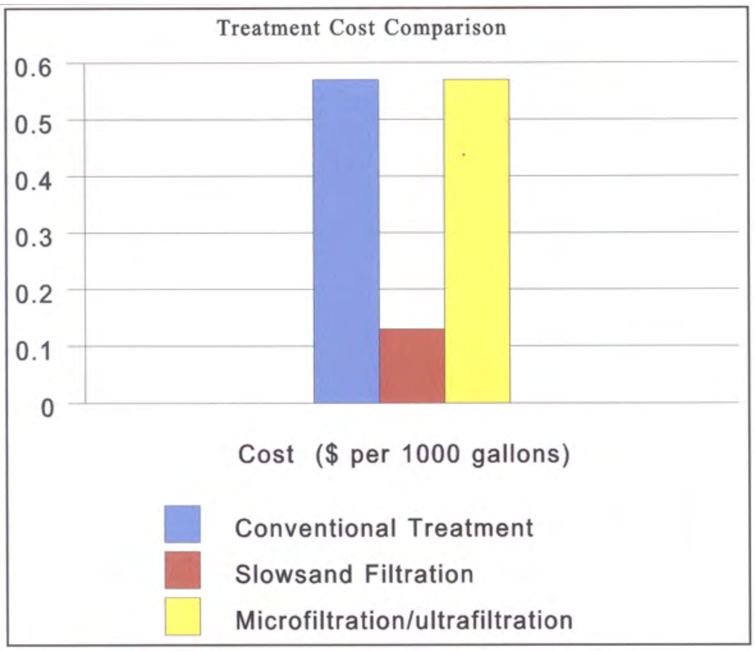


Table III-4.
Summary of costs for treatment alternatives

in a clearwell reservoir from which water is delivered to the main distribution pipeline.

Water Treatment Plant.—Determining the type of treatment to use depends on many factors, including customer preferences, existing concentrations of constituents in the source water, health, water quality required for the intended use, and cost. The source water will require treatment to accommodate seasonal and operational changes in concentration of the water's constituents. Flexibility to accommodate these changes will be a major factor for selecting and designing a WTP.

Water Supply Sources for the Water Treatment Plants

Beardsley Canal

The Beardsley Canal is considered the prime water source for use in this study. See figures III-4 and 5 (Plan Map of Beardsley and Profile of Beardsley Canal Invert) and figures III-6 through III-9 (photos of areas along Beardsley Canal). Beardsley Canal is owned and operated by the MWD. The canal is approximately 33 miles long, stretching from the outlet works of the lower lake at Lake Pleasant to the terminus at Thomas Road. The initial reach capacity is approximately 300 cfs, decreasing to a capacity of 1 cfs at the terminus to a lateral ditch. The canal was constructed in the early 1930s and is primarily a shotcrete-lined, trapezoidal-shaped canal with varying cross sections. No historic as-built of the system is available.

The Beardsley Canal currently takes water delivery directly from a turnout on the CAP Canal, located at the inverted siphon inlet on the west bank of the Agua Fria River. The physical water source is Colorado River through the CAP system (upstream of the reversible flow canal from the Lake Pleasant/ Agua Fria interconnect). Under the option for MWD to deliver water from the historic canal headworks, the water source would be a blend of Colorado River and Agua Fria River Waters, as described earlier. The Beardsley Canal flows for 10 months of the year with a scheduled outage for maintenance and repairs during the time of the year where the monthly water demands are at the lowest. Floodflows in the reaches south of Grand Avenue to Peoria Avenue are partially protected by the McMicken Dam structures.

Navigant Consulting, Inc. (NCI), formerly Bookman-Edmonston Engineering, Inc, completed a technical study. Phase I of the NCI study was to determine the current capacity of the Beardsley Canal theoretically available and the capacity currently used by MWD on an annual and monthly basis. The balance of the capacity would be available for use to transport CAP water to the WESTCAPS WTP participants.

Phase of the NCI study was to perform an appraisal-level cost analysis for the improvements required to increase the canal capacity. The flow regimes studied were for 50,000, 100,000, 150,000, 200,000, and 300,000 ac-ft/yr, in addition to the volume currently delivered to MWD users. Cost of improvements to the existing canal system to achieve the flow regimes were summarized for each reach and for each flow.

Also provided was the ground surface elevation along the canal alignment, showing the relative elevations of the various canal reaches. This data will be used to determine the amount of hydraulic head available for use in proposed WTPs.

Note that the losses due to seepage and evaporation were estimated for the Navigant Study. This will be a factor for this study if a wheeling agreement is discussed and metering is not installed at all turnouts and intermediate canal stations.

The capacity required by MWD water demands will have priority over the water capacity required to transport CAP water to the proposed WTP. The peak summer water demands for MWD and a proposed WTP coincide. The estimate for monthly capacity required will be based on a monthly demand for water, which would be larger than the average annual water demand. This will increase the required capital improvements to Beardsley Canal required to meet domestic water and agricultural water demands from the canal.

Other issues related to water transport for domestic use through the Beardsley Canal that were not studied are:

- Cross drainage flood inflows
- Water quality expected from cross drainage inflows

- Type of present return flows, inflows characteristics: flood, pesticides, fertilizers, petroleum products, and agriculture return flows
- Types of future return flows, inflow characteristics: building and development
- Future decrease of agricultural use (will it increase the municipal capacity?)
- Level of O&M required for domestic use compared with existing O&M for agricultural use
- Water quality of the canal water at different points of the canal
- Lost water and revenues from capturing cross drainage flows
- Current canal lining useful life remaining and replacement cycle

Central Arizona Canal

The CAP was authorized as part of the Colorado River Basin Project Act of 1968 (Public Law 90-537). The CAP is a multipurpose water project that provides a renewable water supply for agricultural, municipal and industrial (M&I) use, as well as for Indian uses and non-Indian agricultural uses in central and southern Arizona. The CAP is capable of delivering up to 2.2 million acre-feet of Colorado River water annually through a system of pumping plants, aqueducts, dams, and reservoirs. The aqueduct system begins at Lake Havasu, Arizona. Here, water is diverted from the Colorado River, travels south and then east through the Phoenix metropolitan area, and continues in a southerly direction to its terminus south of the City of Tucson. The CAP Aqueduct system is composed of three major segments: (1)the Hayden-Rhodes Aqueduct, formerly the Granite Reef Aqueduct; (2)the McFarland Aqueduct (formerly the Salt-Gila Aqueduct); (3)and the Tucson Aqueduct.

Constructed by the Bureau of Reclamation, the first water was carried through the CAP canal in 1985. In 1986, this water was used for agricultural irrigation and the City of Phoenix . See figure III-10, location map of reaches 8 to11, CAP Canal, and photographs of the CAP Canal area, figures III-11 and III-12. The conveyance system is an aqueduct consisting of concrete-lined canals and pipelines extending a length of 336 miles from the Colorado River to Tucson. The CAP is designed with overchutes and culverts that carry local storm runoff water over or under the canal. Earthen dikes paralleling the canal protect the canal from floods. The entire length is fenced, with no public access.

- The system was planned and designed to provide delivery of Colorado River water 365 days a year, with no planned outages. A major component of the CAP system, the New Waddell Dam that forms the new Lake Pleasant, was constructed to provide reliable service. Other CAP features that offer reliable service include the following:
- The first 17 miles of the CAP are oversized to provide storage capacity.
- The pumping plants for the Hayden-Rhodes and Fannin-McFarland Aqueducts are two identical, parallel plants with separate pump manifolds and discharge lines.

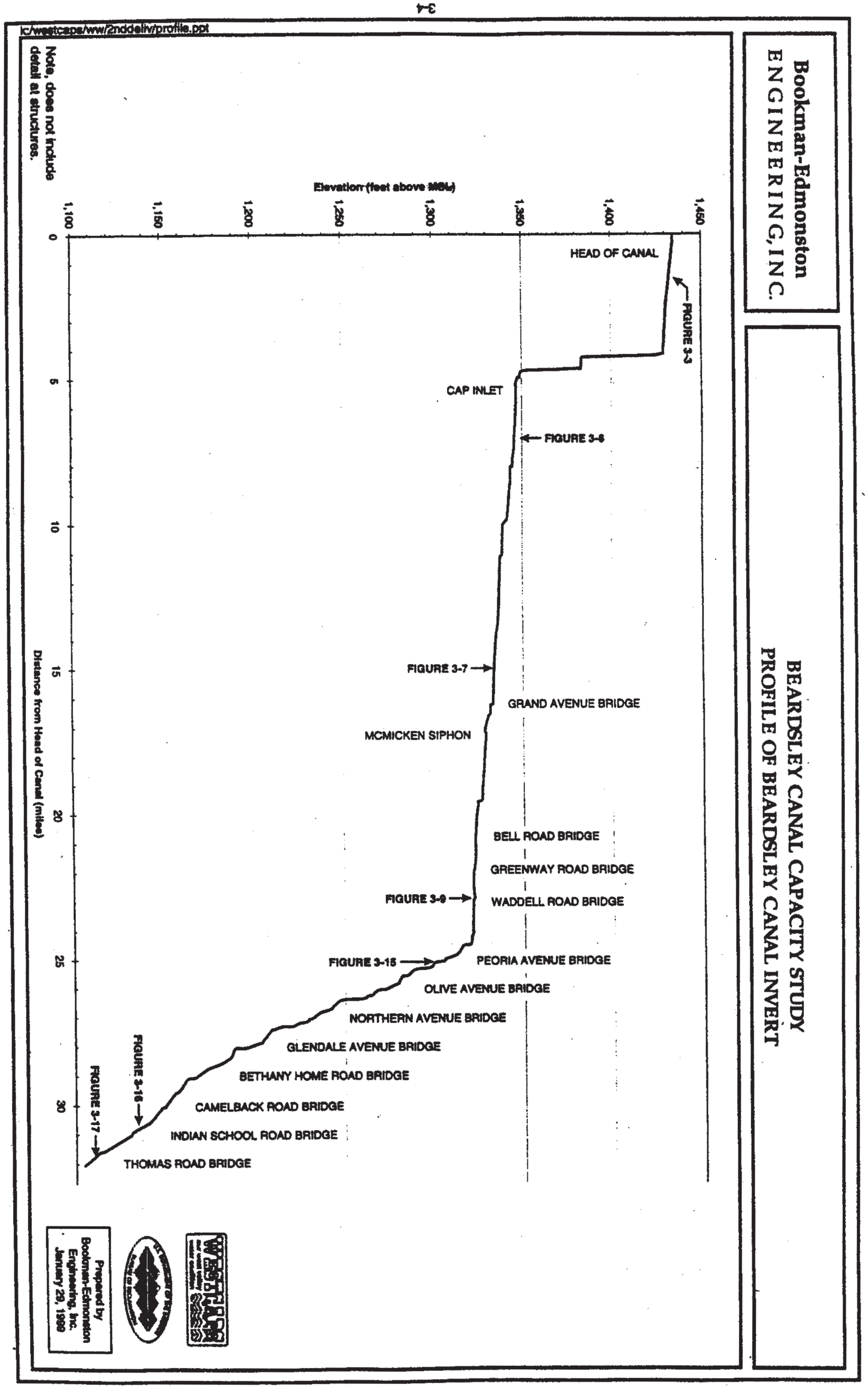


Figure III-5.—Profile view of Beardsley Canal.

Figure III-6. Potential WTP sites.

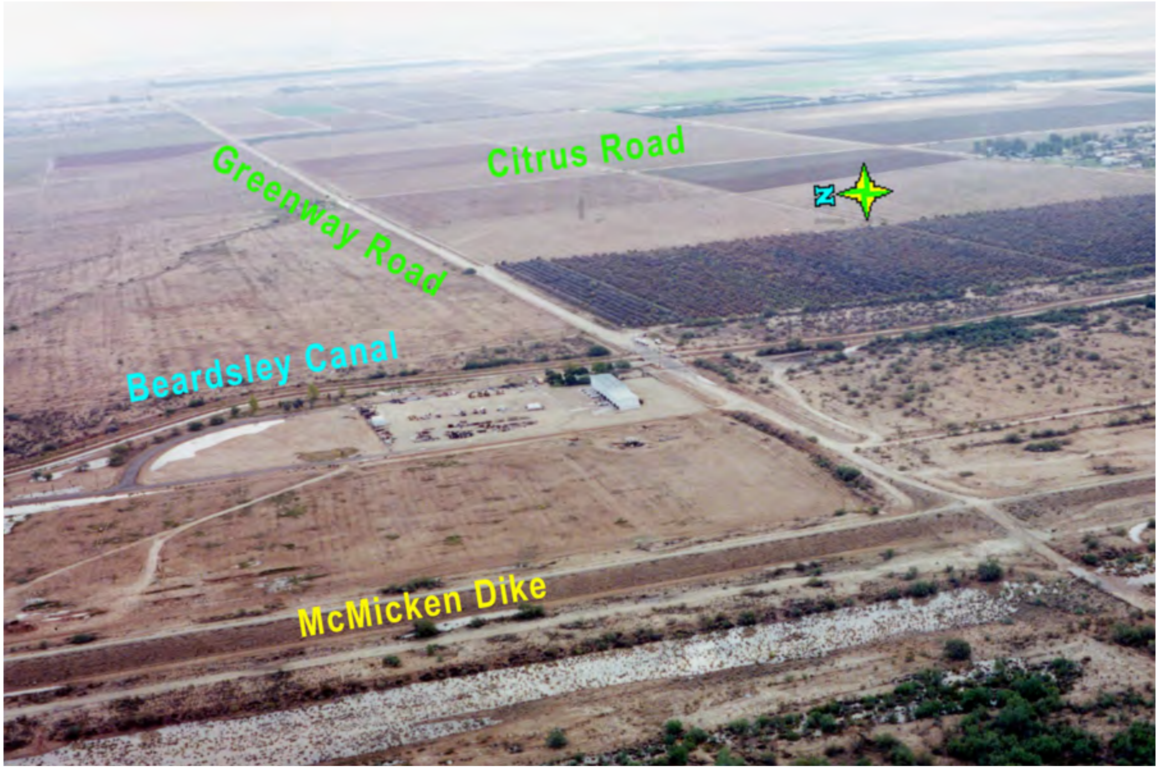


Figure III-7. Potential WTP sites.

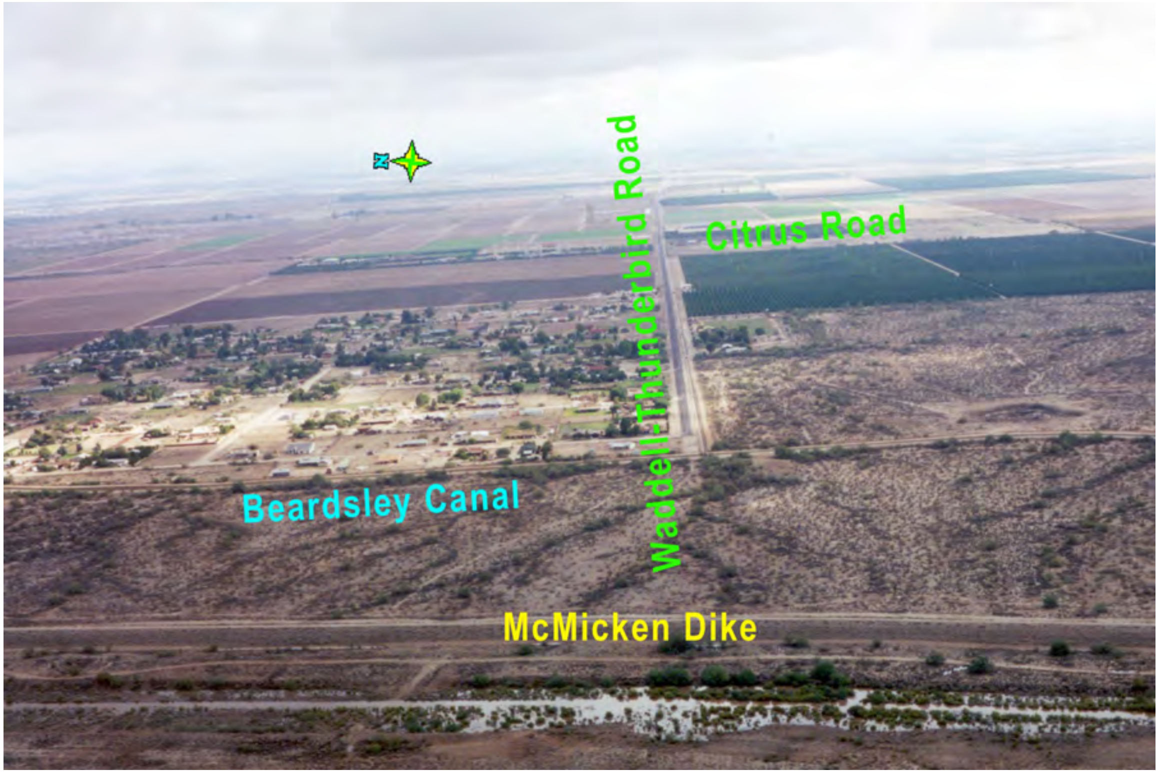


Figure III-8. Potential WTP sites.

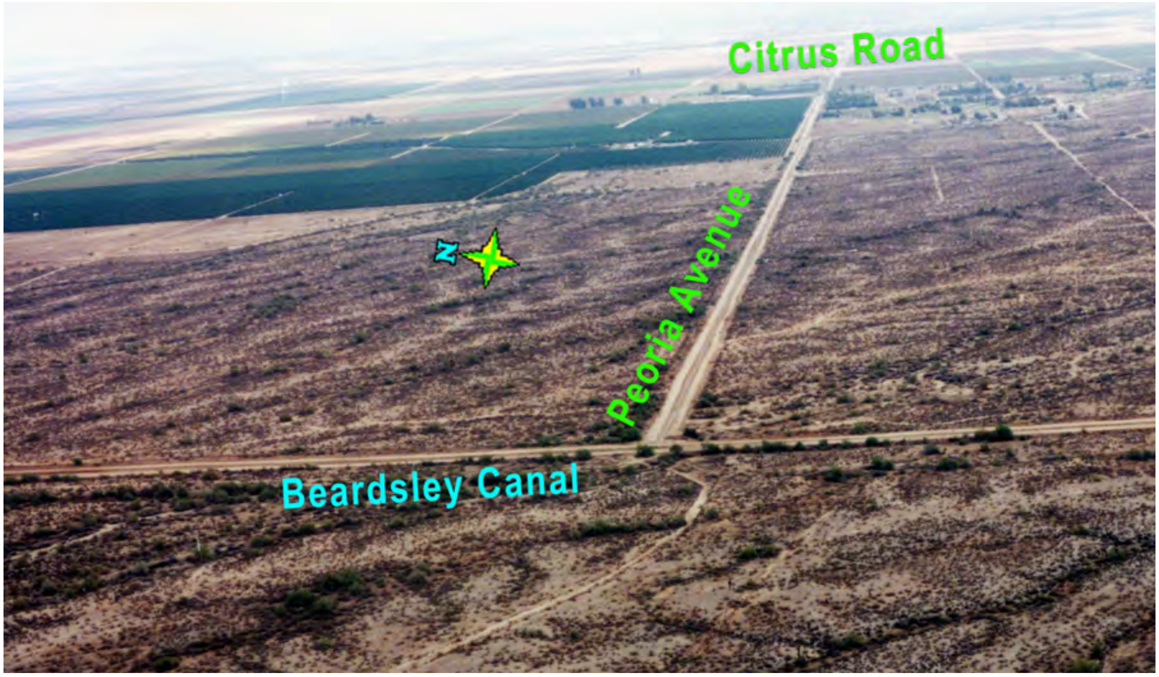


Figure III-9. Potential WTP site.

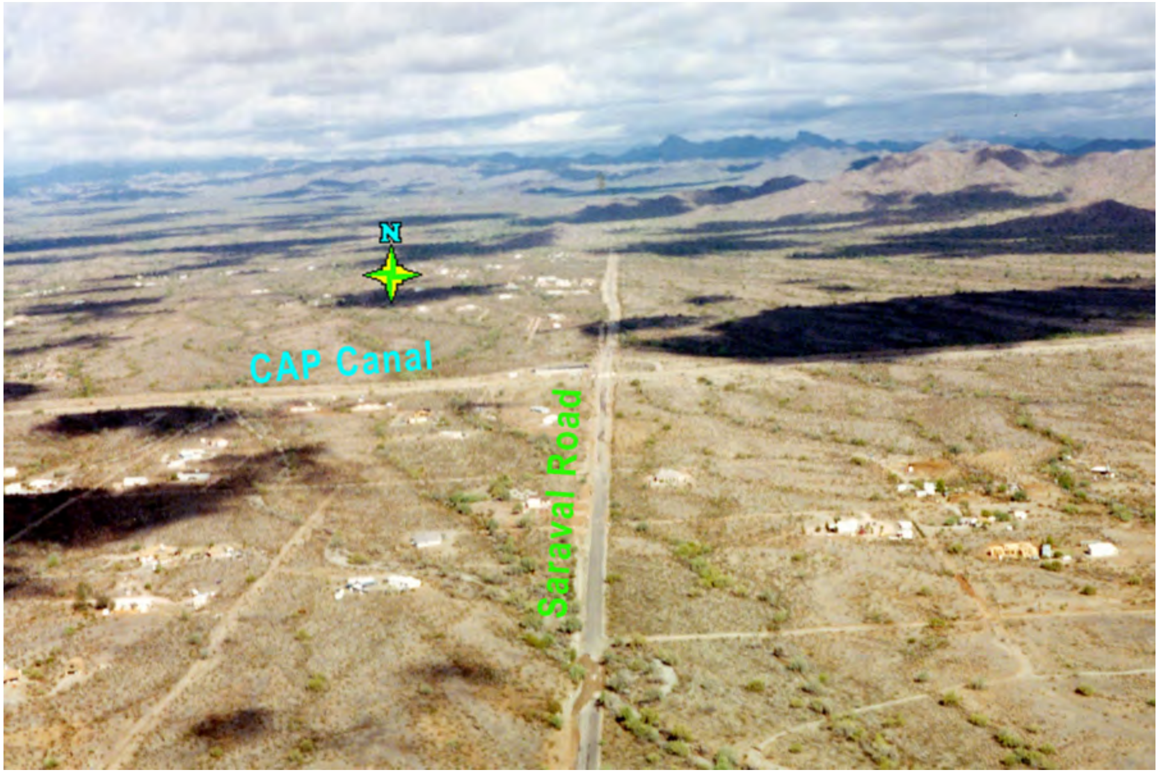
- The siphons have been replaced to prevent potential failure, and the outages that would result.
- The power supply is from the Navajo Powerplant, built by Reclamation for the CAP.
- The entire system can be controlled and monitored by remote operation and monitoring.

The CAWCD is responsible for operating and maintaining the aqueduct system, its associated features, and collecting charges for water delivered. The cost of transporting CAP water is charged at a postage stamp rate, a set charge for delivery along the canal, and special charges dependent on the use.

The CAP canal capacity in the reaches crossing the northern portion of the WESTCAPS area is 3,000 cfs. Water in the CAP Aqueduct is lifted by four pumping plants to a canal water surface elevation of approximately 1536 feet in the CAP reach to the north of the WESTCAPS area. See plan and profile drawings and typical canal section with statistics of the system, in Appendix A.

Source Water Quality.—The source water will be untreated (raw) CAP water. CAP water contains impurities such as suspended solids, TDS, iron, manganese, coliform, and toxic chemicals, and characteristics requiring treatment, such as turbidity, alkalinity, pH, and color. These impurities do not exceed MCLs established under the Safe Water Drinking Act. The Colorado and Agua Fria Rivers are the two sources for CAP water delivered to the Phoenix and Tucson areas, with the Colorado River supplying approximately 90 percent of the water.

The Colorado River has a higher TDS level than the Agua Fria River (about 660 milligrams per liter [mg/L] versus about 430 mg/L). The resulting TDS levels are 743 mg/L for CAP water above to Lake Pleasant and 697 mg/L for CAP water below Lake Pleasant.



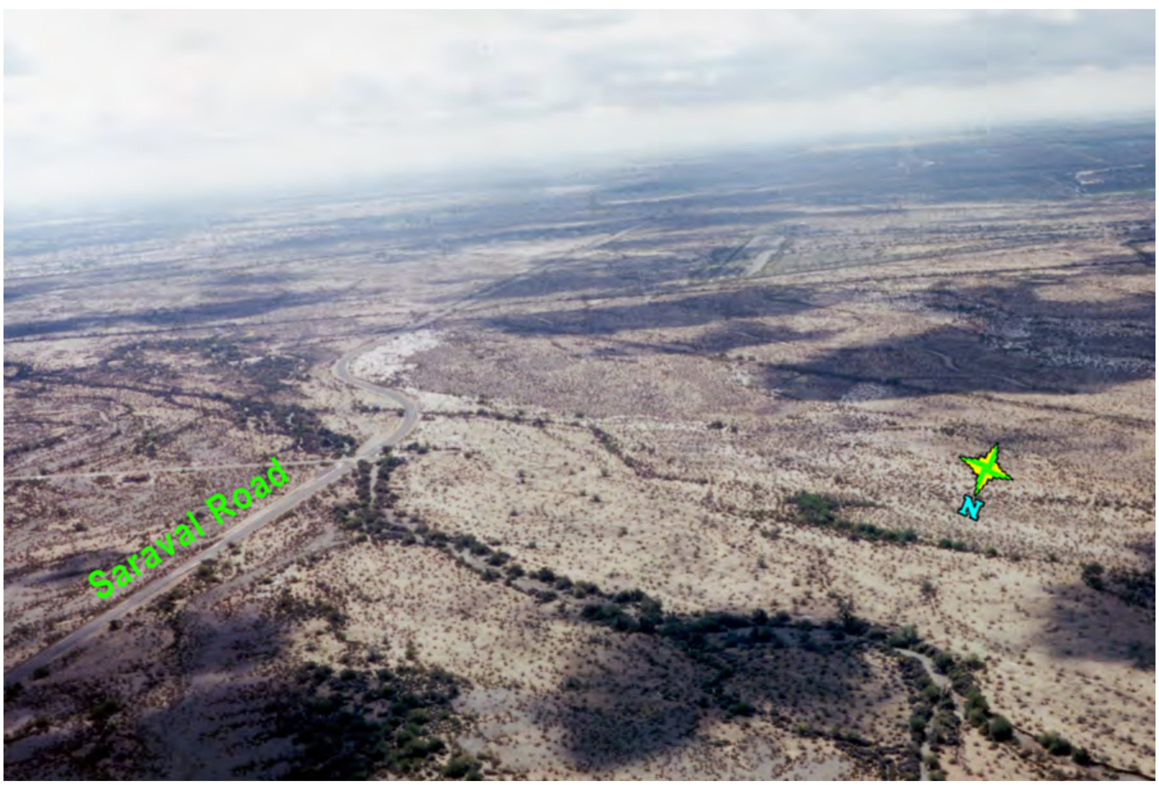


Figure III-11. Potential WTP sites.

