August 26, 1999

Ms. Mary Dahl, President
Colorado River Regional Sewer Coalition
1795 Civic Center Boulevard
Lake Havasu City, AZ 86403

Colorado River Regional Sewer Coalition
Regional Watershed Planning Document
Interim Report
Project No. 98-763-4

Dear Ms. Dahl:

We are pleased to submit our final report on the Regional Watershed Planning Document for the Colorado River Regional Sewer Coalition (CRRSCo). This document was developed in accordance with the Scope of Services for the final report outlined in our Agreement.

The purpose of the final report is to summarize wastewater needs and their costs as identified in available wastewater master planning documents and to project wastewater needs within the planning area where no master planning exists. This report is developed to aid state and federal legislatures in their efforts towards obtaining funding for the construction of the recommended improvements.

The assistance provided by individual CRRSCo member staff during the preparation and review of the interim report is greatly appreciated. The project team remains ready to discuss the details of this report at your convenience.

Sincerely,

Robert S. Schulz
Project Manager

Colorado River Regional Sewer Coalition, Lake Havasu City, Arizona
Regional Watershed Planning Document - Final Report

Project No. 98-763-4

Index and Certification Page

Report Index

CERTIFICATIONS(S)

EXECUTIVE SUMMARY

The Colorado River and its tributaries drain portions of seven states and Mexico (Figure ES-1). The river is over 1,400 miles in length with a watershed area of 246,000 square miles. Benefits derived from the Colorado River and its dams and reservoirs are vast. The dam and reservoir system provides drinking water for millions of residents and flood control for River communities. Over 19 million recreational users visit the reservoirs and river annually; over 20 million residents of Arizona, California and Nevada receive their drinking water from the Colorado River. River-derived economic benefits are in the billions of dollars and include a significant portion of the nation's crop production and non-polluting hydroelectric power generation. In addition, the primary livelihood for thousands of local residents is directly related to the Colorado River.

Lower Colorado River communities are experiencing rapid growth. Figure ES-2a and Figure ES-2b show projected growth in the seven counties bordering on the Lower Colorado River. Population in these counties is projected to increase by 62 percent from the year 2000 to the year 2020. This growth, together with a majority of River residents on septic systems, has contributed to water quality problems for both the surface water and groundwater. Microbial contamination of surface water and high nitrate levels in groundwater have forced regulatory agencies to take strong measures, including beach closures and construction bans in areas where no centralized wastewater collection systems exist. Contact with pathogens like *Cryptosporidium* and *Giardia* can be health-threatening and if ingested life-threatening. High nitrate concentrations in groundwater

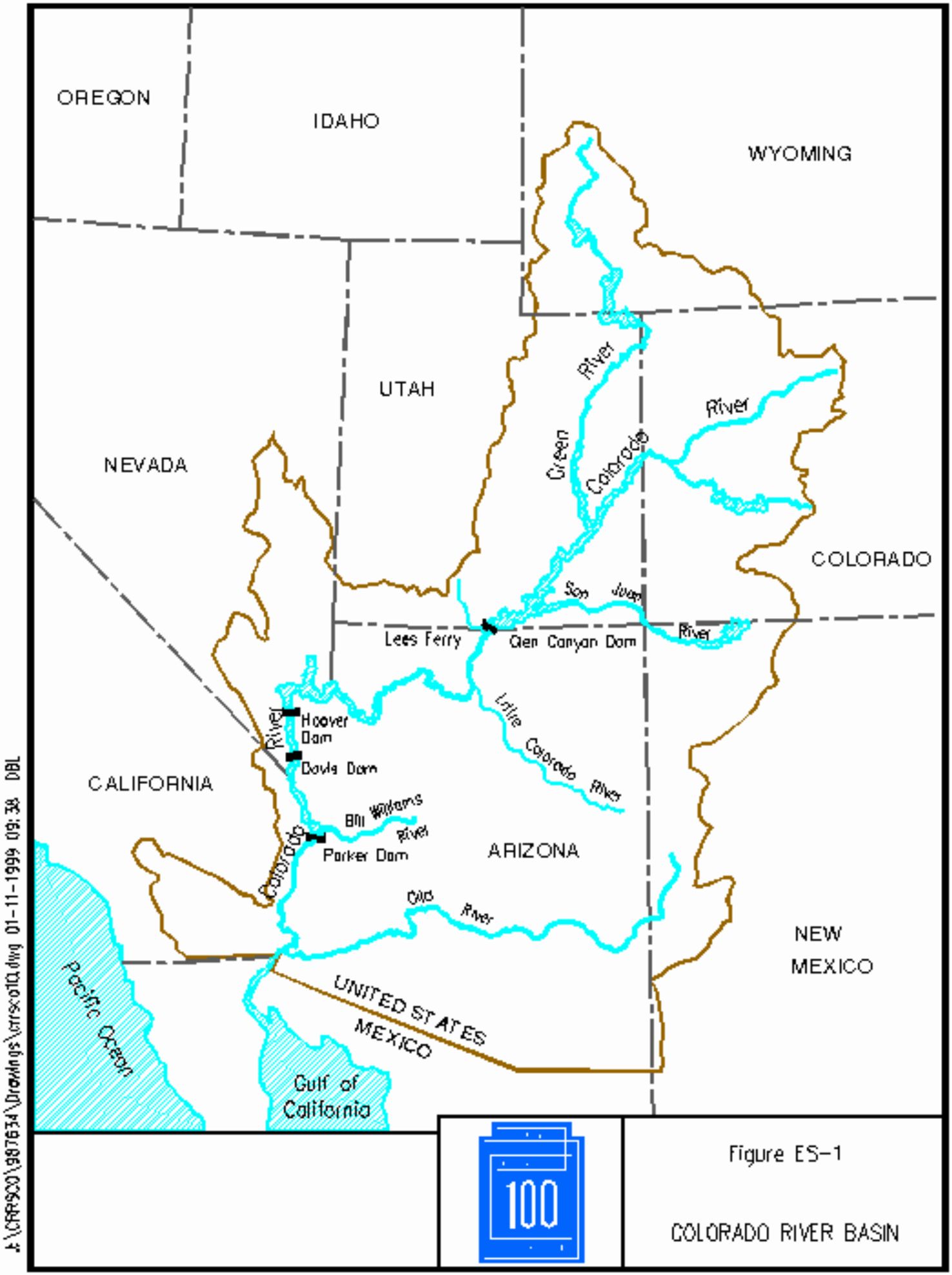
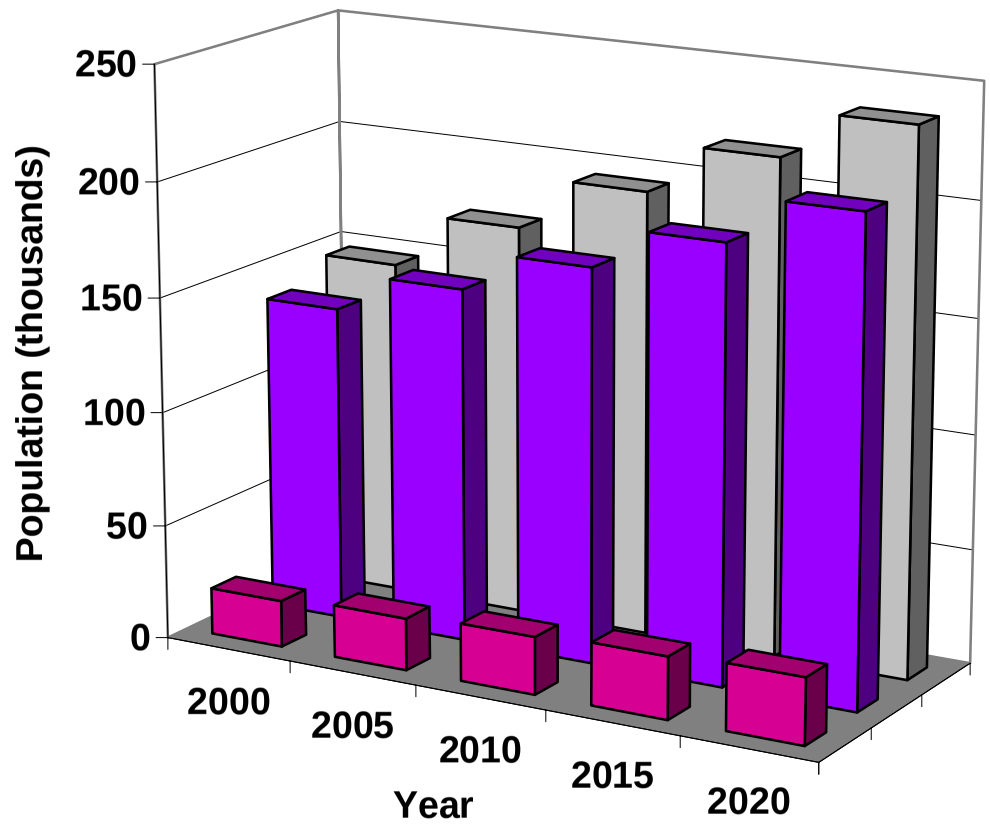


Figure ES-1

COLORADO RIVER BASIN



Burns & McDonnell 100 1898 • 1998

FIGURE ES-2a

Projected Growth in Counties Bordering Lower Colorado River

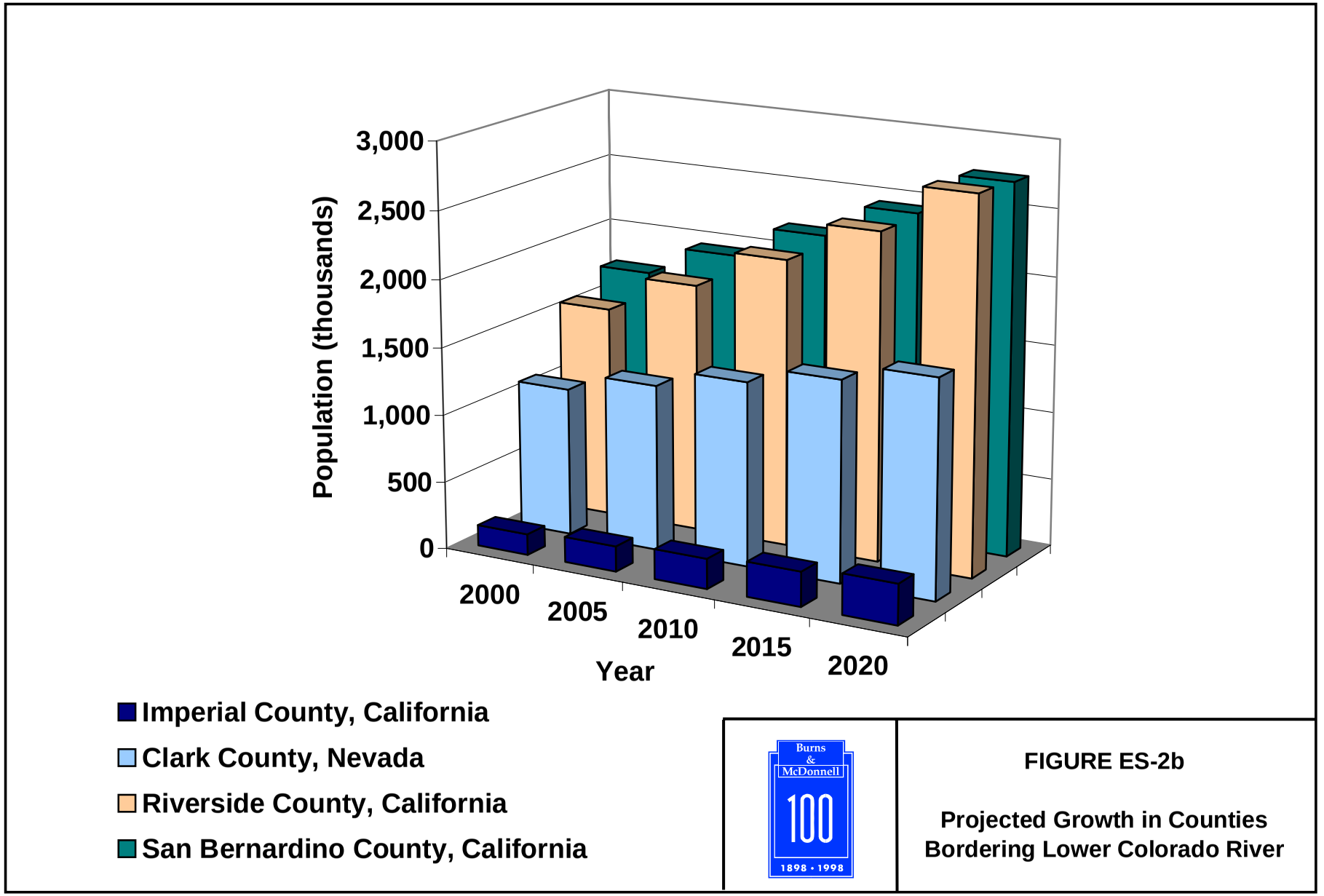


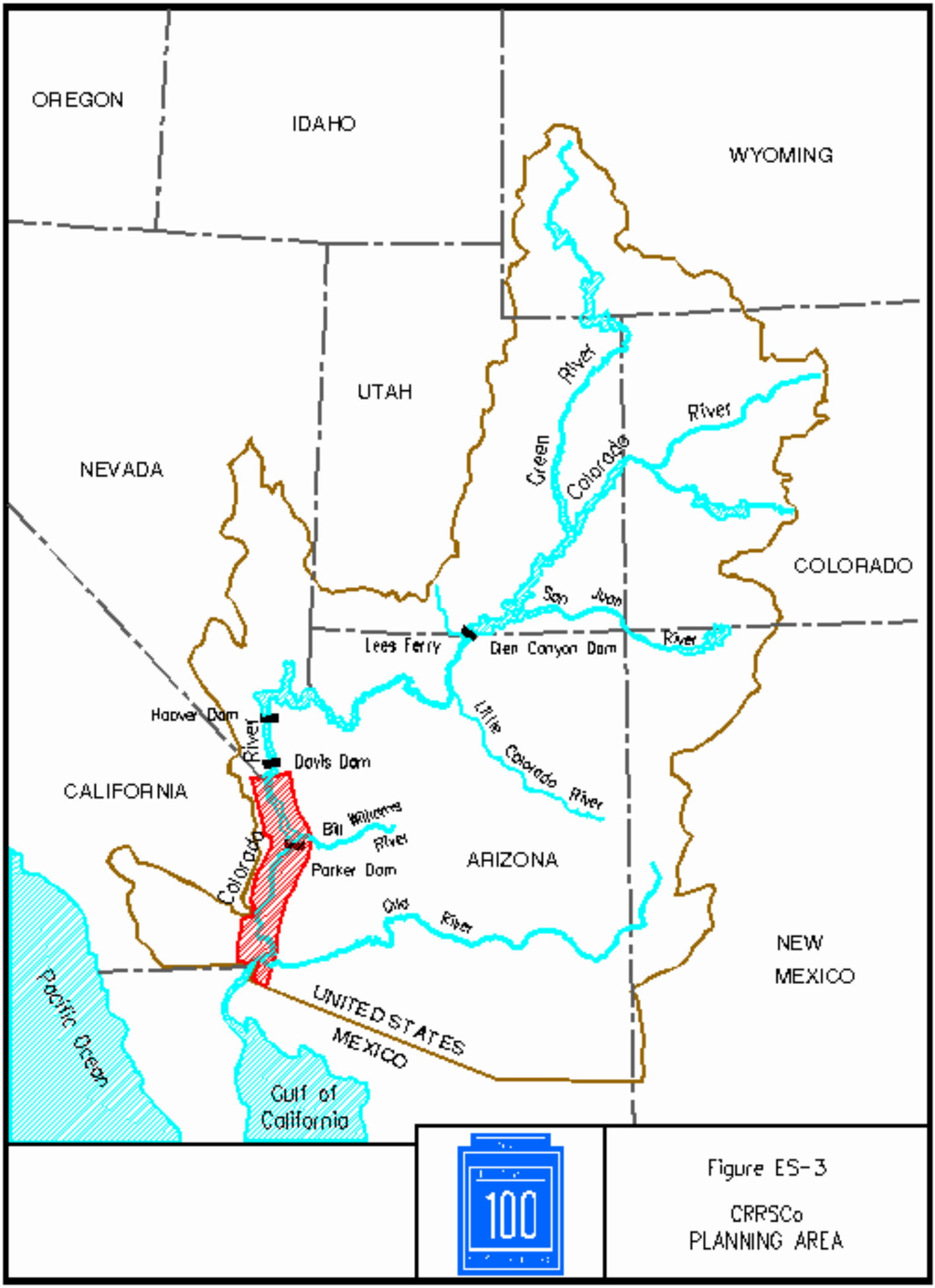
FIGURE ES-2b

Projected Growth in Counties Bordering Lower Colorado River

and surface drinking water can cause "blue-baby syndrome" resulting in infant mortality. To address these, and other water quality-related issues, the Colorado River Regional Sewer Coalition (CRRSCo) was formed.

CRRSCo is an Arizona-based, non-profit corporation of River communities, local governments, Indian tribes, and other entities in the Lower Colorado River Basin. Their charter is to protect and enhance the Colorado River through the improvement of wastewater management practices to ensure a high quality of water for all users. CRRSCo has adopted a watershed philosophy for problem solving to emphasize the impact of River community management practices on one another and the millions of citizens who depend on the Colorado River for water, food, power and economic development. The CRRSCo planning area is shown in Figure ES-3; current CRRSCo members are shown in red in Figure ES-4. A Regional Watershed Planning Document is being developed to: 1) inform members and non-members within the planning area of the gravity of the situation; and 2) provide a cohesive document to assist state and federal legislatures in obtaining funding for the identified needs and subsequent implementation of improvements.

The first step towards achieving these goals was consolidation of information from wastewater master planning efforts previously commissioned by CRRSCo members. For entities where no master planning exists, collection and treatment needs were developed based on recent planning efforts in the region. Table ES-1 summarizes recommended


OREGON
IDAHO
WYOMING
UTAH
NEVADA
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
Green River
Colorado River
San Juan River
Lees Ferry
Glen Canyon Dam
Little Colorado River
Hoover Dam
Davis Dam
Bill Williams River
Parker Dam
Colorado River
Gila River
Pacific Ocean
Gulf of California
UNITED STATES
MEXICO
100
Figure ES-3
CRRSCo
PLANNING AREA
J:\CRRSCO\967834\Drawings\crrsco11.dwg 01-11-1999 09:39 DBL

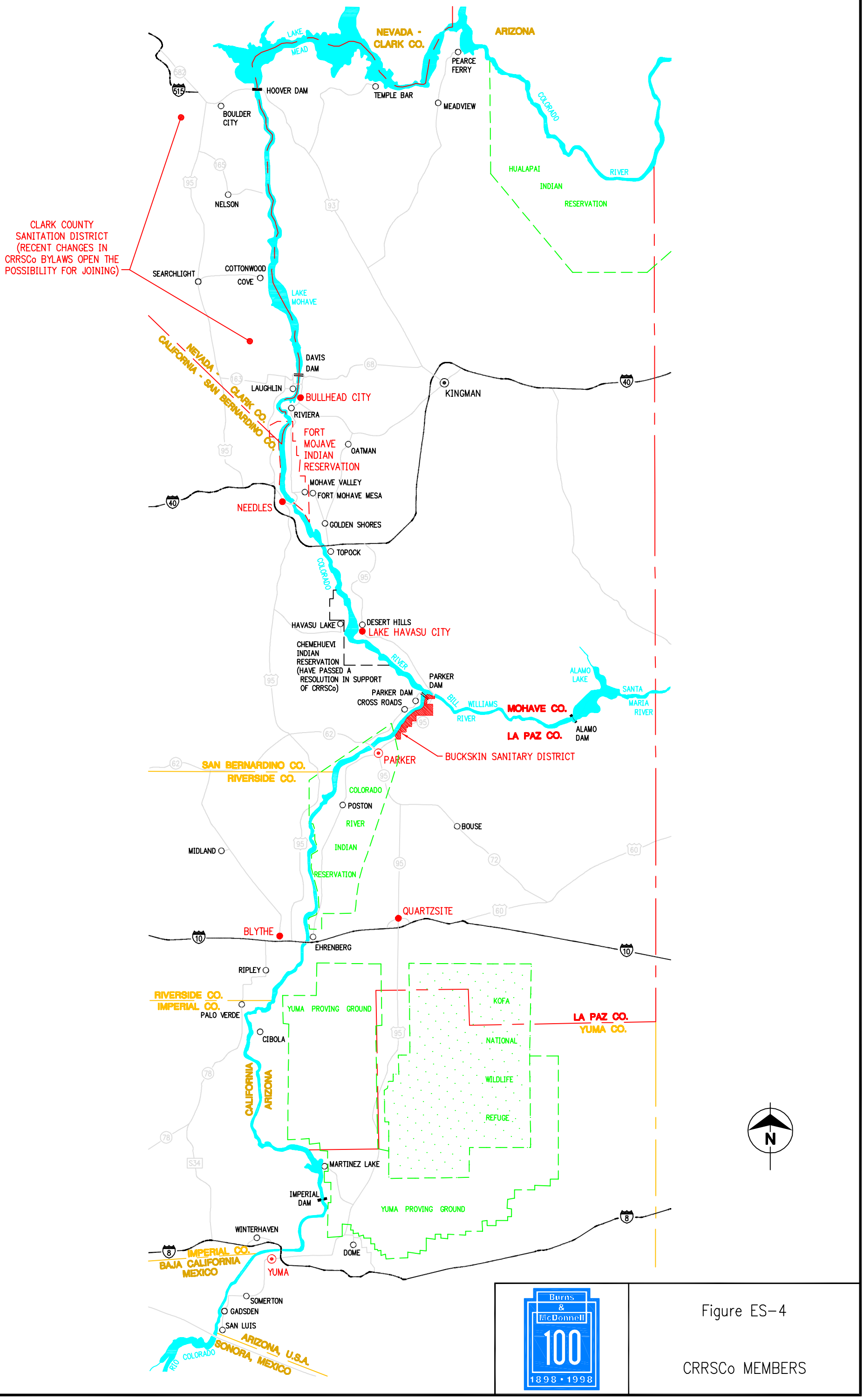


Figure ES-4

CRRSCo MEMBERS

Table ES-1. CRRSCo Planning Area Wastewater Improvements by Phase

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	1,307,489	1,317,489	1,141,489	919,489	530,000	5,215,957
Plant Treatment Capacity, MGD	8.5	3.5	8.1	5.4	9.0	34.5

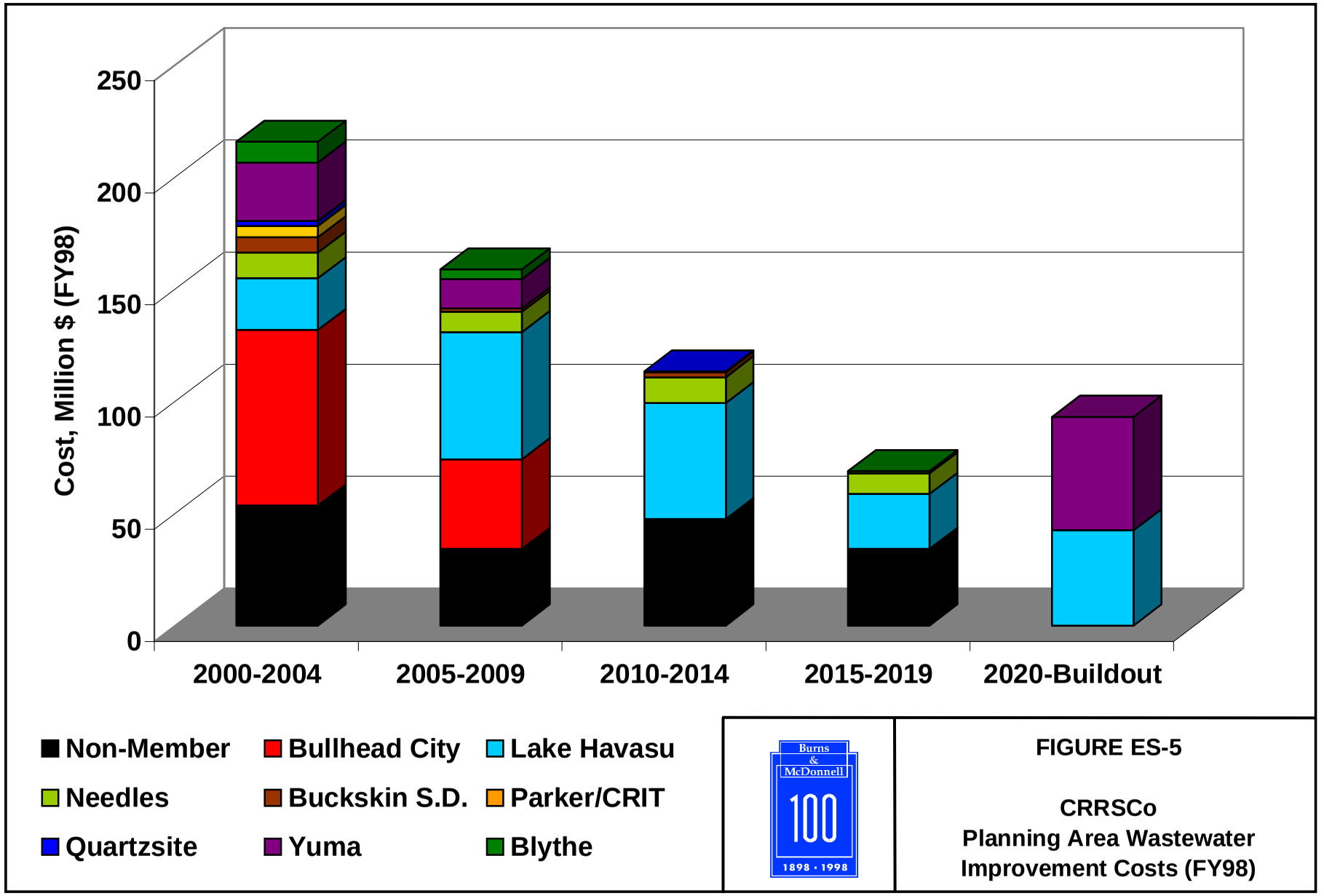


FIGURE ES-5

CRRSCo
Planning Area Wastewater
Improvement Costs (FY98)

wastewater improvements, by construction phase, for CRRSCo members. These improvements consist of over 5 Million lineal feet of sewer collection system and over 34 Million gallons per day of treatment capacity. Figure ES-5 summarizes CRRSCo planning area estimated costs, by construction phase, for the recommended improvements. The total estimated cost to construct the recommended improvements for CRRSCo members is approximately $650 Million (FY98). The actual dollars spent over the next 20 years for these improvements, assuming an average inflation rate of 4 percent, is approximately $1.1 Billion.

The report details a *watershed-prioritized*, multi-year implementation program for the recommended wastewater system improvements with associated costs for the entire CRRSCo planning area. A financial framework is detailed which addresses local, state, federal and philanthropic opportunities for funding.

I. INTRODUCTION

A. Purpose of the Report

The purpose of the report is to present an assessment of wastewater needs of River communities located in the Lower Colorado River Watershed South of Davis Dam down to the US/Mexico border. The report details a top-level *watershed-prioritized*, multi-year implementation program for the identified wastewater system improvements. These needs, together with a framework for examining funding options will be presented to state and federal legislators in support of efforts towards beginning the process of obtaining program funding.

B. Scope of the Report

The report presents wastewater needs and identifies the magnitude of financial resources necessary to provide the recommended wastewater collection and treatment to entities residing with the Colorado River Regional Sewer Coalition (CRRSCo) planning area. This area is defined as the Lower Colorado River Watershed South of Davis Dam down to the US/Mexico border.

This report will be provided to members of state and federal legislatures for the twofold purpose of: 1) informing those members of the gravity of the situation; and 2) providing information to support efforts towards obtaining funding for the identified needs.

In addition to wastewater needs, information on water quality and health concerns is also reviewed. These issues are of great concern given the potential impact on River residents, out-of-watershed populations served (20 million) and annual visitors to the area (19 million). These numbers emphasize the far-reaching impact the Lower Colorado River has on people's lives.

A watershed philosophy is adopted here to emphasize the far-reaching impact of River community management practices on one another and the millions of citizens who depend on the Colorado River for water, food, power and economic livelihood. In areas where either no wastewater master planning has been developed or information does not exist, projections of wastewater collection and treatment needs are developed. Costs associated with these projections are presented based on unit construction costs developed for the Lake Havasu City's Comprehensive Phase II Wastewater Master Plan.

The core of the report is a *watershed-prioritized*, multi-year phased program for recommended sewer system improvements, together with the corresponding construction costs. This program addresses the needs for all entities residing in the CRRSCo planning area. It is envisioned that this report will be a "living" strategic roadmap for CRRSCo with the proposed multi-year phased program being revisited over time based on actual funding secured and other events occurring that could impact priorities.

A funding framework is provided that presents member bonding capacity together with the variety of state, federal and private funding resources. Recommendations for taking

the next steps towards obtaining the necessary funding for construction of the wastewater improvements is presented.

C. The Colorado River Regional Sewer Coalition (CRRSCo)

The Colorado River Regional Sewer Coalition (CRRSCo) is an association of river communities, local governments, Indian tribes, and other entities in the Lower Colorado River Basin whose charter is to protect and enhance the Colorado River through the improvement of wastewater management practices to help assure a high quality of water for all users.

CRRSCo is a non-profit corporation, formed under the provisions of Title X, Chapter 1, Article 16 of the Arizona Revised Statutes. A copy of the CRRSCo By-laws and Articles of Incorporation is provided in Appendix I.

CRRSCo city voting members include: Bullhead City, AZ; Lake Havasu City, AZ; Town of Parker, AZ; Town of Quartzsite, AZ; City of Yuma, AZ; City of Blythe, CA; and City of Needles, CA. County voting members include: La Paz County, AZ and Mohave County, AZ. Sanitation district members include Buckskin Sanitary District, La Paz County, AZ. American Indian voting members include the Fort Mojave Indian Tribe. Non voting members include: 1) Wilson Bale Associates; and 2) Larry Sisk DBA Western Bio-Tek Environment. The Chemehuevi Indian Tribe has passed a resolution to join CRRSCo but is not currently an official member. The Clark County Sanitation District, NV is interested in joining CRRSCo. The major impediment to the County

joining CRRSCo is the language of CRRSCo's by-laws. The County is currently working with CRRSCo to determine how to best overcome this hurdle.

Other entities that have expressed interest in joining CRRSCo include the Metropolitan Water District of Southern California and the Coachella Valley Association of Governments (a California sub-regional council).

II. BACKGROUND

A. Lower Colorado River Watershed

1. Description

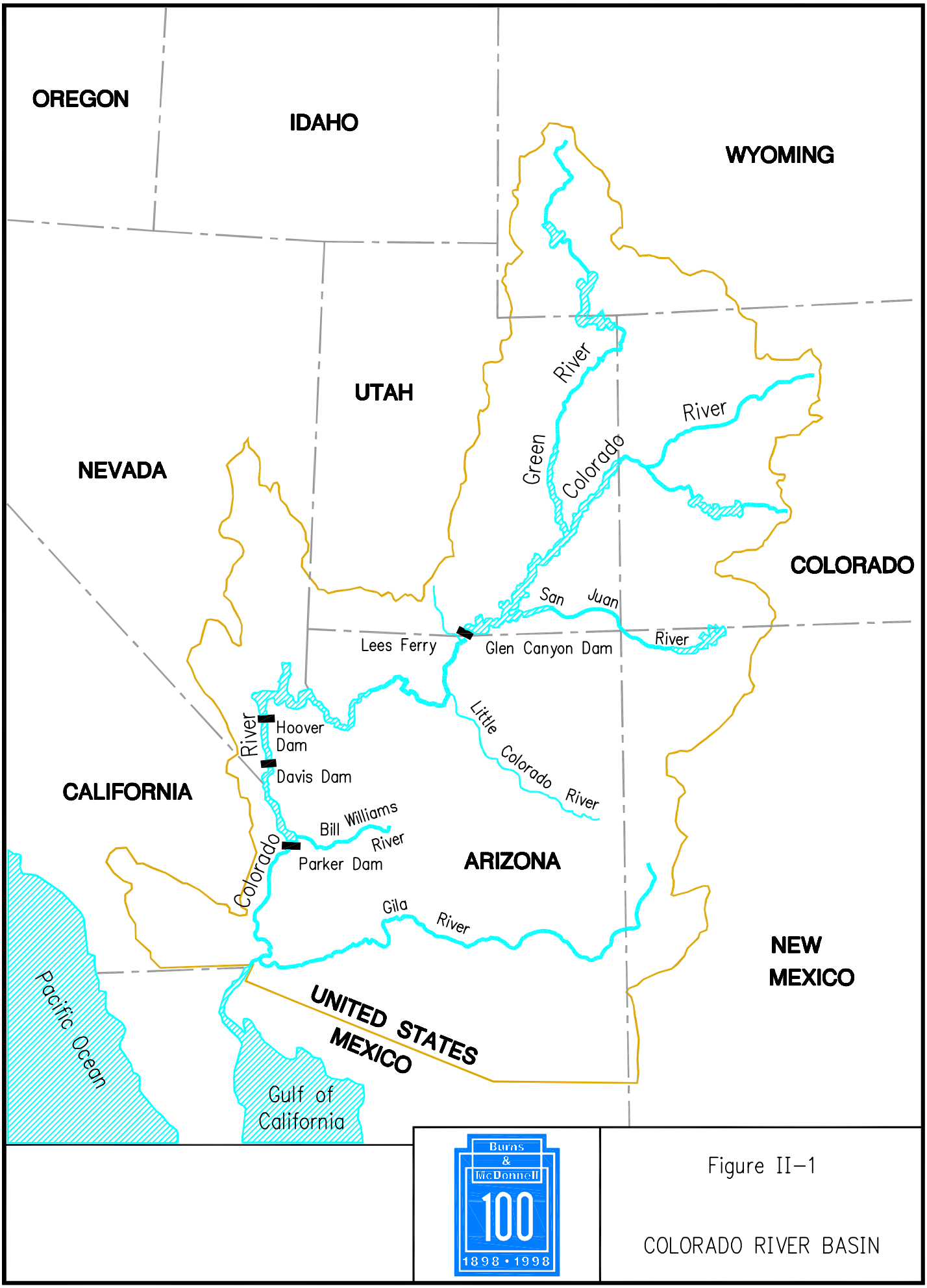
The Colorado River and its tributaries drain portions of seven states and Mexico (Figure II-1). The river is over 1,400 miles in length with a watershed area of 246,000 square miles. The watershed has been divided into the Upper and Lower Colorado Basins, based on water allocation.

The Lower Basin is defined as beginning at Lees Ferry, which is 16 miles downstream of Glen Canyon Dam, and runs 688 miles to the US - Mexico border (Figure II-2). The Lower Basin, with a watershed area of 138,000 square miles, consists of portions of Arizona, California, Nevada and New Mexico.

2. Lower Basin Dam Projects and Reservoirs

Referring to Figure II-2, the following dam/reservoir projects are found in the Lower Colorado River Basin: 1) Hoover Dam and Lake Mead; 2) Davis Dam and Lake Mohave; and 3) Parker Dam and Lake Havasu.

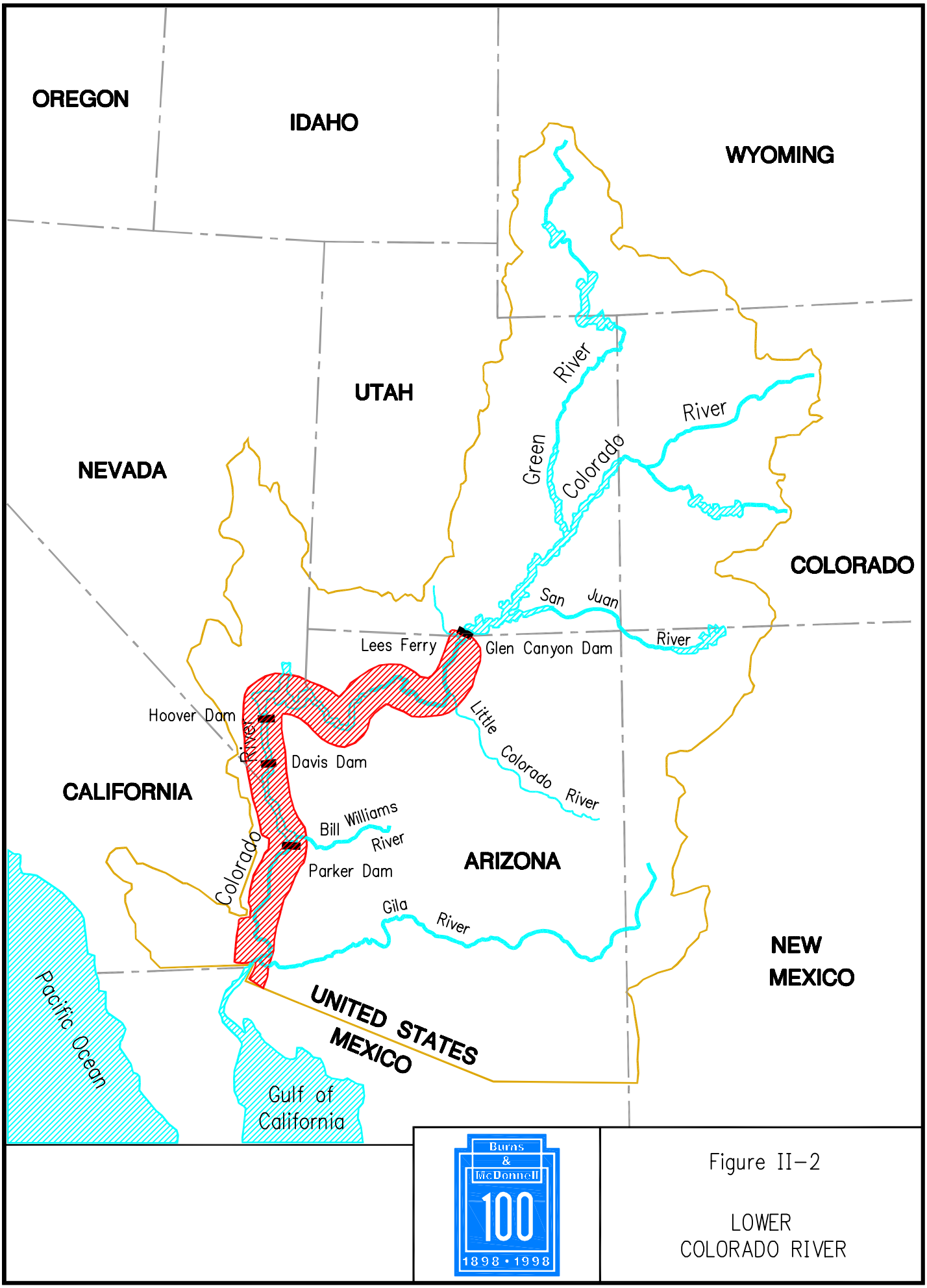
Other dams on the Lower Colorado River include: 1) Headgate Rock Dam (water diversion and hydropower); 2) Palo Verde Diversion Dam (water diversion); 3) Senator Wash Dam (pump - storage); 4) Imperial Dam (water diversion); 5) Laguna Dam (river



J:\CRRSCO\987634\Drawings\crrsco04.dwg 01-11-1999 09:28 DBL

Figure II-1

COLORADO RIVER BASIN



J:\CRRSCO\987634\Drawings\crrsco05.dwg 01-11-1999 13:54 DBL

Figure II-2

LOWER COLORADO RIVER

regulation); and 6) The Republic of Mexico's Morelos Dam (water diversion). The Federal Bureau of Reclamation (BOR) is responsible for the management and operation of dams and reservoirs in the United States. For a more detailed discussion of BOR responsibility for river management, see Appendix II.

3. Water Allocation

The Colorado River Compact of 1922 allocates 16 million acre-feet of consumptive use water per year as follows: 1) 7.5 million acre-feet to the Upper Basin of the Colorado River; and 2) 8.5 million acre-feet to the Lower Basin of the Colorado River. Of this total, 1.5 million acre-feet are guaranteed for delivery to Mexico with each basin contributing 750,000 acre-feet, respectively. For additional information on the Colorado River Compact of 1922 in specific and Colorado River Law in general, see Appendix III.

Lower Basin water allocation is apportioned among states as follows: 1) Arizona: 2.8 million acre-feet; 2) California: 4.4 million acre-feet; and 3) Nevada: 0.3 million acre-feet (Figure II-3). Figures II-4 through II-6 show each of the state's usage predicted for 1998, broken down by major user. The discrepancy between California water allocated water (4.4 million acre-feet) versus California water usage (Figure II-4 shows a total water usage of 5.0 million acre-feet) is due to surplus water conditions in the nearly full reservoirs of which California is entitled to receive half. California is in the process of developing a water use plan that will detail a commitment to live within its 4.4 million acre-feet allocation. The total projected water consumption from the Colorado River in 1998 is 13.5 million acre-feet.