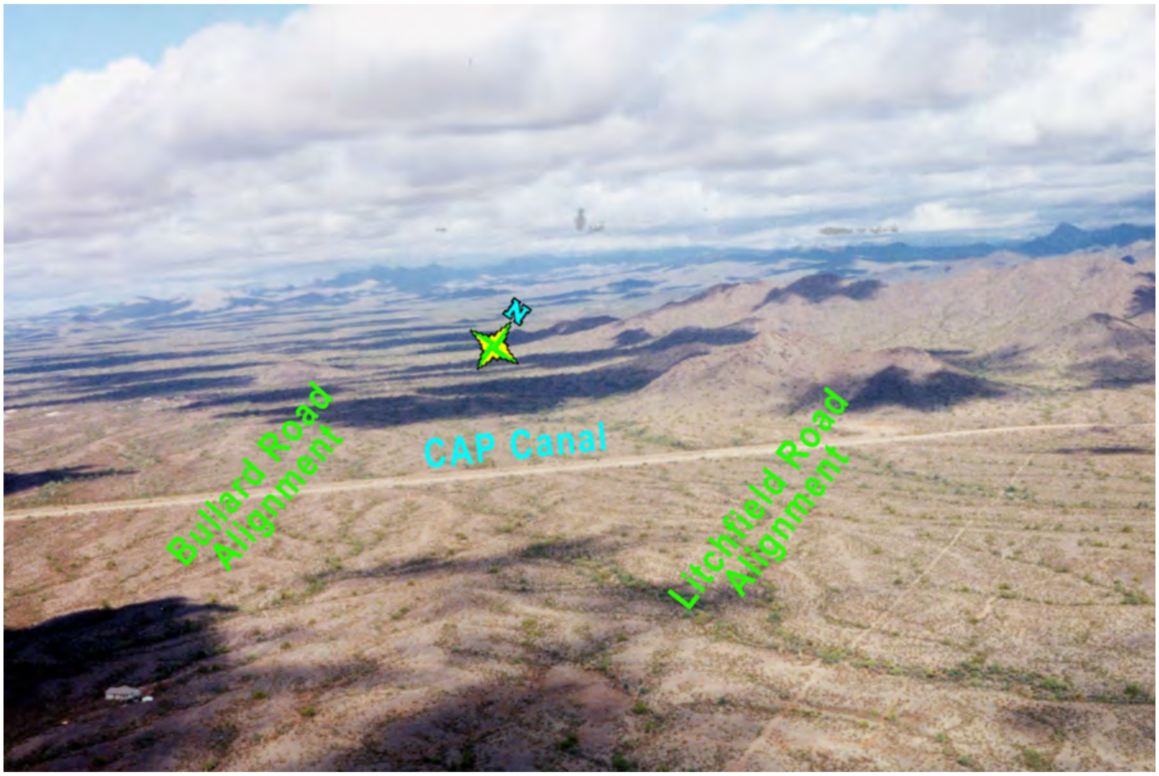
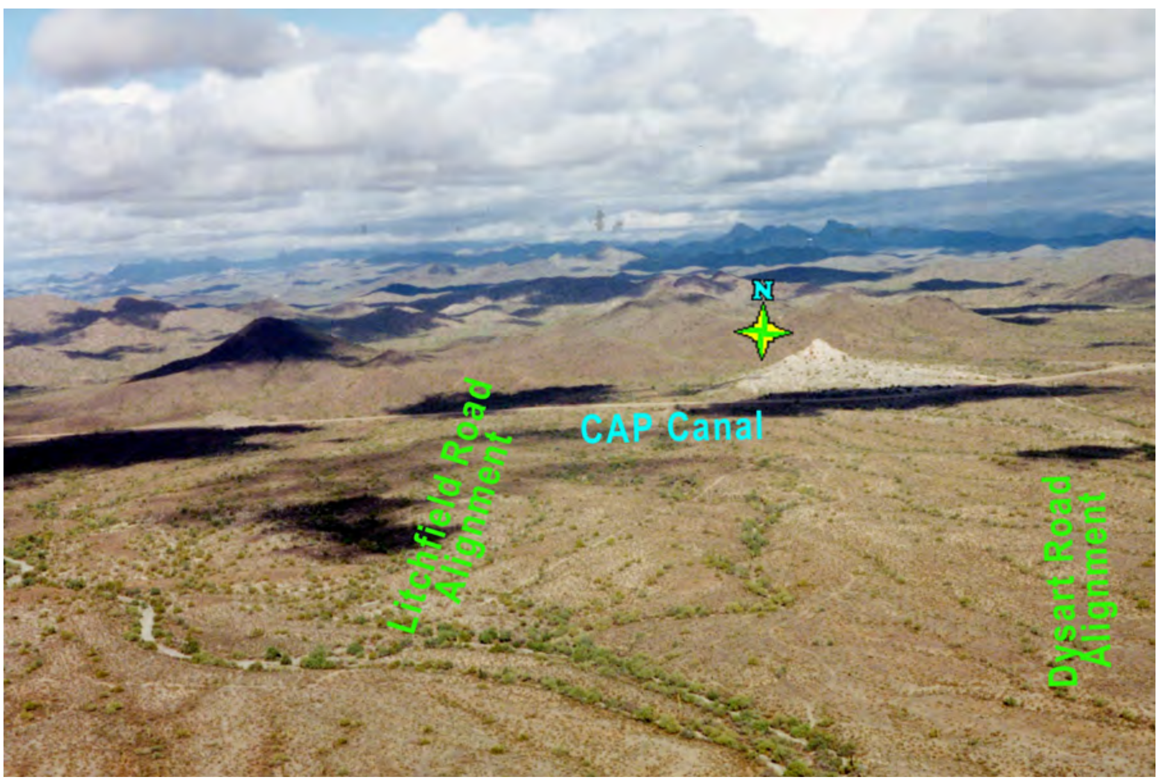


Figure III-12. Potential WTP sites.



CAP water also contains certain natural organic compounds that in combination with the disinfectant chlorine, react to form trihalomethanes (THMs). High concentrations of THMs have been shown to cause cancer in laboratory animals. The filtration and disinfectant process will be selected and designed to remove as much of the organic and disease-causing organisms using the best available technology and management practices.

Table III-5 lists the average water compositions developed from 1993 through 1997 (reference "Reverse Osmosis Treatment of CAP Water for the City of Tucson," draft, November 1998).

O&M Costs.—O&M costs are based on delivering water at design capacity. Routine maintenance and contingency funding for repairs is included in the annual operating costs. Standard maintenance criteria would apply, since fixtures and appurtenant equipment would be readily available.

Water costs are based on the CAWCD's "Final 2000 Rate Schedule" for M&I use. The rate varies from $102 per acre-foot for the year 2000, increasing to $129 per acre-foot for the year 2004. The CAWCD's price for water is comprised of a capital component and a delivery component to cover maintenance and energy costs. The total cost is commonly referred to as the "postage stamp" rate. Since the cost of CAP water will vary over time, a value of $150 per acre-foot has been selected to calculate representative costs that will be used to compare alternatives.

Design Criteria standards for WTPs.—The standard criteria used to size and locate WTPs can be found in Appendix A. In general, peaking factors, storage, and delivery capacity have been standardized to consistently evaluate configurations. The WTP design for each of the configuration will be based on the using conventional treatment type described previously.

Distribution of Treated Water.—Concrete or ductile iron pipes are used in this study for cost comparisons of the alternatives. Keeping the water velocity less than 5 feet per second controls pipe sizing. Actual pipe sizing is also dependent on hydraulic gradient and depth of cover. Controls for the distribution system include pumps, surge tanks or air chambers, pressure reducing valves, and a supervisory control system to monitor and provide remote control of equipment and facilities.

For this study, the total storage reservoir capacity will be 75 percent of the average annual demand. Storage of water provides reserves and allows the damping of the design for the WTP with respect to daily peaking capacity. Reservoir storage is usually calculated for 15 to 30 percent of maximum daily use. For the total system, that would be equivalent to 75 percent of the average annual, 56 percent of July average daily, or 25 percent of the hourly peak. As the system reliability is increased, the storage, including reservoirs and other "on demand" water sources, may be increased from 100 to 200 percent of total average annual demand.

Boundaries.—Study boundaries were set using physical constraints, such as the White Tank Mountain range, and by member service areas. The boundary limits are shown on figure III-13. A summary of water demand for each WPA and the 100-foot topographic contour intervals are also shown. Physical boundaries for this study are:

Table III-5. Average water and design water compositions (October 1993 to December 1997).

Southern Arizona Regional Water Management Study, U.S. Department of the Interior, Bureau of Reclamation, August 2000

Parameter	USGS Analysis No.	Unit	CO River below Parker Dam 09427520	CAP Canal at MP 7.98 Near Parker 09426700	CO River average of two stations	Estimated CO River composition in 2015 (w/743- mg/L TDS)[1]	CAP Canal at MP 162.3 at 7th St. 09427100	CAP Canal at MP 252 near Coolidge 09427300	CAP Canal average of two stations	Estimated CAP Canal composition for 743-mg/L TDS CO River[1]
PH	400		8.1	8.3	8.2	8.2	8.4	8.7	8.5	8.5
Ca	915	mg/L	76.0	75.1	75.6	-	70.0	69.9	70.0	79.2
Mg	00925	mg/L	29.0	28.7	28.8	-	27.8	28.1	28.0	31.6
Na	00930	mg/L	99.0	98.4	98.7	-	92.5	93.5	93.0	105.2
K	00935	mg/L	4.7	4.6	4.7	-	5.0	4.9	4.9	5.6
HCO_3	00453	mg/L	158.8	153.5	156.2	-	156.9	151.2	154.0	174.3
SO4	00945	mg/L	269.0	272.5	270.7	-	245.7	249.1	247.4	280.0
Cl	00940	mg/L	91.7	90.6	91.2	-	83.7	84.0	83.8	94.9
F	00950	mg/L	0.4	0.3	0.3	-	0.4	0.4	0.4	0.4
SiO_2	00955	mg/L	7.7	8.0	7.9	-	9.1	8.3	8.7	9.8
As	01000	µg/L	2.3	2.3	2.3	-	3.3	3.3	3.3	3.7
Ba	01005	µg/L	125.9	128.4	127.2	-	115.9	123.4	119.6	135.4
B	01020	µg/L	137.9	140.4	139.2	-	142.0	141.6	141.8	160.4
Fe, total recoverable	1045	µg/L	94.7	52.8	73.8	-	52.0	465.2	258.6	292.6
Fe, dissolved	01046	µg/L	< 3.0	< 3.0	< 3.0	< 3.0	8.3	18.6	13.4	15.2
Mn[2]	01055	µg/L	28.0	19.2	23.6	-	41.6	88.9	65.2	73.8
Sr[3]		µg/L	1,092.0	1,079.7	1,085.9	1,228.8	1,194.9	1,198.0	1,196.5	1,353.9
TDS, NF/RO sum[4]		mg/L	736.6	732.0	734.3	-	691.2	689.7	690.5	782.7
TDS, 180 □C	70300	mg/L	693.0	682.2	687.6	?	649.0	646.7	647.9	733.1
TDS, sum[5]	70301	mg/L	658.4	654.8	656.6	?	614.1	617.5	615.8	696.8

[1] The design compositions are obtained by multiplying the average compositions to the left by the ratio of the projected mean TDS, sum, in 2015 below Parker Dam with new salinity controls (743 mg/L) and the above 1994-97 average Colorado River TDS, sum, of 656.6 mg/L. The ratio is: 1.132.
[2] Values listed for Fe and Mn are unrepresentatively high because the averages do not include below-detectable observations.
[3] For Colorado River Water, Sr is estimated from Sr/(Ca+Mg) ratios at the Water Quality Improvement Center, April - June 1998. For CAP Canal water, Sr is estimated from Sr/(Ca+Mg) ratios at Tucson Water February - June 1998.
[4] Membrane manufacturers frequently refer to the sum of constituents as TDS. This TDS does not subtract any alkalinity and reports silicon species as SiO_2. For waters in this study, it is related to TDS, sum, by: TDS, NF/RO sum = TDS, sum + 0.508*HCO_3 - 0.27*SiO_2 + concentrations of solutes other than those in footnote 5.
[5] This is the estimated average of "TDS, sum (70301)" in U.S. Geological Survey Water-Data Reports. It is calculated to correspond to TDS by evaporation at 180 degrees C by: TDS, sum = 0.6*alkalinity + Na + K + Ca + Mg + Cl + SO_4 + SiO_3 + NO_3 + F.

- **North -** The CAP Canal with an approximate topographic elevation of 1535 feet, defines the northern limit of the study. There are presently no established or proposed high-density population developments to the north of this boundary. Note: 1450 feet is the minimum elevation needed to make deliveries without booster pumping.

- **South -** The study will include the Goodyear service area (I-10 and Gila River), at their request, to include extension of the water distribution lines past the Gila River.

- **East - Defined by the Agua Fria River.** Most existing domestic water systems east of the Agua Fria end at the riverbank. It is noted that water service mains crossing the river to the west have been proposed but are not included in the Study area.

- **West -** Defined by the White Tank Mountain range. The range extends from north to south on the western edge of the study area. The White Tank Mountains are a physical boundary that service will not cross. The mountain slopes may provide the necessary elevation head required for clearwell reservoir water storage. The west slope area of the White Tank Mountains, including the Buckeye and WMC service areas, have been used to develop a recharge and recovery facility which could be connected by a pipeline designed with reversible flow capability. More consideration will be given to incorporating such a pipeline when study alternatives are implemented.

Siting Issues/Pressure zones.—Contours with a 100-foot interval have been added to the figure to illustrate typical municipal pressure zone limits. This will provide a uniform reference for the municipal delivery zones and pressure requirements for distribution systems.

- Twelve delivery areas (turnouts), each with a specific delivery capacity, were selected from the WPAs located within the study boundaries (see figure III-14). The turnout delivery points were selected by using the centroid of each WPA. Service areas with a year 2025 capacity of less than 1,000 ac-ft/yr were not calculated, except for Surprise #8 (turnout #4). Surprise #8 was included to illustrate a typical pipeline size and hydraulics for comparing with the cost of continued groundwater pumping. Note: the four largest delivery turnout areas are shown with a different symbol, since these turnout areas will have a bearing on WTP location.

- The location of WTPs from the initial WESTCAPS strategy (June 30, 2000) is shown on figures I-5 and Figure III-14 (green and blue squares). Several factors were considered in determining the most economical WTP location:

  - Delivery areas requiring pumping

  - Distance to major delivery capacity service areas

  - Location of potential finished water reservoir sites

  - Raw water reservoir distance and access

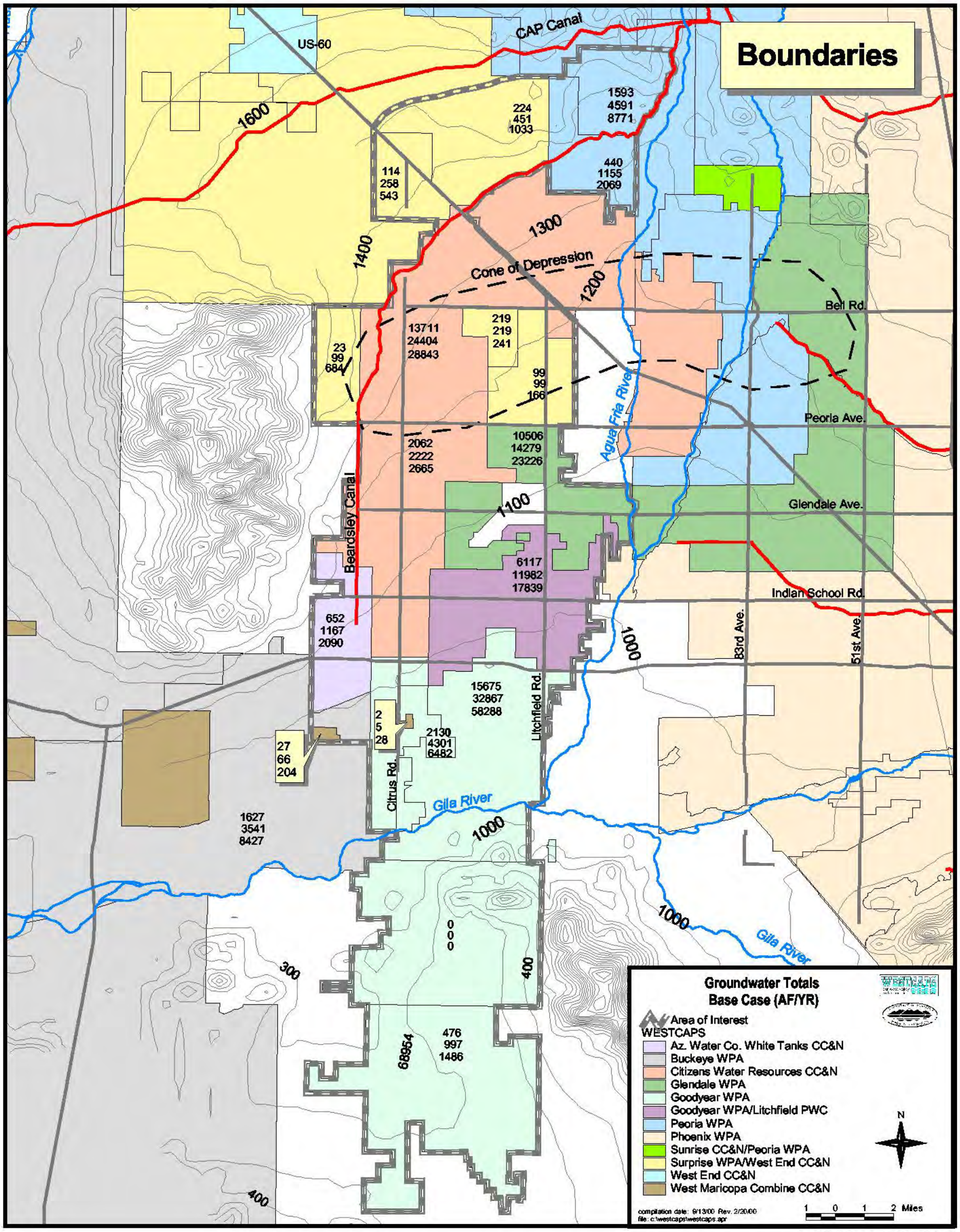


Figure III-13. Service area boundaries for new WTPs.

- Dependable water supplies
- Consistency of water quality
- Flexibility, reliability, and redundancy

An area that would require booster pumping can be shown, relative to a WTP location, by using the topography and required pressure head in the distribution system. This is shown, relative to the WTP location, by a corresponding line of the same color. An assumed,70-psi of pressure head was used to ensure that transportation pressure losses, fixture head losses, delivery pressure criteria, and peaking demands were met.

In considering to the WTP at Grand and the Beardsley Canal, the service to areas 1, 2, 3, and 4 would not be economical, due to pumping costs. However, the plant could be moved to the south, along the Beardsley Canal as far as Cactus (purple square), without losing the pressure gradient advantage compared to the "green" location (see the green and purple lines). This would place the WTP closer to the four major service areas. Note: areas south of Cactus Road may be used as WTP sites, but the slope of the Beardsley Canal increases at a greater rate, which, in turn, loses static pressure head that would be available to make deliveries.

The WTP located at Indian School Road and the Beardsley Canal (light blue) would have a service capability with minimum pressures. This would mean no future pressure reserves that provide flexibility and avoids the addition of future pumping infrastructure.

The location of the CAP Canal WTP was studied to determine if a location that far north was economical. Hydraulically, it provides an additional 200 feet of static head. This would allow delivery to areas 1 to 4 and portions of 5 (as shown on Figure III-6) by gravity. The cost of pipeline installation compares favorably with the cost of pump facilities and corresponding power costs. There are additional reliability and flexibility benefits by using the CAP Canal as a source.

The Proposed location of the North WTP is at the CAP Canal, in the vicinity of the Saraval Road (from Grand Avenue to the inlet portal of Agua Fria Tunnel). The South WTP should be located between Greenway and Cactus Roads, along the Beardsley Canal.

Possible distribution alignments were selected and the use of undeveloped areas was used where possible (see figure III-15). Selection of typical trunkline alignments allowed for a comparison of different system configurations. System reservoirs were located at higher elevations to avoid the need to pump during power outages. The selected alignments are shown on figure III-1.

Water Supply Reliability.—Under the terms of all CAP water service subcontracts, no user is guaranteed water deliveries or water quality. In 1987, Reclamation conducted an evaluation to show the difference in expected aqueduct outages between the Tucson and Phoenix areas for both planned maintenance outages and emergency outages. Reclamation concluded that the only significant difference between the two areas results from planned maintenance outages.[2] Because the majority of the system was not yet under operation, a great number of assumptions were made in the study, including

[2] The evaluation is provided as appendix A to the Final Environmental Impact Statement, Central Arizona Project, Tucson Reliability Investigation, April 1998.

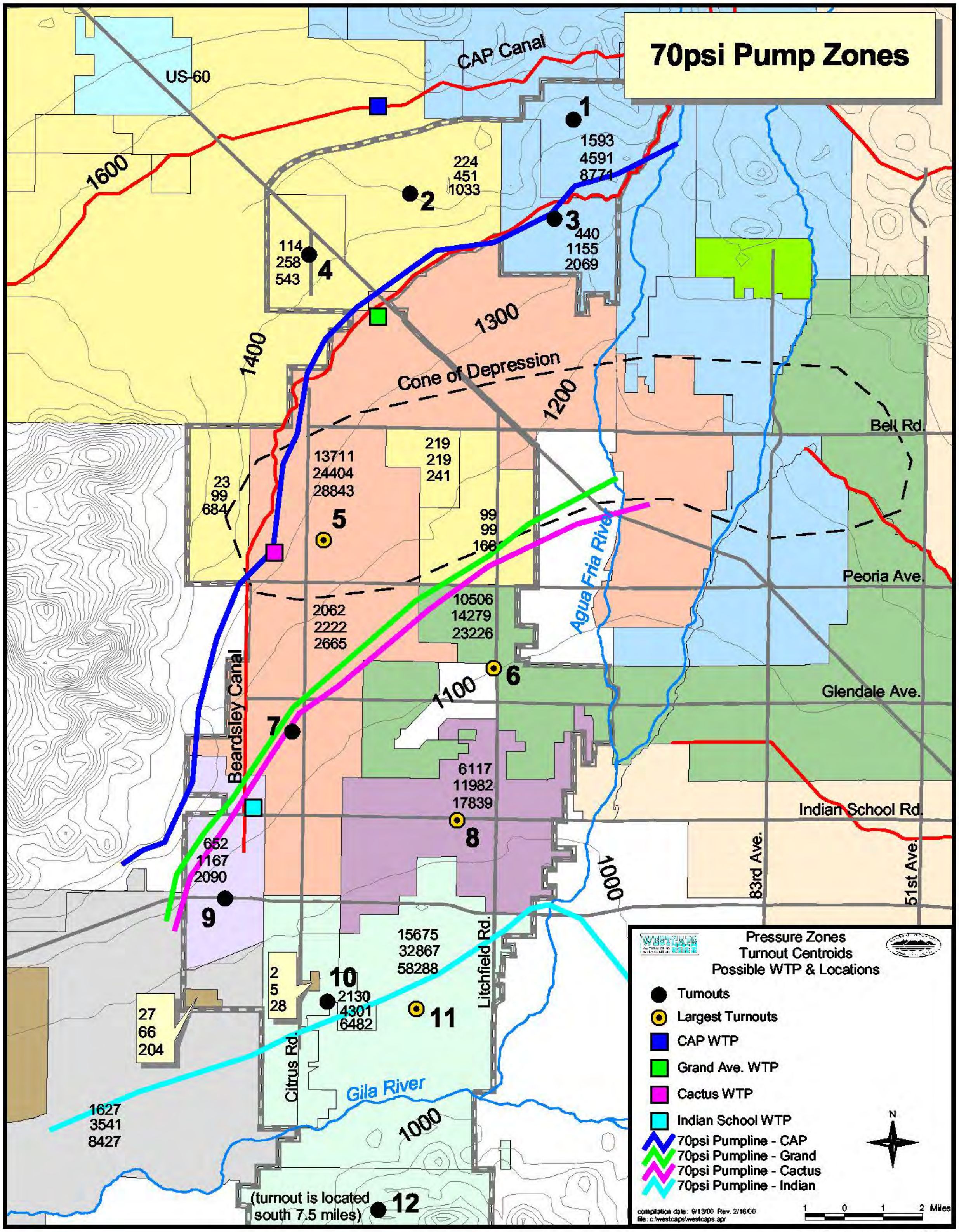


Figure III-14. 70-psi pressure zones.

the assumption that the CAWCD will conduct a proactive and effective maintenance program. This resulted in Reclamation's conclusion that a reservoir sized to meet all of the Tucson area CAP water demand for a 1-month duration during winter would be suitable. Therefore, based on the study Reclamation completed for the Tucson area, Phoenix area users should plan for a 1-month maintenance outage each year.

The Beardsley Canal currently takes water directly from the CAP Canal. Since the Beardsley Canal is operational for 10 months of the year, a 2-month outage for maintenance should be expected.

Although historic maintenance records and the reliability of the Hayden-Rhodes portion of the CAP Canal and Beardsley Canal are very good, options for continuing service in the event of an outage are required. Position of the proposed CAP turnout or Beardsley turnout will not limit the amount of water that could be backflowed from the Lake Pleasant, Waddell Canal, if an upstream outage occurred on the CAP. Gravity flow and temporary pumping of the canal is possible.

Concerns with both long-term CAP water availability (including shortages of Colorado River water) and short-term CAP and direct delivery system maintenance outages, make it necessary to keep well water systems operational. Making the well system an integral part of the supply ensures that wells are maintained and functionally operational. Wells that are periodically operated should function much more efficiently and reliably over the long term. Reliability and redundancy for the distribution system, including the WTP and delivery system downstream, remain water provider responsibilities.