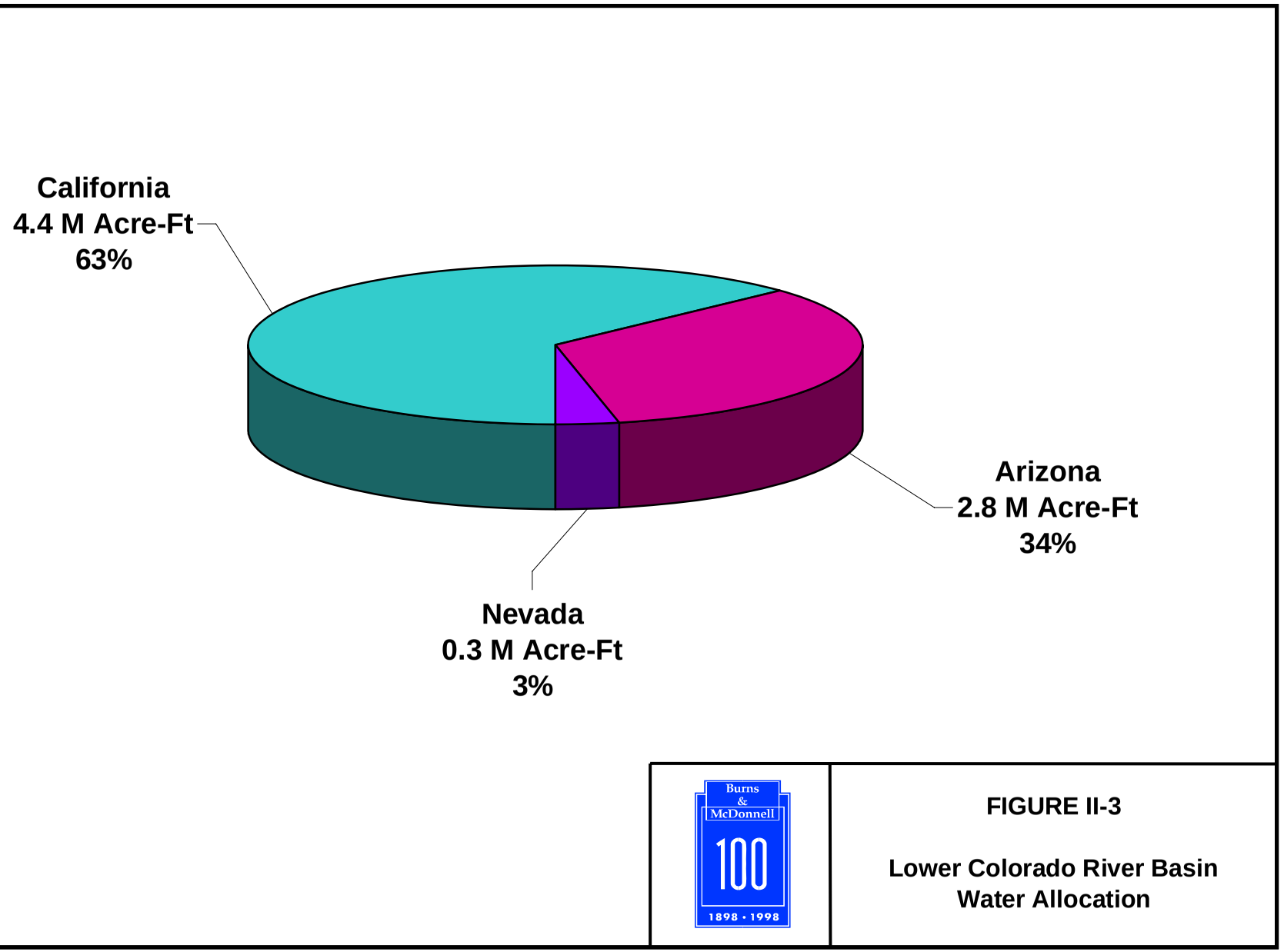


FIGURE II-3

Lower Colorado River Basin
Water Allocation

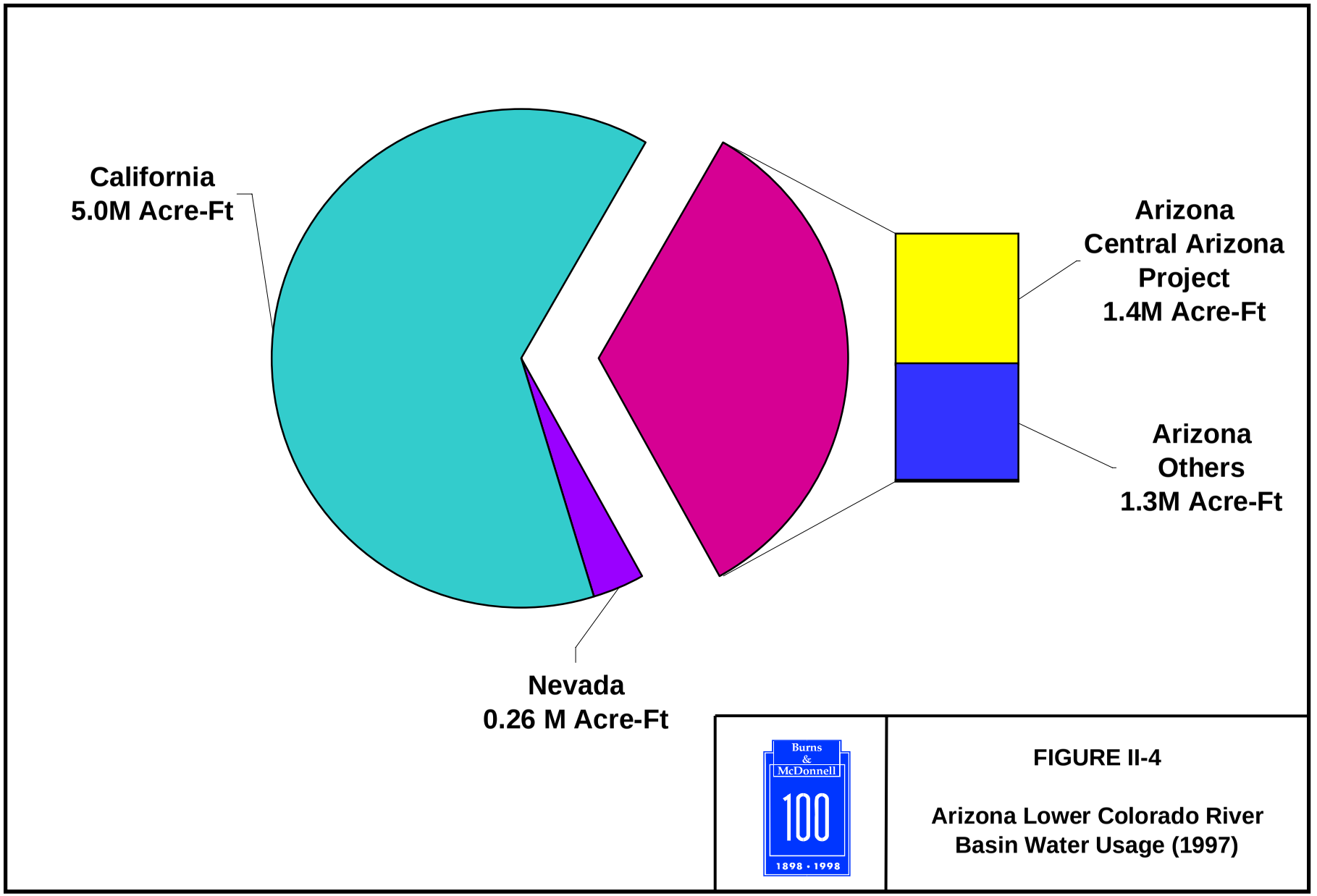
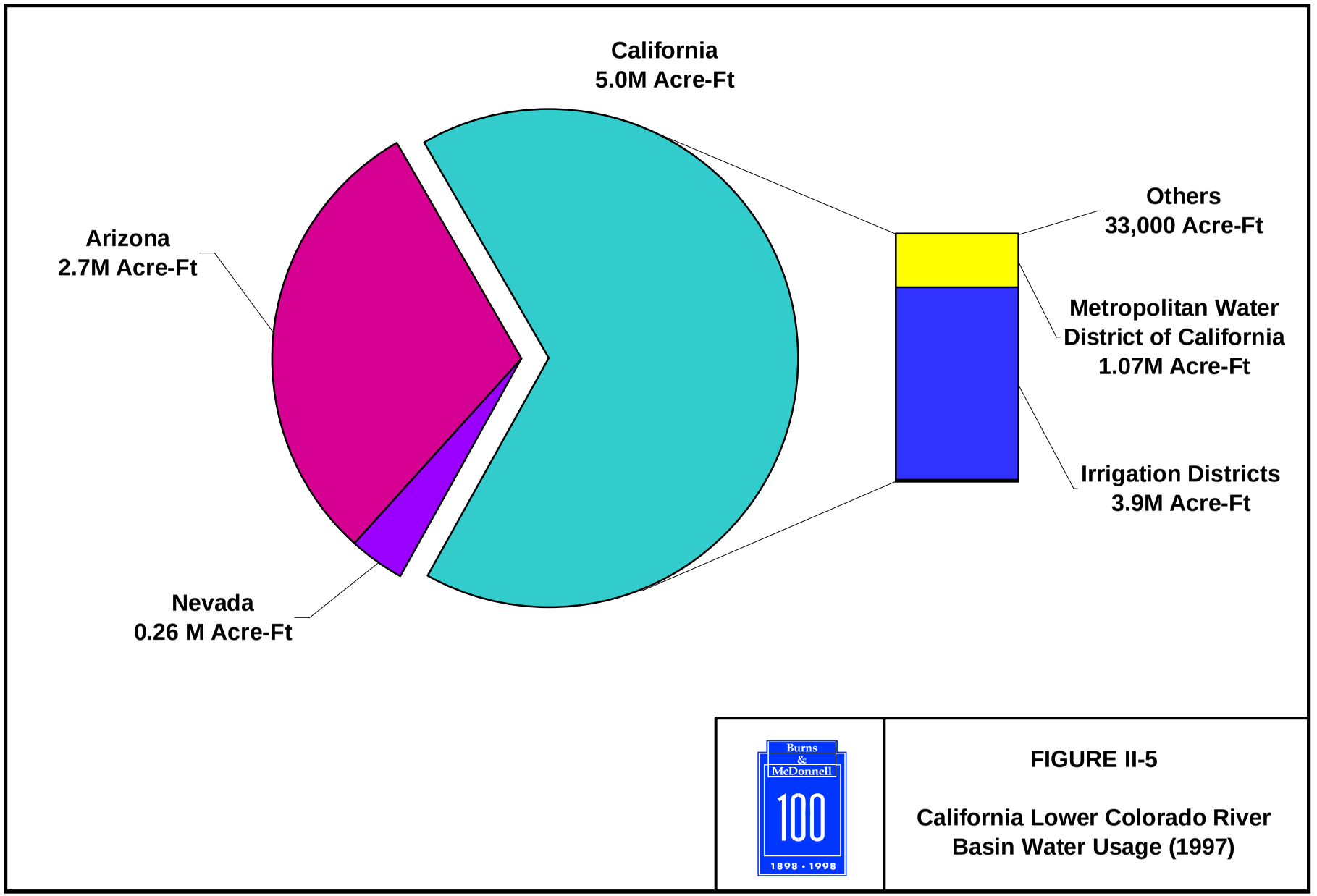


FIGURE II-4

Arizona Lower Colorado River Basin Water Usage (1997)



Burns & McDonnell 100 1898 • 1998

FIGURE II-5

California Lower Colorado River Basin Water Usage (1997)

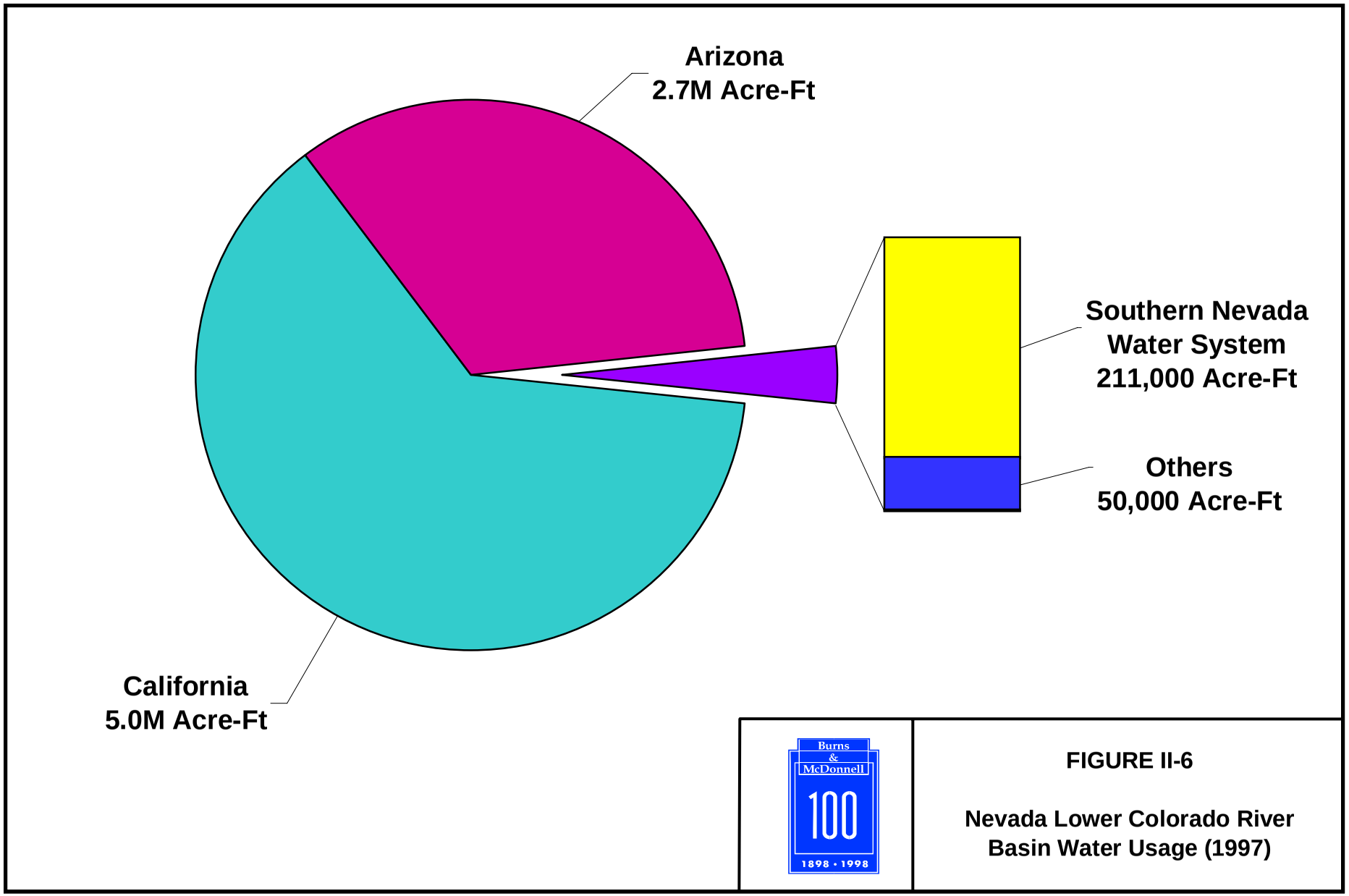


FIGURE II-6

Nevada Lower Colorado River Basin Water Usage (1997)

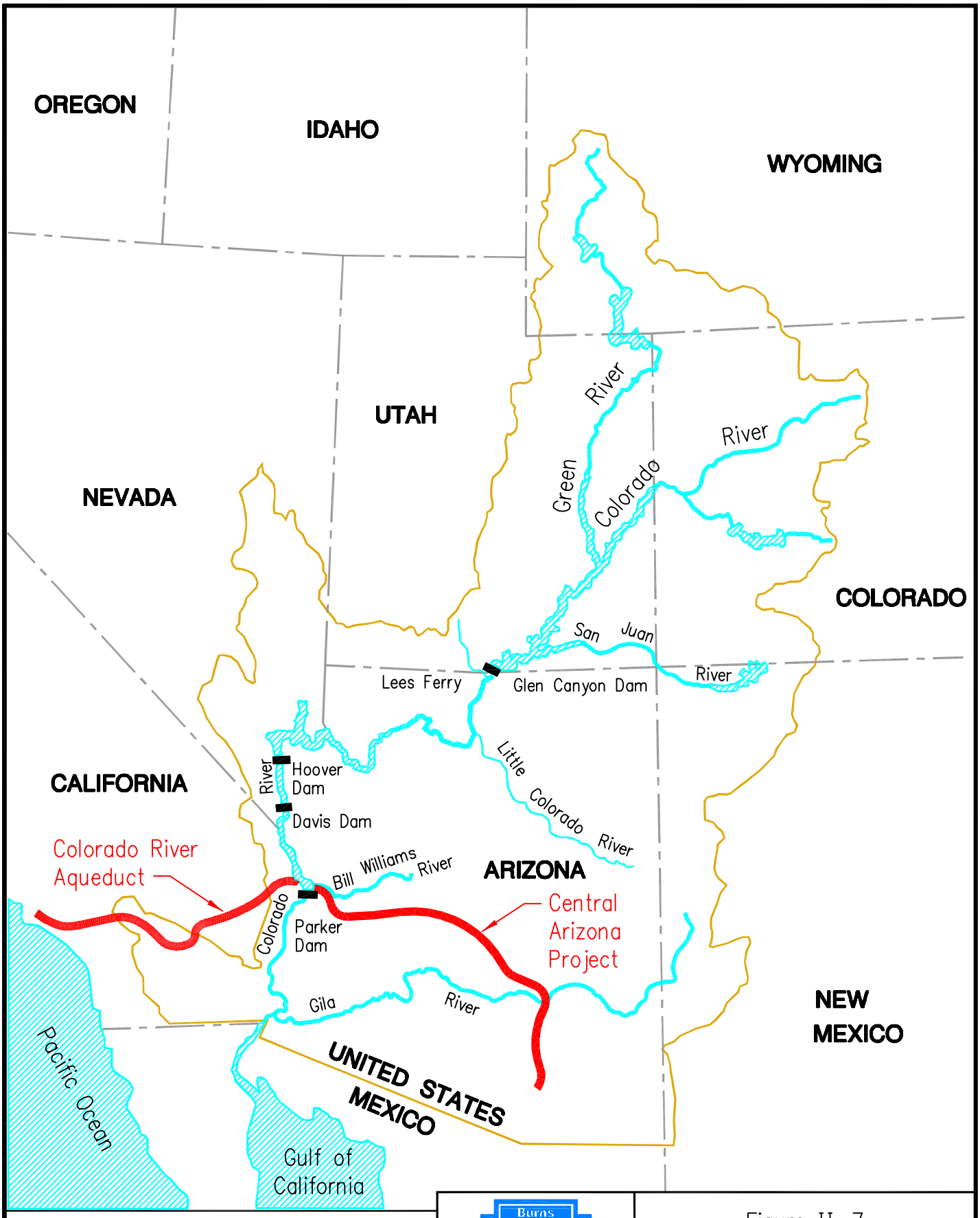
B. Benefits Derived from The Lower Colorado River

1. Overview

Benefits derived from the Colorado River and its dams and reservoirs are vast and numerous. The dam and reservoir system provides drinking water for millions of residents and flood control for river communities. Millions of recreational users visit the reservoirs and river annually. Economic benefits include a significant portion of the nation's crop production and non-polluting hydroelectric power generation. In addition, the primary livelihood for thousands of local residents is directly related to the Colorado River.

2. Drinking Water

The Lower Colorado River is the source of drinking water for over 19 million residents in the States of Arizona, California and Nevada. Two massive water delivery systems have been designed to deliver drinking water to California and Arizona: 1) the California Aqueduct System; and 2) the Central Arizona Project. Figure II-7 shows the extent of these two systems. The California Aqueduct is 242 miles in length and has the capacity to deliver almost 1 billion gallons of water per day from the Colorado River to Lake Mathews, located near Riverside, California. The Central Arizona Project is 336 miles long and has the capacity to deliver almost 2 billion gallons of water per day to Phoenix, Mesa, Scottsdale and Tucson. For more information on the California Aqueduct System; and the Central Arizona Project, see Appendix IV. Figure II-8 demonstrates the

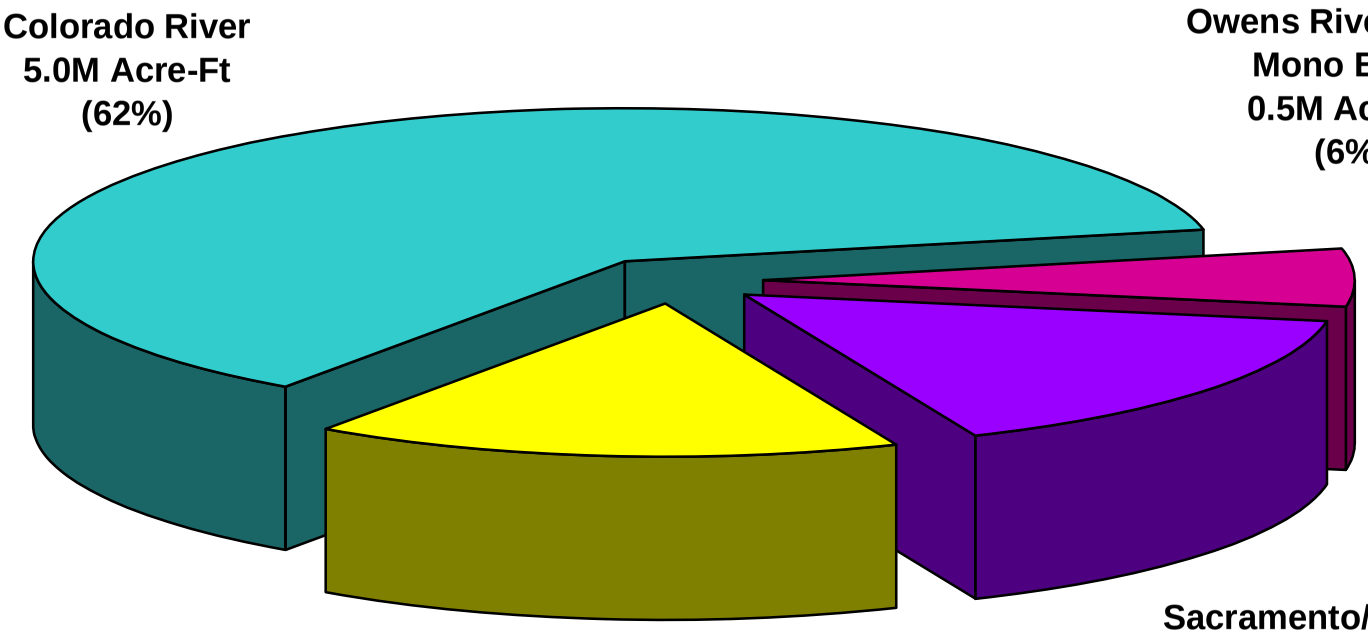


J:\CRRSCO\987634\Drawings\crrsco06.dwg 01-11-1999 09:31 DBL

Burns & McDonnell 100 1898 • 1998

Figure II-7

CALIFORNIA AQUEDUCT SYSTEM AND CENTRAL ARIZONA PROJECT



Source: Colorado River Board, 1997

FIGURE II-8

Importance of Colorado River Water to Southern California

importance of the Colorado River to water usage in Southern California. Over 60% of the residents in Southern California receive their drinking water from the Colorado River.

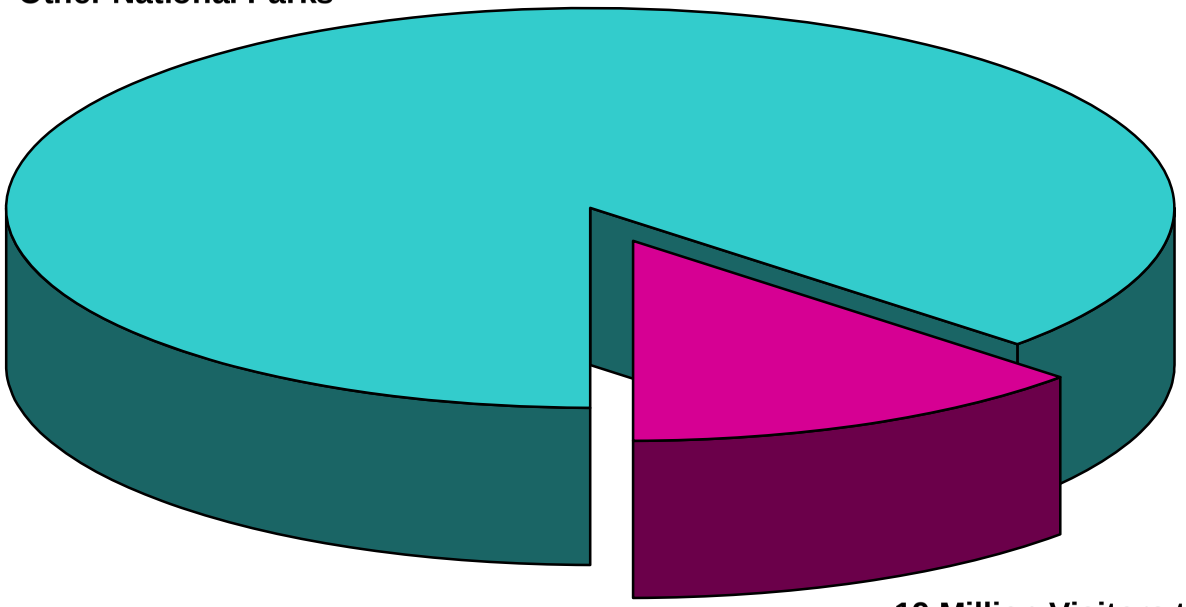
3. Recreational Uses

Three major reservoirs (Lake Mead, Lake Mohave and Lake Havasu) and the river itself provide almost 300,000 surface acres of water and 2,000 miles of shoreline for recreational use. Over 19 million visitors annually make their way to the Lower Basin. Activities range from boating, water sports, camping and horseback riding to sightseeing and wildlife viewing. Figure II-9 shows how Lower Basin recreation area annual visitors compared to all Bureau of Reclamation recreation parks and areas.

Boating, jet skiing and windsurfing enthusiasts take advantage of what the Lower Basin has to offer. River rafting is still one of the most sought after activities. The development of trout fisheries along the river provides excellent opportunities for fishing. To help address environment impacts of the dam/reservoir projects along the river, thousands of acres of land have been purchased and made available to public use. These lands provide excellent hunting and camping opportunities.

4. Economic Benefits

The economic benefits experienced as the result of beneficial uses of Lower Colorado River water are significant. At the macro level, agribusiness and hydroelectric power



Source: US National Parks Service, 1994

FIGURE II-9

Annual Visitors to Lower Colorado Parks and Recreation Areas

generation play significant, national roles. At the micro level, tourism and river-related activities are the mainstay of the local river community economies.

Water released from Hoover Dam irrigates about 1.4 million acres in Arizona and California producing over $2 Billion in crops annually. This accounts for approximately 1.2 percent of all crop sales in the US. The Imperial Irrigation District (IID) is one of the major crop producers, compliments of the Colorado River. For a more detailed description of IID and its agribusiness and power business, see Appendix IV.

The four hydroelectric power plants in the Lower Basin generate more than 6 billion kilowatt-hours of power per year. Total sales of this power approach $400 Million annually.

Local economies also reap the rewards of entertaining 19 million visitors annually. An indirect, yet representative measure of the impact of seasonal population and tourism is the number of retail plus service sector jobs in the community. Figure II-10 shows retail plus service sector jobs as a fraction of total employment in La Paz, Mohave and Yuma Counties, respectively. In all three counties, this combined fraction is approximately two-thirds of the total number of jobs. Although somewhat indirect, this is a reasonable indicator of a significant tourism-driven economy.

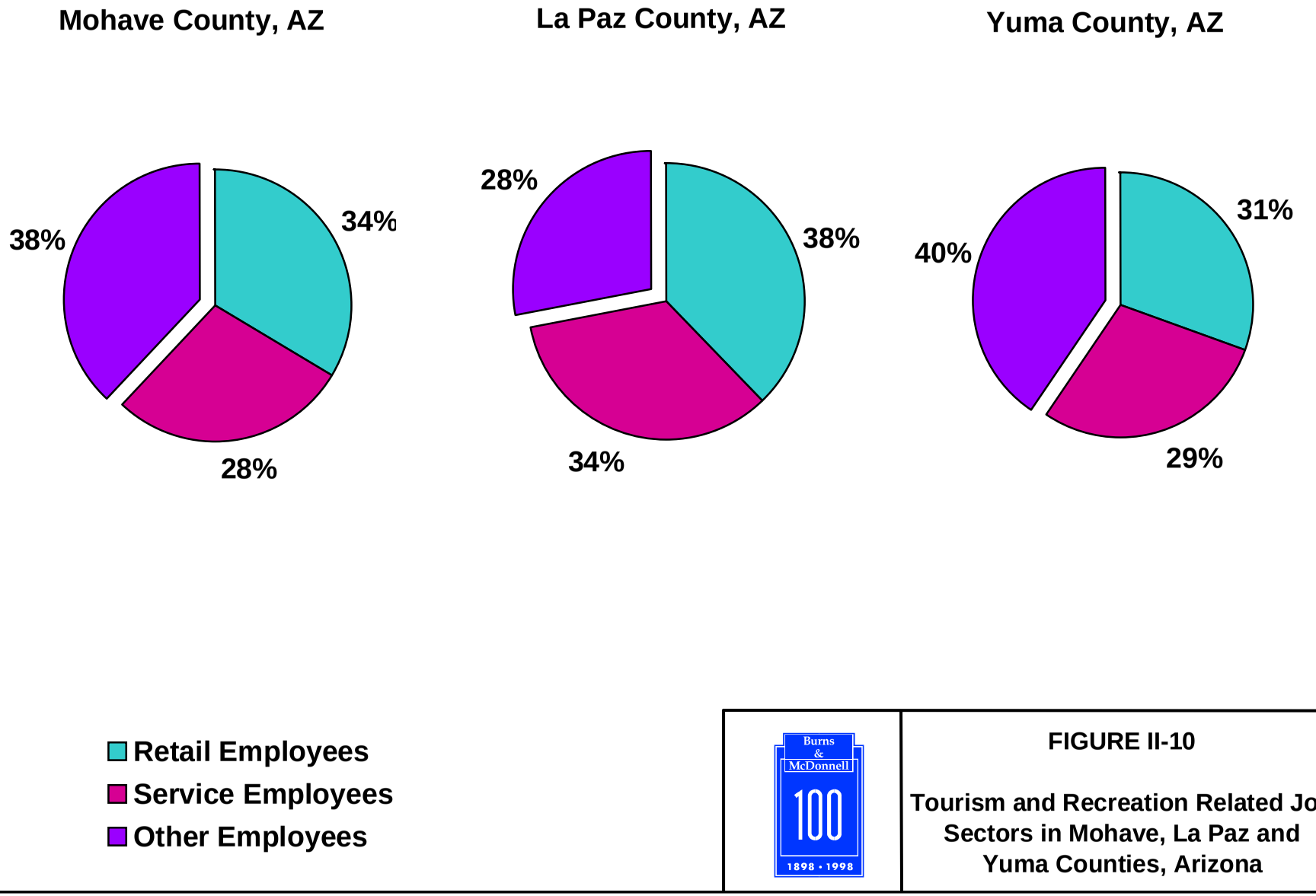


FIGURE II-10

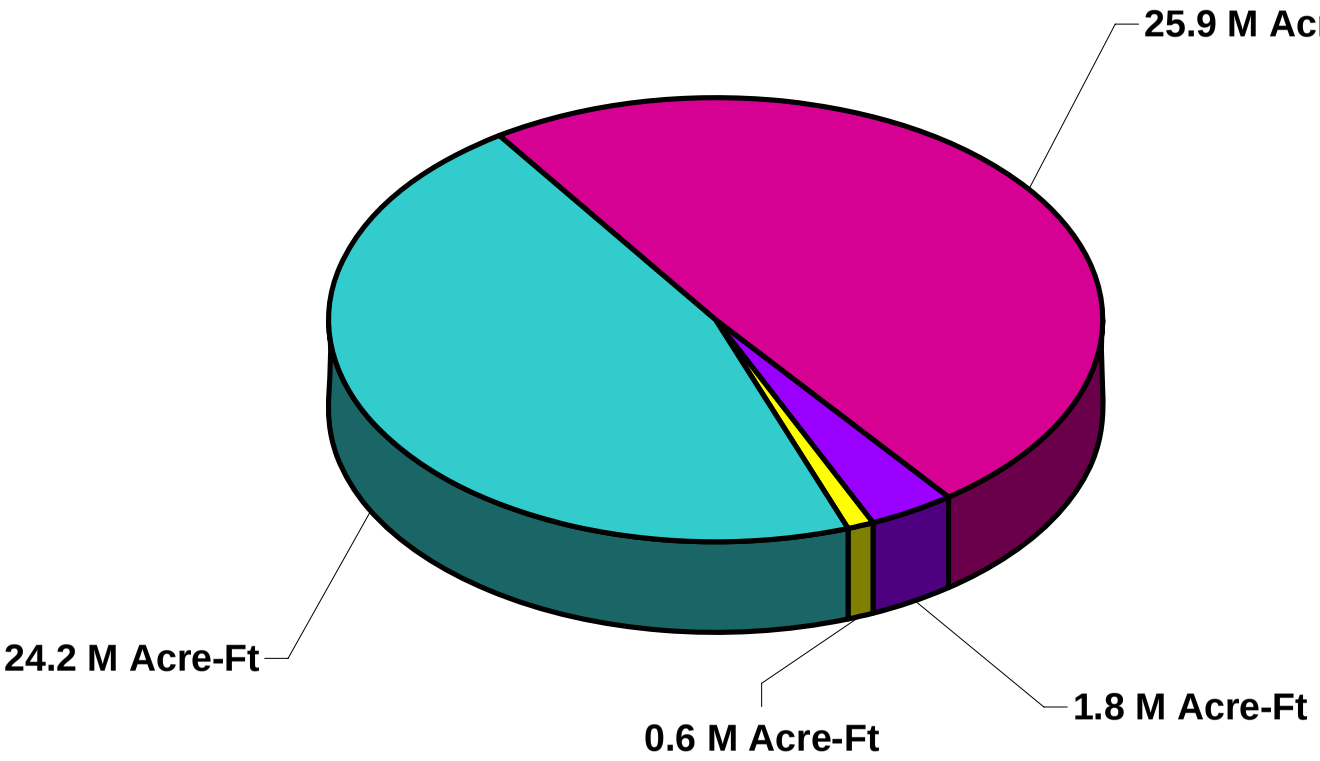
Tourism and Recreation Related Job Sectors in Mohave, La Paz and Yuma Counties, Arizona

5. Other Benefits

The reservoirs and dams along the Colorado River provide for flood control and storage. Reservoir storage capacity in the Upper and Lower Colorado Basins is over 60 million acre-feet or a 4 to 5 year supply of water based on current needs. Figure II-11 shows projected storage volumes in the Lower Colorado Basin. Lake Powell, Lake Mead, Lake Mohave and Lake Havasu provide a maximum storage volume of over 50 million acre-feet.

C. Federal Initiatives and the Environment

To help resolve the inherent conflict between protection of endangered species and future water development, state and federal agencies convened a steering committee to examine options and alternatives for the Colorado River. This committee first met in 1984. A recovery program with the following five components was developed: 1) habitat management; 2) habitat development and maintenance; 3) native fish stocking; 4) controlled non-native and sport fish management; and 5) a research and monitoring program. From this start, numerous recovery programs have been developed for both the Upper and Lower Colorado Basins. Some of these programs in the Lower Basin include the Native Fish Program, the Native Riparian Habitat Program, the Multipurpose Wetlands Program, the Multi-Species Conservation Program and the Lake Havasu Fisheries Improvement Program. An overview of each of these programs is provided below. For a more detailed description of these programs, see Appendix V.



Burns & McDonnell 100 1898 • 1998

FIGURE II-11

Projected Storage Volume in Lower Colorado River Basin

In 1989, the Native Fish Work Group (NFWG) was formed to preserve the Razorback sucker. The decline in the population of this fish was a result of the water management projects on the river and the introduction of highly predatory game fish. The goal of the NFWG is to introduce 50,000 young Razorbacks to Lake Mohave by the year 2000. This program uses facilities such as hatcheries to protect the fish from predation. As of 1997, the breeding program had produced more than 15,000 Razorbacks that will help boost the native population and ensure the continuation of the species.

Native Riparian Habitat Program is a joint program between the Bureau of Reclamation, the National Park Service and the US Fish and Wildlife Service that maintains nurseries for riparian plants native to the Colorado River basin. These plants may be used by these agencies to promote native riparian plant communities in the lower Colorado River basin. The Bureau and the Fish and Wildlife Service also maintain several research areas to study these plant species and what affects their growth.

The Bureau of Reclamation has been instrumental in helping establish a Multipurpose Wetlands Program in Arizona, California and Nevada. Approximately 25 acres in California have been converted to wetlands in order to treat wastewater and blend it with potable water for irrigation and recreational purposes. The Boulder City Wetland Project was completed in Nevada in 1997 to demonstrate the use of wetlands for the treatment of wastewater. The treated water is then used to maintain habitats for threatened and endangered species.

The Multi-Species Conservation Program is a combined effort by Arizona, California, Nevada, federal agencies, Native American tribes, and environmental groups. The goals of the Multi-Species Conservation Program are: 1) to preserve listed species in the lower basin and prevent the listing of any additional species; 2) to continue current water apportions and hydropower generation practices; and 3) to provide opportunities for future water and power development. This program is in the process of being implemented, and will run for 50 years.

The Lake Havasu Fisheries Improvement Program is designed to enhance fish habitats in 42 locations covering 875 aquatic acres and to develop 6 handicapped-accessible fishing areas with docks, trails, parking and restrooms. This is a Bureau of Land Management-lead program whose members include the Arizona Game and Fish Department, Bureau of Reclamation, California Department of Fish and Game, U.S. Fish and Wildlife Service, Metropolitan Water District of Southern California and Anglers United. The project combines exotic sport fish restoration with endangered non-sport fish restoration.

To summarize, the programs described above are an attempt at restoring the original environment so that man can live in harmony with nature while making the resources of the Colorado River available for beneficial use. For additional details on these programs, see Appendix V.

D. Why CRRSCo?

The Colorado River is the lifeblood for countless entities residing in the seven-state reach of the watershed. As mentioned above, benefits derived from the Colorado River are numerous and far-reaching. As utilization of river resources has increased, so has the river community population residing in, and administering to, the watershed. Watershed population increases have taxed existing infrastructure. Of specific concern is the septic tank-based wastewater infrastructure. Changes in design specifications coupled with an increase in septic system density have resulted in numerous permit violations. In areas where high nitrate levels in lake and groundwater have been detected, septic system ban areas have been established, permitting no new construction unless residents install on-site nitrogen removal systems or connect to a centralized collection system, if available. The Colorado River Regional Sewer Coalition (CRRSCo) was formed to provide watershed residents with the necessary wastewater infrastructure, protect groundwater resources, and help maintain Colorado River water quality.

CRRSCo is a growing organization whose vision and goals are congruent with other Colorado River stakeholders: continued protection of the Colorado River to help assure a high quality of water for all users. CRRSCo will attain its goals through the improvement of wastewater management practices among its members. As a first step towards attaining these goals, this report was commissioned to provide a representative baseline of existing wastewater facilities and to identify needs and associated costs for constructing the recommended improvements.

CRRSCo provides a unique forum for the various stakeholders who depend on the Colorado River for their livelihood and existence.

III. WATER QUALITY ISSUES IN THE LOWER COLORADO RIVER

A. Introduction

Colorado River water quality is generally characterized as high in total dissolved solids (TDS) or salinity. High TDS is caused naturally by water runoff over the desert areas and evaporation that occurs as the water travels along the river. Of primary concern in this report are water quality issues related to man-made sources. These sources include the following: 1) agriculture; 2) chemical; 3) livestock; 4) mining; 5) industrial; 6) recreation; 7) urban development; and 8) wastewater. From a health standpoint, there are two primary concerns: 1) microbial contamination; and 2) nitrate contamination of groundwater drinking wells. Microbial pathogens like *Cryptosporidium* and *Giardia* are of great concern because they can survive and accumulate for long periods in the natural aquatic environment. These pathogens can be life-threatening if ingested. High nitrate concentrations in groundwater can cause "blue-baby syndrome", resulting in infant mortality. As will be discussed below, representative groundwater studies conducted along the Lower Colorado River have revealed significant groundwater nitrate contamination.

B. Surface Water Quality

Table III-1 summarizes concentration levels of major inorganic constituents found in Colorado River water. These samples were taken over the period of 1988 to 1996 near the Whitsett Intake to the California Aqueduct. As previously stated, the Colorado River is high in Total Dissolved Solids or TDS. Except for 1996, the TDS trend line steadily

Table III-1. Colorado River Water Quality Data
Lake Havasu Near Whitsett Intake

Constituent	Maximum Contaminant Level (Finished Water) (mg/L)	Fiscal Year							
		88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96
Alkalinity, Total (CaCO3)	NS	131.00	132.00	133.00	136.00	132.00	134.00	133.00	134.00
Arsenic	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloride	250-500-600** (sec)	66.00	73.00	79.00	84.00	83.00	93.00	95.00	92.00
Chromium (total)	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Color	15 units (sec)	NA	NA	NA	NA	NA	NA	NA	4.00
Total Hardness (CaCO3)	NS	282.00	293.00	303.00	312.00	302.00	328.00	328.00	323.00
Iron	0.3 (sec)	ND	0.08	0.07	0.03	ND	ND	0.04	0.05
Lead	0.015 (action level)	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	NS	26.50	28.00	29.00	30.00	29.00	31.50	31.00	31.00
Mercury	0.00	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.00	0.75	0.75	0.75	0.90	0.85	1.05	0.97	0.93
pH	6.5-8.5 (sec)	8.24	8.25	8.23	8.26	8.16	8.24	8.30	8.23
Selenium	0.05	0.00	0.00	0.00	0.00	ND	0.00	0.00	ND
Sodium	NS	76.00	86.00	91.00	97.00	95.00	105.00	108.00	103.00
Total Dissolved Solids	500-1000-1500** (sec)	560.00	589.00	619.00	645.00	628.00	692.00	700.00	680.00
Specific Cond. (uhos)	900-1600-2200** (sec)	882.00	938.00	987.00	1038.00	1015.00	1096.00	1093.00	1079.00
Sulfate	250-500-600** (sec)	225.00	236.00	250.00	261.00	254.00	286.00	290.00	279.00
Total Organic Carbon	NS	NA	NA	NA	NA	NA	2.59	2.47	2.41
Turbidity	1 unit (filtered water)	1.41	1.00	0.94	1.00	4.10	1.30	1.30	0.58

NOTES:
Unts are in milligrams per liter unless otherwise sta AL = Action Level ND = Not Detected
mg/L = milligrams per liter ** = Recommended-Upper-Short Term NA = Not Analyzed
Sec = Secondary MCL (non-health related) NS = No Standard

increases. To get a feel for the weight of the salts conveyed down the river, an acre-foot of river water contains approximately 2,000 pounds of salts. As an on-going process to address salinity, the Colorado River Salinity Control Forum was formed and meets on a regular basis to discuss the issue. To provide acceptable water quality to Mexico, a $500 Million desalting plant was constructed near Yuma, AZ in 1993. This plant has the capacity to produce 100,000 acre-feet of reclaimed water per year (90 MGD). Other constituents of concern are the nitrate values and specific conductance. Although nitrate, a Primary Contaminant, was not measured over its Maximum Contaminant Level (MCL), the reported values do raise concern. Similarly, specific conductance, a Secondary Contaminant, does not exceed its recommended level, but the reported levels should be noted. Of the two, nitrate levels are of greater concern and are addressed in the next section.

Although the data reported in Table III-1 show no problems associated with metals, mining industry in the watershed has continued to cause problems. Referring to Figure II-1, the Bill Williams River Watershed has been designated by the ADEQ as "water quality limited" due to elevated concentrations of arsenic, boron, cadmium, chromium, copper, mercury, selenium and zinc. Industrial-related contamination events are also periodically detected. Recently, Metropolitan Water District of Southern California (MWD) has reported perchlorate showing up in water samples taken at the Whitsett Intake. The most likely source is from industrial waste that ends up in drainage ditches and eventually makes its way into the River. Further discussions with MWD have indicated that

perchlorate was detected in trace amounts during analytical testing of water samples near the intake over a six month period.

Microbial contamination is one of the major concerns to all Colorado River users. Safe recreational contact and drinking water are absolutely paramount. Table III-2 summarizes monthly coliform data measured near the Whitsett Intake to the California Aqueduct. The data reveal a few instances where high concentrations of fecal coliforms were detected. In 1994, Lake Havasu experienced an outbreak of fecal coliforms. To address this problem, a comprehensive sampling program was initiated to quantify the situation. The program consisted of 46 sites sampled from July through mid-August and 27 sites sampled from mid-August through early October. Levels of greater than *80,000 CFU per 100 milliliter* were detected in some swimming areas. ADEQ performed a study to help quantify the conditions under which the outbreak occurred ("Regrowth of Fecal Coliforms in Swim Areas of Lake Havasu, Arizona", 1998). It was determined that high concentrations of nitrogen and carbon in the water coupled with elevated temperatures, provided an optimal environment under which bacterial growth could thrive. It was further posited that primary and secondary nutrients found in sediment enhanced this growth environment. To date, evidence of this type of phenomenon has only been documented in isolated regions. However, the conditions which may have caused the outbreaks are representative of stretches of shoreline located throughout the Lower Colorado River. Fecal coliform or *E. coli* contamination present serious health threats to the public. One of the major drivers behind CRRSCo is to address wastewater management practices and improve wastewater collection and treatment, thereby protecting users from this health hazard.

Table III-2. Monthly Coliform Averages near Whitsett Intake

Measure	1990			1991			1992		
	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL
Total	19.0	24.0	0.0	26.0	18.0	0.0	25.0	111.0	0.0
Average	1.9	2.7	0.0	2.2	1.5	0.0	2.1	9.3	0.0
Median	2.0	0.0	0.0	2.0	0.0	0.0	2.0	7.5	0.0
Minimum	3.0	12.0	0.0	3.0	11.0	0.0	3.0	29.0	0.0
Maximum	1.0	0.0	0.0	1.0	1.0	0.0	2.0	0.0	0.0

Measure	1993			1994			1995		
	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL	No. of Samples	Total Coliforms /100 mL	Fecal Coliforms /100 mL
Total	25.0	162.0	0.0	36.0	81.0	0.0	50.0	120.0	3.0
Average	2.1	13.7	0.0	3.2	6.8	0.0	4.2	10.1	0.4
Median	2.0	10.0	0.0	3.0	5.0	0.0	4.0	8.5	0.0
Minimum	3.0	37.0	0.0	5.0	26.0	0.0	5.0	25.0	2.0
Maximum	2.0	2.0	0.0	2.0	1.0	0.0	4.0	1.0	0.0

In addition to the data collected near Whitsett Intake in Lake Havasu, Arizona, data were obtained from the United States Bureau of Reclamation (BOR) located in Denver, Colorado. The BOR manages and updates a database containing multiple monitoring parameters for numerous sampling locations. The data are contributed by sources ranging from municipal to federal studies. The BOR requests that the results of any sampling event be submitted for inclusion in the database. However, because this is a voluntary process and the BOR does not conduct a scheduled sampling program of their own, the amount of data and frequency of sampling varies for each sampling location.

For the purpose of this study, data were requested for sampling locations along the Lower Colorado River. Table III-3 summarizes the available data from 1980 through 1996 for several constituents that were included in Table III-1. Supporting data for this table is provided in Appendix VI.

As is indicated in Table III-3, no significant trend exists for nitrate and total dissolved solids concentrations from upstream, below the Hoover Dam, to downstream, below Morelos Dam. The data does, however, suggest an increase in the chloride concentrations as well as the total alkalinity, total dissolved solids and total hardness from upstream to downstream locations.

Insufficient data were available to indicate an increasing trend in any of the parameters over time.

Table III - 3 Colorado River Water Quality Data, 1980 - 1996

C. Groundwater Water Quality

1. Overview

Alluvial groundwater wells inherit the same basic water quality characteristics as found in the Colorado River surface water. High TDS and high manganese give the water a distinctive taste but are not in themselves considered a health hazard. Of greater concern in the groundwater is nitrate contamination and its potential to cause methemoglobinemia or "blue-baby" syndrome. The Safe Drinking Water Act has established a Maximum Contaminant Level of 10 mg/L for nitrate in drinking water. The Arizona Department of Environmental Quality (ADEQ) has been conducting groundwater studies in the region to investigate nitrate levels in groundwater and their causes.

2. Groundwater Studies and Nitrate Contamination

Nitrate contamination is of particular concern in the Lower Colorado River due to the number and density of River community septic systems. These systems consist of two treatment steps: 1) a septic tank to separate solids from the liquid wastewater; and 2) a soil absorption field to treat the liquid waste. If the soil absorption field is overloaded, constituents like nitrate will not be removed and can make their way into the groundwater.

A 1994 Groundwater quality study for Northern Mohave Valley revealed significant concentrations of nitrate in groundwater. Figure III-1, reproduced from this 1994 report, shows approximately one-fourth of the wells in Northern Mohave County, South of

Nitrate/Nitrite as N in Water Samples Collected in June 1994 Mohave Valley Study Area

Burns & McDonnell 100 1898 - 1998

FIGURE III-1

Nitrate/Nitrite as N in Water

N

Legend

- Private Land
- Fort Mohave Indian Reservation
- BLM Lands
- State Trust Lands
- Lake Mead National Recreation Area
- Havasu National Wildlife Refuge
- Well
- River Sample Location
- Nitrate <0.10 mg/L
- >=0.10 mg/L Nitrate <3.00 mg/L
- >=3.00 mg/L Nitrate <7.00 mg/L
- >=7.00 mg/L Nitrate <10.00 mg/L
- >=10.00 mg/L Nitrate
- Bullhead City Limits

Scale 1:100,000

2 1 0 2 Miles

Drafted By JTG, April 1995

III-9

Bullhead City experiencing groundwater nitrate levels of 3.0 mg/L and greater. One of the 28 wells South of Bullhead City has a level greater than the Maximum Contaminant Level (MCL) of 10 mg/L. Many of the wells in Bullhead City also experience nitrate levels of 3.0 mg/L and greater. Conversations with ADEQ indicate that these 1994 test results are a two-fold increase over the last measurements taken five years previous. This study has resulted in Bullhead City developing a wastewater master plan to sewer the entire City (see Section V).

As part of the 1998 study conducted by ADEQ to examine fecal coliform regrowth in swim areas in Lake Havasu, groundwater sampling was conducted. Results showed that practically all of the monitoring wells within the City had nitrate concentrations in excess of the background level of 0.6 mg/L. Some of these wells showed nitrate concentrations as great as 21 mg/L. Based on these results, ADEQ recommended a band on new septic systems in areas where nutrients could make their way to the lake (i.e., within the zone of nutrient transport).

Studies conducted by ADEQ in 1995 near the City of Yuma revealed dangerously high nitrate levels. Of 57 samples collected in the Yuma Groundwater Basin, the mean concentration of nitrate was approximately 6.0 mg/L with seven of these samples ranging from 12 mg/L to 122 mg/L. The study did not speculate as to whether or not septic systems were the source of the contaminant. Recent communications with ADEQ reveal that additional sampling and data analysis has been conducted in the Yuma Groundwater Basin. This data suggest nitrate levels may be higher than reported in the 1995 study.

This 1997 sampling program was designed to draw water from the top of the water table as opposed to the 1995 study which concentrated on deeper depths in the aquifer. Five of the eight monitoring wells had nitrate levels ranging from 6 mg/L to 64 mg/L with levels in four of the monitoring wells exceeding the SDW Primary MCL for nitrate which is 10 mg/L.

In 1997, ADEQ conducted a groundwater study near Cibola, Arizona to examine the affect of rapid housing development on groundwater quality. The primary concern about Cibola, and communities like it, is the unchecked, rapid growth couple with the extensive use of septic tank systems for wastewater treatment. Five wells were sampled in the study area. Although none of the samples taken exceeded the Safe Drinking Water Act Primary MCL for nitrate of 10 mg/L, nitrate levels as high as 3.5 mg/L were detected. As a result of this study, ADEQ has recommended that additional samples be taken to help establish of firm baseline from which to assess impacts of continued development in the area.

To summarize, nitrate contamination in groundwater has begun to reach limits where human health will be affected. As will be discussed in Section V, CRRSCo members have begun, or have been mandated by ADEQ, to develop plans to transition residents from septic systems to collection and treatment system.