Analysis of Alternative Configurations

As described in "Introduction, Chapter I," two water supply quantity options were evaluated (each with two water treatment plant configurations) (see table III-2). The first configuration involves constructing a single WTP located along the CAP system, and the second configuration involves constructing two WTPs: one along the CAP system and one along the Beardsley Canal. In addition, for each of the configurations in the unlimited supply option, staging construction of the treatment plant capacity in phases in order to meet the estimated demand at the year 2005, 2015 and 2025 was evaluated. Configurations that were considered but rejected are documented in appendix A.

Appendix A contains detailed analysis of the four configurations, stages and corresponding capacities of table III-2.

Costs were compared using conventional water treatment processes. Costs associated with constructing facilities, acquiring rights-of-way, staging, and other options are shown in Appendix A. The costs do not include other factors that may increase the total, such as mitigation for endangered species, recreational facilities, architectural esthetics, or cultural resource mitigation. Construction costs are an average; thus, many related factors, such as quantity of pavement replacement, extent of utility relocation, drainage crossings, traffic control, and neighborhood disruptions, will affect the total. By including a contingency factor, the costs are representative of what can be expected for this project. The analysis contains a capital recovery factor of 5.5 percent for 20 years. More refined costs will be

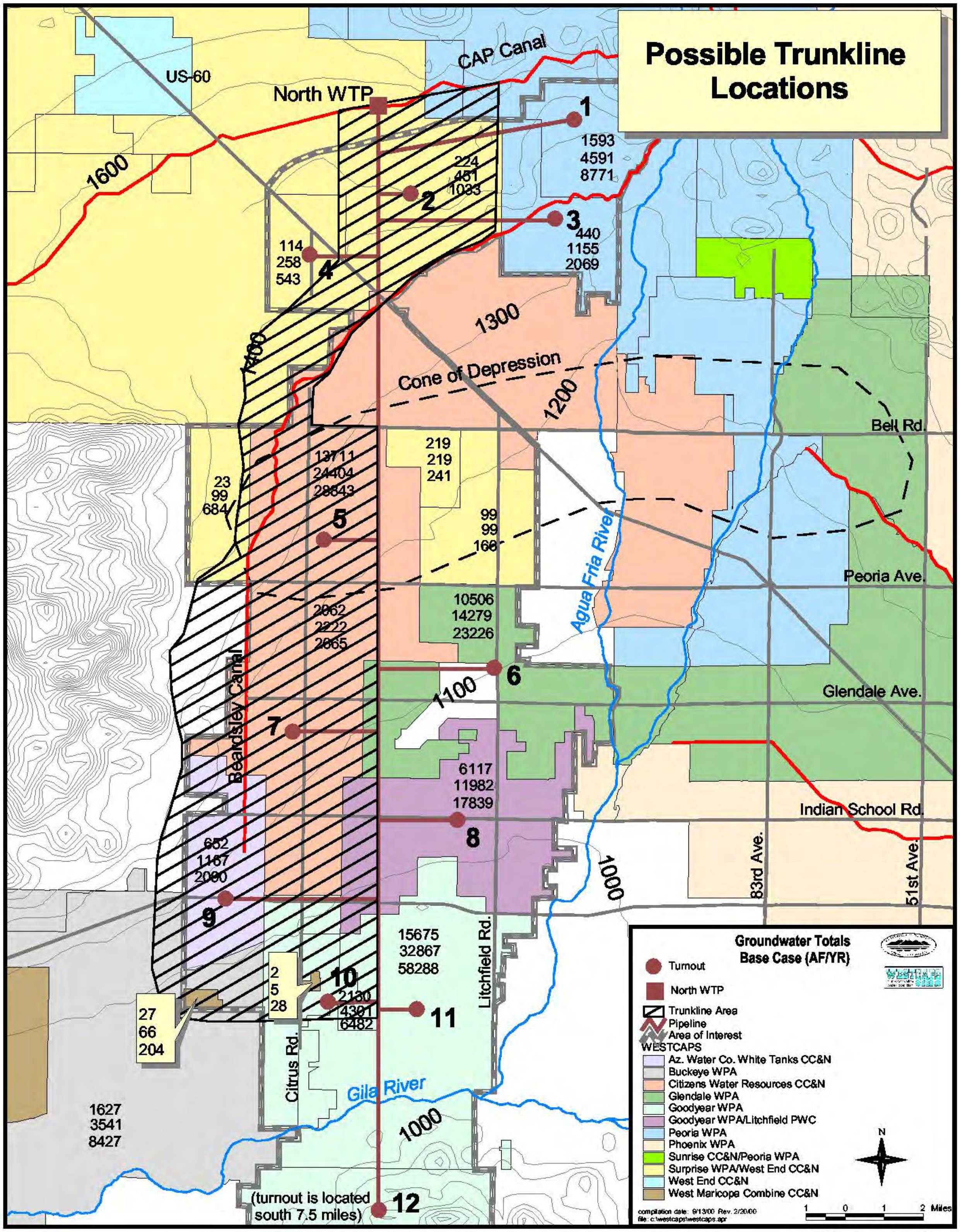


Figure III-15. Possible trunkline locations.

developed when, and if, the project moves to a design phase.

Possible Federal participation in the design and construction of various major portions or features of the WESTCAPS strategy will affect the amortization rate. Potential Federal participation is summarized in table III-6.

In comparing alternative configurations, costs have been converted into unit costs in dollars per ac-ft and per1,000 gallons of use. Each of the configurations includes the cost of the WTP, distribution system, cost of CAP water (at $150 per ac-ft), reservoirs, O&M, and energy costs.

Costs for a raw water reservoir have been shown separately, since this option maybe eliminated. The reservoir provides reliability and water treatment advantages that might be essential to a direct delivery alternative.

Table III-6. Potential Federal participation

Direct delivery alternative feature	Possible Federal participation
Reservoir	Yes
WTP	No
Booster plant	Yes
Distribution pipeline	Yes

Two Plant Configuration - Preferred Alternative

Based on an evaluation of total cost, as well as other significant factors (such as regional flexibility, multiple water supplies, limiting the amount of pumped deliveries, and reliability provided by redundant WTPs), WESTCAPS has selected the two WTP configuration alternatives as the preferred alternative.

Two WTPs will be built as part of the preferred alternative. Treatment trains for each plant will be built as modules. As demand from the plant increases, identical module treatment trains can be added. The WTP locations will maximize the available gravity pressure head, and excess head will provide future reserve delivery capacity.

It is assumed that the South WTP will be built in the year 2005. It is located closest to existing, large water demand areas. The North WTP would not be required for service until the year 2015 (see figure III-8). Incremental pumping will be required at the South WTP until the North WTP goes into operation. At that time, most of the deliveries that require pumping will be transferred to the North WTP. Interconnection of the two plants will provide regional reliability and flexibility of operations. Both plants will be fully utilized to design capacity by the year 2025 (see figure III-9).

The WTP's treatment trains and clearwell reservoirs are to be built as required for service to enable construction by stages according to delivery demands. The designated time periods are the years 2005, 2015, and 2025.

Cost Summary.—The unlimited supply capacity, two WTPs and pipes option is preferred, although it is slightly higher in unit cost than the unlimited supply, one WTP system. The two WTP system was selected rather than the single large WTP system for the following reasons: Additional operating flexibility of multiple WTPs for such a large area; Economics of pipeline sizing and future hydraulic operations flexibility; Reserved hydraulic head, Potential for future growth expansion past the year 2025.

Both the limited supply capacity configurations were more costly and less desirable, because their smaller WTP capacities yielded higher unit cost for water treatment. The distribution systems also were proportionally high for the unit of water delivered. In addition, the pipe sizing has no reserve operational capacity past the year 2010.

Table III-7, shows the cost summary of the four configurations studied. The additional detailed data are located in Appendix A.

Table III-7.-WTPs and distribution pipeline system(total annual cost [$])

Summary						
Description	Annualized capital	O&M	Total annual cost	Cost per ac-ft	Cost per 1,000 gallons[2]	Annual cost per residential unit
Unlimited supply capacity, one WTP and pipes	$36,044,618.00	$29,194,503.00	$65,239,121.00	$425.44	$1.306.00	$212.72
Unlimited supply capacity, two WTP and pipes,[1]	$35,966,967.00	$30,026,879.00	$65,993,846.00	$430.36	$1.321.00	$215.18
Limited supply capacity, one WTP and pipes	$18,389,362.00	$13,172,556.00	$31,561,918.00	$480.54	$1.475.00	$240.27
Limited supply capacity, two WTP and pipes	$18,462,514.00	$13,925,528.00	$32,388,041.00	$493.12	$1.513.00	$246.56

[1]Unlimited supply capacity, two WTP and pipes is the preferred alternative.
[2]Annual cost calculated at 2 residential units per ac-ft, for annual capacities of 153,344.00 and 65,681.00.

The WTPs construction costs (Preferred option, Two WTPs, table III-7) are shown in table III-8. The unit cost of water treatment is slightly less for the South WTP, because it has a larger capacity than the North WTP. Note: at this time, costs for transporting water in the Beardsley Canal to the South WTP are unknown. See table III-11 for the optional cost of a raw water reservoir for the South WTP area. See Appendix A for additional detailed data.

Table III-8.-WTPs

Water Treatment Plants						
Description	**Annualized capital**	**O&M**	**Total annual cost**	**Cost per ac-ft**	**Cost per 1,000 gallons**	**Annual cost per residential unit** [1]
Unlimited supply capacity, North WTP	$8,960,055.00	$2,601,118.00	$11,561,173.00	$179.28	$0.550	$89.64
Unlimited supply capacity, South WTP	$12,414,804.00	$3,336,266.00	$15,751,070.00	$177.26	$0.544	$88.63

[1]Annual cost calculated at 2-residential units per ac-ft, for annual capacities of 153,344.00.

Table III-9 shows the annualized costs for the preferred pipelines study. Included are the pipeline installations, system storage reservoirs, required pumps and other major pipeline appurtenances, as well as the capital and pumping costs for the pumps and boosters for delivery to the listed areas. Note: there is an additional 5 to 7 miles of pipeline linking the north and south WTP systems together to allow a networked system and operational flexibility. See Appendix A for additional detailed data.

Table III-9.-Pipelines, two WTP system

Pipelines - Two WTP System						
Description	**Annualized capital**	**O&M**	**Total annual cost**	**Cost per ac-ft**	**Cost per 1,000 gallons**	**Annual cost per residential unit** [1]
Unlimited supply capacity	$14,592,108.00	$1,087,895.00	$15,680,003.00	$102.25	$0.314	$51.13

[1]Annual cost calculated at 2-residential units per ac-ft, for annual capacities of 153,344.00.

The rate used for the CAP water is assumed to be an unlimited supply priced at $150 per acre-foot. Cost per unit is shown in the summary total in table III-10. Depending on the type and amount of water supply that is available for the year 2025, the actual cost of additional water acquisition may be different than assumed for this cost analysis. Total annual cost represents the purchase of 153,344 acre-feet of water. Cost is for water delivered to a CAP canalside turnout.

Table III-10.-Cost of CAP water

Cost of CAP Water						
Description	**Annualized capital**	**O&M**	**Total annual cost**	**Cost per ac-ft**	**Cost per 1,000 gallons**	**Annual cost per residential unit**[1]
Unlimited supply capacity			$23,001,600.00	$150	$0.460	$75.00

[1]Annual cost calculated at 2-residential units per ac-ft.

Table III-11 shows the cost of an optional raw water reservoir on the Beardsley Canal, South WTP. The costs are shown to estimate the additional cost of providing raw water storage of a certain capacity at a WTP for pretreatment or storage.

Table III-11. Optional, South WTP only, raw water reservoir
(not included in totals of previous tables)

Optional						
Description	**Annualized capital**	**O&M**	**Total annual cost**	**Cost per ac-ft**	**Cost per 1,000 gallons**	**Annual cost per residential unit**[1]
Unlimited supply capacity, South WTP	$992,515.00	$29,645.00	$1,022,160.00	$11.50	$0.035	$5.75
Limited supply capacity, South WTP	$365,602.00	$10,920.00	$376,522.00	$14.06	$0.043	$7.03

[1]Annual cost calculated at 2-residential units per ac-ft, for annual capacities of 153,344.00 and 65,681.00.

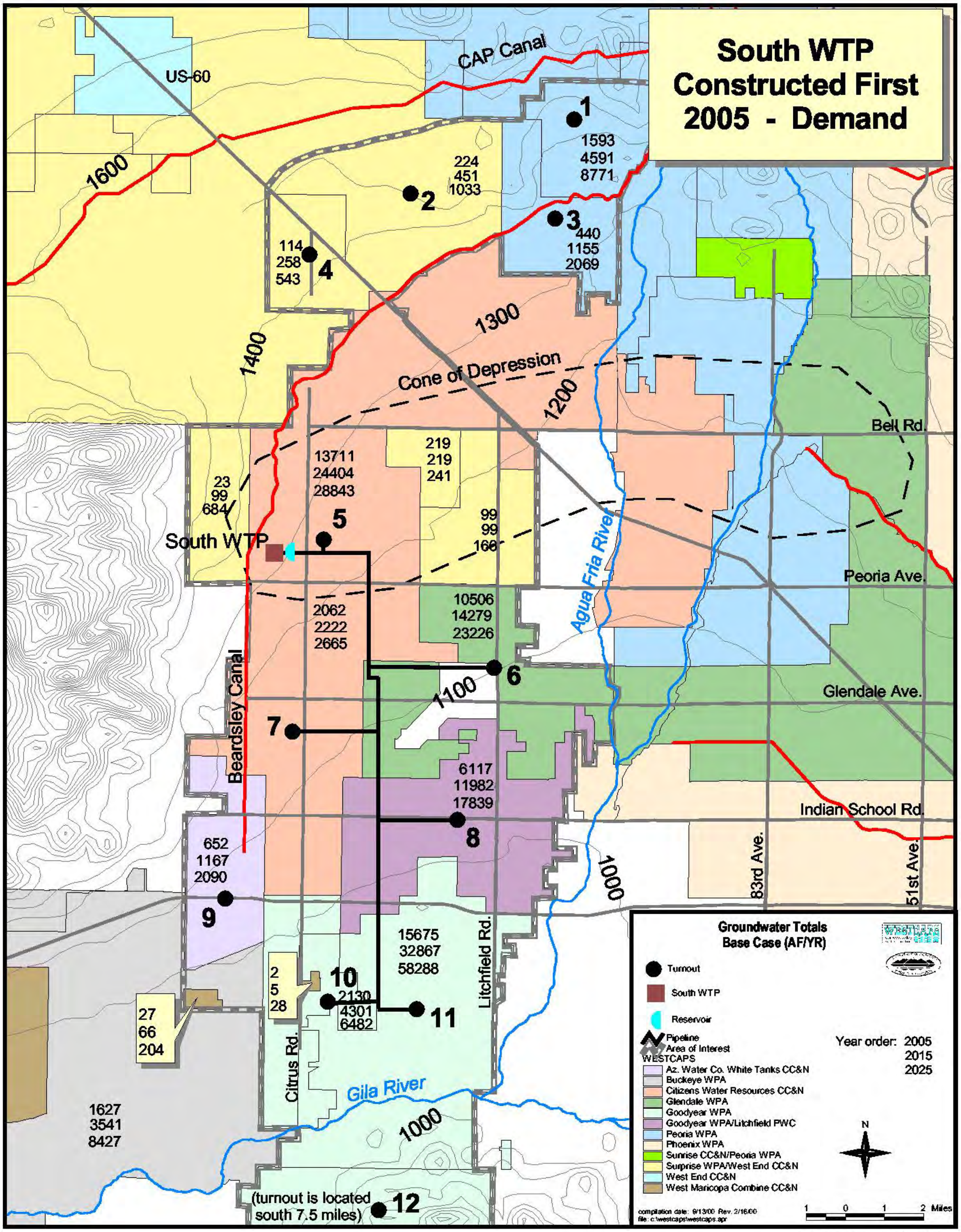


Figure III-16.-South WTP constructed first for the year 2005 demand.

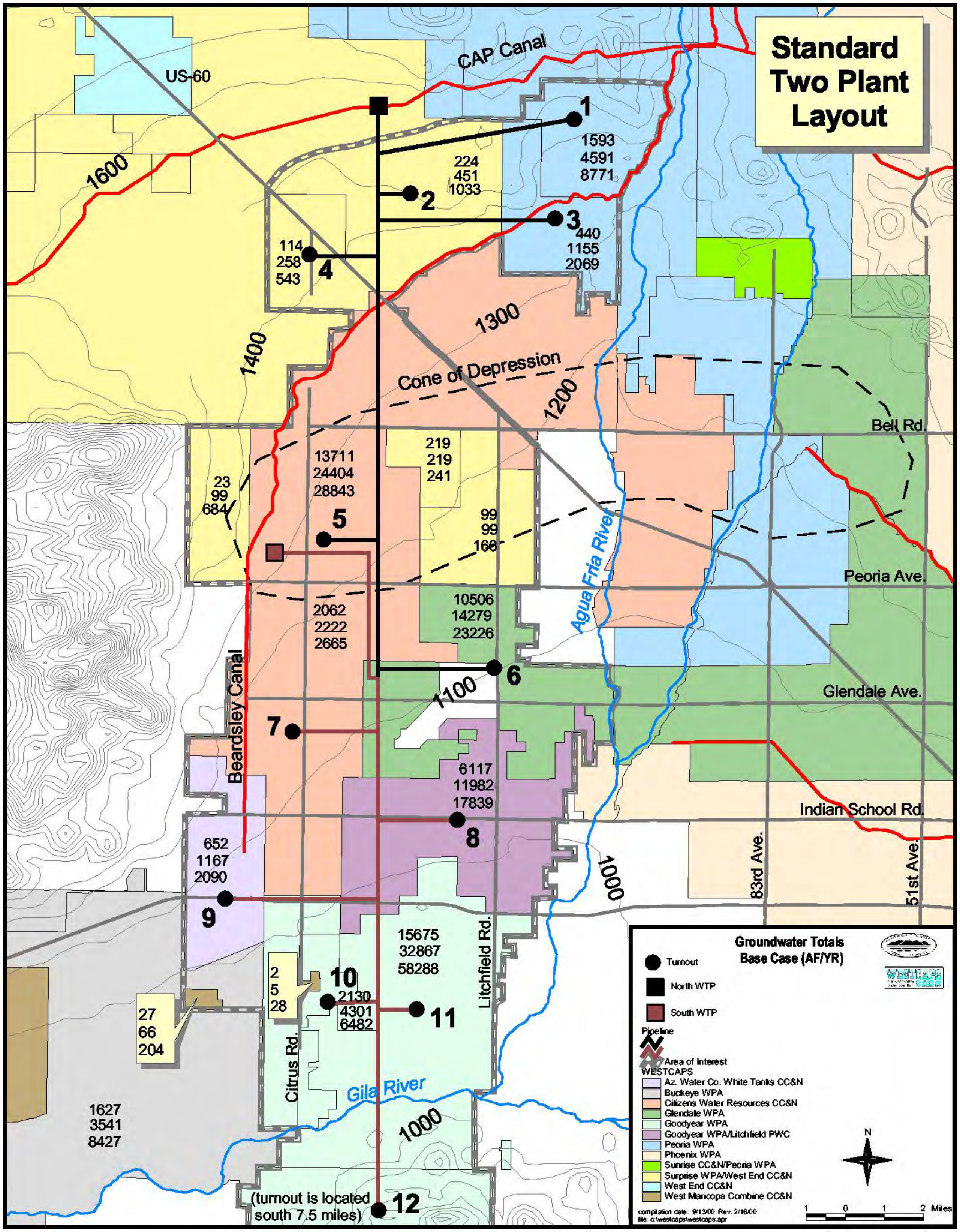


Figure III-17.-Standard two WTP layout.

Chapter IV

Implementation Issues

Institutional Requirements

WESTCAPS evaluated institutional and financing approaches to implement the proposed WESTCAPS Strategy. Possible institutional arrangements are discussed below under two general headings—“No Authority” and “Authority.”

- No Authority—Informal regional cooperation
- No Authority—Subregional partnerships
- Authority—Subregional partnerships and subregional district or authority
- Authority—Regional district or authority

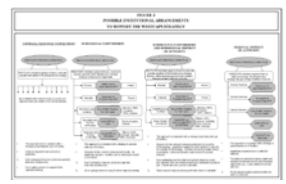
Navigant Consulting, Inc., prepared two figures detailing institutional arrangements WESTCAPS may consider if implementing the WESTCAPS strategy (see figures IV-1 and IV-2).

Figure IV-3 is a drawing that was developed to illustrate similarities and differences between the possible institutional arrangements (i.e., differences between No Authority and Authority considerations).

A comparison was developed to summarize the advantages and disadvantages for No Authority and Authority institutional arrangements (table IV-1).

Financing Options

If the Preferred Strategy is implemented, the following details financial possibilities that could be used:



WESTCAPS concluded that the most significant variable in determining the financing options for implementing the WESTCAPS Strategy would stem from the institutional choice and the authority the institution possessed. Therefore, the timing of the financing decisions likely would occur subsequent to the institutional choice decision.

Research was conducted on the types of financing historically used to implement large public work projects. There are two basic models for financing:

Pay-as-You-Go-Funding

A policy choice in which the entity(s) involved incurs no capital debt.

One aspect of some public works development is to get facilities in place before the need for the facilities is established. This could be seen as a “build it, they will come” plan. When it is necessary to construct facilities prior to k:/whw/templates\11by17.ppt

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Navigant

FIGURE 1
DEFINITION OF POSSIBLE INSTITUTIONAL ARRANGEMENTS
WESTCAPS TECHNICAL COMMITTEE

INSTITUTIONAL ARRANGEMENT	SUMMARY DEFINITION	IMPLEMENTATION STEPS/TIMEFRAME
Compact (or MOU)	Non-binding policy statement outlining cooperative effort to achieve mutual goals.	1. Draft Statement 2. Members Ratify/Sign Projected Time 3 mo-6mo.
Two-Party (or muti-Party)	Ad hoc projects developed by individual members through two party (or multi-party) contracts. Contracts define rights, responsibilities, costs, etc. for project.	1. Ad Hoc Project Definition 2. Contract Negotiations Projected Time: 1 year
Water District	Regional water district formed under state law to provide regional water infrastructure and regional planning for district service area. District governed by elected board representing member's service areas. District has taxing and bonding authority.	1. Amend existing state law 2. Create district 3. Define projects Projected Time 2 to 4 years
Water Authority	Regional water authority formed under state law to provide regional water infrastructure and regional planning for authority service area. Authority governed by an elected or appointed board representing member's service area. Authority may or may not have taxing authority depending upon authorizing legislation.	1. Amend existing state law 2. Create authority 3. Define projects Projected Time 2 to 4 years
Compact /Contact Hybrid	Compact provides framework for coordinated effort of members while members develop projects consistent with their individual needs. Projects may involve multi-party contracts	1. Draft statement 2. Members ratify/sign 3. Define Ad Hoc projects 4. Negotiate contracts Projected Time 1 to 3 years

EXAMPLE INSTITUTIONAL ARRANGEMENTS

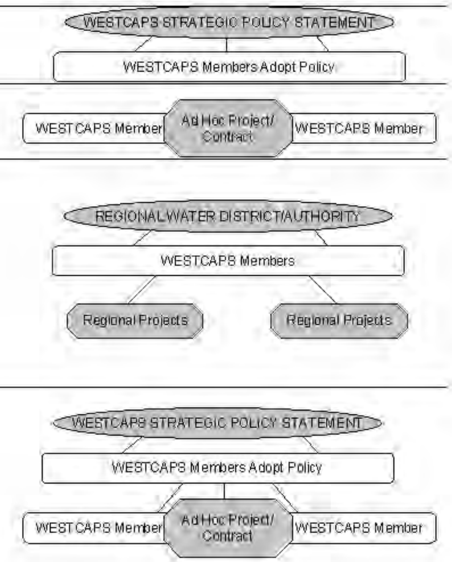

Figure IV-1. Definition of possible institutional arrangements (prepared by Navigant Consulting, Inc.).

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FIGURE 2
COMPARISON OF POSSIBLE INSTITUTIONAL ARRANGEMENTS
WESTCAPS TECHNICAL COMMITTEE

INSTITUTIONAL ARRANGEMENT	ABILITY TO FINANCE INFRASTRUCTURE O&M	ABILITY AND EASE FOR MAKING DECISIONS	DEGREE OF MEMBER CONTROL OVER COST AND QUALITY	EASE OF/ TIMELINESS OF IMPLEMENTATION	ABILITY TO PLAN AND ADAPT	ABILITY TO ACHIEVE ECONOMY OF SCALE	ABILITY TO MEET MEMBER NEEDS	FLEXIBILITY IN MEMBERSHIP
Compact or MOU	Member responsibility	Member responsibility	NA	Construct and Ratify Compact (3 to 6 mo.)	Member responsibility	NA	Member responsibility	New members join by adopting Compact
Two-Party Contract (and/or Multi-Party Contract)	Individual responsibility	Limited to Contract Parties	Based on form of Contract	Negotiate and approve contracts (1 year)	Limited to Contract Parties	Limited to Contract Parties	Limited to Contract Parties	Limited to Contract Parties
Water District[1]	District taxing and bonding authority	District Board responsible for decision-making	Control derived from make-up of District Board	Modify existing Arizona law (1 to 2 years), and create district (1 to 2 years)	District responsible for planning for district needs	District can achieve economy of scale for projects and water allocations	District responsible for membership needs	Requires action by Board pursuant to Arizona law to add members
Water Authority[2]	Authority could have taxing and bonding authority	Authority Board responsible for decision-making	Control derived from make-up of Authority Board	Modify existing Arizona law (1 to 2 years), and create district (1 to 2 years)	Authority responsible for planning for district needs	Authority can achieve economy of scale for projects and water allocations	Authority responsible for membership needs	Requires action by Board pursuant to Arizona law to add members
Compact/Contract Hybrid[3]	Individual responsibility	Limited to Contract Parties with project coordinated with Compact Members	Based on form of Contract	Construct and Ratify Compact (3 to 6 mo.) and negotiate and approve contracts (1 year)	Member responsibility, coordinated with Compact Members	Limited to Contract Parties	Member responsibility, coordinated with Compact Members	New members join by adopting Compact

1 – Water Districts may be loosely defined as special taxing districts pursuant to Arizona Revised Statutes Title 48, Chapters 19 – 22, and 27 – 28. The districts have taxing and bonding authority. Irrigation districts typically require a landowner vote for formation, while multi-county water conservation districts (CAWCD) and replenishment districts require petition by a percentage of landowners and approval by the County Board of Supervisors or Director of ADWR.