IV. CRRSCo PLANNING AREA

A. Planning Area Overview

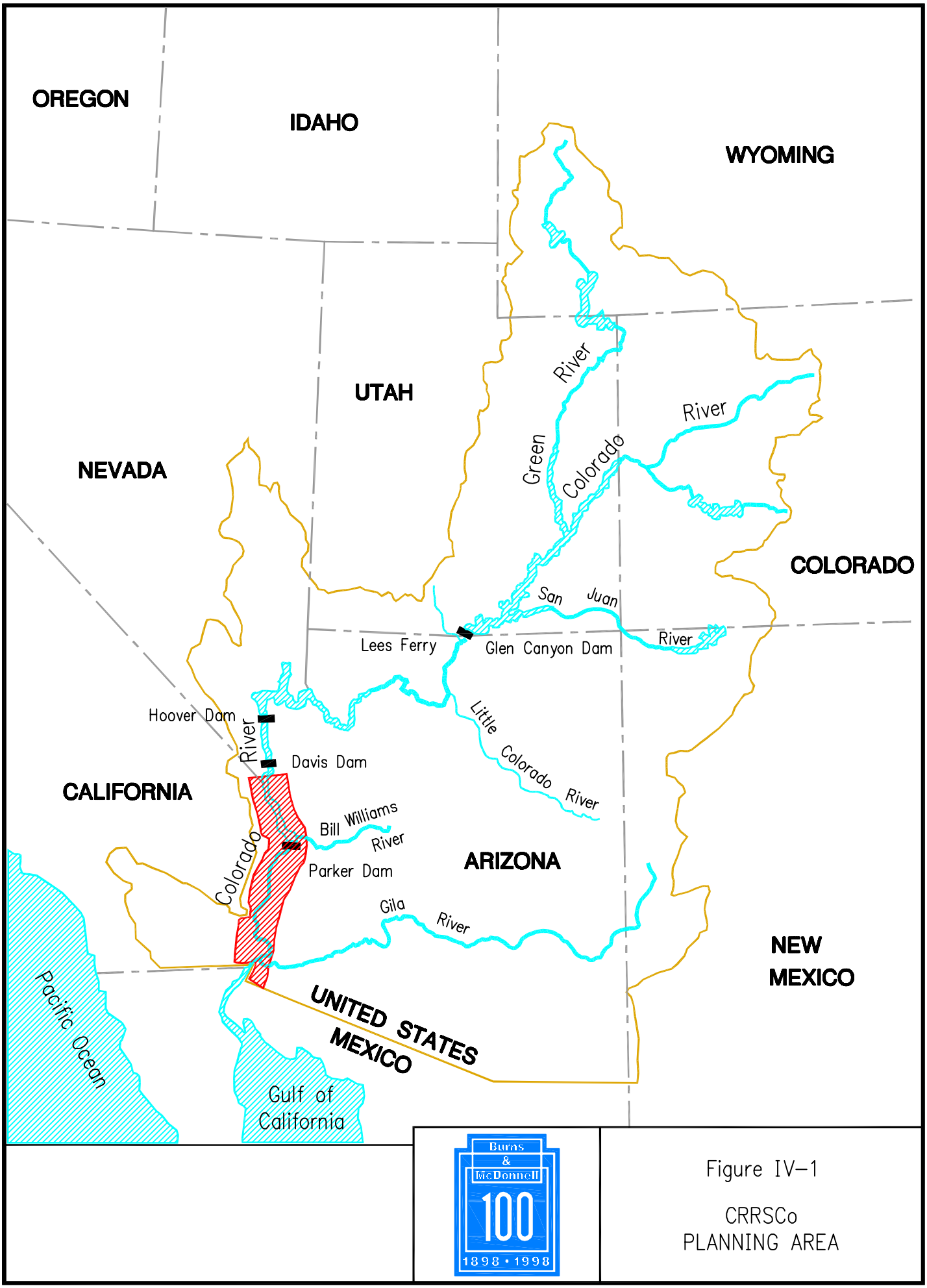
Figure IV-1 shows the CRRSCo planning area. Intersecting parts of Arizona, California and Nevada, this swath of land covers approximately 7,000 square miles from South of Davis Dam down to the US/Mexico border. The planning area encompasses parts of the following counties: 1) Mohave County, AZ; 2) La Paz County, AZ; 3) Yuma County, AZ; 4) Imperial County, CA; 5) Riverside County, CA; 6) San Bernardino County, CA; and 7) Clark County, NV. Figure IV-2 shows the CRRSCo members highlighted in red.

B. Population

1. County and Member Projections

Lower Colorado River communities are experiencing rapid growth. Figure IV-3 shows projected growth in the three Arizona counties bordering on the Lower Colorado River. Population in these counties is projected to increase by 55 percent from the year 2000 to the year 2020.

Figure IV-4 shows projected growth over the next 20 years for key Arizona Cities and Indian Tribes in the CRRSCo planning area. These key entities include: Buckskin Sanitary District, La Paz County, Fort Mojave Indian Tribe, Town of Parker, Town of Quartzsite, Colorado River Indian Tribe (CRIT), Bullhead City, Lake Havasu City and



J:\CRRSCO\987634\Drawings\crrsco07.dwg 01-11-1999 09:33 DBL

Figure IV-1

CRRSCo
PLANNING AREA

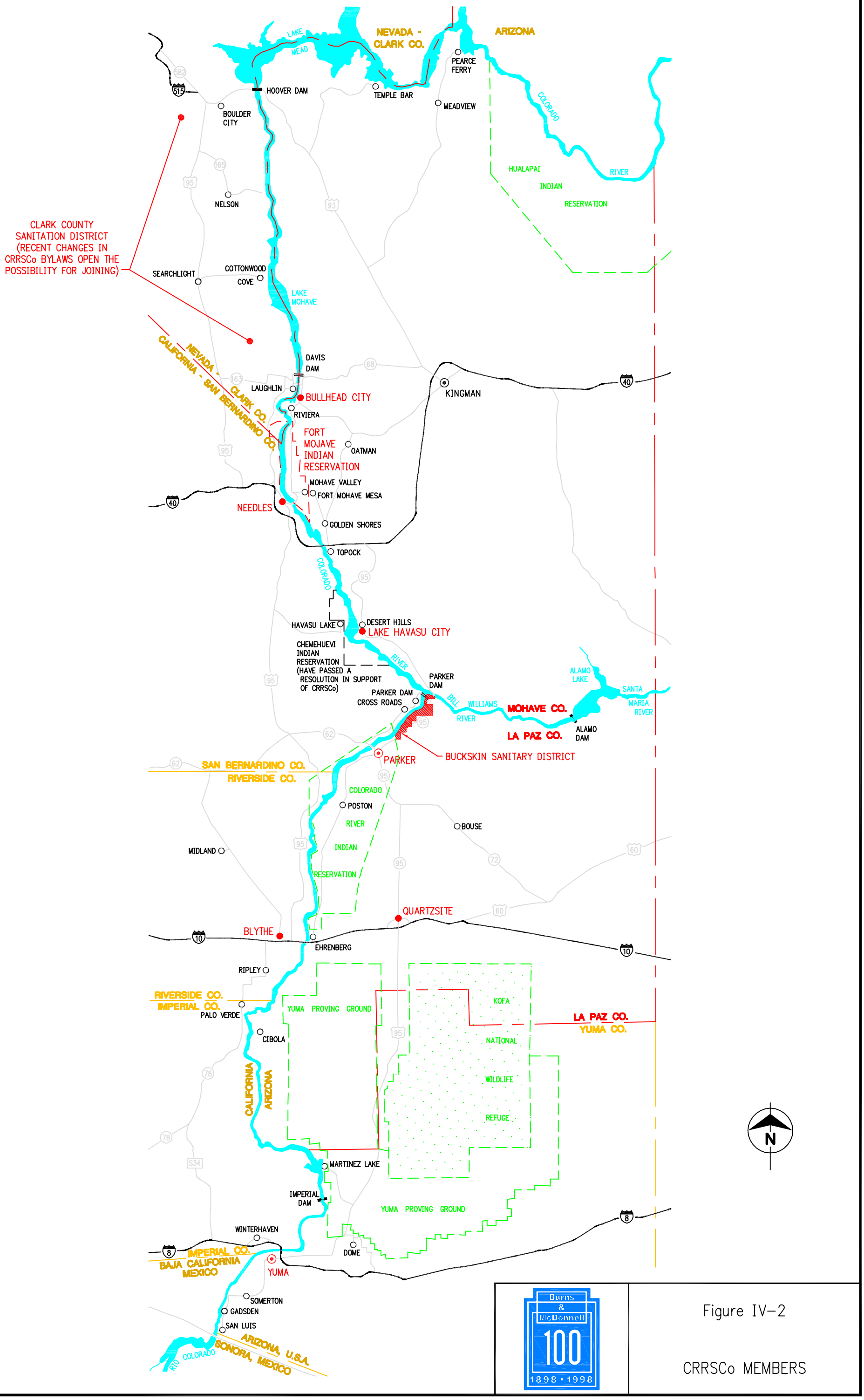


Figure IV-2

CRRSCo MEMBERS

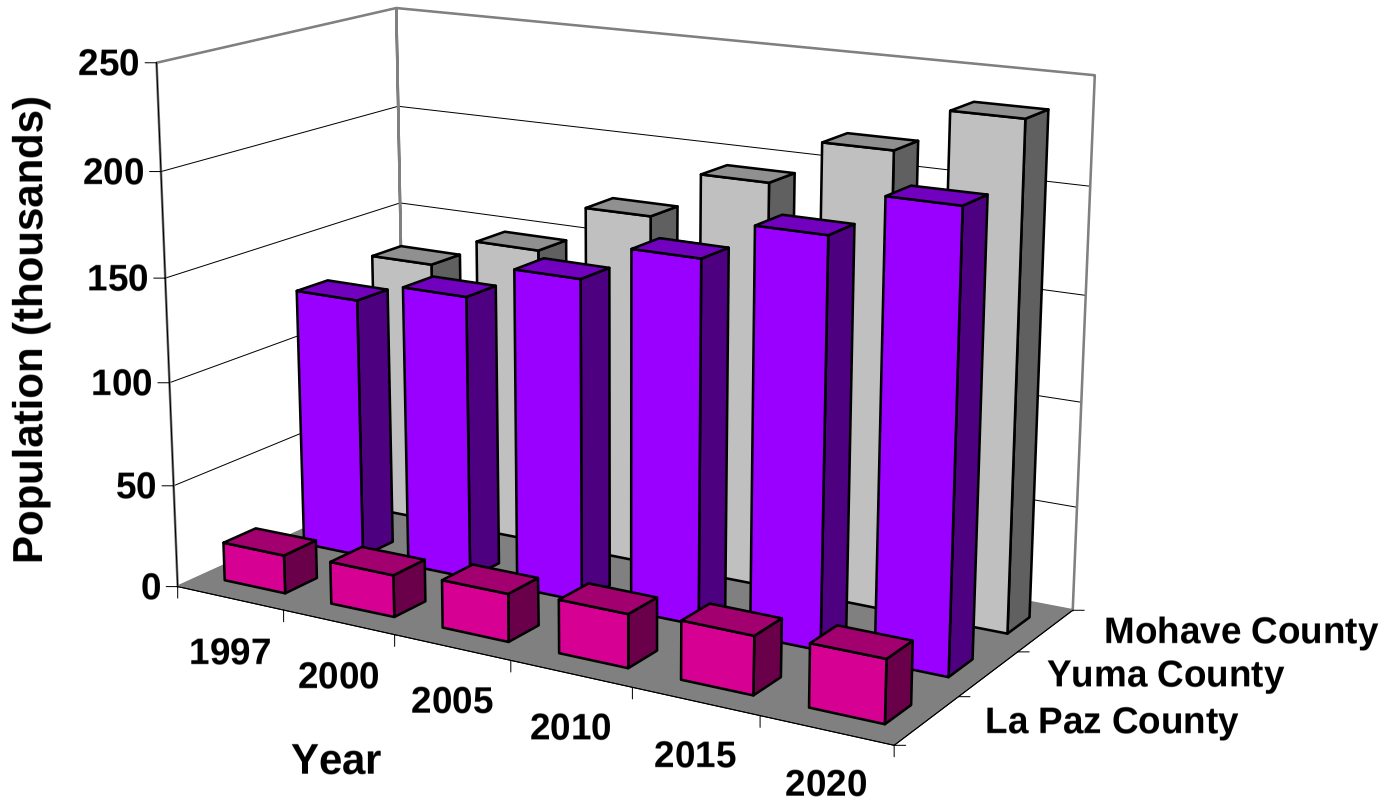
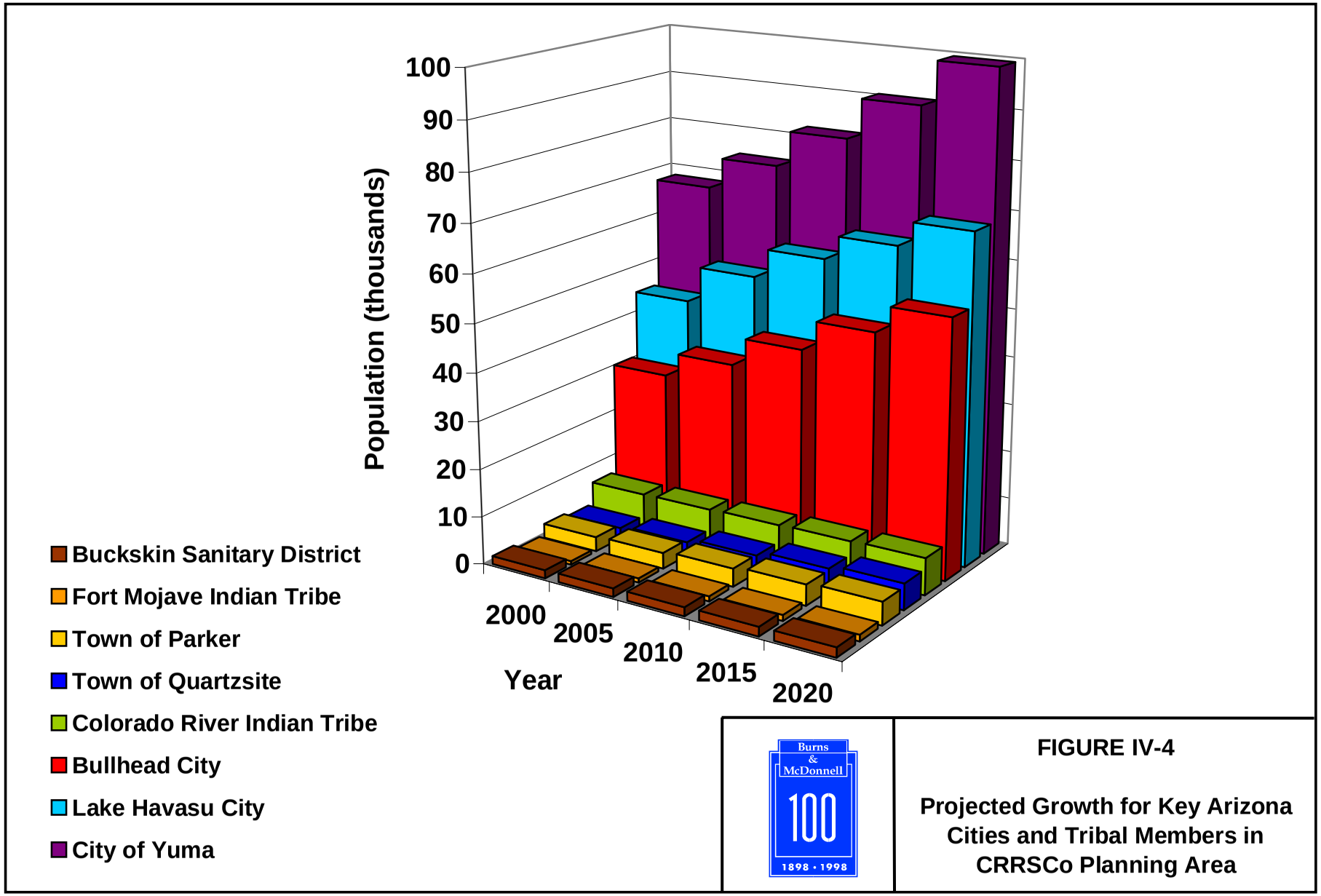


FIGURE IV-3

Projected Growth for La Paz, Mohave and Yuma Counties



Burns & McDonnell 100 1898 • 1998

FIGURE IV-4

Projected Growth for Key Arizona Cities and Tribal Members in CRRSCo Planning Area

the City of Yuma. Although not a CRRSCo member, the CRIT is an important entity in the Lower Colorado River Watershed and is therefore included in this figure.

Population in the California counties bordering the Colorado River is also growing. Population in these counties is projected to increase by 69 percent from the year 2000 to the year 2020. Figure IV-5 shows projected growth for these counties. Figure IV-6 shows projected growth for the two California CRRSCo members, the City of Blythe and the City of Needles. Growth in the City of Blythe follows the general growth trend in Riverside County. From 1990 to 1997, the City of Needles grew at a slower rate of one percent. Since no data were available for projected growth in City of Needles, the 1990 to 1997 trend is used for development of projections.

Although population in Clark County, Nevada is projected to grow by over 46 percent from the year 2000 to the year 2020, the Town of Laughlin is experiencing minimal growth. This is due in part to the symbiotic relationship the Town of Laughlin finds itself in with the Bullhead City, AZ. The gaming industry in the Town of Laughlin continues to grow and provide a sound employment base. The overall cost of living is slightly cheaper in Arizona than in Nevada. Therefore, people who live in the area typically work in the Town of Laughlin but reside in Bullhead City. The current population of the Town of Laughlin is 8,990. For purposes of developing projections, growth is assumed to be one percent per year. Figure IV-7 shows population growth in the Town of Laughlin and Clark County, NV.

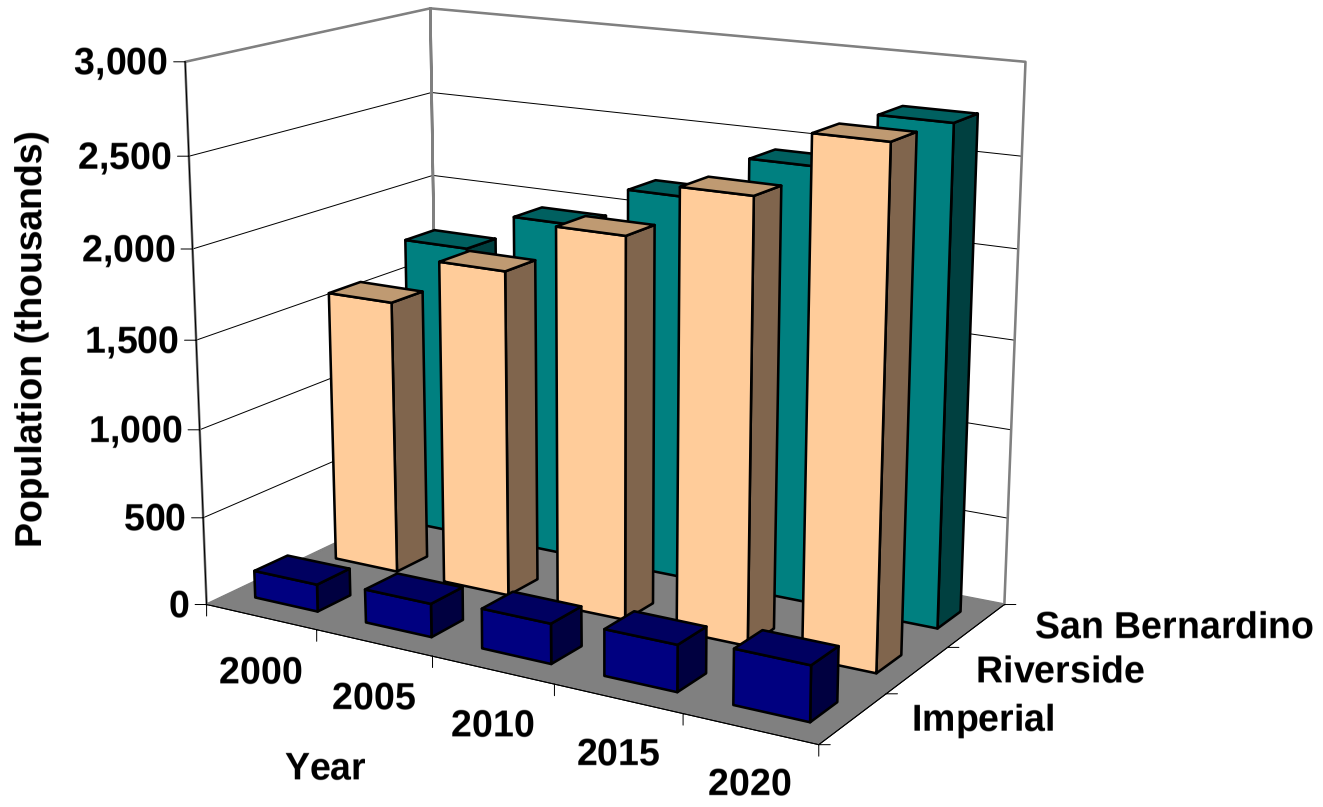


FIGURE IV-5

Projected Growth for Imperial, Riverside and San Bernardino Counties in California

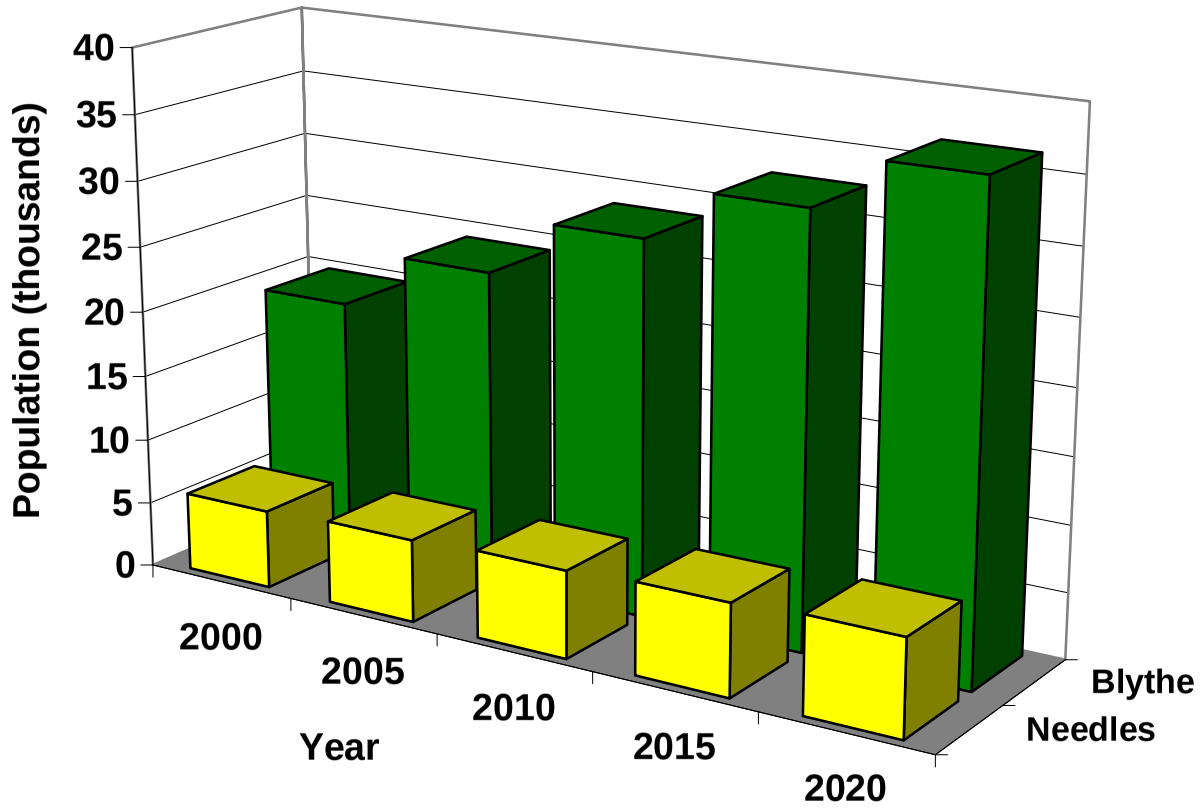


FIGURE IV-6

Projected Growth for CRRSCo Members in California

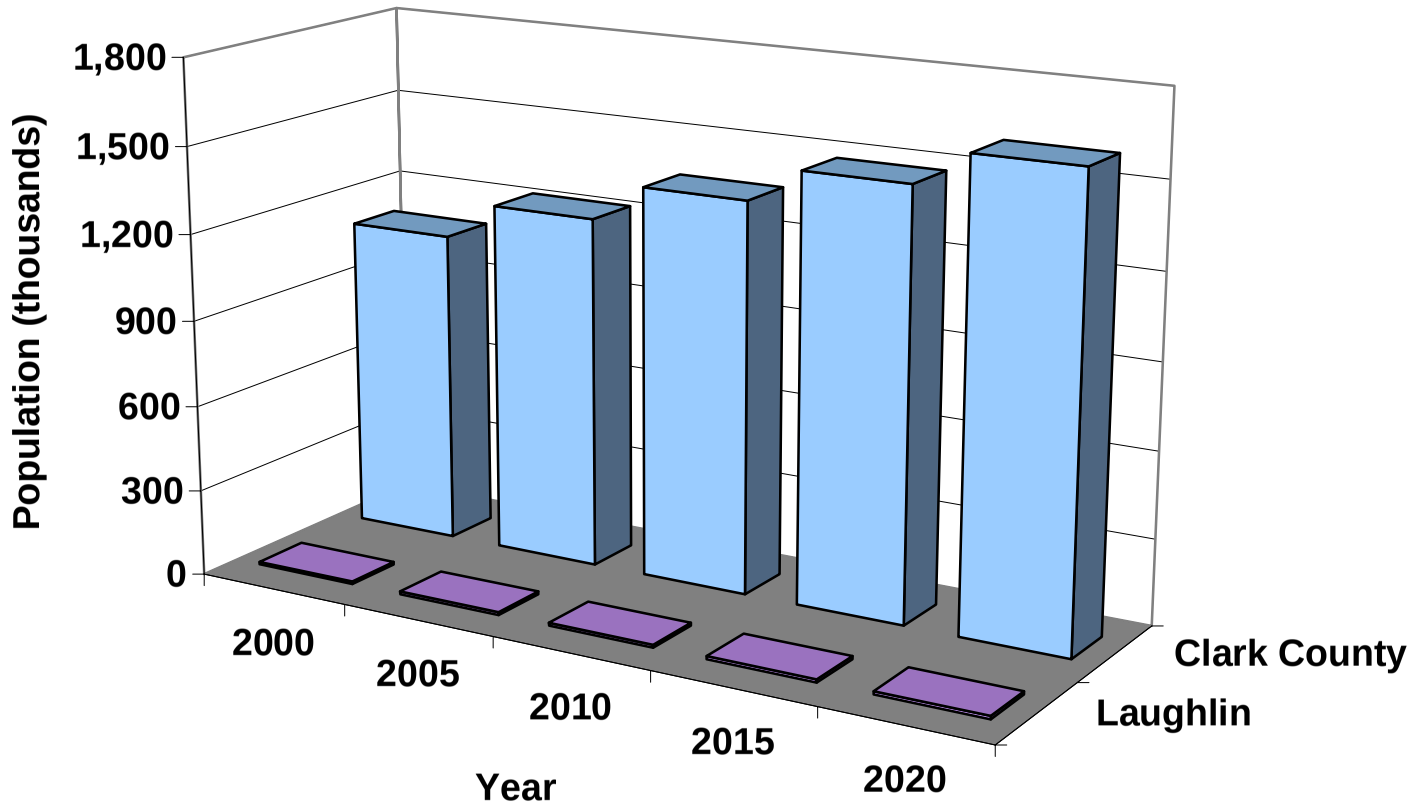


FIGURE IV-7

Projected Growth for Laughlin, Nevada and Clark County, Nevada

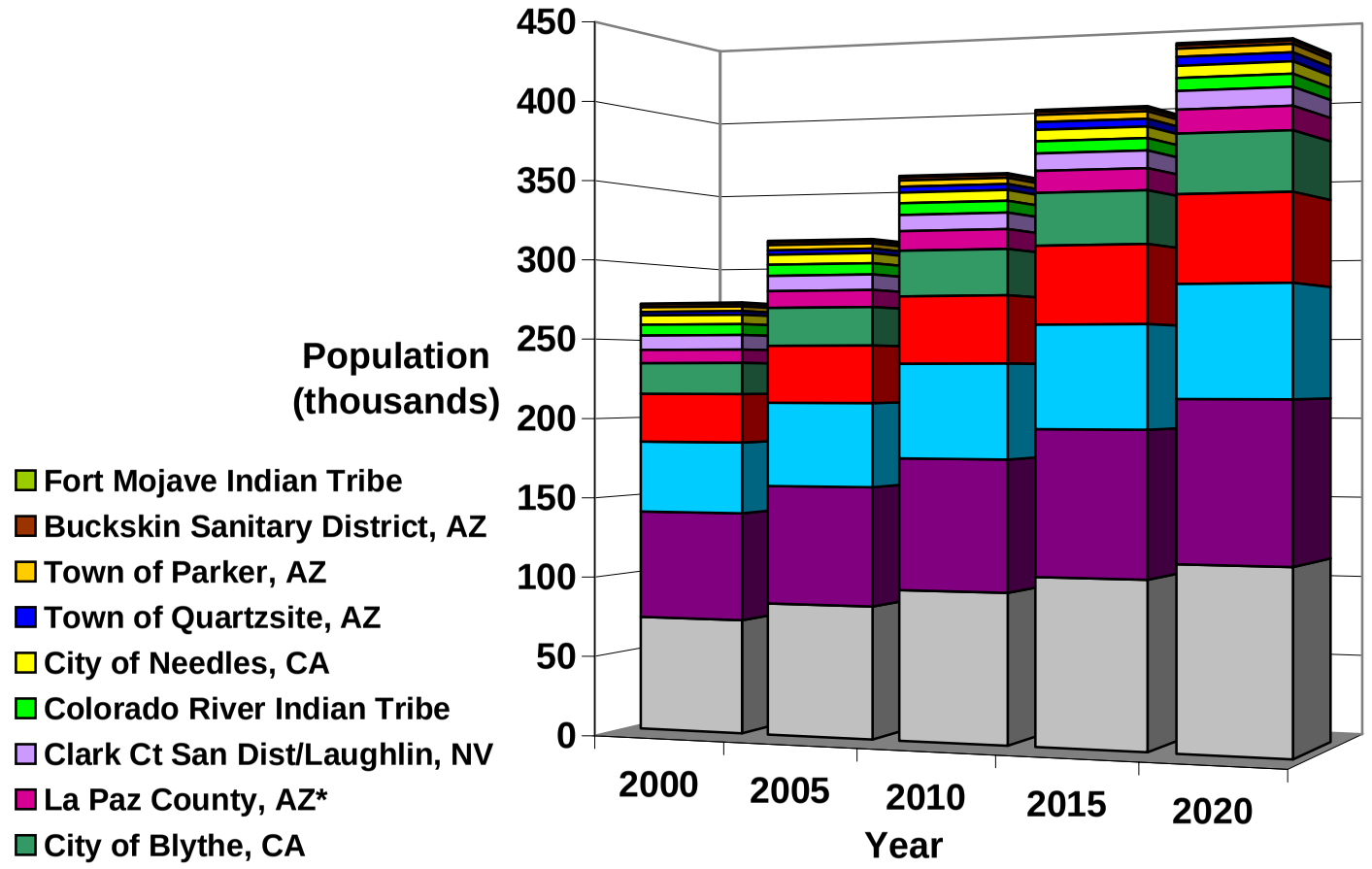
Figure IV-8 summarizes population projections for CRRSCo members and other key entities in the planning area from the year 2000 to the year 2020. Population is projected to increase by 55 percent from the year 2000 to the year 2020, with a total population projection of over 300,000 people by the year 2020.

2. Impact of Seasonal Population

As previously mentioned, the Lower Colorado River plays host to over 19 million visitors annually. In addition to these visitors, communities along the river have a large part-time resident population. This population is sometimes referred to as *Snowbirds*. In this report, this population is referred to as Winter Visitors. This population typically consists of retired persons who take up residence in either seasonal homes or RV parks over the winter months.

Figure IV-9 compares permanent resident population and Winter Visitor population for Bullhead City, Quartzsite, and Yuma County. Quartzsite seasonal population overwhelms the local residents by a four-to-one margin. Quartzsite also has an annual rock and gem show in January. This show attracts up to 1,000,000 people over a one-week period. In Yuma County, the Winter Visitor population has a significant impact on the local economy, bringing in an estimated $380 Million in tourism dollars between April 1994 and May 1995.

Seasonal population increase has significant impact on infrastructure in general and wastewater systems in particular. Figure IV-10 shows annual variation in daily flows to



*Mohave and La Paz County Populations not including City and Tribal CRRSCo Members.

FIGURE IV-8
Projected Growth for CRRSCo Members and other Key Entities in the CRRSCo Planning Area

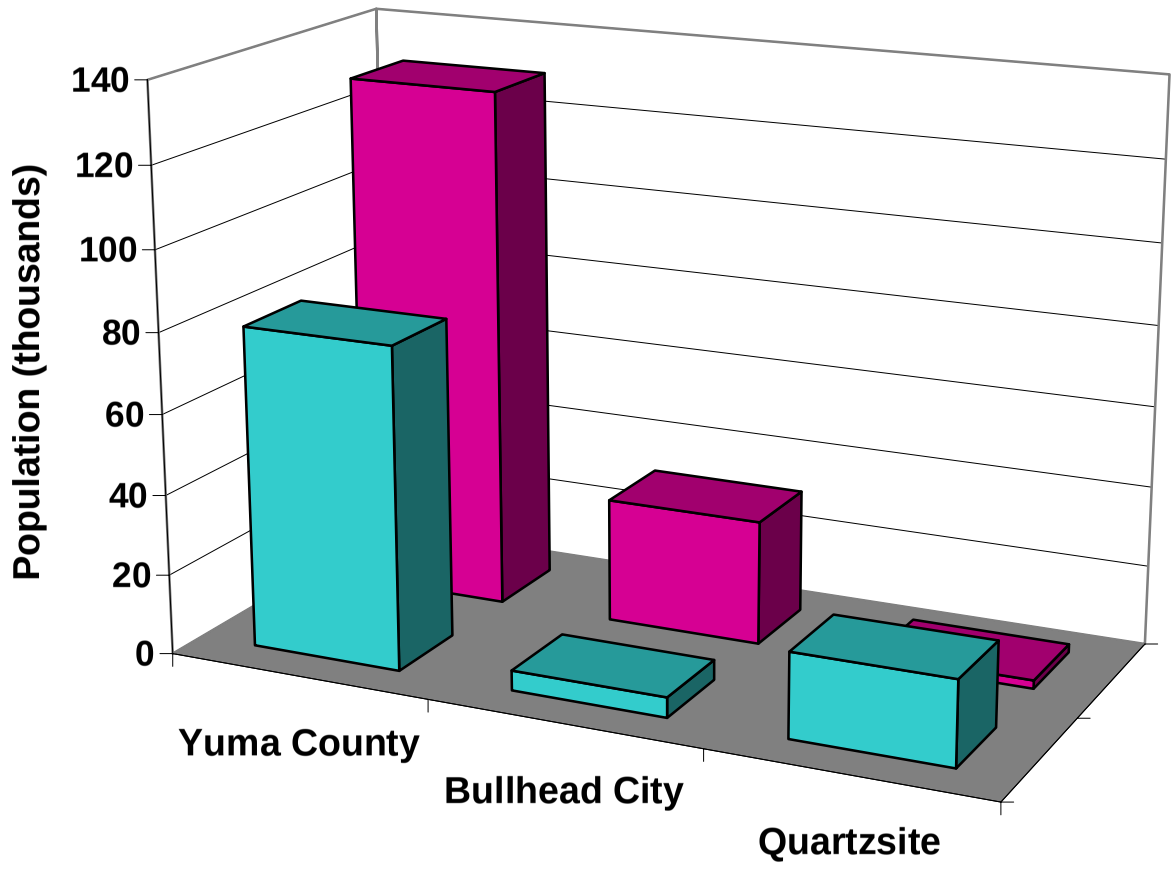


FIGURE IV-9
Permanent and Seasonal Population for Bullhead City, AZ Town of Quartzsite, AZ and Yuma County, AZ

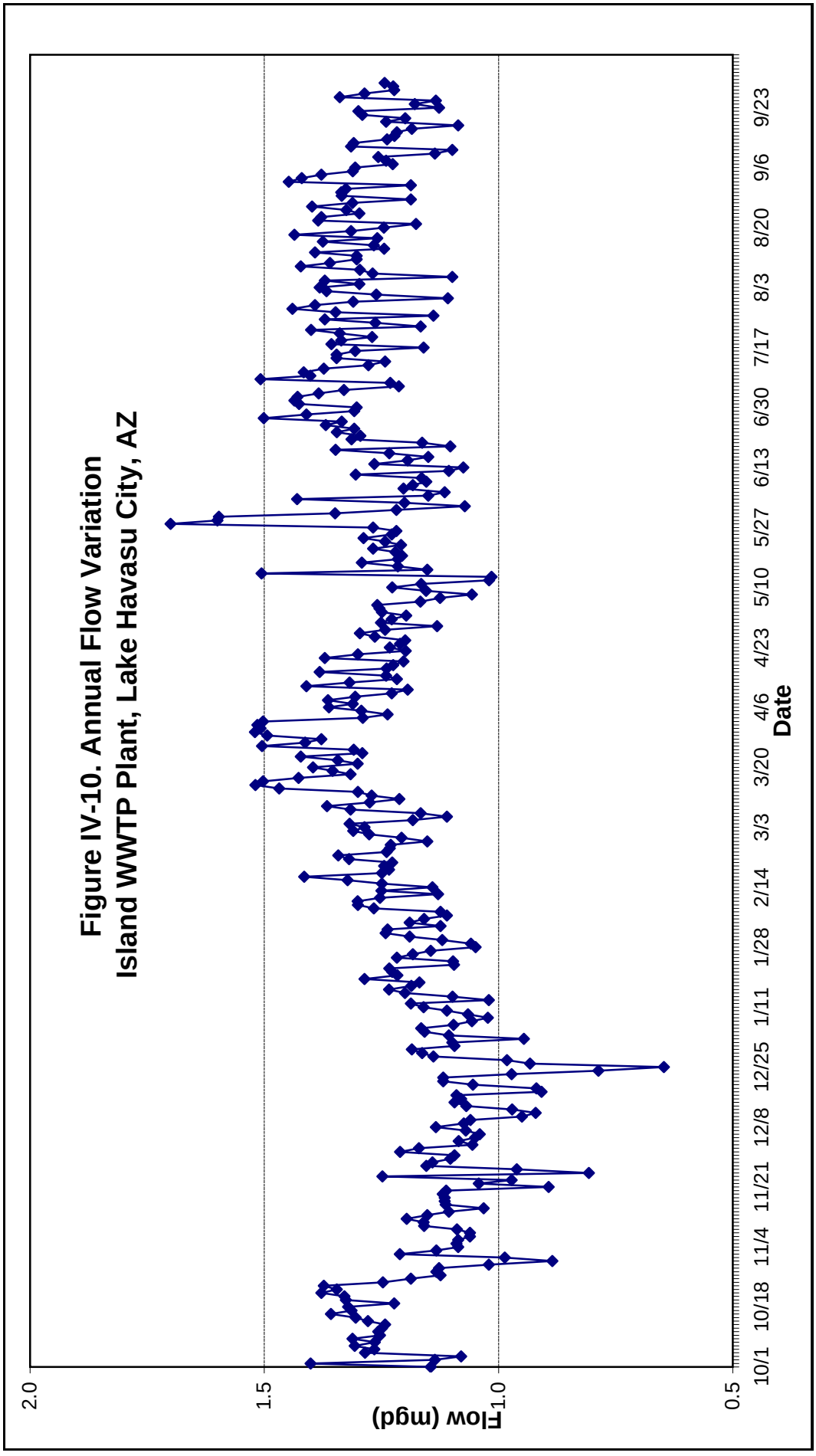
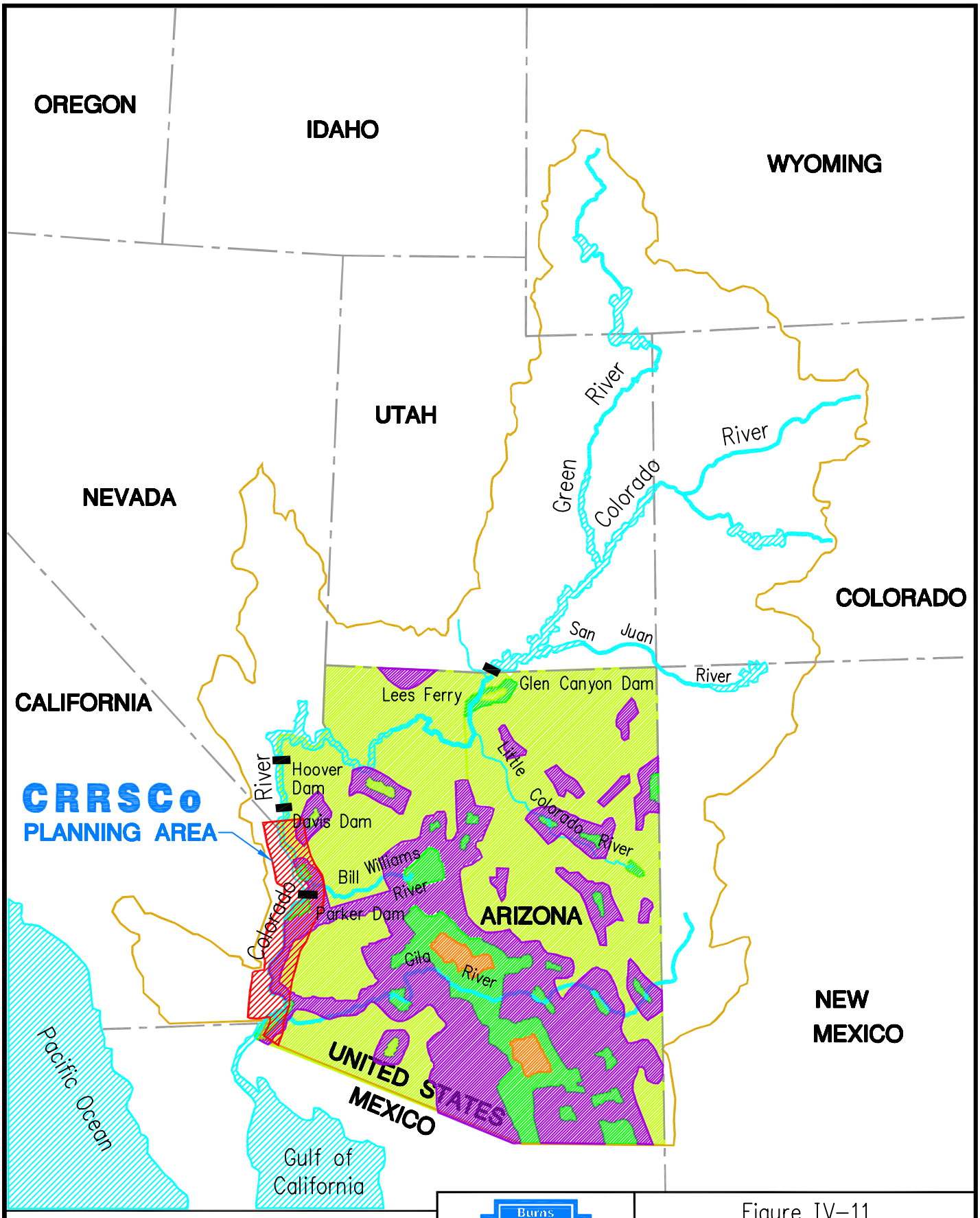


Figure IV-10. Annual Flow Variation
Island WWTP Plant, Lake Havasu City, AZ
Flow (mgd)
2.0
1.5
1.0
0.5
10/1
10/18
11/4
11/21
12/8
12/25
1/11
1/28
2/14
3/3
3/20
4/6
4/23
5/10
5/27
6/13
6/30
7/17
8/3
8/20
9/6
9/23
Date

the Island Wastewater Treatment Plant in Lake Havasu City, AZ. The trend shows a 50% increase in flow to the plant over the time frame when Winter Visitors typically reside in Lake Havasu City (Christmas to April). Flow decreases over the April to June time frame. The increase observed over the period from June to August is due to the various summer events sponsored by Lake Havasu City to attract tourists in summer. By fall, flows begin to decrease, reflecting the number of residents who permanently reside in the City.

3. Population Density

Figure IV-11 shows permanent population density in Arizona with a CRRSCo planning area overlay. This figure stresses the condition under which most CRRSCo communities find themselves: small population densities. From a wastewater infrastructure perspective, this translates into smaller number of connections per acre and higher cost per connection to maintain the system. Constructing and maintaining centralized wastewater collection and treatment systems under these circumstances is inevitably expensive.


OREGON
IDAHO
WYOMING
UTAH
NEVADA
COLORADO
CALIFORNIA
NEW MEXICO
ARIZONA
UNITED STATES
MEXICO
Green River
Colorado River
San Juan River
Lees Ferry
Glen Canyon Dam
Little Colorado River
Hoover Dam
Davis Dam
Bill Williams River
Parker Dam
Colorado River
Gila River
CRRSCo
PLANNING AREA
Pacific Ocean
Gulf of California
Population Density
Number of Persons per Square Mile
More than 50
10 to 50
5 to 10
Less than 5
Burns & McDonnell
100
1898 • 1998
Figure IV-11
POPULATION DENSITY
IN ARIZONA
J:\CRRSCO\987634\Drawings\crrsco08.dwg 01-11-1999 09:34 DBL

C. CRRSCo Members

Referring to Figure IV-2, the following entities are members of CRRSCo (members are marked in red in the figure:

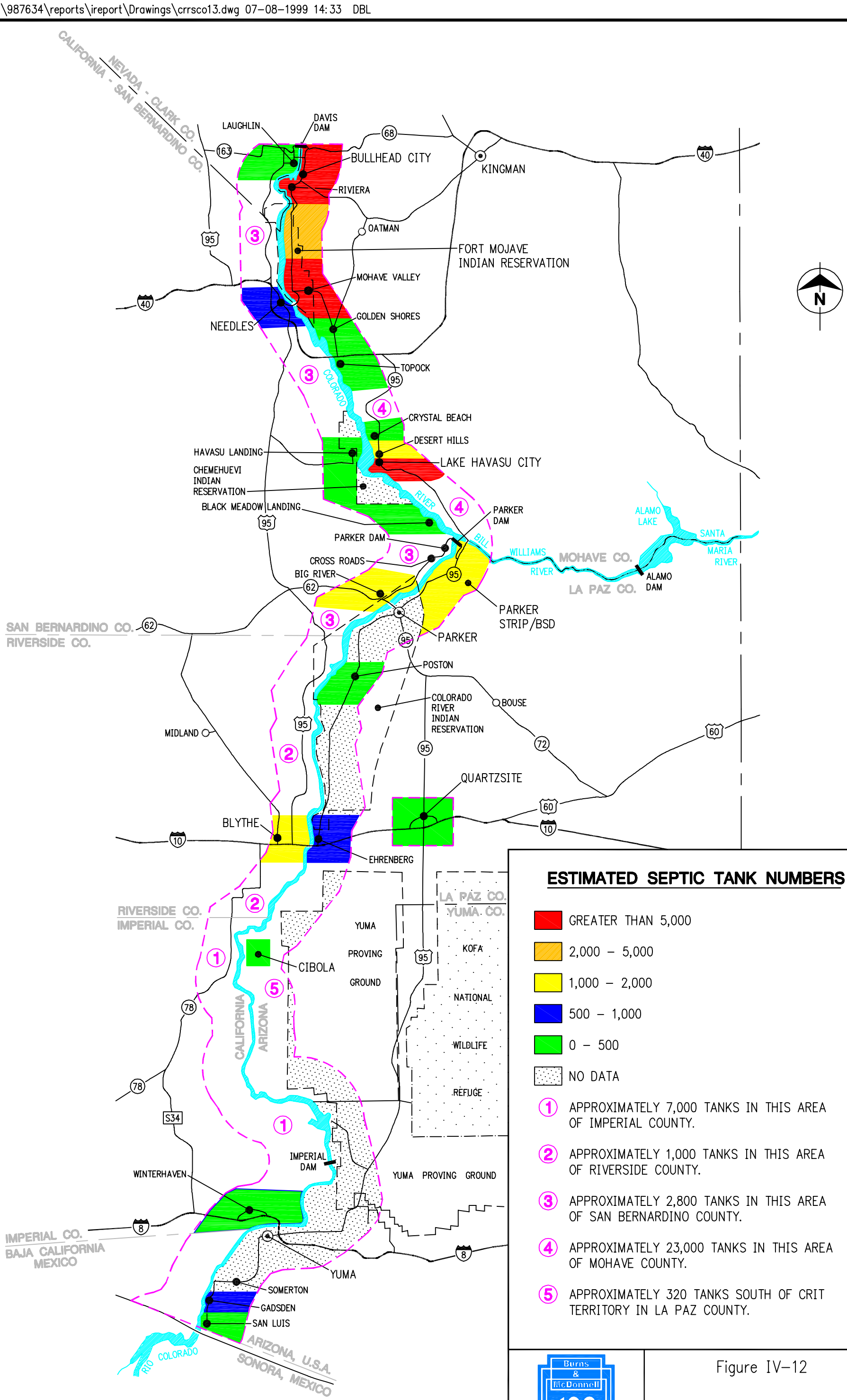
- Bullhead City, Arizona
- Lake Havasu City, Arizona
- Buckskin Sanitary District, La Paz County, Arizona
- Town of Parker, Arizona and Colorado River Indian Tribe
- Fort Mojave Indian Tribe
- Town of Quartzsite, Arizona
- City of Yuma, Arizona
- City of Blythe, California
- City of Needles, California
- La Paz County, Arizona
- Mohave County, Arizona

The Clark County Sanitation District has expressed interest in joining CRRSCo but at this time has elected to remain just an interested party.