2 – Water Authorities may or may not have the ability to tax but generally do have bonding authority. Non-taxing authorities may be found in ARS 45 and ARS 48. Non-taxing authorities may raise revenues through the sale of water and or water infrastructure capacity, or rely on tax revue streams from special taxing districts (ie. AWBA funding).

3 - Compact/Contract Hybrid assumes that the WESTCAPS members develop and sign a compact that outlines ad hoc projects that are then developed by individual members through 2 or multi-party contracts.

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Figure IV-2. Comparison of possible institutional arrangements (prepared by Navigant Consulting, Inc.).

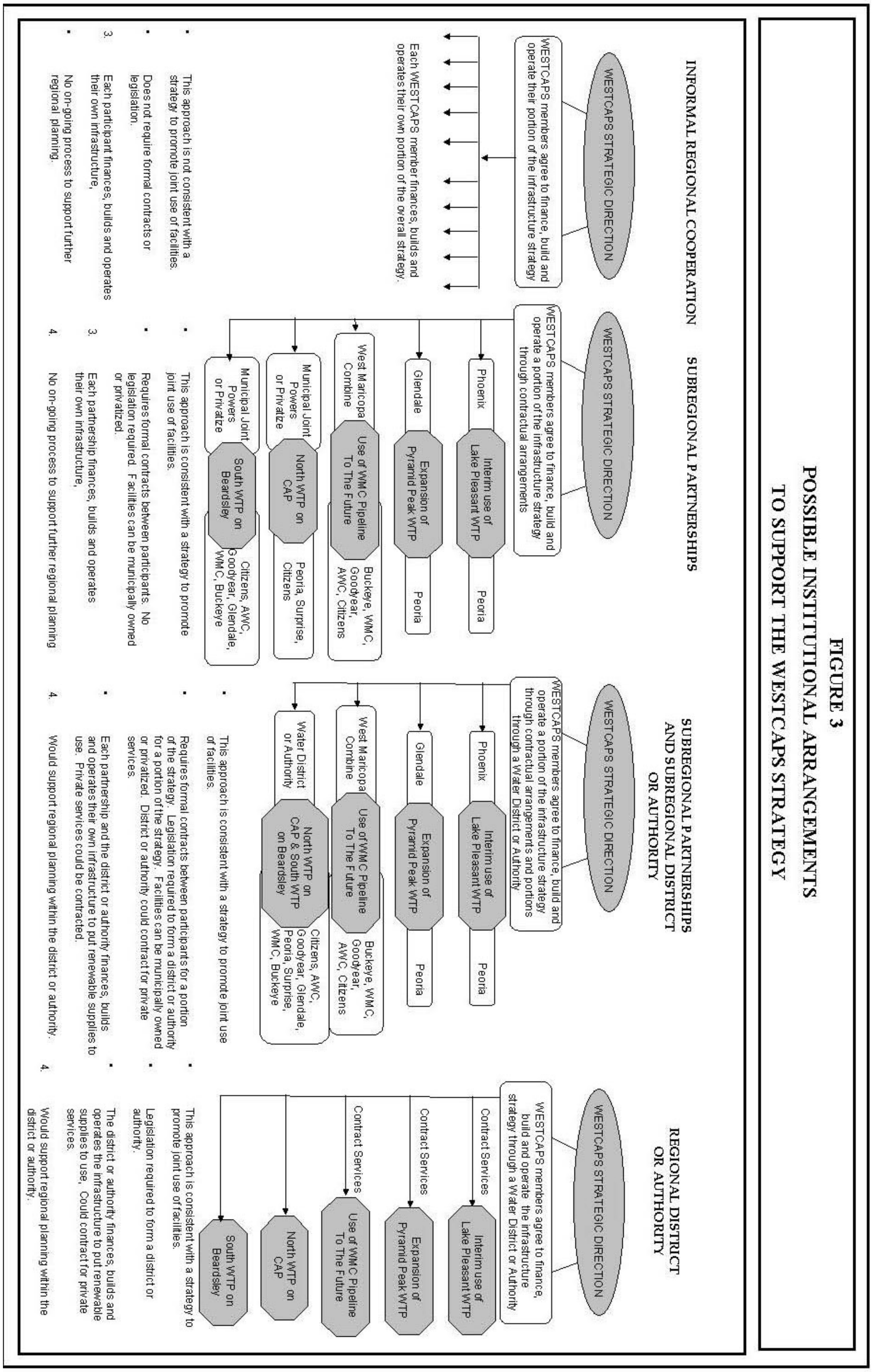


Figure IV-3. Possible institutional arrangements to support the WESTCAPS strategy.

Table IV-1. No Authority versus Authority comparisons

No Authority		Authority	
Advantages	***Disadvantages***	***Advantages***	***Disadvantages***
Easier to implement initially Can be effected without legislation			Requires legislative action to implement Costly to startup
Does not require a new administrative entity Not as political Market driven; only those projects truly needed will be built; projects will be built as needed	No clear leadership on a subregional or regional basis Lack of a regional solution Lack of long-term planning Lack of coordination could lead to inefficiency Creates competition between entities for supplies; exacerbates "haves" and "have nots" Some may do a better job than others; less consistency	Regional water planning and management: (1) ability to negotiate for water acquisitions and (2) additional groundwater, surface water, and reclaimed water infrastructure as needed Ability to meet long-term infrastructure and water supply needs Potential to develop a regional AWS umbrella status More regional economic benefit Ensures regional benefit (greater consistency) More political and bargaining power Regulatory buy-in Pass on costs through the ACC	Loss of control by local entities Additional layer of governing

No Authority		Authority	
Advantages	***Disadvantages***	***Advantages***	***Disadvantages***
Incremental, easy to change overall direction Flexibility to make changes if a two-party agreement More responsive to parties in the contract	Contentious and time-consuming decision-making process (technical and financial) if more than two parties	Once formed, authority for more timely implementation of technical decisions (new construction and O&M) Formal decisionmaking	Harder to hold accountable Harder to shut down if things go awry
	Less reliability in treatment, distribution, and supply	Improved reliability of treatment, distribution, and supplies through integration of resources	
	Inability to tax members below signors of the agreement Compromised ability to finance Higher user fee's	Greater buying power (taxing authority for bonding capacity) Potential to tax property to generate revenue Lower user fee's	Property tax impacts
Voluntary participation	Some entities are excluded and not served	Involuntary membership creates affordability benefits and protects those who will make investments from those who are unwilling to make investments	Involuntary membership

Table IV-1. No Authority versus Authority comparisons (continued from previous page)

the establishment of the economic base, which is the paying public, "pay as you go" may not be viable. Funding under this method is usually considered least cost because it does not involve paying for the cost to use the money (interest). Based on various legal restrictions, this source is normally limited to small-value projects. When applied to a large project, this approach requires facilities to be constructed in small increments, and unit efficiencies are not optimized.

Advantage(s):

- No financing arrangement delay
- More flexibility in contracting out the work

Disadvantage(s):

- Cannot exceed "cash-on-hand."
- Entities assume all the financial risk.
- Pay-as-you-go requires unusually large liquidity to finance large infrastructure projects.
- Typically, this approach is usually most applicable for smaller maintenance and improvement projects rather than larger infrastructure projects.

Revenues to Finance.— Revenues to finance Pay-as You-Go can be accessed through a number of ways:

- Taxes - State law usually grants taxes and taxing authority. These could be property taxes, use taxes, sales taxes, among others.
- Grants - these can be monies given to entities with no repayment. For example, grants could come from the Environmental Projection Agency.
- User fees - fees collected from real estate developers and/or individual parties to pay the costs for construction of the water infrastructure and for acquiring new sources of water. These could be up front fees.
- Water rates - these are usually monthly bills to water users to pay for water service costs, including long-term capital costs and operation, maintenance, and replacement costs. Based on given circumstances, there are many different ways to determine water rates.
- Investment interest - if a fund is established for holding and collecting monies, that fund can accrue interest that is debited to the fund.
- Third party ownership of facilities - services provided to the water service provider on a unit delivery cost basis.

Debt Financing

A decision in which the entity(s) involved incur long-term capital debt on all or a part of their revenue need.

Bonds

Bonds can be private or municipal; there are different types (e.g., general obligation bonds, revenue bonds, municipal development authority bonds, improvement district bonds, and community facilities district bonds.

Characteristic(s):

- "Full faith and credit" bond
- Secured by unlimited property tax pledge

Advantage(s):

- Generally lowest cost financing approach

- No limitation on which projects can be financed (i.e., revenue or nonrevenue projects)
- Risk is spread among various stakeholders, not just the entity with the funding

Disadvantage(s):

- Subject to voter authorization.
- Pursuant to Arizona Constitution, bond principal issuance may not exceed 20 percent of net secondary assessed valuation for water, sewer, lighting, and parks.
- Open spaces, and recreational purposes, and 6 percent of net secondary assessed valuation for all other purposes.

Utility Revenue Bonds.—

Characteristic(s):

- For acquiring, constructing, or improving utility systems (i.e., water, sewer, gas, electric)
- Not a general or "full faith and credit" obligation by the city
- Revenues are secured by the applicable utility

Advantage(s):

- If large liquidity is not available up front as in Pay-As-You-Go, investors front the funding and debt is repaid through existing revenues.
- Risk is spread among various stakeholders.

Disadvantage(s):

- Subject to voter authorization.
- To issue a bond, prior years' net revenues must exceed maximum annual debt service by a specific factor (i.e., revenues divided by the existing annual debt service would need to equal a factor of 1.25).

Municipal Development Authority Bonds.—

Characteristic(s):

- Cities makes annual payments equal to debt service under a lease-purchase or loan agreement with a municipal property corporation.
- City payments can be guaranteed by a pledge of excise taxes, enterprise revenues, or annual appropriations.
- Cities receive ownership of a project when debt is retired.

Advantage(s):

- Cities approve projects, and no voter authorization is required.
- All types of projects are possible.
- Can be used to implement projects with limited public support.

Disadvantage(s):

- To issue a bond, prior years' revenues must exceed maximum annual debt service by some factor.

Improvement District Bonds.—

Characteristic(s):

- Includes financing waterworks, sewers, streets, levees, etc.
- Secured by assessments levied against property located within the district but is backed by a contingent liability of a city/cities general fund.
- Improvements to be made cannot be of general benefit to only the city/cities; they must also be of benefit to the district.
- Not subject to voter authorization but may be rejected by a majority of property owners within the district.

Advantage(s):

- Opportunity to accomplish a larger project if benefit is not only for cities but also the district
- Potential for raising more capital
- No legal limitations

Disadvantage(s):

- It may be possible that the only authority for use of such bonds is for improvement purposes only.
- Limited by value of property within the district.
- Limited by the general creditworthiness of city and existing debt burden.

Street and Highway Revenue Bonds.—

Characteristic(s):

- For improving, constructing, or maintaining city streets and highways or for acquisition of necessary rights-of-way
- Typical projects are strictly for streets and highways.
- Financing secured through city's receipts of state-shared gas taxes and other highway user fees and charges.
- No further discussion since water and sewer projects are not applicable.

Loans

Loans can be public or private. There are several different types of loans from the public and private sectors. The most widely used public loan source in Arizona is the Water Infrastructure Finance Authority revolving fund, which provides loans with significant savings through reduced borrowing amounts, lower interest rates than market rates, and shared or reduced closing costs. These loans have changed the way funding is historically acquired, through appropriations and grants. Federal and State contributions are used to capitalize funds. Funds are repaid, and repaid funds are used to finance new loans. States can leverage capitalization. Other loans can be financed through Federal agencies through the Bureau of Reclamation and the Bureau of Indian Affairs. These often offer much lower interest rates and longer repayment periods.

Federal Funding.—

U.S. Department of Agriculture, Rural Utilities Service
The U.S. Department of Agriculture's (USDA) Rural Utilities Service (RUS) loan and grant programs assist eligible applicants in rural areas and cities and towns of up to 10,000 people. Drinking water facilities may be financed with direct and guaranteed loans and grants. Applicants must be unable to finance their needs through their own resources or with credit from commercial sources. About $1.2 billion was available for loans and grants during fiscal year 1997. The State and local USDA Rural Development offices oversee the programs.

U.S. Department of the Interior,
Bureau of Reclamation

The Central Arizona Project's Colorado River Basin Project Act of 1968 authorizes construction of various features, including:

- Municipal and Industrial Water Distribution Systems - Also known as 9c loans, authorized by the Reclamation Act of 1939 - Specific funding was established and has been indexed up; this funding has a low repayment interest rate of 3.3 percent.

- Indian Distribution Division Water Systems - Funding is available and could be used for on Reservation or off Reservation systems if the systems are for the benefit of a tribe, (in this case probably the Gila River Indian Community). A repayment contract would be required.

State Funding.—

State of Arizona, Arizona State Drinking, Water Revolving Fund

Created by the Arizona State Legislature on April 22, 1997, the goal of this fund was to assist public water systems in financing the costs of infrastructure needed to achieve or to maintain compliance with the Safe Drinking Water Act. The funding is intended for any public water system within State boundaries, but a particular emphasis was assigned to smaller systems providing water to less affluent communities. Funding is derived from the legislature at approximately $3.4 million and EPA funding at approximately $17 million.

Cost of Water

The cost of water is separated into two parts: water budget and costs. The water budget discussion details both the project groundwater pumping demands estimated for year 2025 and how that groundwater pumping could be replaced by renewable water supplies from alternative water resources. The costs portion of the cost of water discussion presents recent acquisitions costs for obtaining new water supplies. In addition to the estimate for the potential acquisition cost of water, an estimate has been made as to the expected cost for operation, maintenance, and replacement associated with each water supply.

Water Budget

In 2025, WESTCAPS projected groundwater pumping is estimated to be 211,874 ac-ft/yr. Available water supplies that are expected to offset the projected groundwater pumping include: incidental recharge water, unused CAP water allocations, reallocated CAP water, MWD surface water, and GRIC water leases. The estimated total available water supply is 107,962 ac-ft/yr. Other potential water supplies include leases from Indian communities, CAP agricultural priority water, groundwater from waterlogged areas, reclaimed water, and Butler Valley groundwater. The estimated volume of water supply from these potential sources is 103,912 ac-ft/yr. Figure IV-4 shows the distribution of the potential water budget with respect to existing and potential water resources.

Analysis Estimating Amount of Reclaimed Water

WESTCAPS estimated the amount of reclaimed water available to address future industrial and turf demands served by the potable water system. Several steps were taken in estimating the amount to reclaimed water. First, there was an estimate for the number of new residents that would be added into each member's service area between 2000 and 2025 (see figure IV-5). The estimate included information that each resident would generate 77 gallons of effluent a day. A calculation was made to determine the total quantity of reclaimed water potentially available. Next, an allocation of that total

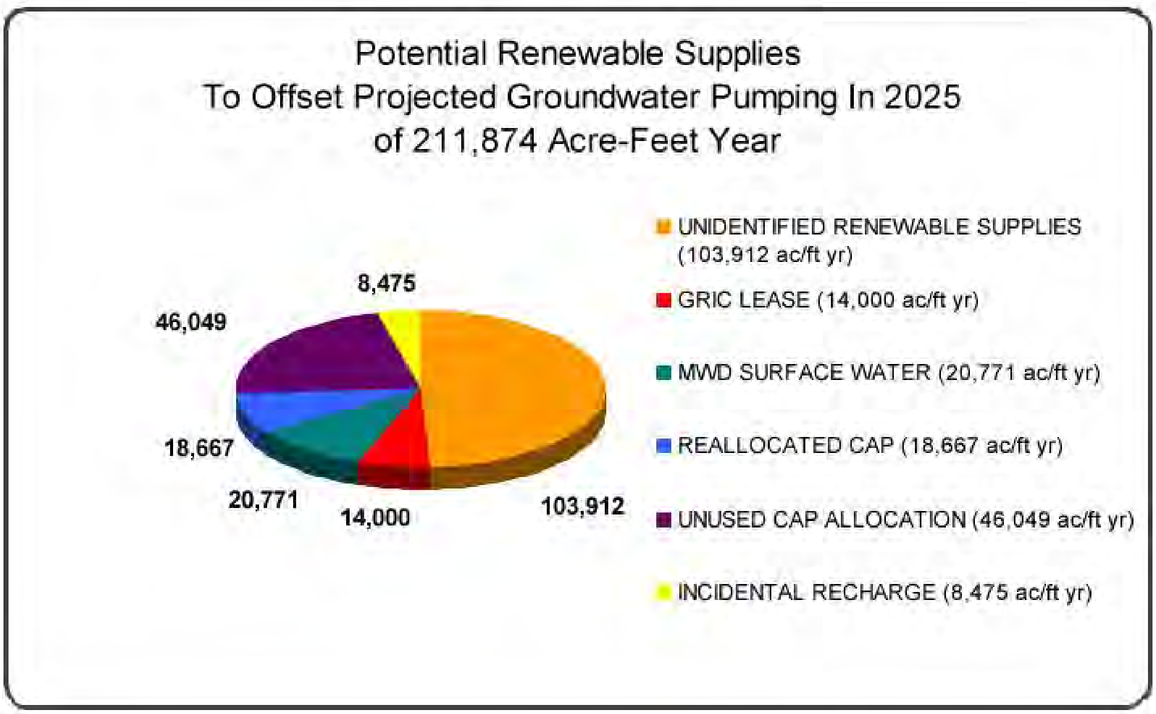


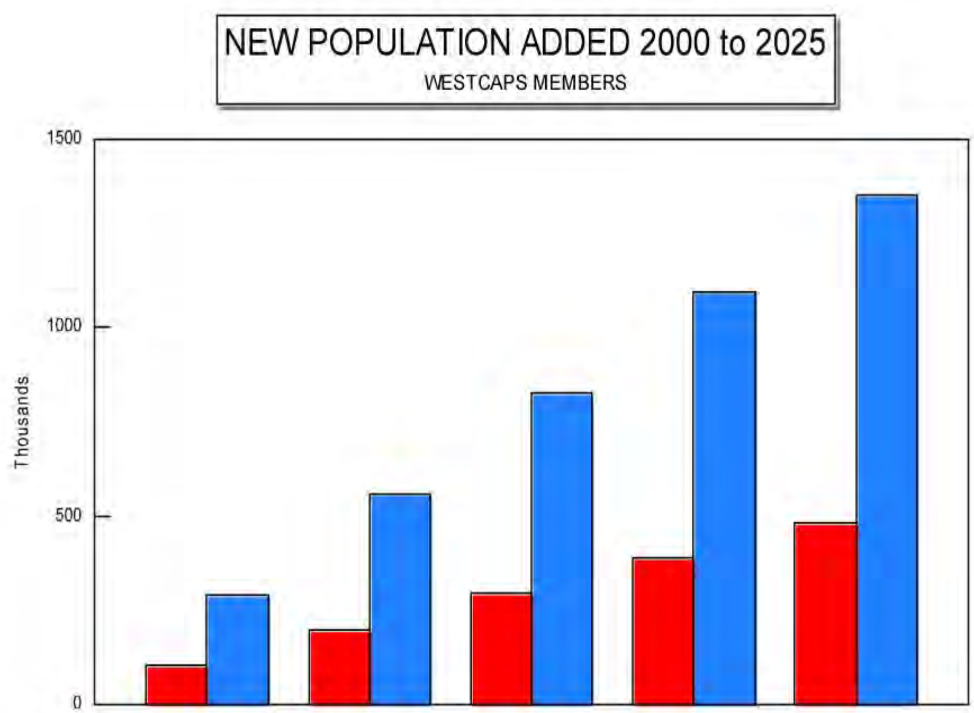
Figure IV 4. WESTCAPS potential water budget to offset projected groundwater pumping quantity was made for industrial and turf needs. The remaining quantity of reclaimed water was assumed to be available for reallocation to other uses. The other uses, in this case, would be used to offset demand from new population growth in each WESTCAPS member's water service areas (see figure IV-6).

Costs of Future Water Supplies

As part of this general report, Alan Kleinman, Reclamation Regional Economist, prepared a report featuring the potential cost of water in the CAP area. Kleinman's research focused on the development of expected projections for source and availability of water supply and its associated costs—capital and operation, maintenance, and replacement costs for the year 2025.

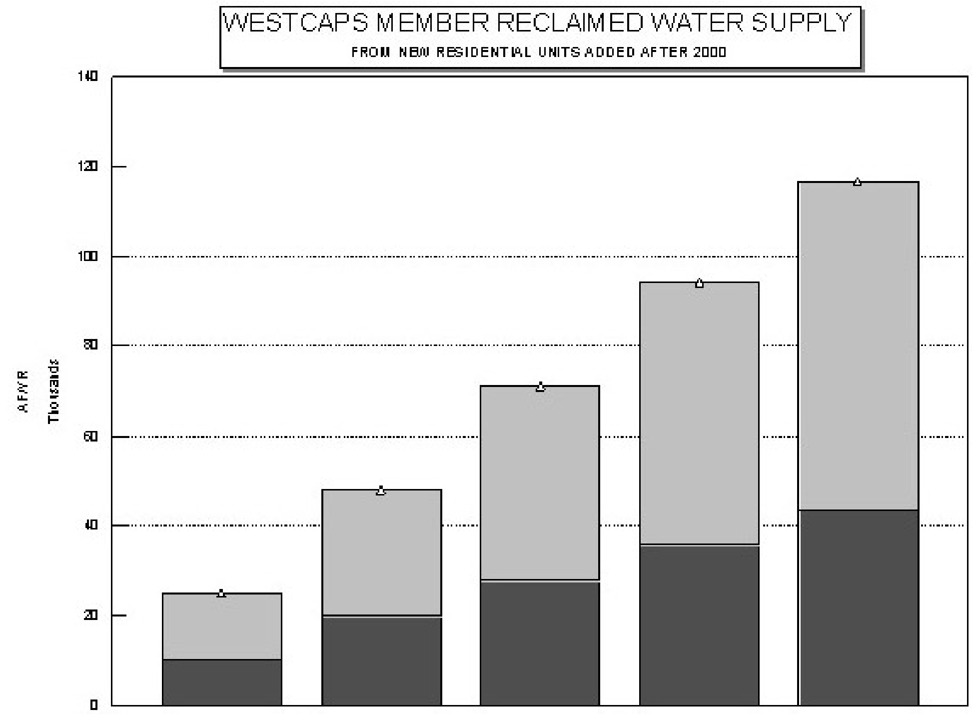
Potential Cost of Water for CAP Area

The best indicators of the potential cost for additional water supplies are actual market transactions. However in Arizona, market transactions involving water are rare. Any transactions that have occurred are severely constrained with institutional and political considerations. In actual transactions, it is often difficult to ascertain the true costs paid for a water right, but attempts have been made to arrive at actual costs.



YEAR	2005	2010	2015	2020	2025
Residential Units	103562	199679	294219	390525	482549
PEOPLE	289974	559101	823813	1093470	1351137

Figure IV-5. Between years 2000 to 2025, new population added to WESTCAPS members' service areas.



YEAR	2005	2010	2015	2020	2025
INDUST/TURF	10443	19794	27777	35748	43581
NOT ALLOCATED	14568	28429	43279	58565	72957
TOTAL	25011	48223	71055	94313	116538

Figure IV-6. WESTCAPS potential reclaimed water supply.

Review of Actual Reported Market Transactions

A starting point for this current review is data published in *The Water Strategist*. This publication collects data on water transactions from most of the western States. The most recent data are summarized in table IV-2. Reported transactions were selected because they appear to be representative of the type of water supplies in which the WESTCAPS group might be interested. Included are data for both actual sales and leases. The leased values are typically on a per ac-ft basis for each year of the lease. Sales prices vary widely between regions and within fairly local areas. It appears that prices applicable to central Arizona are in the range of $1,000 to $1,500 per ac-ft of water right. It is apparent that the price per unit of water is significantly influenced by the quantity purchased. Smaller transactions usually have a higher cost per ac-ft. The reported values include costs for surface water, groundwater, and reclaimed water.

The City of Scottsdale transaction for CAP M&I water rights is at the rate of $1,100 per ac-ft, and is a 100-year lease and not an actual sale. The Tucson water transaction for $1,500 per ac-ft is a Type II grandfathered water right and continues into perpetuity. Reclaimed water transactions costs range from $450 to $500 per ac-ft. This water is suitable only for outdoor use and is usually applied to golf turf areas.

Summary of Actual Water Costs in Central Arizona

A summary of computed costs of alternative water supplies is shown in table IV-3. In an attempt to place water costs on a comparable basis and in addition to the cost of securing the right, a cost must be added for annual OM&R associated with the water supply. For example, if one has a right to groundwater, the cost of pumping the water to the surface must also be considered.

For this analysis, capital costs are assumed to occur at the present. In addition, the associated OM&R costs are assumed to escalate at the rate of 3 percent annually. Capitalization of the OM&R costs is accomplished using a 6-percent discount rate. All costs in the sample water cost table are on an ac-ft basis.
Ten estimates of the cost of alternative sources of water are provided. The equivalent capital costs range from $1,095 to $3,724 per ac-ft. This range includes reclaimed water. Elimination of reclaimed water results in a lower bound of $1,692 per ac-ft. Table IV-2 presents a summary of water sales and leases as researched from recent articles in *The Water Strategist.*

Type II Grandfathered Water Rights

The 1980 Groundwater Management Act established only a few Type II grandfathered water rights. However, these water rights do exist and are occasionally transferred. Transfer can occur within an AMA. Transaction costs are in the range of $1,500 per ac-ft. A pumping cost of $30 per ac-ft is added to the initial capital cost. Capitalization of the pumping cost results in a value of $892. The total equivalent cost then becomes $2,392 per ac-ft.

CAP M&I Subcontract Water

There is a limited amount of CAP M&I subcontract water that becomes available from time to time. The capital cost associated with such water is shown to be $647 per ac-ft, which represents the present value of the capital obligation to CAWCD. The OM&R portion is estimated to be $1,724, which includes both variable and fixed OM&R charged over the next 50 years. These costs are inflated at 3 percent annually and then discounted at a 6-percent rate. In addition to these estimated costs, CAWCD will likely add other costs associated with the reassignment of an M&I subcontract. The magnitude of such costs is unknown at this time.

Indian Water Leases

One of the most promising sources of substantial quantities of water would be 100-year leases of water from local Indian communities. There have been a number of transactions that have already occurred with a capital cost of $1,200 per ac-ft. It is not readily apparent what the basis is for the $1,200 cost, but it appears to be rather “fixed” and not likely to vary much over time. When the OM&R cost associated with CAP water is added, the total cost is estimated to be $2,924 per ac-ft.

Underground Storage Credits

Presently, a certain amount of underground storage credits exist. Additionally, more credits are being generated each year, because of excess

TABLE IV-2. Summary of recent water sales and leases (source - *The Water Strategist)*

Summary of recent water sales and leases – from *The Water Strategist*						
Area	**Quantity (ac-ft)**	**Use or purpose**	**Source**	**Sales price**	**Lease price**	**Transaction period**
California West Coast Area	4195.60	M&I	Groundwater	N/A		July 1998 to June 1999
California Central Area	335.50	M&I	Groundwater	$3000.00		July 1998 to June 1999
California West Coast Area	23,223.04	M&I	Groundwater		$107.00	July1998 to June 1999
California Central Area	31,128.83	M&I	Groundwater		$206.00	July 1998 to June 1999
California West Cost Area	3,211.00	M&I	Groundwater		no takers	July 1998 to June 1999
California Central Area	33,204.00	M&I	Groundwater		no takers	July 1998 to June 1999
Bureau of Reclamation, Colorado		M&I	Colorado River		$55,000.00	
Albuquerque, New Mexico	72.01	M&I	Rio Grande	$4,100.00		1999
Schertz, Texas	2,800.00	M&I	Groundwater		$85.00	1999
Nevada		M&I	Truckee River	$2,700.00		1999
Tucson, Arizona	9,809.50	Landscaped	Reclaimed	$475.00		1999
Salt Lake City, Utah	9,503.00		Irrigation. district	$455.00		1999
Tucson, Arizona	170.10	M&I	Groundwater	$1,500.00		1999
Nevada	15.00	Instream	Newlands	$604.00		1999
City of Scottsdale	14,591.00	M&I	CAP M&I	$1,100.00		
Lafayette, Colorado	301.00	M&I	River	$4,250.00		1998
Westminster, Colorado	22.50	M&I	River	$8,555.00		1998
Boulder, Colorado	54.25	M&I	River	$774.00		1998
Albuquerque, New Mexico	199.00	M&I	Rio Grande	$2,200.00		1998

TABLE IV-2. Summary of recent water sales and leases (source - *The Water Strategist)*
(continued from previous page.

Summary of recent water sales and leases – from *The Water Strategist*						
Area	**Quantity (ac-ft)**	**Use or purpose**	**Source**	**Sales price**	**Lease price**	**Transaction period**
Parker, Arizona	3,030.00	M&I	Colorado River	$750.00		
Tucson Water	8,511.00	Landscaped	Reclaimed	$462.00		
Las Vegas Valley Water District	7,500.00	M&I	Groundwater	$3,000.00		
Longmont, Colorado; Ditch, Colorado	28.00	M&I	River	$1,250.00		
Bureau of Reclamation, Colorado	2,000.00		Stored	$1,200.00		
Albuquerque, New Mexico	33.00	M&I	Rio Grande	$2,200.00		
Los Lunas, New Mexico	86.00	M&I	Groundwater	$4,800.00		
El Paso, Texas	102.00	M&I	Rio Grande	$5,500.00		

Sample water costs and sources in the CAP area (all costs on a per ac-ft basis).

Note: Purchase cost based on recent sales thought to be representative of CAP area; future costs are inflated at 3 percent annually and capitalized at 6 percent. Table IV-4 presents sample water costs and sources of potentially available water supplies for year 2025.

CAP water availability. Actual capital costs are difficult to estimate but are believed to be $800 per ac-ft. This cost is based on the actual cost of storage of units of water extended over a 100-year period. Adding the cost of groundwater withdrawal brings the total cost per ac-ft to $1,692.

Reclaimed Water

The cost of reclaimed water is significantly less than any other water supply. Because of the large requirement of outdoor irrigation in the area, consideration should be given to supplementing the total water budget needs with some quantity of reclaimed water. As shown, the total cost of reclaimed water is estimated to be about $1,095 when including an OM&R component of $20 per ac-ft.

Irrigation District Water

Non-Indian irrigation water rights might be a viable source of water at a fairly reasonable cost. A number of valley cities are engaged in a Hohokam buy-out arrangement. The cost of the water is $2,174 per ac-ft. Under the stipulated agreement between the United States and CAWCD, it is likely that a form of "9(d) debt forgiveness" will be provided to current non-Indian contractors. However, a significant portion of the obligation to the United States will be transferred to CAWCD that will seek to place the cost burden on other parties.

Conceptually, rights to non-Indian agricultural water could be negotiated with CAWCD even though such rights are being extinguished.

Colorado River Water

The consideration of water rights along the mainstem of the Colorado River is fraught with considerable uncertainty. The value provided in the table IV-3 of $2,474 per ac-ft is based on a single transaction between the United States and the City of Needles. It is well known that the Cibola Irrigation District has long sought to market its water right, which is of a fairly high priority. Currently, Cibola is seeking to sell about 16,000 ac-ft at a price thought to be in the range of $2,500 per ac-ft. A Cibola water right would face the difficult task of arranging for wheeling of the water through the CAP facilities. Although there is excess capacity for wheeling in the aqueduct, negotiating a reasonable cost may be a formidable task. CAWCD is required to allow wheeling of additional water through the system, but it may require very severe restrictions and costs.

Purchase and Retirement of Agricultural Lands

Agricultural lands that have Type I grandfathered water rights have a right of conversion of ground water for M&I use at 1 ac-ft per acre. It is assumed that the land could be purchased for about $4,000 per acre, with half the cost attributable to the groundwater right. The total cost would be estimated at about $2,892 per ac-ft.

Purchase and Conversion of Agricultural Lands

Agricultural lands that have not extinguished its CAP water right carry a right of conversion to M&I use of 1 ac-ft per acre. Though not totally clear, it is generally believed the water must be used on urban development on those same lands. The stipulated settlement between the United States and CAWCD will probably result in extinguishing the rights. The estimated cost of converted rights is about $3,724 per ac-ft.

Remote Water Farms

Because they one of the higher cost alternatives, water farms are now somewhat in disfavor. Their costs are estimated at $3,116 per ac-ft. Wheeling of the water is a major consideration. Once thought to be the solution for obtaining future water supplies, the fact that the water must be pumped out of the ground increases costs considerably.

Groundwater Impacts

A Modflow groundwater simulation, referred to as "Solution strategy September 15, 2000 (Sun City pumping)," was run to predict how future water demand assumptions associated with the initial WESTCAPS strategy (September 15, 2000), might affect WSRV groundwater levels in the years 2025 and 2100. This model is derived from the WESTCAPS strategy (June 30, 2000, ["Solution strategy June 30, 2000, Sun City not pumping"]), but with slightly different assumptions regarding groundwater pumping in the Sun City/Sun City West areas. Solution strategy (September 15, 2000) is similar to

Solution strategy (June 30, 2000), but with more groundwater pumping in the Sun City areas. Solution strategy (June 30, 2000) was one alternative scenario that would begin in the year 2010. Under this alternative, groundwater pumping was reduced an equal amount to the volume of CAP water supplies that would be renewed.

This section compares and contrasts the simulated water levels of Solution strategy (September 15, 2000 [Sun City pumping]) with Solution strategy (June 30, 2000 [Sun City not pumping]) and the Basecase. The Solution strategy (September 15, 2000 [Sun City pumping]) will be referred to as "Solution September 15, 2000," and Solution strategy (June 30, 2000 [Sun City not pumping]) will be referred to as "Solution June 30, 2000," for the remainder of this section.

Solution September 15, 2000, shows that the SRV groundwater model can be sensitive to changes in pumping within localized WSRV areas. Compared to Solution September 15, 2000, Solution June 30, 2000, meets the Sun City Water Company and Sun City West water demands until the year 2025, by using CAP

Table IV-3. Sample water costs and sources in the CAP area

Water source	Capital cost ($/af)	OM&R cost ($/af)	Total cost ($/aft)
Type II grandfathered water wights[1]	1,500	892	2,392
CAP M&I subcontract[2]	647	1,724	2,371
Indian water lease[3]	1,200	1,724	2,924
Underground storage credits[4]	800	892	1,692
Reclaimed water[5]	500	595	1,095
Irrigation district water[6]	450	1,724	2,174
Colorado River water[7]	750	1,724	2,474
Purchase and retire agricultural land (GW)[8]	2,000	892	2,892
Purchase and convert agricultural land (SW)[9]	2,000	1,724	3,724
Remote water farm[10]	500	2,616	3,116

[1]OM&R cost based on $30 per ac-ft pump cost.
[2]Capital cost based on $43 per ac-ft for period of repayment. OM&R based on $58 per ac-ft.
[3]OM&R based on $58 per ac-ft.
[4]Capital cost based on in-lieu recharge water at $45 per ac-ft, with a net cost of $24 per ac-ft.
[5]Based on sales in the Tucson AMA. OM&R at $20 per ac-ft.
[6]Based on Hohokam sales of agricultural water rights.
[7]Based on recent transactions.
[8]Based on land cost of $4,000 per acre and pumping cost of $30 per ac-ft.
[9]Based on land cost of $4,000 per acre and OM&R cost of $58 per ac-ft.
[10]Based on land cost of $2,000 per acre, pumping cost of $30 per ac-ft, and OM&R cost of $58 per ac-ft.

surface water supplies and not having to pump any groundwater.

In contrast, between the years 2010 and 2025, Solution September 15, 2000, requires Sun City Water to pump about 4,200 ac-ft/yr of water from their groundwater wells. During that time, Sun City West would need to pump about 2,400 ac-ft/yr of water from their groundwater wells. By the year 2025, the Solution September 15, 2000, groundwater model predicts a 20- to 60-foot drop in the water table from that of Solution June 30, 2000, in the Agua Fria River area between about Grand Avenue (US-60) and Union Hills. By the year 2100, the water table will drop 60 to 80 feet because of this pumping.

Figure IV-7 shows six key WSRV point (hydrograph) locations and the recharge facilities in addition to the contours of depth to water. It is at these hydrograph locations where simulated water levels from the Basecase and Solution June 30, 2000, are comparing and contrasting information to Solution September 15, 2000, between the years 2000 to 2100. Comparisons are shown on selected hydrographs and bar charts at several selected hydrograph locations for the middle alluvial unit (MAU). One bar chart type compares the simulated changes in water levels (drawdown) from the year 1989 to 2000, 2025, and 2100. Another chart type compares the difference in feet between the simulated depths to water for Solution June 30, 2000, and Solution September 15, 2000, versus the Basecase.

Simulated water levels in the lower alluvial unit (LAU) generally mimic those of the MAU, with some exceptions as discussed later. It is for this reason LAU hydrographs and charts are not included. The depth to water in the year 2100 for Solution September 15, 2000 is shown in figure IV-8, and the depth to water in the year 2025 for the upper alluvial unit (UAU) is shown in figure IV-9. Hydrographs and charts were not generated for the UAU, because much of it is already dewatered or is projected to be dewatered in future years and had a limited areal extent.

These hydrograph locations were chosen to represent historical and/or predicted groundwater conditions unique to the area. For example, locations A (Bell and 83rd Avenue) and F (Beardsley Road and Grand Avenue), and location D (Luke Cone) are in areas with relatively severe predicted and historical water level drawdown declines, respectively. Locations B (CAP Canal at US-60) and E (I-17 and Indian School) were chosen because their historical and predicted drawdowns, water table gradients, and rates of decline were moderate. At these locations, the simulations are relatively insensitive to changing pumping/recharge assumptions in other WSRV. Location C (Buckeye at AZ-85) reflects shallow groundwater level conditions where waterlogging is prevalent and water levels are predicted to remain or rise above their 1989 levels over time.

Comparison of Results - Basecase versus Solution strategy (September 15, 2000) (WESTCAPS strategy [September 15, 2000])

Solution September 15, 2000, depth to water levels in the year 2025 for the MAU and LAU range from 0 to 250 feet less than the Basecase across the WSRV. Simulated water level elevations are nearly identical in most of the WSRV between the two aquifers. This was not necessarily true in previous solutions (i.e., Basecase) where large pumping contrasts existed for the two layers in places and with the presence of aquitards that led to distinct vertical gradients between the layers in later years.

In the year 2025, the simulated water table in Solution September 15, 2000, is nearly 200 feet higher than the Basecase at Bell and 83rd Avenue (see figure IV-10), and 250 feet at I-10 and Litchfield Road.

Also, in the year 2025, there is no change between the two scenarios in the eastern one-third of the WSRV area and Buckeye area, a part of the WSRV. For these areas, the recharge and pumping conditions are unchanged from Solution June 30, 2000, and the Basecase. Along the foothills of the White Tank Mountains, the Solution September 15, 2000, groundwater levels are 100- to 150-feet higher than for the Basecase (see figure IV-11).

By the year 2100, Solution September 15, 2000, water levels are simulated to be about 600 feet higher than the Basecase at Bell and 83rd Avenue (see figure IV-12), 300 to 500 feet higher along the White Tank Mountains, and 300 to 350 feet higher than Basecase at I-10 and Litchfield Road.

In the southeast WSRV (i.e., hydrograph location), the differences range from 50 to 100 feet higher. In the year 2100, water level differences from the Basecase in the Luke area and at Beardsley and Grand Avenue are about 500 and 425 feet higher, respectively, than the difference between the solutions at Bell and 83rd Avenue (Basecase).

For the Basecase, the interpolated water level decline rates from the years 2025 to 2100 are significant. The Luke and Beardsley/Grand area decline rates are similar at about 3 to 4 feet per year. However, at Bell and 83rd Avenue, the Basecase rate of decline is almost 6 feet per year (see figure IV-10). In contrast, for Solution September 15, 2000, the water level changes between the years 2025 and 2100 are nearly flat at Bell and 83rd Avenue and actually rise about 50 feet over that time period in the two hydrograph areas. In the Buckeye area, there are no solution differences. All three solutions show depths to water of about 30 feet between the years 2025 and 2100 (see figure IV-13). Finally, in the CAP Canal and US-60 area, Solutions September 15, 2000, and June 30,2000, show little to no water level decline out to the year 2100. At I-17 and Indian School Road, the water table declines about 50 feet from the years 2025 to 2100 (see figure IV-14) in Solutions September 15, 2000, and June 30, 2000.

Depth to Water Levels.—Solution September 15, 2000, model differences are similar between the MAU and LAU in most of the WSRV except in one northern area and east of the White Tank Mountains. Near the Agua Fria recharge facility and the Surprise McMicken facility, the MAU seems to show about 100 feet of recovery (positive drawdown) since the years 1989 to 2025, and 100 to 200 feet of recovery at the year 2100, respectively. These facilities may have significant positive influence on MAU water levels in both the years 2025 and 2100, and/or from the reduced Sun City pumping in the MAU. For either the years 2025 or 2100, there is no recovery indicated in the LAU in this location.

In the years 2025 and 2100, depth to water in the UAU ranges from zero along the Gila River in the Buckeye area, to about 350 feet on the north at Peoria Road on either side of the Agua Fria River (see figure IV-9). Some square mile

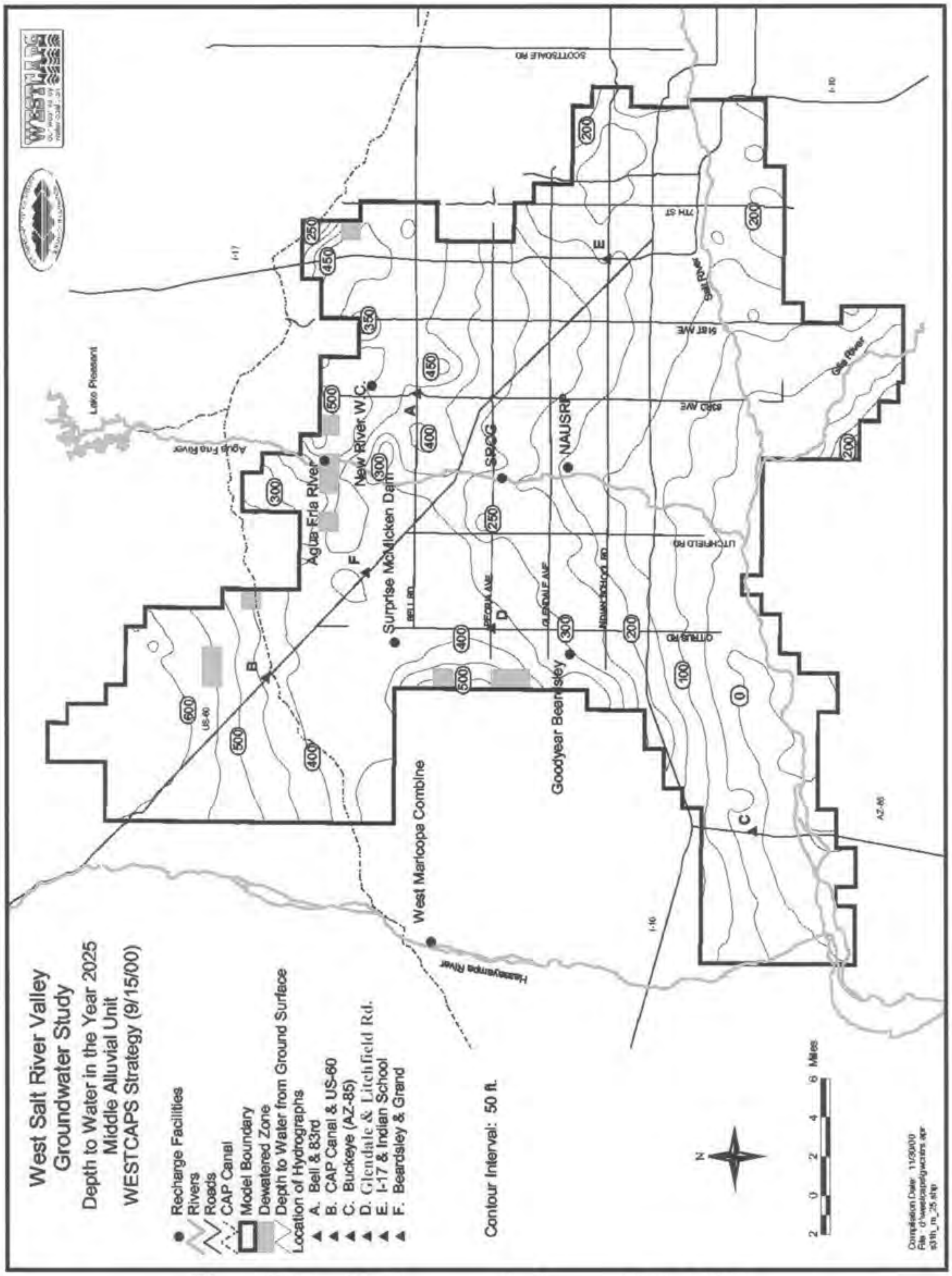


Figure IV-7.Depth to water in the year 2025, MAU
(WESTCAPS strategy, dated September 15, 2000)

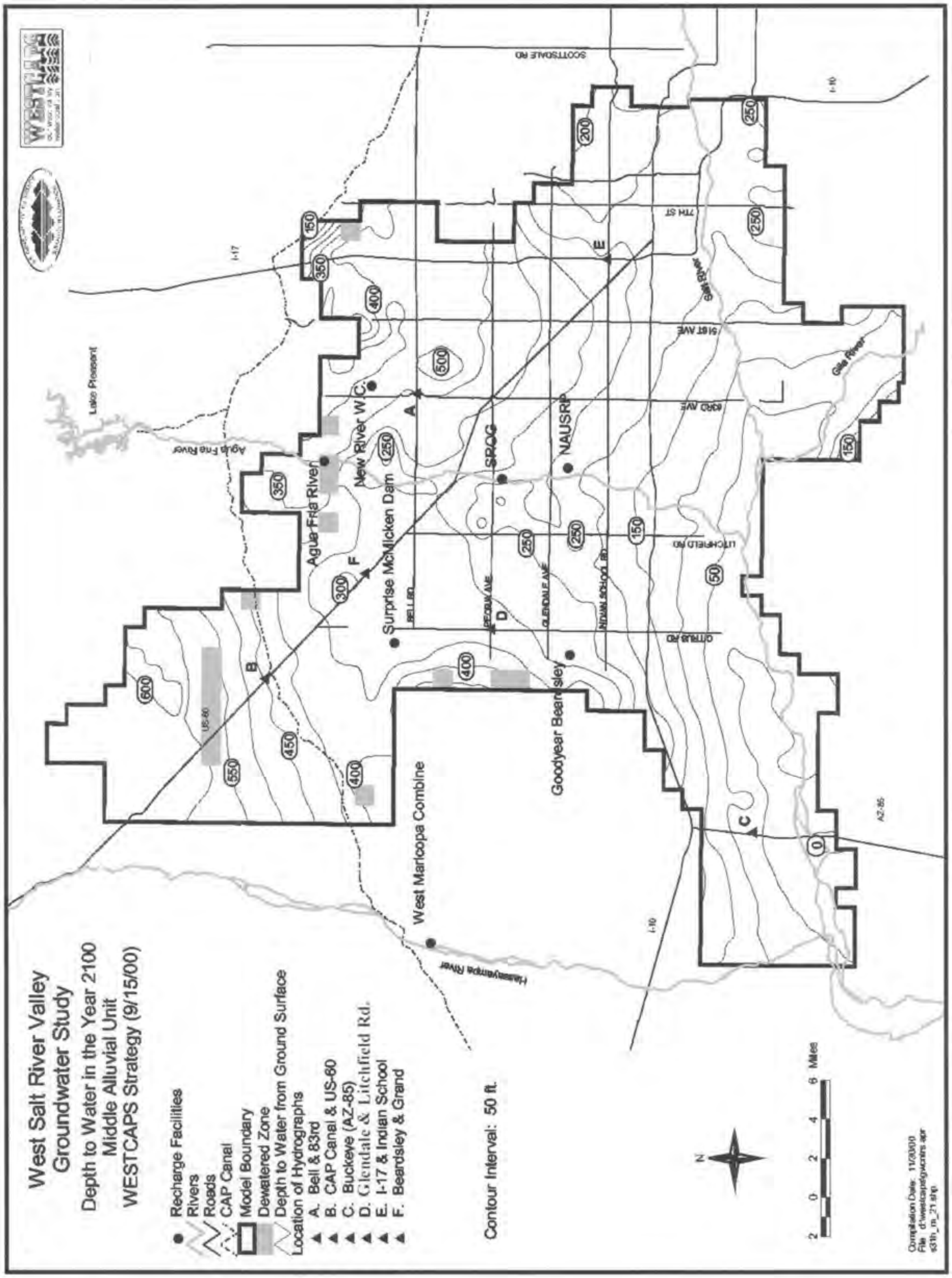


Figure IV-8. Depth to water in the year 2100, MAU
(WESTCAPS strategy, dated September 15, 2000).

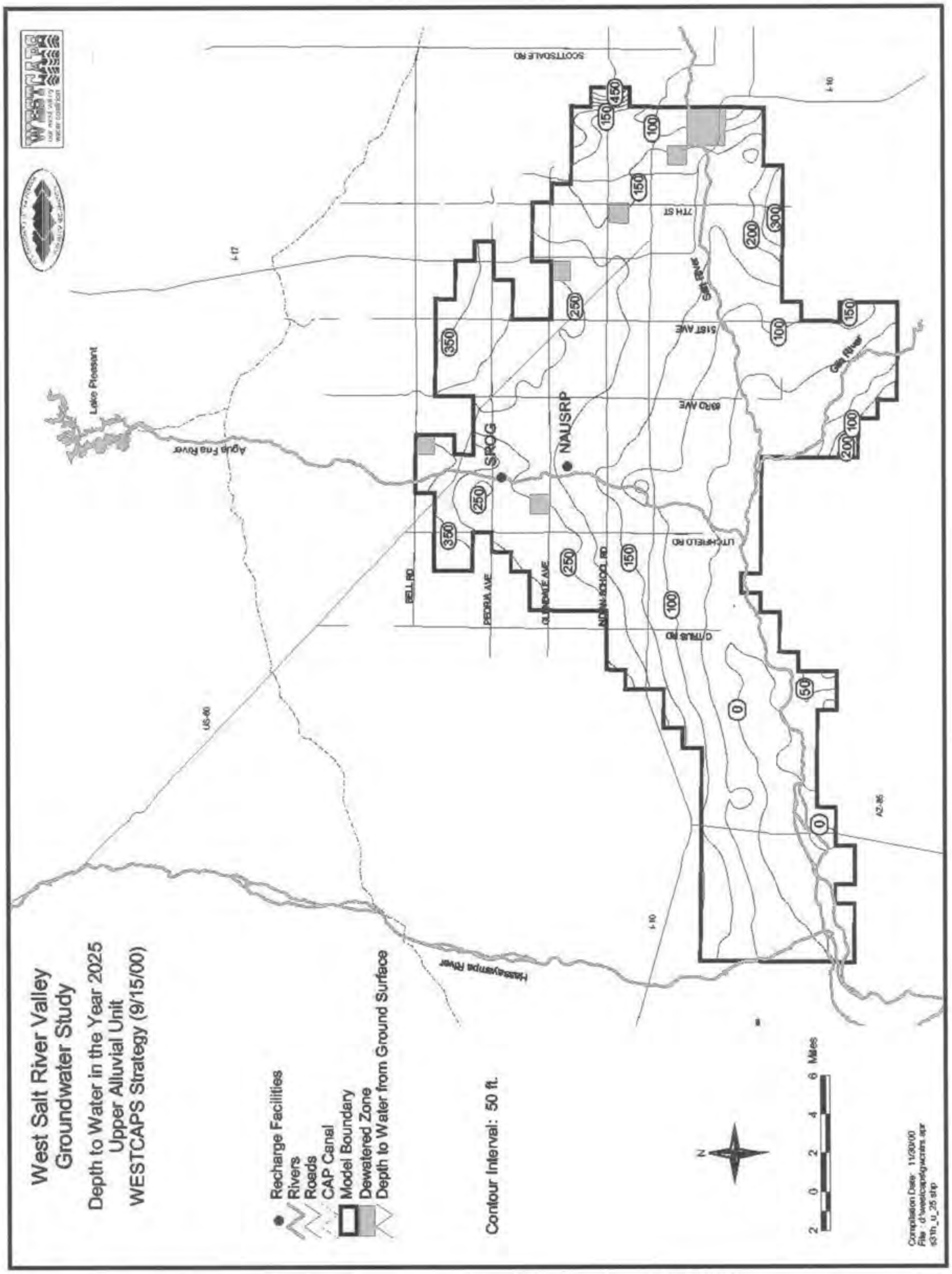


Figure IV-9.—Depth to water in the year 2025, UAU
(WESTCAPS strategy, dated September 15, 2000).

cell areas have dewatered in the year 2025, but much of the eastern portion of the UAU (north of South Mountain east of about 43rd Avenue and northeast of US-60) is dewatered by year 2100 .