D. Non-member Entities Within CRRSCo Planning Area

The following is a list of non-member entities that reside within the CRRSCo planning area:

- Mohave Valley, Arizona
- Golden Shores, Arizona
- Topock, Arizona
- Crystal Beach, Arizona
- Desert Hills, Arizona
- Poston, Arizona
- Ehrenberg, Arizona
- Cibola, Arizona
- Somerton, Arizona
- San Luis, Arizona
- Gadsden, Arizona
- Black Meadow Landing, California
- Big River / Earp, California
- Winterhaven, California
- Boulder City, Nevada



ESTIMATED SEPTIC TANK NUMBERS

- GREATER THAN 5,000
- 2,000 – 5,000
- 1,000 – 2,000
- 500 – 1,000
- 0 – 500
- NO DATA

(1) APPROXIMATELY 7,000 TANKS IN THIS AREA OF IMPERIAL COUNTY.

(2) APPROXIMATELY 1,000 TANKS IN THIS AREA OF RIVERSIDE COUNTY.

(3) APPROXIMATELY 2,800 TANKS IN THIS AREA OF SAN BERNARDINO COUNTY.

(4) APPROXIMATELY 23,000 TANKS IN THIS AREA OF MOHAVE COUNTY.

(5) APPROXIMATELY 320 TANKS SOUTH OF CRIT TERRITORY IN LA PAZ COUNTY.

Burns & McDonnell 100 1898 • 1998

Figure IV-12

ESTIMATED NUMBERS OF SEPTIC TANKS

E. Septic Tank Systems

Currently, the majority of residents in the CRRSCo planning area are on septic tank systems. Quantification of septic tank numbers is shown in Figure IV-12. The data shown on this map were generated from telephone conversations with all available entities shown on the map. This figure depicts the reason CRRSCo exists: to help communities migrate from septic tank systems to centralized wastewater collection and treatment systems.

The driving force behind wastewater master plans previously developed by CRRSCo members is to develop recommendation for improvements to ameliorate the detrimental affects of septic systems on drinking water wells, lake water quality and the Colorado River in general. Degraded water quality and potential health dangers have forced regulatory agencies to take strong measures including beach closures and new construction bans in areas where no centralized wastewater collection systems exist.

The purpose of the Regional Watershed Plan is to develop a long-term program for the replacement of septic tank systems with collection and treatment facilities to mitigate these issues.

F. Innovative Approaches For Collection and Disposal

As part of the wastewater assessment, innovative approaches for wastewater collection and effluent disposal are examined. For collecting wastewater for centralized treatment,

alternative collection systems are discussed. For effluent disposal, two options are discussed: 1) wetlands system; and 2) bamboo farming.

The rationale for using these approaches is threefold: 1) to reduce construction costs; 2) make the project eligible for grants funding; and 3) generate revenue. As was presented in the Lake Havasu Phase 2 Wastewater Master Plan, bamboo is a cash crop with the potential for significant revenue generation. Based on current bamboo shoot market value and the acreage of bamboo required for effluent disposal, food crop revenues of 40 Million Dollars (FY97) could be generated over a 60-year period.

1. Alternative Collection Systems

With little collection system in place and sparse development in most parts of the planning area, conventional gravity collection systems are very expensive. Alternative collection systems have the potential for reducing construction costs by:

- Reducing excavation
- Eliminating or minimizing lift stations
- Improved construction methods and materials

The following describes the alternative collection systems applicable to the CRRSCo planning area:

TYPE	DESCRIPTION	MOTIVE FORCE	WASTEWATER CHARACTER
Small Diameter Gravity	Two inch minimum diameter collectors laid with variable grade with sufficient fall to drain interceptor tanks at each connection without requirements for self-cleansing	Gravity	Settled
Grinder Pump Pressure	Two inch minimum diameter collectors laid with uniform burial collecting wastes from a pump vault at each connection	Pressure	Macerated
STEP Pressure	One and one-half inch minimum diameter collectors laid with uniform burial collecting wastes from interceptor tanks at each connection	Pressure	Settled
Vacuum	Three inch minimum diameter collectors laid in a saw-tooth pattern with vacuum interface valves at each connection collecting wastes at a central collection tank	Vacuum	Raw

Small Diameter Gravity (SDGS)

SDGS collect settled wastewater from each connection. Interceptor or septic tanks are installed upstream of the connections to remove and store the settleable solids in the raw wastewater. With the settleable solids removed, SDGS are not required to be designed to carry solids. As a result, the collectors can be smaller in diameter (2 to 4 in. minimum) and laid with variable gradients to reduce the amount of excavation necessary. Since the collectors can be installed to conform more closely to the surface topography, some lift stations can be eliminated. Also, the number of manholes can be reduced. These changes in

design can result in significant construction costs savings over conventional gravity sewers because excavation and material costs are lower. Construction cost savings of up to fifty percent over conventional gravity sewer construction have been experienced in the U.S.

The collection of settled wastewater requires that sedimentation be provided upstream of each connection. This is accomplished by interceptor or septic tanks located on the property served. This tank is typically the responsibility of the utility district to ensure that it is installed and maintained properly. Therefore, permanent easements are needed for unlimited access to the interceptor tanks for periodic septage removal and inspection by the utility. To save costs, easements are usually established by reference to the location of the tank and service lateral.

Grinder Pump (GP)

Grinder pump pressure sewers utilize a pump with a cutting head installed in a small sump at each connection. The pump macerates the solids in the wastewater and forces the slurry through small diameter collectors (2-inch minimum) installed at uniform depth. The wastewater is pumped directly to the treatment plant or a municipal sewer connection. The sumps typically are located on private property but installed and maintained by the utility district. As with SDGS, perpetual easements must be secured by the utility for maintenance access.

Septic Tank Effluent Pumping (STEP)

STEP pressure sewers pump settled wastewater received from interceptor tanks (septic tanks) installed at each connection through small diameter collectors (1-1/2-inch minimum) installed at uniform depth. The settled wastewater is pumped from each connection to the

treatment plant or municipal sewer connection. The tanks and pumps typically are located on private property but installed and maintained by the utility district. As with SDGS, perpetual easements must be secured by the utility for periodic septage removal and maintenance access.

Vacuum

Vacuum sewers collect raw wastewater and convey it through small diameter pipes under vacuum air. A central pump station maintains vacuum in the collectors. Interface valves are installed at each connection that open by demand to allow raw wastewater to enter the collector followed by a volume of air. The wastewater forms a slug that is driven by the air due to differential pressure until the slug breaks up. The slug reforms in low points intentionally placed along the collector. The reformed slug is driven further along the collector by air when another upstream interface valve opens.

2. Effluent Disposal

a) Wetlands Effluent Treatment Systems

A number of wastewater wetlands treatment systems are in operation throughout Arizona, treating secondary effluent. For communities with sufficient available land area, wetlands can provide treatment and disposal of effluent at a significantly lower cost than conventional wastewater treatment systems.

The most successful large-scale constructed wetlands treatment systems are of the free water surface type, in which a water-holding basin is constructed and planted with

emergent and submergent wetlands plants, and secondary effluent is discharged to the wetlands for treatment. Floating aquatic plant wetlands systems have also been constructed as large-scale systems, but are susceptible to wind and cold weather die-off, and require higher maintenance for plant harvesting. Other types of wetlands include the slightly more efficient subsurface flow wetlands, best suited to single residence scale applications, due to significantly greater cost for large-scale systems.

Wetlands can reduce biochemical oxidation demand, total suspended solids, and nitrogen concentration in effluent; produce treated wastewater suitable for aquifer recharge, surface water discharge, or direct beneficial reuse for agricultural and/or landscape irrigation. Additionally, several zero-discharge wetlands in the State (e.g., Show Low, Springerville) provide disposal by consumptive use and evaporation. Wetlands treatment systems also provide wildlife habitat for waterfowl and other animals. The aesthetic qualities of a constructed wetlands treatment system typically represent a tradeoff with treatment efficiency. To provide a required level of treatment and achieve also some degree of aesthetic attractiveness, will require greater amounts of land and higher costs, than a less attractive wetlands design.

Wetlands treatment systems do require periodic maintenance, as a part of management of the treatment process. Banks must be frequently inspected to identify and remedy erosion, and damage from burrowing animals. As wetlands plants complete their life cycle, the dead emergent plants will fall onto the water surface and can form a thick thatch prior to decomposing and sinking below the water surface. A thatch can form an

excellent habitat for vectors such as mosquitoes. Vector control expenses vary with wetlands design, plant selection, and wetlands management practices. Costs can range from several hundred to thousands of dollars per month.

City of Phoenix Tres Rios Constructed Wetlands Pilot Project

Burns & McDonnell toured the Tres Rios wetlands on May 11, 1999 with Mr. Roland Wass, P.E., City of Phoenix Project Manager for the wetlands pilot project. There are currently two wetlands projects in operation at the site: the Cobblestone Wetlands, and the Haystack Wetlands. The Cobblestone wetlands treat 2 MGD of secondary effluent using 12 acres of free water surface wetlands. The City has tried several wetlands planting strategies, and is currently using a second generation of wetlands plants.

The first planting strategy consisted of planting 60% of the area with several species of bulrush. The City had to address several problems, including dense stands of plants retarding water flow through the wetlands, die off of plants after 2-3 growing seasons, and new plants unable to penetrate the floating mat of dead plant material. They found that to remove the thatch, the wetlands had to be drained and then left to dry for about 35 days, before equipment could be brought in the remove the accumulated thatch. They also experienced a mosquito control problem, and spent an average of $500 every three weeks on larvicidal treatments during the mosquito propagation season.

The second-generation wetlands planting strategy includes using a diversity of both emergent and floating plants, and varied lifetimes. The City is now constructing islands,

and gravel bars planted with cottonwoods in the middle of the wetlands cells, to provide enhanced wildlife habitat. They have found that establishing a canopy of cottonwood and willows planted along the periphery of the wetlands will out compete salt cedars.

They have also found that the wetlands area attracts many offers of volunteer help to assist with projects to enhance the attractiveness of the wetlands. The wetlands have also attracted many animal species, including some birds of prey, waterfowl, and mammals.

b) Bamboo Farming Using Effluent

The comprehensive wastewater master plan for Lake Havasu City has identified bamboo farming as an alternative for effluent disposal. The projected buildout flow for Lake Havasu City is 13.8 MGD. Of this flow, existing users, existing and planned golf courses and Highway 95 irrigation are predicted to have a reuse demand of 4.7 MGD. The remaining 9.1 MGD will have to be disposed of by other means. The three alternatives examined were: 1) percolation ponds; 2) injection wells and 3) bamboo farming. Although not the cheapest alternative (a net present value analysis showed injection wells to be the cheapest option), bamboo farming was recommended due to its flexibility (can receive no flow or intermittent flow without perishing) and potential for revenue. Based on current bamboo shoot market value and the acreage of bamboo required for effluent disposal, food crop revenues of 40 Million Dollars (FY97) could be generated over a 60-year period.

Based on data from experts on the bamboo plant, bamboo can take up to 20 gpd per plant. With approximately the 9 MGD of treated effluent at buildout, there is a maximum need of 460,000 bamboo plants. For proper care and harvesting activities there is a recommendation for a 10 feet by 15 feet plot for each plant. This translates into approximately 1700 acres. Based on land cost and plant cost, the 1,700-acre bamboo farm is estimated to cost approximately 3 Million Dollars (FY97).

Bamboo has the ability to utilize the nutrients found in wastewater. Some studies have been completed and indicate that approximately 750 pounds of nitrogen are used per acre of planting. This then offers a good potential for uptake of the nutrients if the bamboo is irrigated with wastewater effluent, which will minimize nutrients returning to the groundwater aquifer.

There are over 240 species of bamboo currently identified in the world. There are two main root systems for all of these species. One is a clump and the other is a runner. Certain species favor different climatic conditions. Some species are best as a food crop in the production of bamboo shoots. There are miniature varieties that can be used as ground cover. Other species are better used for fuel, furniture, or building materials. Bamboo is valuable as a building material because of its long fibers, which are very strong. Bamboo is being used in particleboard, laminates, and flooring. Bamboo is environmentally friendly. When burned as a fuel it does not degrade the oxygen/carbon-dioxide balance. Bamboo has a BTU rating comparable to lignite coal. It has a high sugar content and can be used in the production of ethanol.

A demonstration project consisting of several plantings is currently underway at the Island Wastewater Treatment Plant. The purpose of the project is to determine the best species of plant for the area and monitor the water and nutrient uptake that occurs with the plants. With data that is generated from the demonstration project over a prolonged period, an evaluation can be made as to the applicability of this vegetation as a user of wastewater effluent.

V. CRRSCo PLANNING AREA WASTEWATER NEEDS ASSESSMENT

A. Overview

The objective of the Regional Watershed Plan is to identify wastewater needs and the required financial resources to provide recommended wastewater improvements to River and neighboring River communities located in the CRRSCo Watershed planning area (see Figure IV-1).

Data presented herein are based on two sources: 1) existing wastewater master plans previously commissioned by CRRSCo members; and 2) projections developed for entities within the planning area where no master planning exists. Based on available and developed data, a *watershed-prioritized*, phased program detailing wastewater improvements with associated cost for the entire CRRSCo planning area is presented.

B. CRRSCo Member Wastewater Needs Assessment

1. Overview

Figure V-1 shows areas within the CRRSCo planning area where wastewater master planning has been performed. These plans discuss recommended improvements and present phased programs with estimated costs. Each of these is discussed in turn with

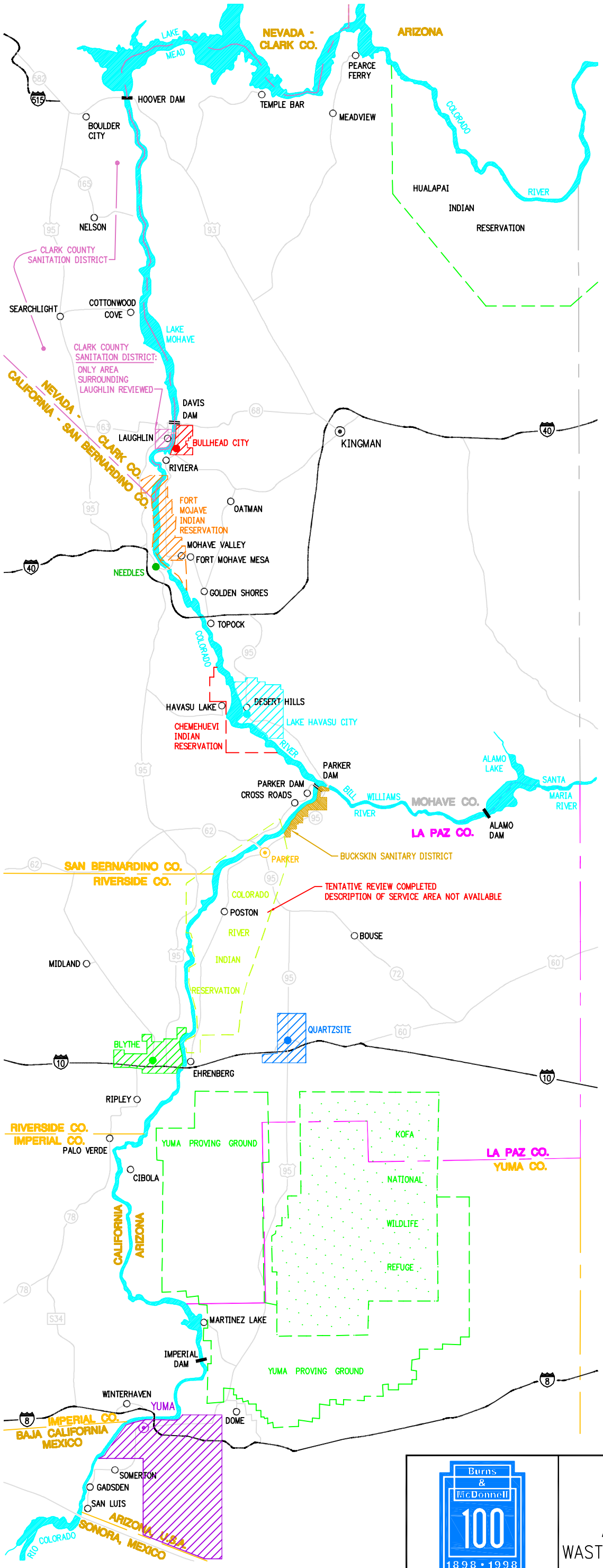


Figure V-1

AREAS WITH EXISTING WASTEWATER MASTER PLANNING

wastewater needs and costs presented followed by a summary of member needs and costs.

2. Bullhead City, Arizona

a) Overview

Referring to Figure V-1, the Bullhead City, AZ is located in Mohave County, south of Davis Dam and east of the Town of Laughlin, NV. The City's planning area encompasses 43 square miles. The impetus for master planning was the 1994 Arizona Department of Environmental Quality's (ADEQ) Northern Mohave Valley Groundwater Study. Well testing performed during this study revealed high nitrate concentrations (> 3 mg/L and < 7 mg/L) in many of the wells located in and near Bullhead City. Two wells showed nitrate concentrations in excess of the Maximum Contaminant Level (MCL) of 10 mg/L. The City's response to these findings was to develop a wastewater improvements plan to sewer the entire City.

Planning area population is just under 31,000 people and is projected to grow to 53,000 by the year 2020. Over this same time frame, flows are projected to increase from 2.6 MGD to 4.7 MGD. Projected costs to construct the required collection and treatment infrastructure to handle these flows is $118 Million (FY98). For a more detailed overview of Bullhead City's existing facilities, see Appendix VII.

b) Existing Facilities

Currently, the City and its planning area are serviced by three wastewater utilities: 1) Bullhead City; 2) Bullhead Sanitary District; and 3) Citizens Utility Company. As of the writing of this report, only information on the City's utility are considered. The City has recently acquired Citizens Utility Company and will soon acquire the Bullhead Sanitation District.

The City's utility consists of over 400,000 lineal feet of collection system and three treatment facilities that provide a total treatment capacity of 1.1 MGD. All three plants use an activated sludge process. Table V-1 summarizes plant unit treatment processes. All three treatment plants use rapid infiltration beds to dispose of their effluent.

Although there are three treatment facilities, the majority of City residents are serviced by septic systems.

c) Population and Wastewater Flow Projections

Figure V-2 shows population and wastewater flow projections for the planning area from the year 2000 to the year 2020. During this time, permanent resident population increases from 31,000 people to 53,000 and flow increases from 2.6 MGD to 4.7 MGD. Seasonal

Table V-1. Unit Treatment Processes,
City of Bullhead City

TREATMENT PROCESSES		Sunridge	Tierra Grande	Section 10
Bar Screen		X		
Equalization Basin				
Grit Removal				X
Primary Clarification			X	X
Secondary Treatment				
	Activated Sludge	X	X	X
	Oxidation Ditch			
	Contact Stabilization			
	Nitrification/Denitrification	X		
	Sequencing Batch Reactors			
Secondary Clarification		X	X	X
Tertiary Filtration				X
Disinfection		X		
	Chlorination		X	
	Chlorination/Dechlorination			
	Ultraviolet			X
Digestion				
	Aerobic			
	Anaerobic			
Dewatering				
	Belt Filter Press			
	Drying Beds			

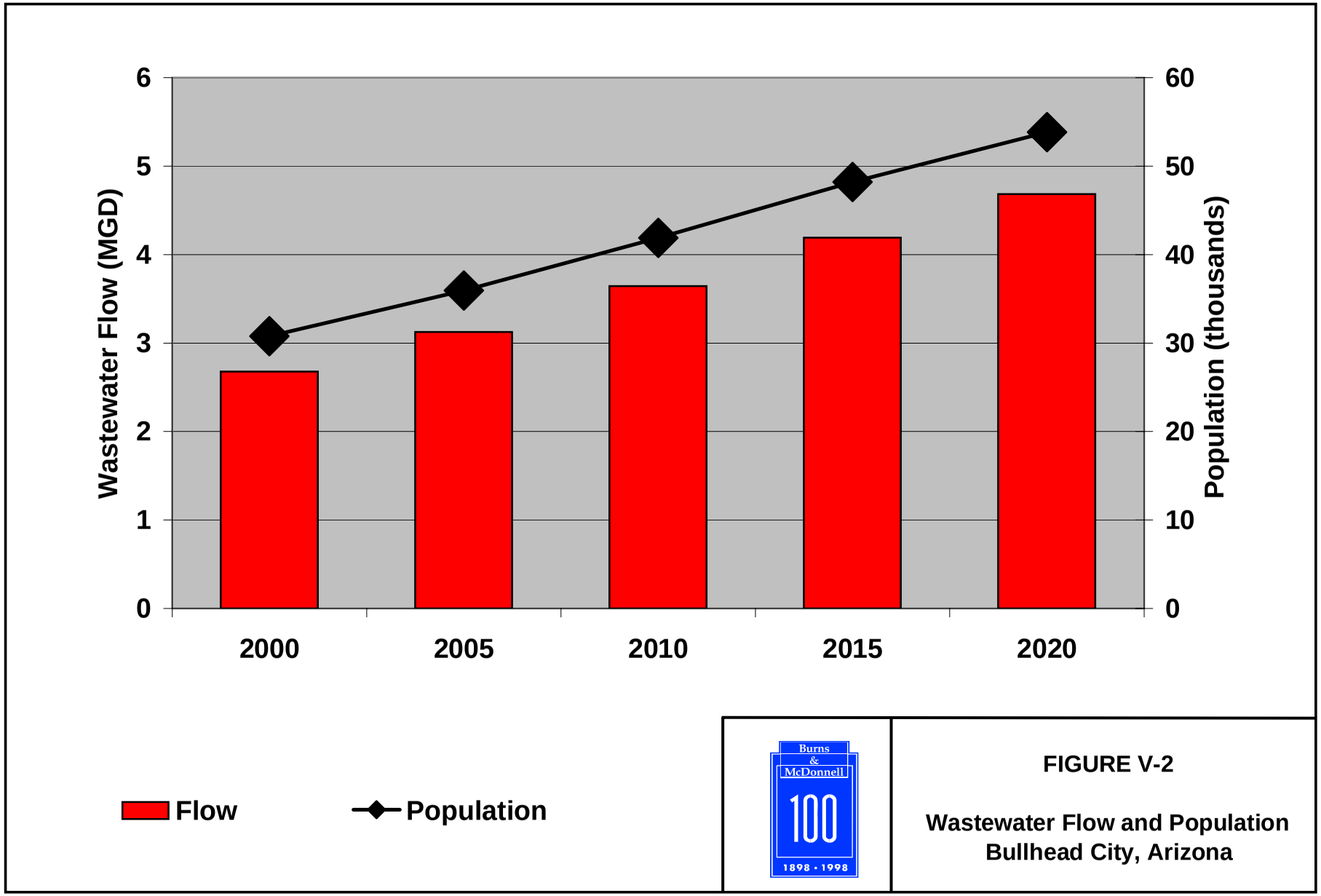


FIGURE V-2

Wastewater Flow and Population
Bullhead City, Arizona

Winter Visitor population increases the total population approximately 15 percent with the corresponding increase in flow.

d) Recommended Improvements

Table V-2 summarizes recommended improvements, by construction phase. Figure V-3 shows projected capital cost, by construction phase. The total projected improvements cost is $118 Million (FY98).