In the year 2025, depth to water for the MAU (see figure IV-7) and LAU ranges from zero along the Gila River in Buckeye, to over 500 feet in the northern portion of the WSRV and from the alluvial fans flanking the White Tank Mountains. The depth to water is 400 feet between Peoria and Bell Roads east of the Agua Fria River. The depth to water goes as deep as 700 feet in the LAU aquifer basin towards Wickenburg as the ground surface rises towards the Vulture Mountains. By the year 2100 in most locations, the water table has remained level or has risen some because of to recharge in the north-central Agua Fria portion of the WSRV (north of Peoria Road).

Regional Groundwater Flow Trends.—The simulated groundwater flow field (resultant groundwater fluxes in and out of each square mile cell) shown for the UAU at the year 2025 in Solution September 15, 2000, is similar to the Basecase. In the UAU, some flow from the East Salt River Valley (ESRV) passes between the Phoenix and South Mountains towards the aquifer interior. In the south central UAU area (about Litchfield Road and I-10), flows radiating outward indicate groundwater recharging (2.4 million ft^3/day) and mounding, possibly the effects from the NAUSRP facility. Only the Arizona Municipal Water Users Association Sub-Regional Operating Group (SROG) and NAUSRP facilities occur within the UAU boundary and directly recharge the UAU artificially.

In the Buckeye area, groundwater within several miles north of the Gila River flowed towards the river and then westward as both gained surface flow and subflow from the WSRV. In year 2100, the east one-third of the UAU aquifer flow field (north of South Mountain) shows little to no flow (most of the area is dewatered) and most groundwater flow occurs between the Sierra Estrella/South Mountain pass.

The simulated groundwater flow field for the MAU and LAU aquifers shows regional groundwater flow generally converging into the central portion of the WSRV towards the depression cone areas. As with the Basecase, groundwater flows enter the WSRV sub-basin around the southwest side of South Mountain from the ESRV sub-basin.

Groundwater also flows westward originating along the mountain front area of the Phoenix Mountains, and flows from the Hassayampa sub-basin into the WSRV sub-basin. Beginning approximately in the year 2020, a one square-mile area at about Litchfield Road and Peoria Avenue has in the MAU and LAU a 1.7 million ft^3/day (14,455 ac-ft/yr.) recharge. This greatly exceeds the MAU pumping rate of 256,939 ft^3/day (2153 ac-ft/yr). This translates to mounding which causes flows to radiate outwards in both the MAU and LAU at this location. This location seems to occur between the Surprise McMicken and SROG recharge facilities. Flows converge radially towards an area near Citrus and Indian School Roads, in a square mile area with over 250,000 ft^3/day (2100 ac-ft/yr) of concentrated pumping from the years 2010 to 2100.

In Solution September 15, 2000, the magnitudes and flow patterns of the two LAUs are similar to each other at the years 2025 and 2100. Groundwater flowlines from the Hassayampa basin enter the WSRV sub-basin and gently

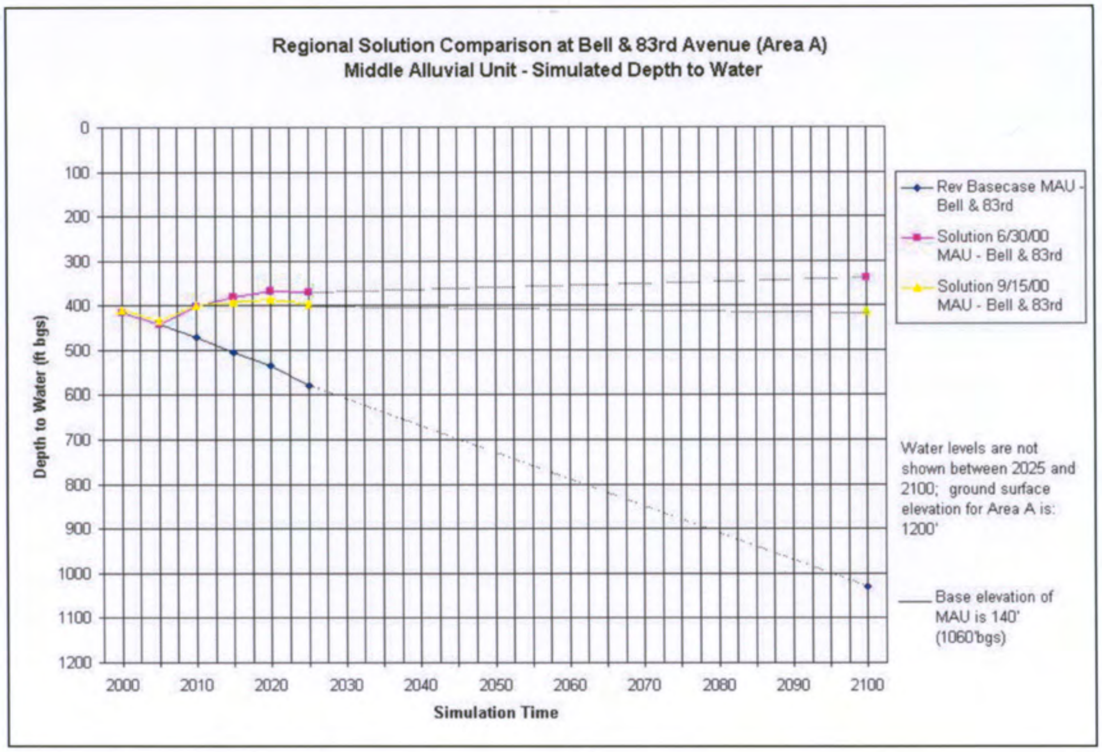


Figure IV-10. Regional solution comparison at Bell and 83rd Avenue (area A).

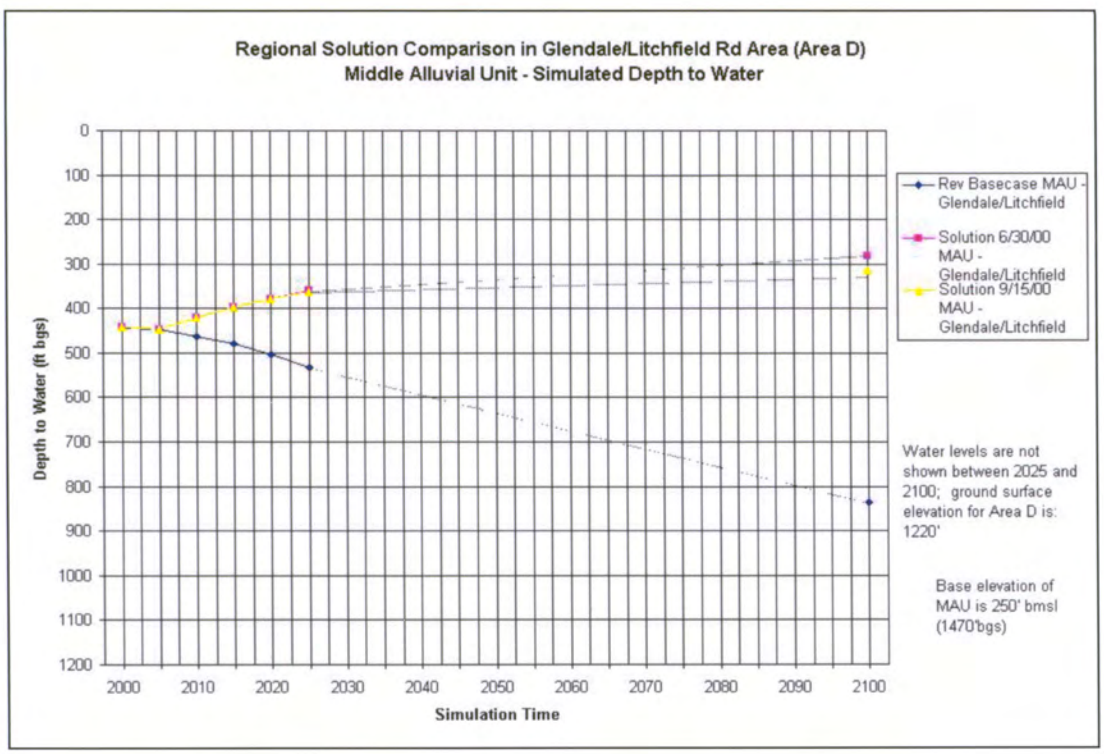


Figure IV-11. Regional solution comparison in Glendale/Litchfield Road area (area D).

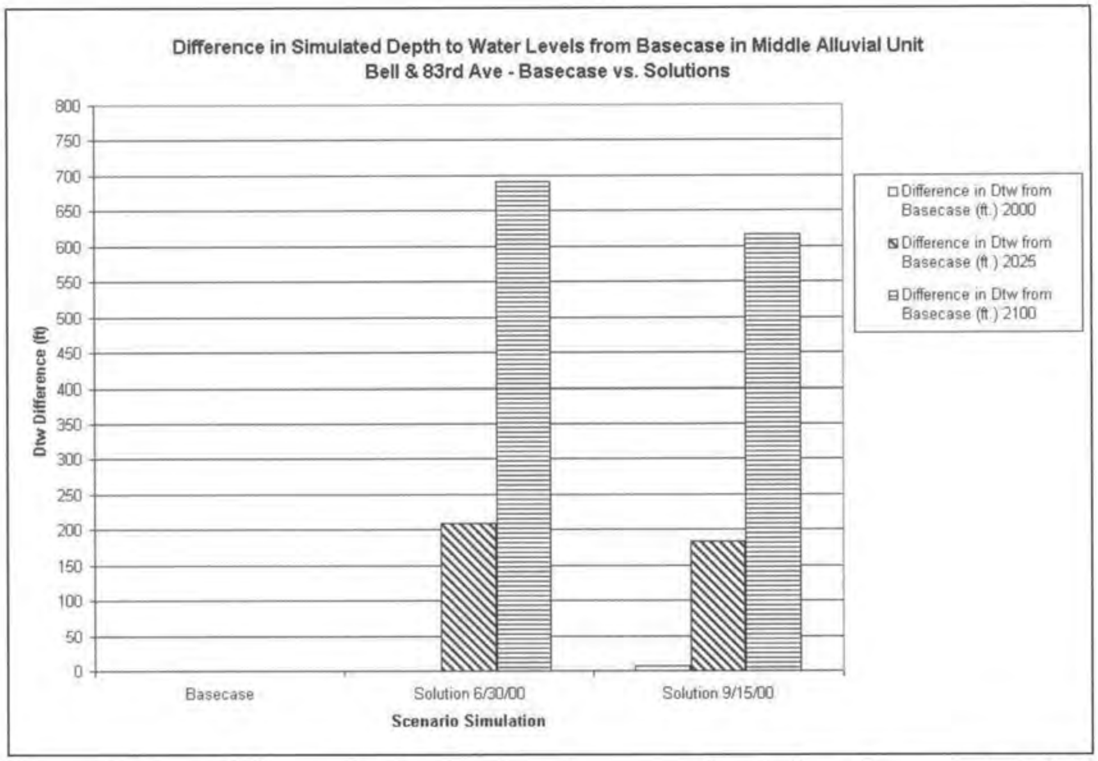


Figure IV-12. Difference in simulated depth to water levels from Basecase in MAU.

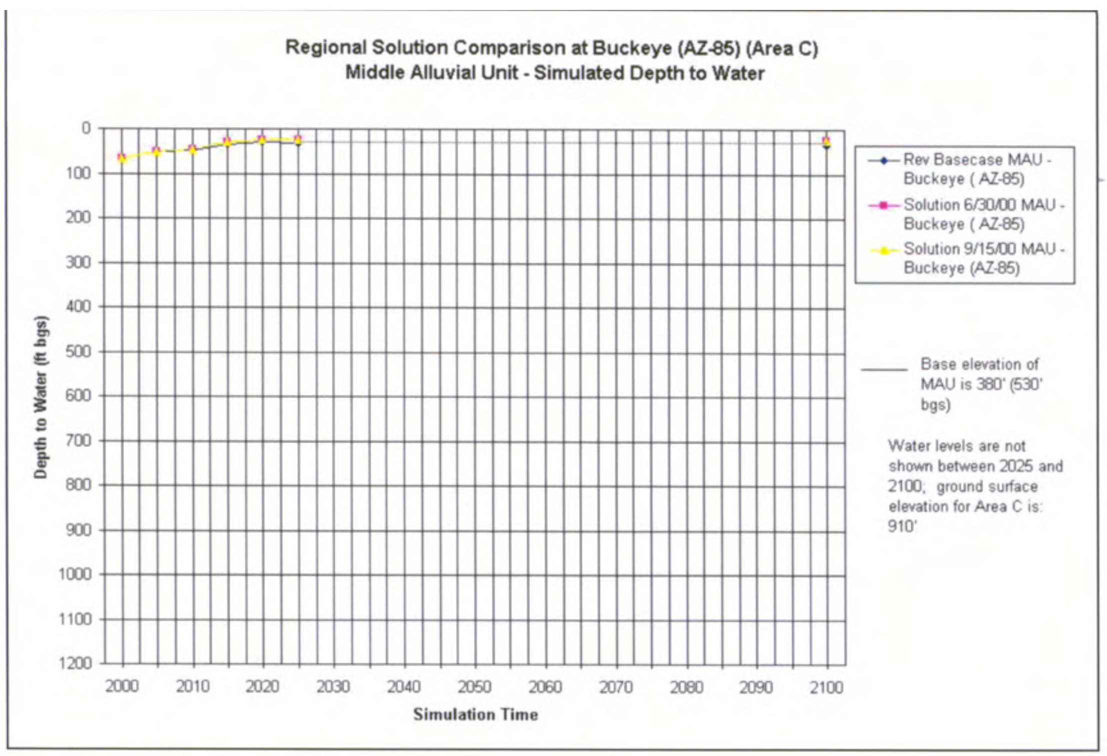


Figure IV-13. Regional solution comparison at Buckeye (AZ-85) (area C).

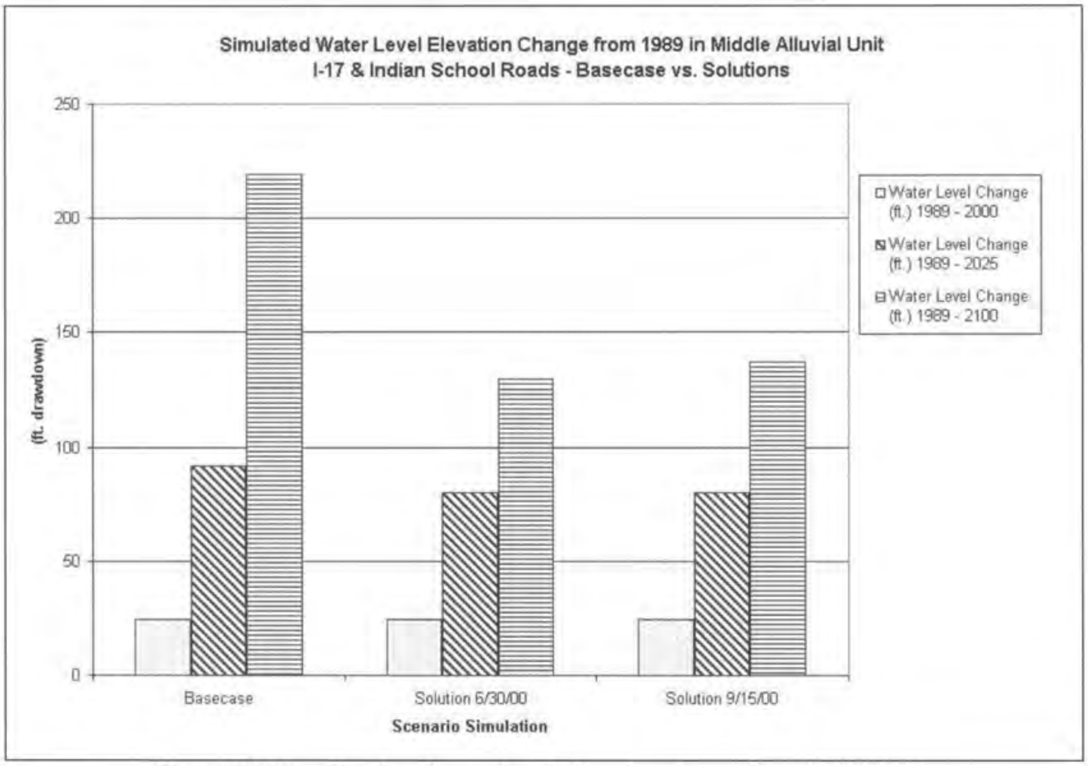


Figure IV-14. Simulated water level elevation change from 1989 MAU.

curve eastwards towards the shallow north-central area cone of depression (an oval shaped trough in the water table trending generally northeast-southwest). Groundwater also flows westward towards this depression from the east originating along the mountain front area of the Phoenix Mountains. Unlike the Basecase, which shows a strong eastward component of mountain front recharge flow in the year 2025, Solution September 15, 2000, shows a component of flow traveling southwards along the White Tank Mountains front. The north-central cone of depression was much steeper and well defined in the Basecase because of its heavy pumping projections (in relation to either Solutions June 30, 2000, or September 15, 2000). The central WSRV area flow field (the region west of the Agua Fria River along Peoria Avenue) in the MAU also shows much of the flow volume entering from the UAU above.

Table IV-4 breaks down by alluvial aquifer unit the representative daily volume of pumpage, evapotranspiration, and recharge over the final month (final time step) of the years 2025 and 2100 for the WSRV sub-basin. This budget applies to the WSRV portion of the SRV model domain only. These rates may or may not be representative over the preceding months of these years or other yearly periods. Nonetheless, representative daily volumes for the ending periods of the years 2025 and 2100 provide a basis for comparison by aquifer layer between the Basecase model and Solutions June 30, 2000, and September 15, 2000. Evapotranspiration and aquifer recharge from river leakage is relevant for the UAU aquifer.

Total pumpage for all three layers of a given scenario was similar between the years 2025 and 2100 since pumping assumptions are generally assumed to remain constant from the year 2025 on. Most pumping is from the MAU in each scenario. Pumpage is two to three times more in the UAU than in the LAU in all the solutions. Total pumpage was slightly

Table IV-4. Aquifer flow budget comparison for the Basecase, Solution strategy (June 30, 2000), and Solution strategy (September 15, 2000).

Alluvial unit, year	Pumpage ft^3/day	ac-ft/day	Evapotranspiration ft^3/day	ac-ft/day	River leakage ft3/day	ac-ft/day	Recharge ft^3/day	ac-ft/day
				Basecase				
UAU, 2025	18,087,977	415	4,358,215	100	10,248,748	235	31,455,476	722
MAU, 2025	42,173,208	968					8,933,912	205
LAU, 2025	8,527,422	196					376,079	9
	68,788,607	1,579					40,765,467	936
UAU, 2100	17,927,374	412	4,358,215	100	10,248,748	235	31,086,924	714
MAU, 2100	42,226,553	969					8,933,912	205
LAU, 2100	8,527,422	196					376,079	9
	68,681,349	1,577					40,396,915	927
				Solution strategy (June 30, 2000)				
UAU, 2025	16,429,266	377	4,771,566	110	6,293,874	144	31,452,131	722
MAU, 2025	22,834,112	524					8,937,257	205
LAU, 2025	5,715,455	131					376,080	9
	44,978,833	1,033					40,765,468	936
UAU, 2100	16,429,266	377	4,771,566	110	6,293,874	144	31,452,131	722
MAU, 2100	22,834,112	524					8,937,257	205
LAU, 2100	5,715,455	131					376,080	9
	44,978,833	1,033					40,765,468	936
				Solution strategy (September 15, 2000)				
UAU, 2025	16,473,090	378	4,771,348	110	6,305,183	145	31,500,361	723
MAU, 2025	24,078,964	553					8,889,028	204
LAU, 2025	6,069,488	139					376,080	9
	46,621,542	1,070					40,765,469	936
UAU, 2100	14,886,592	342	4,307,550	99	9,379,543	215	31,177,250	716
MAU, 2100	24,078,964	553					9,040,965	208
LAU, 2100	6,069,488	139					376,080	9
	45,035,044	1,034					40,594,295	932

less in Solution June 30, 2000, compared to Solution September 15, 2000, consistent with the Solution June 30, 2000, assumption of full CAP surface water use by the year 2025, with some pumping in the Sun City area in Solution September 15, 2000. The Basecase pumpage was about two-thirds of what it was in the other solutions.

As Solution June 30, 2000, had the highest water levels in the UAU in the years 2025 and 2100, it is not surprising that its daily evapotranspiration rates were the greatest (greater phreatophyte uptake rates with a shallower water table). However, the gain to aquifer storage from river leakage more than offsets the loss from evapotranspiration. Both budget terms are relatively insignificant compared to pumping and recharge.

In all solutions, recharge was very significant in the UAU and was about double the UAU pumping rate. Recharge volumes were similar among the three simulations regardless of alluvial layer. However, in the MAU, recharge only accounted for about one-third of the pumping rates in Solutions June 30, 2000 and September 15, 2000, and one-fifth of that in the Basecase. Additionally, LAU recharge is insignificant in 11 simulations accounting for small offsets against the LAU pumping demand.

In summary, it is clear in any of the strategies that pumping in the MAU is the primary negative stress on the WSRV groundwater system. Pumping from the MAU must be reduced to mitigate declining groundwater levels, additional subsidence, and movement of poor quality water towards existing cones of depressions or deeper down, especially from about the year 2020 and beyond. Recharging water by surface spreading is effective in offsetting pumping from the UAU. However, even with well injection recharge into the MAU, and especially the LAU, aquifers, the current MAU pumping rates will continue to overshadow any benefits from recharge.

Chapter V

Cost Analysis

WESTCAPS outlined three strategies for which an appraisal cost analysis would be developed. The initial WESTCAPS strategy (September 15, 2000) (figure II-1) was selected as the base strategy for two cost comparisons. The first cost analysis compared strategy September 15, 2000, to strategy June 30, 2000, and a second cost analysis compared the strategy December 1, 2000, to strategy September 15, 2000.

The WESTCAPS General Committee requested the Technical Committee to prepare a cash flow for the strategy September 15, 2000, projecting the timing requirements for funds to implement the option. The cash requirements are shown for the years 2005, 2015 and 2025. This information is in the final section of this chapter (see table V-3).

The strategy June 30, 2000 (figure I-2), among other things, located two new surface WTPs on the Beardsley Canal, North and South Regional WTPs. WESTCAPS tentatively adopted strategy June 30, 2000. The General Committee requested the locations of the two new proposed WTPs be further investigated.

After further analyzing the strategy June 30, 2000, WESTCAPS proposed a change to the General Committee on September 15, 2000. WESTCAPS recommended that both of the new proposed WTPs be moved northward to higher elevations to take advantage of operational efficiencies by reducing their power and energy requirements. WESTCAPS requested the Technical Committee provide them with an infrastructure and operational cost estimate for the initial WESTCAPS strategy (September 15, 2000). WESTCAPS requested this analysis include cost comparisons between the strategies September 15, 2000, and June 30, 2000.

On December 1, 2000, WESTCAPS reviewed the cost comparisons between the strategies June 30, 2000, and September 15, 2000. In that meeting, WESTCAPS identified an additional planning scenario that it wanted evaluated from a cost perspective. WESTCAPS requested a cost comparison between the strategy September 15, 2000, and an infrastructure strategy in which WESTCAPS members would achieve the results of the strategy September 15, 2000. This scenario would not require WESTCAPS members to participate in the construction of the regional facilities, as was outlined in the initial WESTCAPS strategy. It was defined as a strategy where the results would be the same, but members would independently build and operate facilities to transport and treat municipal water. This third cost strategy was titled, Informal Regional Cooperation Strategy (December 1, 2000) (see figure V-1).

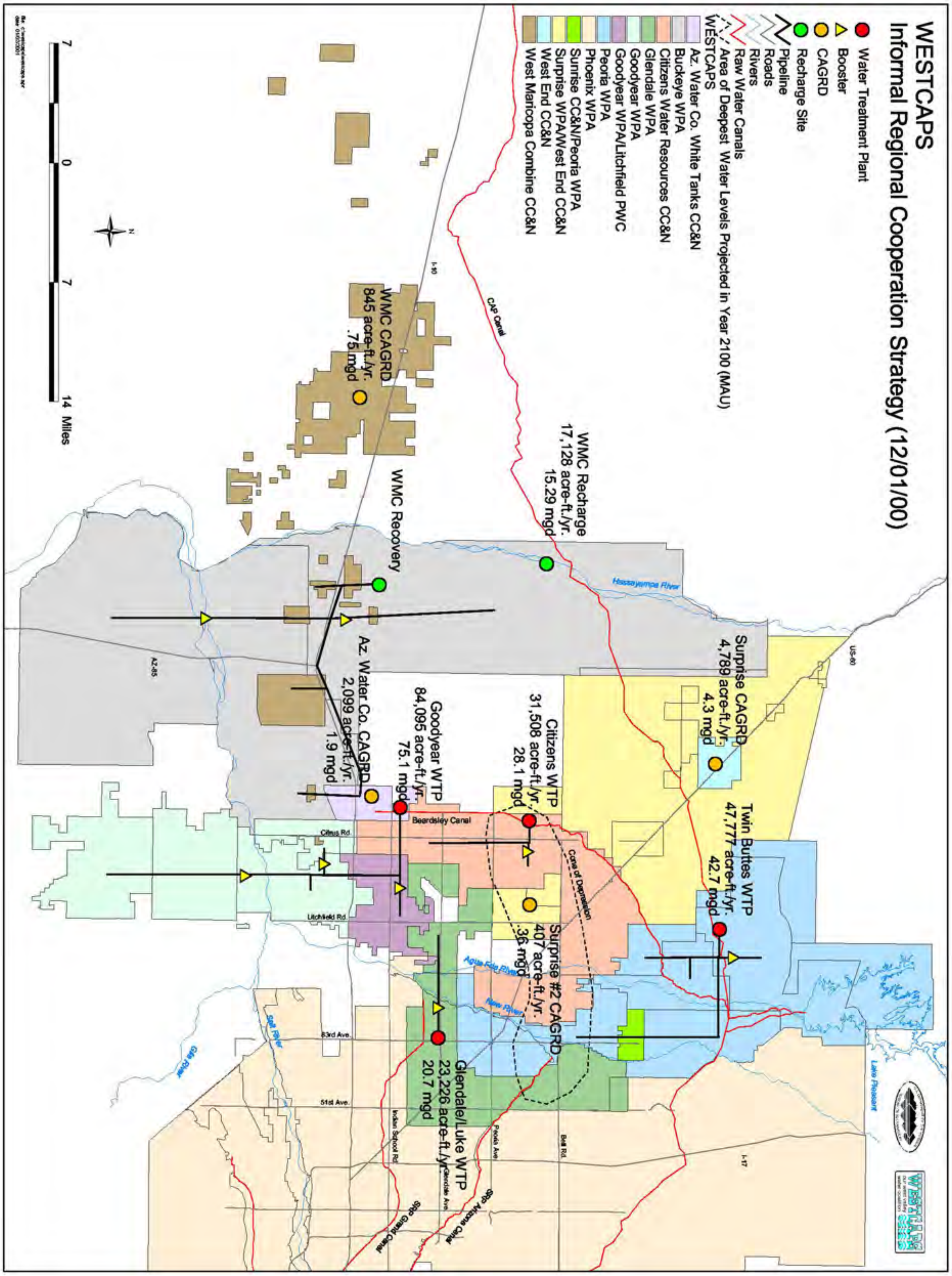


Figure V-1. WESTCAPS Informal Regional Cooperation Strategy (December 1, 2000)

Results of the Cost Comparison Between the Strategies June 30, 2000, and September 15, 2000

As noted in chapter II, the significant change between the strategies June 30, 2000, and September 15, 2000, was locating the two new proposed WTPs more to the north. This proposed relocation of the WTPs would provide additional elevation head to replace required booster pumping plant facilities, as opposed to locating the WTPs further to the south where they would be constructed at lower elevations. Other changes included placing the northwestern service area of Surprise on wells rather than connecting those subareas to the North WTP and transferring most of Peoria's water demand from the Phoenix Lake Pleasant WTP to the new North WTP.

The resulting change in the regional cost from strategies June 30, 2000, to September 15, 2000, was a decrease in total capital costs of $1.7 million and an annual $2.5 million OM&R cost reduction (see table V-1). Most WESTCAPS members saw a capital reduction because of changes from the strategies June 30, 2000, to September 15, 2000, with the exception of Peoria, Goodyear, and the Arizona Water Company. If Peoria moved its WTP needs from the City of Phoenix's Lake Pleasant WTP facility to the North WTP, Peoria's capital cost would be approximately $4 million higher and Goodyear's would be nearly $9.8 million higher. This cost increase is due mostly to higher pipe costs because of the greater distance from the South WTP. The Arizona Water Company would be about $ 2.3 million higher. This higher capital cost is due mostly to higher pipe costs because of the greater distance from the South WTP.

Most of the O&M cost reductions came from a system-wide power savings. These cost savings were due to the pressure head gained in the distribution lines resulting from locating the regional WTPs to higher elevations. Peoria was expected to see an increase in their O&M costs due to higher O&M costs at the new North WTP as compared to Phoenix's Lake Pleasant WTP.

In reviewing the cost data, it should be noted that the capital costs are a one-time savings, and O&M costs are a yearly reoccurring savings. For example, the strategy September 15, 2000, has increased Goodyear's capital costs by $9.8 million, but reduced their O&M costs by $1.3 million for each year of operations. To determine if the strategy September 15, 2000, benefits or harms Goodyear, several things must be considered. One being, evaluating additional considerations would require analysis not performed in this study. Several issues that could be given additional consideration are analyzing:

- Present worth comparing a WESTCAPS member's one-time capital savings against the reoccurring O&M savings
- A WESTCAPS member's ability to finance the increased capital cost during construction rather than recover costs during the O&M timeframe (up front funding versus pay- as-you-go)
- Economic consideration of the intangible benefits derived by the members through implementing the WESTCAPS strategy, such as improving climate for growth and development by demonstrating an adequate, safe,

and reliable water supply, which would result in increased municipal and private sources of revenue, and avoid costs from improving system adequacy and reliability

Cost Comparison Between the Strategies December 1, 2000, and September 15, 2000

In its December 2000 meeting, WESTCAPS requested an analysis of cost differences that might be derived if member entities constructed the regional WTPs outlined in the initial WESTCAPS strategy compared to each WESTCAPS member building their own separate facilities. The analysis would assume the same level of service between the two approaches.

Given the approach that each member achieves the same level of service attained in the strategy September 15, 2000, but does so by independently building and operating WTPs, WESTCAPS developed an Informal Regional Cooperation Strategy (see figure V-1). The costs of strategy. December 1, 2000, is compared to the initial WESTCAPS strategy (see table V-2).

The capital cost reduction is $1.8 million when comparing the capital cost change between the Informal Regional Cooperation Strategy and the initial WESTCAPS strategy. While the $1.8 million seems a great deal less when compared to the overall $500 million cost of the entire strategy, more information about the strategy is revealed when studied further.

Most of the cost reduction seen in the comparison comes from the south SRV members. Significantly less amount of pipe ($32.2 million) was used in the Informal Regional Cooperation Strategy than the strategy September 15, 2000. In areas other than pipe, Goodyear would see a $15.2 million reduction in plants/pumps because reservoir size would be reduced at its WTP. Neither the Arizona Water Company nor Glendale would share in using Goodyear's WTP. The booster pump system used in the strategy September 15, 2000, to move water northward from the South WTP would be eliminated. Glendale's plant on a lateral fed from the Arizona Canal (Informal Regional Cooperation Strategy) was estimated to be about $6.9 million less than the initial WESTCAPS strategy plan to connect Glendale's Luke area to the South WTP.

The cost increase between the comparisons was seen mainly in Peoria ($24.8 million). The Informal Regional Cooperation Strategy has Peoria building its own WTP rather than connecting to the City of Phoenix's Lake Pleasant WTP. The City of Surprise has an increase in capital costs in those subareas that will be served by the CAGRD in the Informal Regional Cooperation Strategy. These increases in capital cost are more expensive than the expected costs of connecting those subareas to the North WTP.

In summary, the comparison between the Informal Regional Cooperation Strategy and the initial WESTCAPS strategy indicate that, at the regional level, they appear comparable. The analysis suggests that at the member level when considering individual member costs, as allocated by capacity used, the initial WESTCAPS strategy (regionalization of

TABLE V-1

WESTCAPS 6/30/00 STRATEGY COST COMPARED TO 9/15/00 STRATEGY COST

1/10/2001
(With Wellhead Treatment)

WPA NAME	WPA No.	6/30/00 COST: BEARDSLEY REHAB	6/30/00 COST: PLANTS/PUMPS NEW	6/30/00 COST: PIPE NEW	6/30/00 COST: 6/30/00 OPERATIONS ONE YEAR	9/15/00 COST: BEARDSLEY REHAB	9/15/00 COST: PLANTS/PUMPS NEW	9/15/00 COST: PIPE NEW	9/15/00 COST: 9/15/00 OPERATIONS ONE YEAR	6/30/00 minus 9/15/00: BEARDSLEY CANAL DIFFERENCE	6/30/00 minus 9/15/00: PLANTS/PUMPS DIFFERENCE	6/30/00 minus 9/15/00: PIPE DIFFERENCE	6/30/00 minus 9/15/00: TOTAL STRATEGY DIFFERENCE	6/30/00 minus 9/15/00: OPERATIONS DIFFERENCE
ARIZONA WATER CO. WHITE T	3	$236,341	$5,176,937	$118,558	$223,994	$43,306	$4,498,160	$3,270,612	$188,737	$193,035	$678,777	($3,152,054)	($2,280,242)	$35,257
BUCKEYE IM	45	$0	$6,707,657	$6,049,907	$370,973	$0	$6,627,053	$4,693,064	$366,584	$0	$80,604	$1,356,843	$1,437,447	$4,389
BUCKEYE OM	46	$0	$2,146,337	$4,145,881	$97,200	$0	$2,131,714	$4,277,752	$96,534	$0	$14,624	($131,871)	($117,247)	$667
BUCKEYE SOUTH	79	$0	$3,752,181	$5,805,446	$213,000	$0	$3,714,649	$5,283,277	$211,026	$0	$37,532	$522,170	$559,702	$1,973
	SUB-TOTAL	$0	$12,606,176	$16,001,234	$681,173	$0	$12,473,416	$14,254,092	$674,144	$0	$132,760	$1,747,142	$1,879,902	$7,029
CITIZENS AGUA FRIA	4	$773,491	$59,431,354	$7,049,560	$3,076,510	$0	$51,886,800	$12,911,446	$2,307,531	$773,491	$7,544,554	($5,861,886)	$2,456,159	$768,979
CITIZENS AGUA FRIA # 2	82	$71,423	$5,494,885	$2,792,022	$284,427	$55,050	$5,718,000	$1,491,522	$239,919	$16,373	($223,116)	$1,300,499	$1,093,757	$44,508
	SUB-TOTAL	$844,915	$64,926,239	$9,841,582	$3,360,937	$55,050	$57,604,800	$14,402,969	$2,547,451	$789,865	$7,321,439	($4,561,387)	$3,549,916	$813,487
GLENDALE OUT OF SERVICE	12	$619,264	$46,256,184	$11,860,542	$2,090,568	$0	$41,783,200	$15,088,799	$1,858,200	$619,264	$4,472,984	($3,228,258)	$1,863,990	$232,368
GOODYEAR # 2	13	$6,566,279	$123,855,548	$14,808,875	$6,218,449	$1,203,760	$125,033,600	$26,179,835	$5,246,235	$5,362,519	($1,178,052)	($11,370,961)	($7,186,494)	$972,214
GOODYEAR OUTSIDE	94	$730,091	$13,769,888	$1,662,431	$691,365	$133,772	$13,894,740	$3,271,538	$583,004	$596,319	($124,853)	($1,609,107)	($1,137,641)	$108,361
GOODYEAR # 3	96	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GOODYEAR # 4	97	$167,593	$2,442,401	$3,827,482	$120,952	$30,645	$4,049,020	$4,812,944	$158,312	$136,949	($1,606,619)	($985,462)	($2,455,133)	($37,360)
LPSCO	14	$2,009,897	$37,913,090	$6,427,742	$1,903,480	$368,468	$38,272,480	$6,711,959	$1,605,860	$1,641,429	($359,390)	($284,217)	$997,823	$297,620
	SUB-TOTAL	$9,473,860	$177,980,927	$26,726,529	$8,934,245	$1,736,644	$181,249,840	$40,976,276	$7,593,411	$7,737,216	($3,268,913)	($14,249,747)	($9,781,444)	$1,340,834
PEORIA # 2	98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA # 2A	77	$0	$45,277,608	$8,714,537	$2,534,624	$0	$45,282,320	$8,752,862	$2,534,887	$0	($4,712)	($38,325)	($43,037)	($264)
PEORIA # 3	44	$0	$6,636,721	$3,448,106	$383,239	$0	$6,640,500	$3,167,400	$383,257	$0	($3,779)	$280,706	$276,926	($18)
PEORIA # 5	73	$0	$12,520,966	$4,083,399	$701,639	$0	$16,844,937	$4,368,264	$847,722	$0	($4,323,971)	($284,865)	($4,608,836)	($146,084)
PEORIA # 6	75	$0	$2,954,813	$3,335,030	$165,579	$0	$3,723,600	$2,175,812	$165,597	$0	($768,787)	$1,159,219	$390,432	($18)
PEORIA - YAV CO	71	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA SRP	63	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SUNRISE	76	$0	$1,842,392	$216,793	$103,136	$0	$1,837,680	$218,368	$102,873	$0	$4,712	($1,575)	$3,137	$264
	SUB-TOTAL	$0	$69,232,500	$19,797,865	$3,888,217	$0	$74,329,037	$18,682,706	$4,034,337	$0	($5,096,537)	$1,115,159	($3,981,378)	($146,120)
WEST END	74	$12,166	$1,003,388	$814,463	$48,061	$0	$1,257,842	$0	$28,841	$12,166	($254,454)	$814,463	$572,174	$19,220
SURPRISE # 1	80	$6,279	$494,029	$58,667	$25,606	$0	$0	$0	$0	$6,279	$494,029	$58,667	$558,974	$25,606
SURPRISE # 10	102	$392	$40,132	$779,978	$1,921	$0	$49,976	$0	$1,146	$392	($9,844)	$779,978	$770,527	$775
SURPRISE # 11	103	$0	$12,623	$457,403	$558	$0	$8,447	$0	$210	$0	$4,176	$457,403	$461,579	$348
SURPRISE # 12	104	$0	$13,410	$924,714	$643	$0	$16,893	$0	$387	$0	($3,483)	$924,714	$921,230	$255
SURPRISE # 13	110	$1,177	$92,886	$666,658	$4,400	$0	$108,398	$0	$2,485	$1,177	($15,512)	$666,658	$652,323	$1,915
SURPRISE # 2	81	$4,317	$345,415	$57,600	$17,854	$0	$0	$0	$0	$4,317	$345,415	$57,600	$407,331	$17,854
SURPRISE # 3	100	$27,863	$2,300,222	$362,421	$110,128	$0	$1,981,898	$374,196	$99,751	$27,863	$318,324	($11,775)	$334,412	$10,377
SURPRISE # 4	105	$12,558	$1,055,651	$848,664	$50,488	$0	$1,310,634	$0	$30,052	$12,558	($254,983)	$848,664	$606,239	$20,436
SURPRISE # 5	99	$11,773	$976,372	$1,510,855	$46,756	$0	$1,221,944	$0	$28,018	$11,773	($245,573)	$1,510,855	$1,277,055	$18,738
SURPRISE # 6	16	$28,648	$2,379,994	$374,377	$113,912	$0	$2,969,691	$0	$68,093	$28,648	($589,697)	$374,377	($186,673)	$45,820
SURPRISE # 7	106	$18,444	$1,383,911	$167,814	$72,899	$0	$0	$0	$0	$18,444	$1,383,911	$167,814	$1,570,169	$72,899
SURPRISE # 8	108	$14,520	$1,216,177	$1,161,194	$58,173	$0	$1,040,577	$705,484	$52,380	$14,520	$175,600	$455,710	$645,830	$5,792
SURPRISE # 9	109	$785	$79,870	$1,653,281	$3,790	$0	$94,321	$0	$2,163	$785	($14,451)	$1,653,281	$1,639,615	$1,627
	SUB-TOTAL	$138,922	$11,394,078	$9,838,088	$555,189	$0	$10,060,622	$1,079,680	$313,527	$138,922	$1,333,456	$8,758,408	$10,230,787	$241,662
WEST MARICOPA COMBINE 85	85	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WEST MARICOPA COMBINE 86	86	$0	$121,036	$40,163	$6,700	$0	$119,690	$15,554	$6,625	$0	$1,346	$24,609	$25,955	$75
WEST MARICOPA COMBINE 87	87	$0	$18,844	$6,248	$1,057	$0	$18,818	$2,447	$1,033	$0	$26	$3,801	$3,827	$23
WEST MARICOPA COMBINE 88	88	$0	$5,358	$4,563	$279	$0	$5,358	$2,152	$279	$0	$0	$2,410	$2,410	$0
WEST MARICOPA COMBINE 89	89	$23,294	$440,636	$1,377,899	$22,089	$0	$160,044	$2,011,900	$8,866	$23,294	$280,592	($634,000)	($330,114)	$13,223
WEST MARICOPA COMBINE 90	90	$0	$12,114	$490,810	$679	$0	$12,114	$396,854	$679	$0	$0	$93,956	$93,956	$0
WEST MARICOPA COMBINE 91	91	$0	$2,692	$893	$151	$0	$2,692	$99,170	$151	$0	$0	($98,277)	($98,277)	$0
WEST MARICOPA COMBINE 92	92	$0	$2,509,399	$3,506,913	$138,932	$0	$2,482,453	$2,981,406	$137,230	$0	$26,946	$525,507	$552,453	$1,702
WEST MARICOPA COMBINE 95	95	$785	$0	$0	$277	$0	$0	$0	$0	$785	$0	$0	$785	$277
WMC TONOPAH	201	$0	$2,401,126	$0	$35,948	$0	$2,400,996	$0	$35,831	$0	$130	$0	$130	$117
	SUB-TOTAL	$24,079	$5,511,205	$5,427,489	$206,112	$0	$5,202,165	$5,509,484	$190,695	$24,079	$309,040	($81,995)	$251,125	$15,417
	TOTAL	$11,337,380	$393,084,245	$99,611,887	$19,940,435	$1,835,000	$387,201,239	$113,264,618	$17,400,500	$9,502,380	$5,883,005	($13,652,730)		
				$504,033,512 TOTAL 6/30/00				$502,300,857 TOTAL 9/15/00					$1,732,655 DIFFERENCE	$2,546,965

Note - RED values indicate higher cost in 9/15 STRATEGY as compared to 6/30 STRATEGY, BLACK values indicate lower cost in 9/15 STRATEGY compared to 6/30 STRATEGY

Table V-1. WESTCAPS strategy June 30, 2000, costs compared to strategy September 15, 2000.

TABLE V-2

WESTCAPS 12/1/00 STRATEGY COST COMPARED TO 9/15/00 STRATEGY COST

110/2001
(With Wellhead Treatment)

WPA NAME	WPA No.	12/1/00 COST BEARDSLEY REHAB	12/1/00 COST PLANTS/PUMPS NEW	12/1/00 COST PIPE NEW	12/1/00 COST 36,861 OPERATIONS ONE YEAR	9/15/00 COST BEARDSLEY REHAB	9/15/00 COST PLANTS/PUMPS NEW	9/15/00 COST PIPE NEW	9/15/00 COST 9/15/00 OPERATIONS ONE YEAR	12/1/00 minus 9/15/00 BEARDSLEY CANAL DIFFERENCE	12/1/00 minus 9/15/00 PLANTS/PUMPS DIFFERENCE	12/1/00 minus 9/15/00 PIPE DIFFERENCE	12/1/00 minus 9/15/00 TOTAL STRATEGY DIFFERENCE	12/1/00 minus 9/15/00 OPERATIONS DIFFERENCE
ARIZONA WATER CO. WHITE T	3	$0	$6,051,500	$0	$27,287	$43,306	$4,498,160	$3,270,612	$188,737	($43,306)	$1,553,340	($3,270,612)	($1,760,578)	($161,450)
BUCKEYE IM	45	$0	$6,386,736	$4,665,411	$921,745	$0	$6,627,053	$4,693,064	$366,584	$0	($240,318)	($27,653)	($267,970)	$555,161
BUCKEYE OM	46	$0	$2,085,639	$3,882,815	$303,387	$0	$2,131,714	$4,277,752	$96,534	$0	($46,074)	($394,937)	($441,012)	$206,853
BUCKEYE SOUTH	79	$0	$3,615,177	$5,229,088	$486,770	$0	$3,714,649	$5,283,277	$211,026	$0	($99,472)	($54,189)	($153,661)	$275,744
	SUB-TOTAL	$0	$12,087,552	$13,777,314	$1,711,902	$0	$12,473,416	$14,254,092	$674,144	$0	($385,864)	($476,779)	($862,643)	$1,037,758
CITIZENS AGUA FRIA	4	$329,494	$59,163,831	$3,190,600	$2,635,673	$0	$51,886,800	$12,911,446	$2,307,531	$329,494	$7,277,031	($9,720,846)	($2,114,320)	$328,142
CITIZENS AGUA FRIA # 2	82	$30,444	$5,273,669	$2,679,739	$165,230	$55,050	$5,718,000	$1,491,522	$239,919	($24,606)	($444,331)	$1,188,216	$719,279	($74,689)
	SUB-TOTAL	$359,939	$64,437,500	$5,870,339	$2,800,903	$55,050	$57,604,800	$14,402,969	$2,547,451	$304,889	$6,832,700	($8,532,630)	($1,395,041)	$253,453
GLENDALE OUT OF SERVICE	12	$0	$47,335,000	$2,653,759	$1,597,020	$0	$41,783,200	$15,088,799	$1,858,200	$0	$5,551,800	($12,435,040)	($6,883,240)	($261,180)
GOODYEAR # 2	13	$5,963,164	$112,632,142	$17,044,288	$5,245,920	$1,203,760	$125,033,600	$26,179,835	$5,246,235	$4,759,404	($12,401,458)	($9,135,547)	($16,777,601)	($315)
GOODYEAR OUTSIDE	94	$663,142	$13,615,418	$2,591,836	$691,370	$133,772	$13,894,740	$3,271,538	$583,004	$529,371	($279,322)	($679,702)	($429,654)	$108,366
GOODYEAR # 3	96	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GOODYEAR # 4	97	$152,025	$3,737,455	$4,799,644	$158,497	$30,645	$4,049,020	$4,812,944	$158,312	$121,381	($311,565)	($13,300)	($203,484)	$185
LPSCO	14	$1,825,022	$36,065,985	$4,367,039	$1,902,708	$368,468	$38,272,480	$6,711,959	$1,605,860	$1,456,554	($2,206,495)	($2,344,920)	($3,094,861)	$296,848
	SUB-TOTAL	$8,603,353	$166,051,000	$28,802,808	$7,998,495	$1,736,644	$181,249,840	$40,976,276	$7,593,411	$6,866,709	($15,198,840)	($12,173,468)	($20,505,599)	$405,084
PEORIA # 2	98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA # 2A	77	$0	$62,070,218	$17,356,851	$2,534,640	$0	$45,282,320	$8,752,862	$2,534,887	$0	$16,787,898	$8,603,989	$25,391,887	($247)
PEORIA # 3	44	$0	$8,742,838	$1,356,974	$433,692	$0	$6,640,500	$3,167,400	$383,257	$0	$2,102,338	($1,810,426)	$291,912	$50,435
PEORIA # 5	73	$0	$17,183,281	$2,454,312	$701,680	$0	$16,844,937	$4,368,264	$847,722	$0	$338,344	($1,913,952)	($1,575,608)	($146,042)
PEORIA # 6	75	$0	$4,053,381	$1,524,286	$165,520	$0	$3,723,600	$2,175,812	$165,597	$0	$329,781	($651,525)	($321,744)	($77)
PEORIA - YAV CO	71	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA SRP	63	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SUNRISE	76	$0	$2,525,282	$541,217	$103,120	$0	$1,837,680	$218,368	$102,873	$0	$687,602	$322,849	$1,010,451	$247
	SUB-TOTAL	$0	$94,575,000	$23,233,641	$3,938,652	$0	$74,329,037	$18,682,706	$4,034,337	$0	$20,245,963	$4,550,935	$24,796,898	($95,685)
WEST END	74	$0	$1,292,622	$0	$7,530	$0	$1,257,842	$0	$28,841	$0	$34,779	$0	$34,779	($21,311)
SURPRISE # 1	80	$0	$678,945	$0	$4,015	$0	$0	$0	$0	$0	$678,945	$0	$678,945	$4,015
SURPRISE # 10	102	$0	$51,476	$0	$300	$0	$49,976	$0	$1,146	$0	$1,500	$0	$1,500	($846)
SURPRISE # 11	103	$0	$8,579	$0	$50	$0	$8,447	$0	$210	$0	$133	$0	$133	($160)
SURPRISE # 12	104	$0	$17,159	$0	$100	$0	$16,893	$0	$387	$0	$265	$0	$265	($287)
SURPRISE # 13	110	$0	$111,532	$0	$650	$0	$108,398	$0	$2,485	$0	$3,133	$0	$3,133	($1,836)
SURPRISE # 2	81	$0	$467,655	$0	$2,766	$0	$0	$0	$0	$0	$467,655	$0	$467,655	$2,766
SURPRISE # 3	100	$0	$2,954,156	$0	$17,210	$0	$1,981,898	$374,196	$99,751	$0	$972,257	($374,196)	$598,062	($82,542)
SURPRISE # 4	105	$0	$1,346,958	$0	$7,847	$0	$1,310,634	$0	$30,052	$0	$36,324	$0	$36,324	($22,205)
SURPRISE # 5	99	$0	$1,255,445	$0	$7,314	$0	$1,221,944	$0	$28,018	$0	$33,500	$0	$33,500	($20,704)
SURPRISE # 6	16	$0	$3,051,388	$0	$17,776	$0	$2,969,691	$0	$68,093	$0	$81,697	$0	$81,697	($50,316)
SURPRISE # 7	106	$0	$1,956,091	$0	$11,395	$0	$0	$0	$0	$0	$1,956,091	$0	$1,956,091	$11,395
SURPRISE # 8	108	$0	$1,552,862	$0	$9,046	$0	$1,040,577	$705,484	$52,380	$0	$512,285	($705,484)	($193,199)	($43,334)
SURPRISE # 9	109	$0	$97,233	$0	$566	$0	$94,321	$0	$2,163	$0	$2,912	$0	$2,912	($1,596)
	SUB-TOTAL	$0	$14,842,100	$0	$86,565	$0	$10,060,622	$1,079,680	$313,527	$0	$4,781,478	($1,079,680)	$3,701,799	($226,961)
WEST MARICOPA COMBINE 85	85	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WEST MARICOPA COMBINE 86	86	$0	$115,199	$15,369	$16,626	$0	$119,690	$15,554	$6,625	$0	($4,491)	($185)	($4,675)	$10,001
WEST MARICOPA COMBINE 87	87	$0	$18,189	$2,427	$2,625	$0	$18,818	$2,447	$1,033	$0	($629)	($20)	($649)	$1,592
WEST MARICOPA COMBINE 88	88	$0	$4,547	$3,322	$656	$0	$5,358	$2,152	$279	$0	($811)	$1,169	$359	$378
WEST MARICOPA COMBINE 89	89	$0	$154,609	$3,332,199	$22,314	$0	$160,044	$2,011,900	$8,866	$0	($5,434)	$1,320,299	$1,314,865	$13,447
WEST MARICOPA COMBINE 90	90	$0	$12,126	$392,577	$1,750	$0	$12,114	$396,854	$679	$0	$12	($4,278)	($4,265)	$1,071
WEST MARICOPA COMBINE 91	91	$0	$3,032	$98,144	$438	$0	$2,692	$99,170	$151	$0	$340	($1,026)	($686)	$287
WEST MARICOPA COMBINE 92	92	$0	$2,392,658	$2,891,638	$345,313	$0	$2,482,453	$2,981,406	$137,230	$0	($89,795)	($89,768)	($179,563)	$208,083
WEST MARICOPA COMBINE 95	95	$0	$21,221	$0	$3,063	$0	$0	$0	$0	$0	$21,221	$0	$21,221	$3,063
WMC TONOPAH	201	$0	$2,388,750	$0	$10,985	$0	$2,400,996	$0	$35,831	$0	($12,246)	$0	($12,246)	($24,846)
	SUB-TOTAL	$0	$5,110,332	$6,735,676	$403,769	$0	$5,202,165	$5,509,484	$190,695	$0	($91,833)	$1,226,193	$1,134,360	$213,074
	TOTAL	$8,963,292	$410,489,984	$81,073,537	$18,564,592	$1,835,000	$387,201,239	$113,264,618	$17,400,500	$7,128,292	$23,288,744	($32,191,081)		
				$500,526,813 TOTAL 12/1/00				$502,300,857 TOTAL 9/15/00					($1,774,045) DIFFERENCE	$1,164,093

Note - RED values indicate higher cost in 9/15 STRATEGY as compared to 12/1 STRATEGY, BLACK values indicate lower cost in 9/15 STRATEGY compared to 12/1 STRATEGY

Table V-2. WESTCAPS strategy December 1, 2000, costs compared to strategy September 15, 2000.

facilities) tends to provide the north SRV members with a less costly option than south SRV members.

Given the apparent benefit from regionalizing facilities to do drought planning, establish system reliability to reduce risk, distribute O&M costs over a large service base, and improve the possibilities for project financing, it would seem the allocation costs of a regional plan by "capacity used" might distort the benefits gained that are not capacity utilization. It is customary to prepare a cost/benefit analysis in determining the answers to this kind of complex question of cost allocation. That has not been carried out at this time, but might be the next necessary step to take based on the preliminary cost analysis already completed.

WESTCAPS Strategy (September 15, 2000), Cash Flow Analysis

The final element in this chapter is the cash-flow table for the initial WESTCAPS strategy (see table V-3). General assumptions were used in compiling this table. Essentially, the construction of the large WTPs could be staged, and the Beardsley Canal could be rehabilitated, as capacity was needed in later years. Most of the pipe is installed early in the construction process and smaller features would be built to capacity during the early part of the project. This information was gathered from WTPs appraisal-level analysis, not from feasibility or design level data, and should be viewed from that perspective. The approach taken to design a WTP will greatly depend on the staging of the construction.

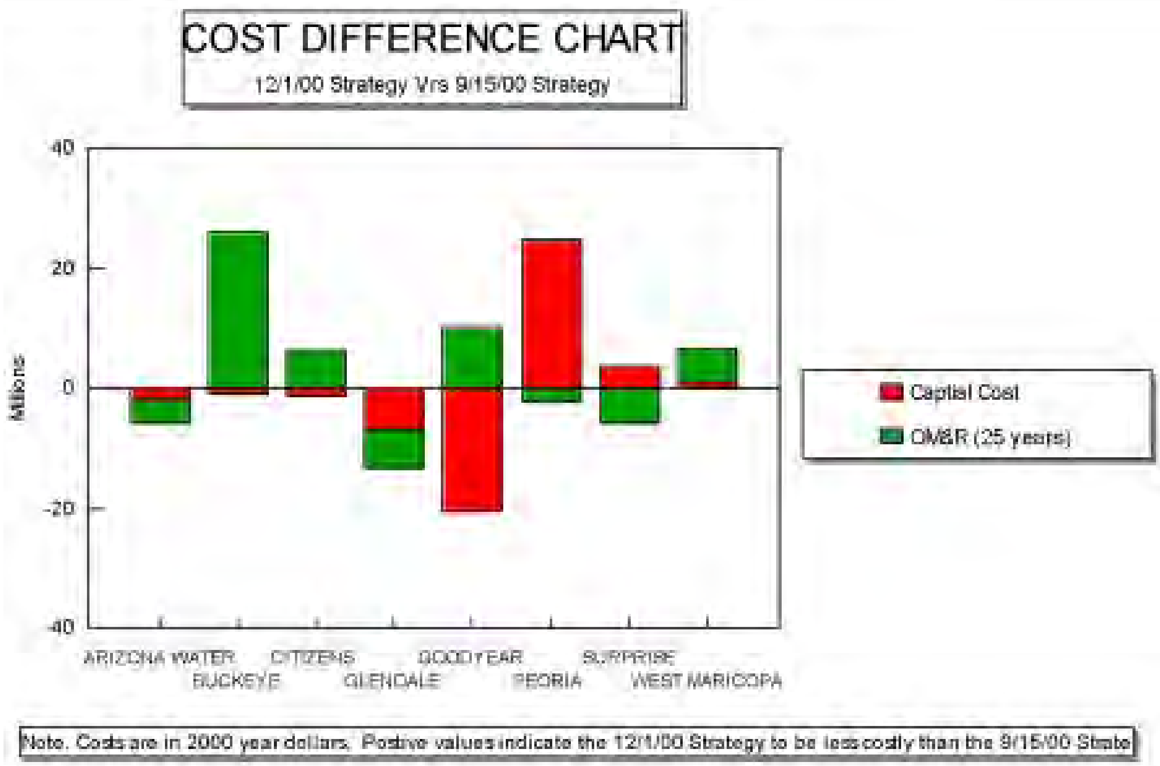
TABLE V-3

WESTCAPS STRATEGY, 9/15/00 CASH FLOW ANALYSIS

1/10/2001
(With Wellhead Treatment)

WPA NAME	WPA No.	FACILITIES other than PIPES and CANALS 2005	2015	2025	TOTAL	PIPES 2005	2015	2025	TOTAL	BEARDSLEY CANAL REHAB 2005	2015	2025	TOTAL	CASH FLOW BY YEAR SUBTOTAL 2005	SUBTOTAL 2015	SUBTOTAL 2025	TOTAL ALL FACILITIES	COST OF OPERATIONS FOR ONE YEAR
ARIZONA WATER CO. WH	3	$2,454,400	$0	$2,043,760	$4,498,160	$2,941,133	$0	$329,466	$3,270,599	$0	$8,228	$35,078	$43,306	$5,395,533	$8,228	$2,408,304	$7,812,065	$188,737
BUCKEYE IM	45	$6,627,053	$0	$0	$6,627,053	$4,693,013	$0	$0	$4,693,013	$0	$0	$0	$0	$11,320,066	$0	$0	$11,320,066	$366,584
BUCKEYE OM	46	$2,131,714	$0	$0	$2,131,714	$4,044,602	$0	$233,139	$4,277,742	$0	$0	$0	$0	$6,176,316	$0	$233,139	$6,409,455	$96,534
BUCKEYE SOUTH	79	$3,714,649	$0	$0	$3,714,649	$5,283,264	$0	$0	$5,283,264	$0	$0	$0	$0	$8,997,913	$0	$0	$8,997,913	$211,026
	SUB-TOTAL	$12,473,416	$0	$0	$12,473,416	$14,020,879	$0	$233,139	$14,254,018	$0	$0	$0	$0	$26,494,295	$0	$233,139	$26,727,434	$674,144
CITIZENS AGUA FRIA	4	$0	$36,678,600	$15,208,200	$51,886,800	$0	$12,911,270	$0	$12,911,270	$0	$0	$0	$0	$0	$49,589,870	$15,208,200	$64,798,070	$2,307,531
CITIZENS AGUA FRIA # 2	82	$3,120,000	$0	$2,598,000	$5,718,000	$1,072,699	$0	$418,813	$1,491,512	$0	$10,460	$44,591	$55,050	$4,192,699	$10,460	$3,061,403	$7,264,562	$239,919
	SUB-TOTAL	$3,120,000	$36,678,600	$17,806,200	$57,604,800	$1,072,699	$12,911,270	$418,813	$14,402,782	$0	$10,460	$44,591	$55,050	$4,192,699	$49,600,330	$18,269,603	$72,062,632	$2,547,451
GLENDALE OUT OF SERV	12	$0	$29,536,400	$12,246,800	$41,783,200	$0	$15,088,686	$0	$15,088,686	$0	$0	$0	$0	$0	$44,625,086	$12,246,800	$56,871,886	$1,858,200
GOODYEAR # 2	13	$68,224,000	$0	$56,809,600	$125,033,600	$17,022,181	$0	$9,158,039	$26,180,220	$0	$228,714	$975,046	$1,203,760	$85,246,181	$228,714	$66,942,685	$152,417,580	$5,246,235
GOODYEAR OUTSIDE	94	$7,581,600	$0	$6,313,140	$13,894,740	$2,253,844	$0	$1,017,715	$3,271,559	$0	$25,417	$108,355	$133,772	$9,835,444	$25,417	$7,439,210	$17,300,070	$583,004
GOODYEAR # 3	96	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GOODYEAR # 4	97	$2,602,800	$0	$1,446,220	$4,049,020	$4,812,957	$0	$0	$4,812,957	$0	$5,822	$24,822	$30,645	$7,415,757	$5,822	$1,471,042	$8,892,621	$158,312
LPSCO	14	$20,883,200	$0	$17,389,280	$38,272,480	$3,908,733	$0	$2,803,253	$6,711,986	$0	$70,009	$298,459	$368,468	$24,791,933	$70,009	$20,490,992	$45,352,934	$1,605,860
	SUB-TOTAL	$99,291,600	$0	$81,958,240	$181,249,840	$27,997,714	$0	$12,979,007	$40,976,721	$0	$329,962	$1,406,682	$1,736,644	$127,289,314	$329,962	$96,343,929	$223,963,205	$7,593,411
PEORIA # 2	98	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA # 2A	77	$45,282,320	$0	$0	$45,282,320	$8,752,839	$0	$0	$8,752,839	$0	$0	$0	$0	$54,035,159	$0	$0	$54,035,159	$2,534,887
PEORIA # 3	44	$6,640,500	$0	$0	$6,640,500	$3,167,359	$0	$0	$3,167,359	$0	$0	$0	$0	$9,807,859	$0	$0	$9,807,859	$383,257
PEORIA # 5	73	$1,068,937	$11,152,000	$4,624,000	$16,844,937	$0	$4,368,210	$0	$4,368,210	$0	$0	$0	$0	$1,068,937	$15,520,210	$4,624,000	$21,213,147	$847,722
PEORIA # 6	75	$0	$2,632,200	$1,091,400	$3,723,600	$0	$2,175,823	$0	$2,175,823	$0	$0	$0	$0	$0	$4,808,023	$1,091,400	$5,899,423	$165,597
PEORIA - YAV CO	71	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PEORIA SRP	63	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SUNRISE	76	$1,837,680	$0	$0	$1,837,680	$218,367	$0	$0	$218,367	$0	$0	$0	$0	$2,056,047	$0	$0	$2,056,047	$102,873
	SUB-TOTAL	$54,829,437	$13,784,200	$5,715,400		$12,138,565	$6,544,034	$0	$18,682,599	$0	$0	$0	$0	$66,968,002	$20,328,234	$5,715,400	$93,011,636	$4,034,337
WEST END	74	$1,257,842	$0	$0	$1,257,842	$0	$0	$0	$0	$0	$0	$0	$0	$1,257,842	$0	$0	$1,257,842	$28,841
SURPRISE # 1	80	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SURPRISE # 10	102	$49,976	$0	$0	$49,976	$0	$0	$0	$0	$0	$0	$0	$0	$49,976	$0	$0	$49,976	$1,146
SURPRISE # 11	103	$8,447	$0	$0	$8,447	$0	$0	$0	$0	$0	$0	$0	$0	$8,447	$0	$0	$8,447	$210
SURPRISE # 12	104	$16,893	$0	$0	$16,893	$0	$0	$0	$0	$0	$0	$0	$0	$16,893	$0	$0	$16,893	$387
SURPRISE # 13	110	$108,398	$0	$0	$108,398	$0	$0	$0	$0	$0	$0	$0	$0	$108,398	$0	$0	$108,398	$2,485
SURPRISE # 2	81	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SURPRISE # 3	100	$125,898	$1,312,000	$544,000	$1,981,898	$0	$374,184	$0	$374,184	$0	$0	$0	$0	$125,898	$1,686,184	$544,000	$2,356,082	$99,751
SURPRISE # 4	105	$1,310,634	$0	$0	$1,310,634	$0	$0	$0	$0	$0	$0	$0	$0	$1,310,634	$0	$0	$1,310,634	$30,052
SURPRISE # 5	99	$1,221,944	$0	$0	$1,221,944	$0	$0	$0	$0	$0	$0	$0	$0	$1,221,944	$0	$0	$1,221,944	$28,018
SURPRISE # 6	16	$2,969,691	$0	$0	$2,969,691	$0	$0	$0	$0	$0	$0	$0	$0	$2,969,691	$0	$0	$2,969,691	$68,093
SURPRISE # 7	106	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SURPRISE # 8	108	$66,177	$688,800	$285,600	$1,040,577	$0	$705,489	$0	$705,489	$0	$0	$0	$0	$66,177	$1,394,289	$285,600	$1,746,066	$52,380
SURPRISE # 9	109	$94,321	$0	$0	$94,321	$0	$0	$0	$0	$0	$0	$0	$0	$94,321	$0	$0	$94,321	$2,163
	SUB-TOTAL	$7,230,222	$2,000,800	$829,600	$10,060,622	$0	$1,079,673	$0	$1,079,673	$0	$0	$0	$0	$7,230,222	$3,080,473	$829,600	$11,140,294	$313,527
WEST MARICOPA COMBI	85	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WEST MARICOPA COMBI	86	$119,690	$0	$0	$119,690	$15,553	$0	$0	$15,553	$0	$0	$0	$0	$135,243	$0	$0	$135,243	$6,625
WEST MARICOPA COMBI	87	$18,818	$0	$0	$18,818	$2,447	$0	$0	$2,447	$0	$0	$0	$0	$21,265	$0	$0	$21,265	$1,033
WEST MARICOPA COMBI	88	$5,358	$0	$0	$5,358	$2,152	$0	$0	$2,152	$0	$0	$0	$0	$7,510	$0	$0	$7,510	$279
WEST MARICOPA COMBI	89	$160,044	$0	$0	$160,044	$2,011,889	$0	$0	$2,011,889	$0	$0	$0	$0	$2,171,933	$0	$0	$2,171,933	$8,866
WEST MARICOPA COMBI	90	$12,114	$0	$0	$12,114	$396,860	$0	$0	$396,860	$0	$0	$0	$0	$408,974	$0	$0	$408,974	$679
WEST MARICOPA COMBI	91	$2,692	$0	$0	$2,692	$99,171	$0	$0	$99,171	$0	$0	$0	$0	$101,863	$0	$0	$101,863	$151
WEST MARICOPA COMBI	92	$2,482,453	$0	$0	$2,482,453	$2,981,361	$0	$0	$2,981,361	$0	$0	$0	$0	$5,463,814	$0	$0	$5,463,814	$137,230
WEST MARICOPA COMBI	95	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WMC TONOPAH	201	$2,400,996	$0	$0	$2,400,996	$0	$0	$0	$0	$0	$0	$0	$0	$2,400,996	$0	$0	$2,400,996	$35,831
	SUB-TOTAL	$5,202,165	$0	$0	$5,202,165	$5,509,433	$0	$0	$5,509,433	$0	$0	$0	$0	$10,711,598	$0	$0	$32,134,795	$381,389
		$184,601,239	$82,000,000	$120,600,000	$387,201,239	$63,680,423	$35,623,663	$13,960,425	$113,264,511	$0	$348,650	$1,486,350	$1,835,000	$248,281,662	$117,972,313	$136,046,775	$502,300,750	$17,400,500

Table V-3. WESTCAPS strategy (September 15, 2000), cash flow analysis



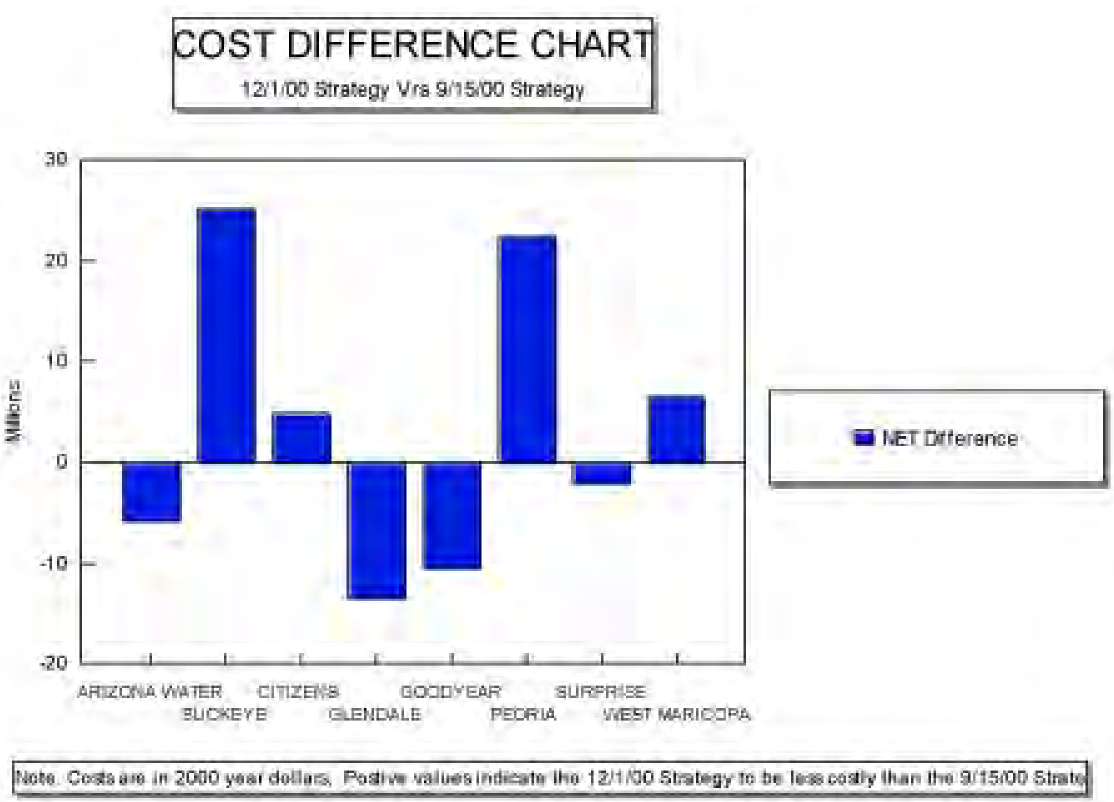


Figure V-2. Cost comparison between strategies December 1, 2000, and September 15, 2000.

WESTCAPS STRATEGY (9/15/00)
COST BY RESIDENTIAL UNIT AND ACRE-FOOT DEMAND

1/16/2001

WPA NAME	WPA #	FACILITY COST: Stage 1 2005	FACILITY COST: Stage 2 2015	FACILITY COST: Stage 3 2025	FACILITY COST: Total Cost	Residential Units Added: 1990 to 2005	Residential Units Added: 2005 to 2015	Residential Units Added: 2015 to 2025	Residential Units Added: Total Residential Units Added	IMPACT FEES TO NEW RESIDENTIAL UNITS: UNITS ADDED DIVIDED BY COST STAGE 1 2005	IMPACT FEES: UNITS ADDED DIVIDED BY COST STAGE 2 2015	IMPACT FEES: UNITS ADDED DIVIDED BY COST STAGE 3 2025	IMPACT FEES: MEMBER Total Costs Divided by Residential Units	COST DIVIDED BY ACRE-FOOT: WPA TOTAL 25 Yr. Demand (Acre-Feet)	COST DIVIDED BY ACRE-FOOT: MEMBER TOTAL 25 Yr. Demand (Acre-Feet)	COST DIVIDED BY ACRE-FOOT: 25 Yr. Cost Divided by 25 Yr. Demand	BOND RECOVERY: Monthly Cost (Rate) Per Residential Unit
ARIZONA WATER CO. WHITE T	3	$5,395,533	$8,228	$2,408,304		607	1,021	1,830		$8,889	$8	$1,316		6851			
					$7,812,065				3458				$2,259		6851	$1,140	$19
BUCKEYE IM	45	$11,320,066	$0	$0		1,335	4,029	10,287		$8,479	$0	$0		22789			
BUCKEYE OM	46	$6,176,316	$0	$233,139		26	476	2,717		$237,551	$0	$86		3169			
BUCKEYE SOUTH	79	$8,997,913	$0	$0		75	1,598	5,713		$119,972	$0	$0		6660			
					$26,727,434				26256				$1,018		32618	$819	$8
CITIZENS AGUA FRIA	4	$0	$49,589,870	$15,208,200		19,950	16,747	6,952		$0	$2,961	$2,188		122436			
CITIZENS AGUA FRIA # 2	82	$4,192,699	$10,460	$3,061,403		2,788	251	693		$1,504	$42	$4,418		12559			
					$72,062,632				47381				$1,521		134995	$534	$13
GLENDALE OUT OF SERVICE	12	$0	$44,625,086	$12,246,800		956	1,072	2,542		$0	$8	$1,316		87153			
					$56,871,886				4570				$12,445		87153	$653	$104
GOODYEAR # 2	13	$85,246,181	$228,714	$66,942,685		4,630	6,889	13,927		$18,412	$33	$4,807		183341			
GOODYEAR OUTSIDE	94	$9,835,444	$25,417	$7,439,210		1,716	1,867	1,876		$5,732	$14	$3,965		22477			
GOODYEAR # 3	96	$0	$0	$0		7,245	7,896	7,936		$0	$0	$0		0			
GOODYEAR # 4	97	$7,415,757	$5,822	$1,471,042		384	448	420		$19,312	$13	$3,502		5159			
LPSCO	14	$24,791,933	$70,009	$20,490,992		6,171	7,523	7,512		$4,017	$9	$2,728		63075			
					$223,963,205				76440				$2,930		361205	$620	$24
PEORIA # 2	98	$0	$0	$0		5,531	3,158	388		$0	$0	$0		0			
PEORIA # 2A	77	$54,035,159	$0	$0		16,388	16,894	6,354		$3,297	$0	$0		134680			
PEORIA # 3	44	$9,807,859	$0	$0		250	1,446	4,198		$39,231	$0	$0		8311			
PEORIA # 5	73	$1,068,937	$15,520,210	$4,624,000		2,032	4,461	6,219		$526	$3,479	$744		24929			
PEORIA # 6	75	$0	$4,808,023	$1,091,400		654	1,064	1,360		$0	$4,519	$803		6196			
PEORIA - YAV CO	71	$0	$0	$0		10	21	10		$0	$0	$0		0			
PEORIA SRP	63	$0	$0	$0		10,114	651	43		$0	$0	$0		0			
SUNRISE	76	$2,056,047	$0	$0		1,616	580	0		$1,272	$0	$0		6633			
					$93,011,636				83442				$1,115		180749	$515	$9
WEST END	74	$1,257,842	$0	$0		464	80	352		$2,711	$0	$0		1999			
SURPRISE # 1	80	$0	$0	$0		487	0	50		$0	$0	$0		1316			
SURPRISE # 10	102	$49,976	$0	$0		6	5	12		$8,329	$0	$0		77			
SURPRISE # 11	103	$8,447	$0	$0		2	1	4		$4,223	$0	$0		8			
SURPRISE # 12	104	$16,893	$0	$0		3	3	7		$5,631	$0	$0		16			
SURPRISE # 13	110	$108,398	$0	$0		8	8	56		$13,550	$0	$0		110			
SURPRISE # 2	81	$0	$0	$0		215	0	152		$0	$0	$0		691			
SURPRISE # 3	100	$125,898	$1,686,184	$544,000		352	516	1,321		$358	$3,268	$412		2887			
SURPRISE # 4	105	$1,310,634	$0	$0		177	186	658		$7,405	$0	$0		1256			
SURPRISE # 5	99	$1,221,944	$0	$0		59	109	405		$20,711	$0	$0		1687			
SURPRISE # 6	16	$2,969,691	$0	$0		245	291	1,506		$12,121	$0	$0		3025			
SURPRISE # 7	106	$0	$0	$0		52	172	1,329		$0	$0	$0		1588			
SURPRISE # 8	108	$66,177	$1,394,289	$285,600		192	328	647		$345	$4,251	$441		1562			
SURPRISE # 9	109	$94,321	$0	$0		7	12	37		$13,474	$0	$0		115			
					$11,140,294				10516				$1,059		16337	$682	$9
WEST MARICOPA COMBINE 85	85	$0	$0	$0		0	0	0		$0	$0	$0	$0	0			
WEST MARICOPA COMBINE 86	86	$135,243	$0	$0		2	51	167		$67,622	$0	$0	$615	346			
WEST MARICOPA COMBINE 87	87	$21,265	$0	$0		0	9	26		$0	$0	$0	$608	54			
WEST MARICOPA COMBINE 88	88	$7,510	$0	$0		0	2	2		$0	$0	$0	$1,878	23			
WEST MARICOPA COMBINE 89	89	$2,171,933	$0	$0		44	61	222		$49,362	$0	$0	$6,642	483			
WEST MARICOPA COMBINE 90	90	$408,974	$0	$0		0	6	9		$0	$0	$0	$27,265	57			
WEST MARICOPA COMBINE 91	91	$101,863	$0	$0		0	1	2		$0	$0	$0	$33,954	15			
WEST MARICOPA COMBINE 92	92	$5,463,814	$0	$0		522	949	2,609		$10,467	$0	$0	$1,339	9898			
WEST MARICOPA COMBINE 95	95	$0	$0	$0		0	5	37		$0	$0	$0	$0	56			
WMC TONOPAH	201	$2,400,996	$0	$0		221	266	762		$10,864	$0	$0	$1,922	2424			
					$10,711,598				5975				$1,793		13356	$802	$15
		$248,281,662	$117,972,313	$136,046,775													
				Total Cost	$502,300,750			Total New Units	258038			Project Average	$1,947	746111	826413	$608	$16

Note: Bond Rate assumes bonds are issued at build-out amount and in the first year of the project. Rate was calculated by dividing Member cost by the residential units added (between 1990 and 2025), dividing by 12 (monthly factor) and dividing by .1 (the premium factor) .

Table V-4. Cost by residential unit and ac-ft demand
(WESTCAPS strategy, dated September 15, 2000)