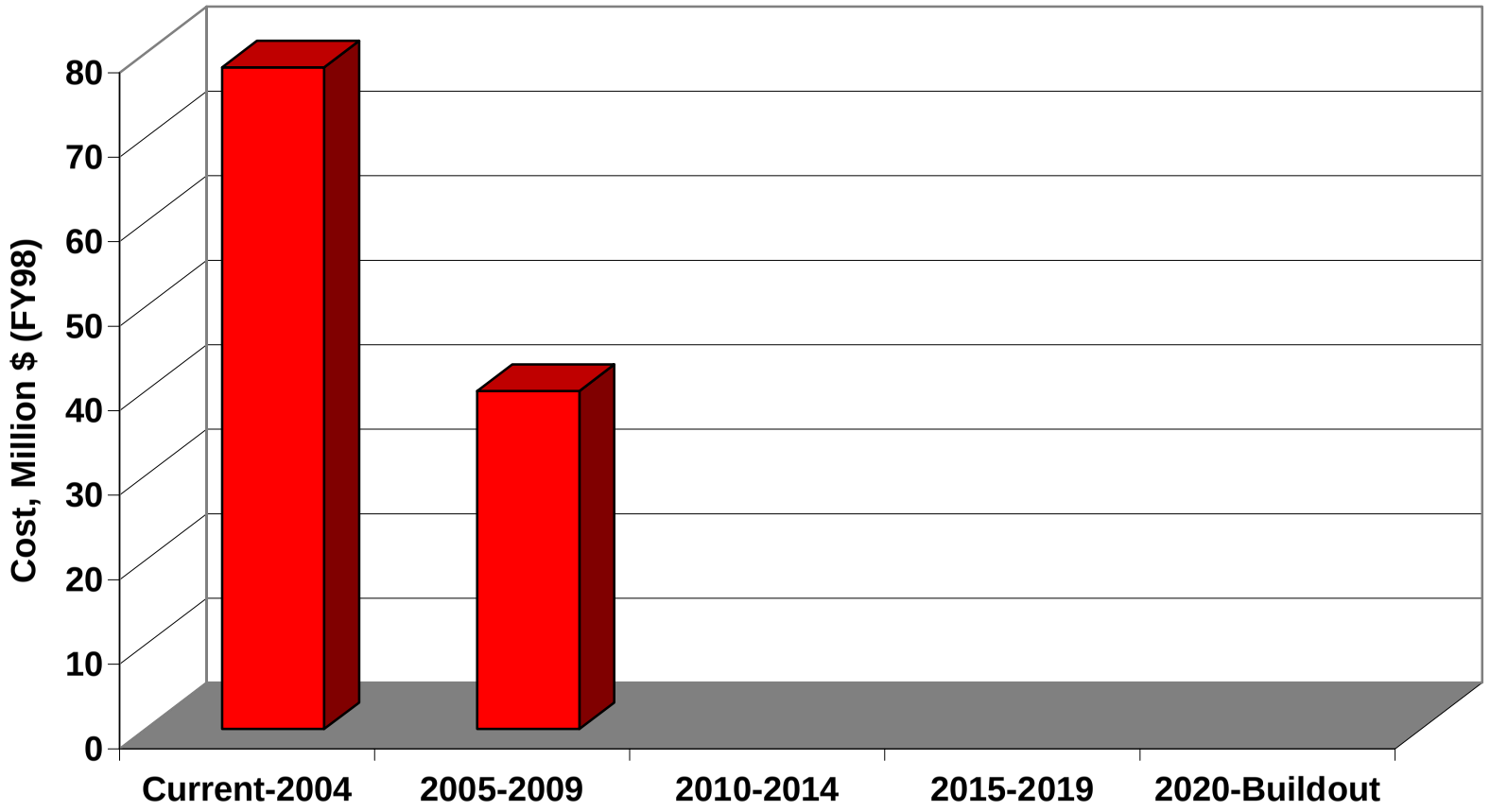
3. Lake Havasu City, Arizona

a) Overview

Referring to Figure V-1, the Lake Havasu City planning area covers 56 square miles and a current population of over 41,000 people. The population is projected to approach 96,000 by year 2060. Growing concerns over the number of residents on septic systems (~85 percent) and recent detection of high total nitrogen in monitoring wells have prompted the Arizona Department of Environmental Quality (ADEQ) to ban new construction unless residents install an on-site nitrogen removal systems or connect to the centralized collection system. The 1998 Phase II Wastewater Master Plan was commissioned by the City to respond to these concerns as well as the explosive growth being experienced. The plan details a phased approach for sewering the entire City and its extended planning area. The initial improvements phase concentrates on areas where new construction bans are in effect and areas nearest the Lake.

Table V-2. Summary of Recommended Wastewater Improvements by Phase, City of Bullhead City

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	220,000	230,000	80,000			530,000
Plant Treatment Capacity, MGD	0.9	1.5	0.2			2.6



Burns & McDonnell 100 1898 • 1998

FIGURE V-3

Construction Costs (FY98) for Bullhead City, Arizona

The estimated cost for sewering the entire area is almost $200 Million (FY98). For a more detailed description of the City of Lake Havasu City's existing facilities and wastewater needs, see Appendix VII.

b) Existing Facilities

Lake Havasu wastewater infrastructure consists of septic systems and a centralized collection and treatment system. Currently 85 percent of the 41,000 population are on septic systems. The remaining 15 percent of residents are connected to the centralized wastewater treatment system. The existing collection system consists of 680,000 lineal feet of collection system and two treatment plants with a total treatment capacity of 3.6 MGD. With only 15% of residents currently connected, the collection, pumping and treatment systems have not been experiencing any major problems. Lake Havasu has two treatment plants: 1) the Island Treatment Plant; and 2) the Mulberry Treatment Plant. These plants have a combined treatment capacity of 3.6 MGD. Table V-3 lists unit processes found in each plant. Both plants employ a biological nitrification/denitrification process.

Effluent from the existing plants can not be discharged into the Colorado River; the City must have beneficial reuse for its effluent. Both plants have Aquifer Protection Permits. With modifications to the existing 208 plan, the City could apply for National Pollution Discharge Elimination Permits (NPDES) to discharge effluent from both plants to the Colorado River.

c) Population and Wastewater Flow Projections

Figure V-4 summarizes population and flow projections from the year 2000 to the year 2020. Over the planning time period, flow is expected to more than double from its current value of 4.5 MGD to 8.9 MGD. At the projected buildout date of 2060, flow is predicted to reach 13.8 MGD. The combination of continued growth and transitioning from septic to centralized collection and treatment systems will prove a significant cost burden to residents.

d) Recommended Improvements

Table V-4 summarizes recommended system improvements for Lake Havasu City. Small diameter gravity (SDG) sewers were recommended over conventional gravity sewers for the collection system improvements. The cost analysis shows significant construction cost savings with SDG versus conventional gravity collection ($119 Million versus $221 Million). Three options for effluent disposal were examined: 1) percolation ponds; 2) injection wells; and 3) bamboo farming. Although injection wells have the lowest capital cost, bamboo farming has the potential to generate income by marketing the bamboo for alternative uses. The City is currently undertaking a bamboo demonstration project to investigate the viability of this disposal method. Until this alternative has been further investigated, no recommendation for effluent disposal is offered. Bamboo farming effluent disposal cost data is used for developing overall collection, treatment and disposal costs.

Table V-3. Unit Treatment Processes,
City of Lake Havasu City

TREATMENT PROCESSES		Island	Mulberry
Bar Screen		**X**	**X**
Equalization Basin		**X**	**X**
Grit Removal			**X**
Primary Clarification			
Secondary Treatment			
	Activated Sludge		
	Oxidation Ditch		
	Contact Stabilization		
	Nitrification/Denitrification	**X**	**X**
	Sequencing Batch Reactors		
Secondary Clarification		**X**	**X**
Tertiary Filtration		**X**	**X**
Disinfection			
	Chlorination		
	Chlorination/Dechlorination		
	Ultraviolet	**X**	**X**
Digestion			
	Aerobic		**X**
	Anaerobic		
Dewatering			
	Belt Filter Press		**X**
	Drying Beds	**X**	

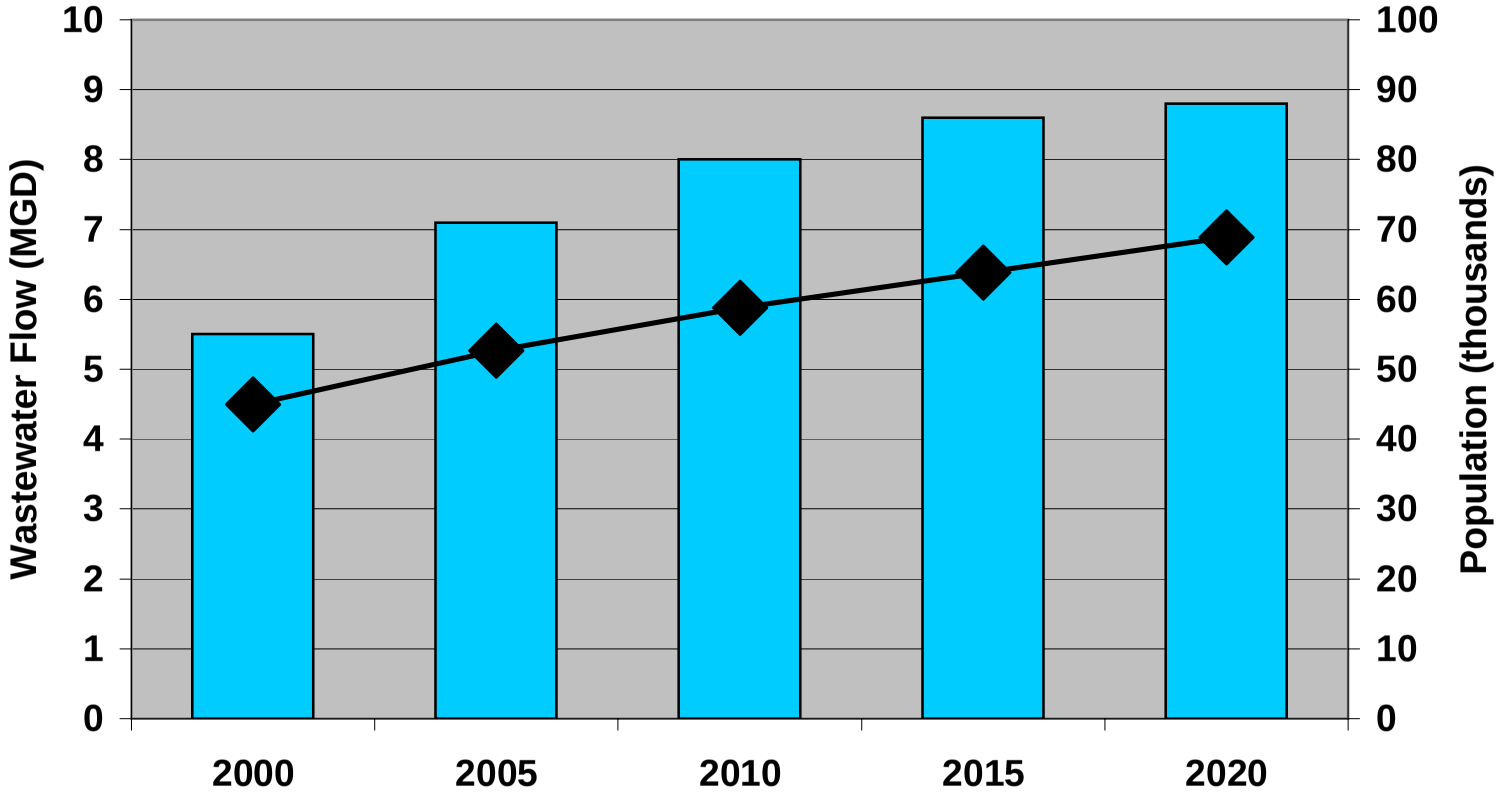


FIGURE V-4

Wastewater Flow and Population
Lake Havasu City, Arizona

Table V-4. Summary of Recommended Wastewater Improvements by Phase, City of Lake Havasu City

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	490,000	690,000	670,000	520,000	440,000	2,810,000
Plant Treatment Capacity, MGD			4.1	3.0	4.0	11.1

The total capital cost for the required collection, treatment and disposal is $200 Million (FY98). Figure V-5 shows cost breakdown, by construction phase, for the recommended system improvements.

4. Buckskin Sanitary District, La Paz County, Arizona

a) Overview

The Buckskin Sanitary District (BSD) is located on the shores of the Colorado along the Parker Strip situated on Business Route AZ 95. Referring to Figure V-1, the Buckskin Sanitary District (BSD) planning area covers the most densely populated portion of the district; this is approximately 40 percent of the district's 7 square miles or 2.8 square miles. The planning area has a current population of 1,844 with a projected buildout population of 2,230. Individual complaints concerning improper on-site disposal methods prompted the Arizona Department of Environment Quality (ADEQ) to issue notices-of-violation to many residents and businesses. To address these issues, BSD entered into an Inter-governmental Agreement (IGA) with ADEQ stating that the areas in question, which are currently on septic tanks, would be sewered within a two-year period. The 1995 Buckskin Sanitary District Engineering report was developed to examine alternatives for sewering BSD. The plan details a phased approach for sewering the planning area by 2015. This 1995 report addresses phases one through three; phase four, phase five and further additions are not addressed. The estimated cost for sewering phases one through three is $10.3 Million (FY98). The cost to sewer the remaining

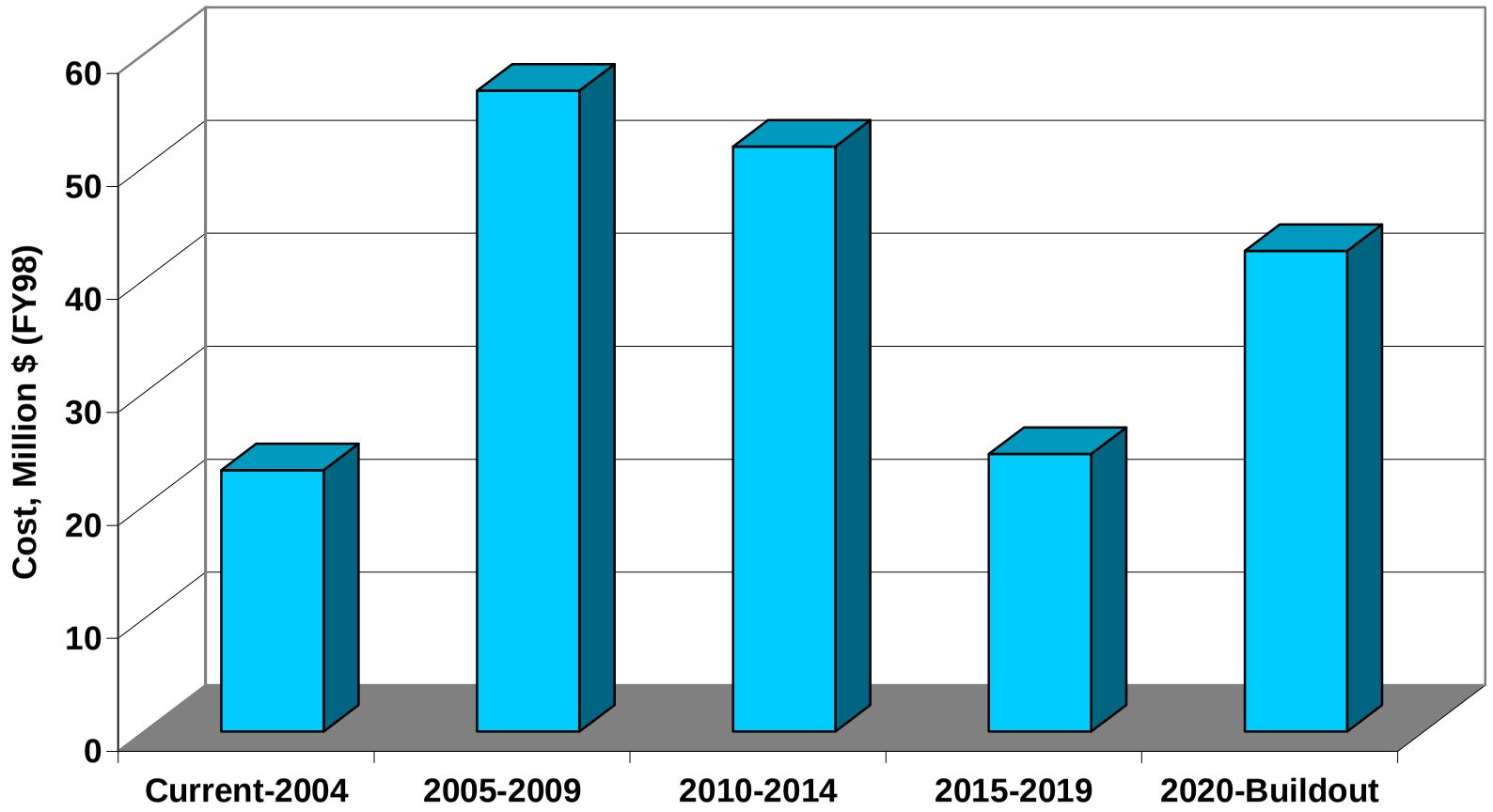


FIGURE V-5

Construction Costs (FY98) for Lake Havasu City, Arizona

phases has been estimated to be $24 Million (FY98). For a more detailed description of the Buckskin Sanitary District's existing facilities and wastewater needs, see Appendix VII.

b) Existing Facilities

Most developments within the BSD use septic tanks to collect, treat, and dispose of wastewater. Many of the septic tanks are now in permit violation due to the following changes in design requirements: 1) separation between water-supply watershed and on-site system; and 2) soil conditions that result in unacceptable percolation rates.

There are two existing treatment plants in the vicinity of the BSD: 1) the Sandpiper Wastewater Treatment plant (recently purchased by the BSD); and 2) the Colorado River Sewage System Joint Venture (CRSSJV) wastewater treatment plant (located outside of the BSD). Table V-5 lists unit processes for the Sandpiper Wastewater Treatment plant (see Table V-7 for a description of unit processes for CRSSJV plant). The Sandpiper plant was designed to serve the 75 condominium Sandpiper Resort. Currently, the plant serves 33 condominium units and 33 residential hookups. Due to a lack of flow generated by the resort, raw water from the Colorado River is pumped to provide enough hydraulic flow to operate the plant. Plant effluent is disposed of through irrigation.

The Colorado River Sewage System Joint Venture (CRSSJV) wastewater treatment plant uses a biological contact stabilization process. For a list of plant effluent characteristics, see Appendix VII. Like the Sandpiper plant, effluent is disposed of through irrigation. As of the

Table V-5. Unit Treatment Processes,
Buckskin Sanitary District

TREATMENT PROCESSES		Sandpiper
Bar Screen		**X**
Equalization Basin		
Grit Removal		
Primary Clarification		
Secondary Treatment		
	Activated Sludge	
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	**X**
	Sequencing Batch Reactors	
Secondary Clarification		**X**
Tertiary Filtration		
Disinfection		
	Chlorination	**X**
	Chlorination/Dechlorination	
	Ultraviolet	
Digestion		
	Aerobic	**X**
	Anaerobic	
Dewatering		
	Belt Filter Press	
	Drying Beds	

writing of this report, CRSSJV has stated they have no interest in receiving flows from the BSD.

c) Population and Wastewater Flow Projections

Figure V-6 summarizes population and flow projections from the year 2000 to the year 2020. Currently, the planning area is experiencing rapid growth. Due to limited available property, this growth will soon taper off. As of 1995, it was estimated that 80% of the land within the planning area had already been developed. From the year 2000 to the year 2020, average daily flow is projected to increase from 0.19 million gallons per day to 0.23 million gallons per day.

d) Recommended Improvements

Table V-6 summarizes recommended system improvements for Buckskin Sanitary District. These improvements include upgrades to the Sandpiper Plant. The total capital cost for the recommended improvements is approximately $10.3 Million (FY98).

5. Town of Parker, Arizona and Colorado River Indian Tribe

a) Overview

Referring to Figure V-1, the Town of Parker, AZ is located in La Paz County, east of the San Bernardino, County, CA-Riverside County, CA border. Referring to Figure V-1, it can be seen that The Colorado River Indian Tribe (CRIT) land straddles over the

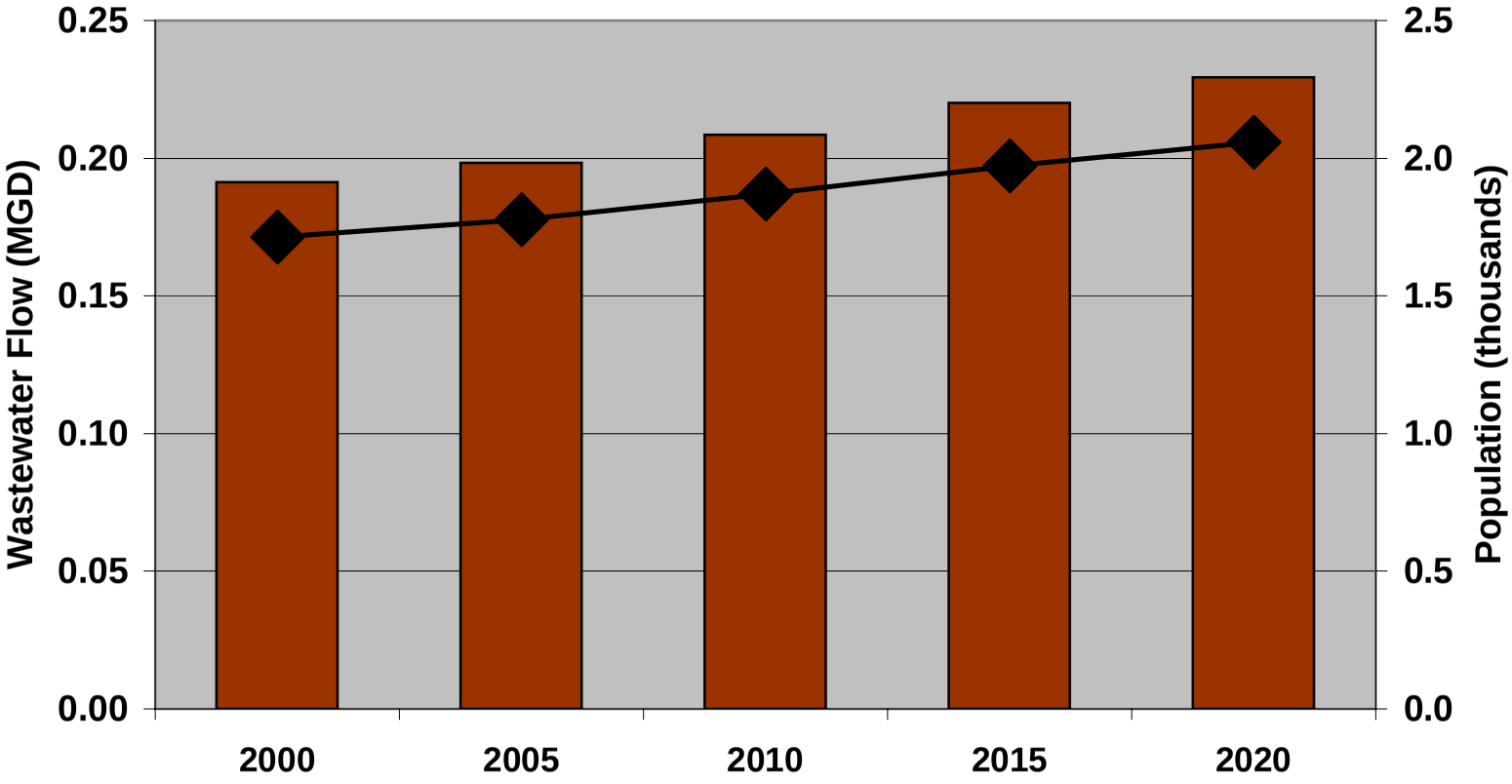


FIGURE V-6

Wastewater Flow and Population
Buckskin Sanitary District,
La Paz County, Arizona

Table V-6. Summary of Recommended Wastewater Improvements by Phase, Buckskin Sanitary District

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	41,000					41,000
Plant Treatment Capacity, MGD	0.2					0.2

Arizona-California border. Portions of the CRIT are found in La Paz, San Bernardino and Riverside Counties. The Town of Parker consists of 25 square miles; the CRIT consists of approximately 400 square miles.

The Town of Parker planning area population is just under 3,000 people and is projected to grow to over 4,800 by the year 2020. CRIT population is just under 7,000 people and is expected to grow to almost 8,000 by the year 2020. No flow projection data were available. CRIT has built a new casino and has estimated that the existing plant capacity of 1.2 MGD will eventually have to be expanded to 3.0 MGD to treat the additional flows. The estimated cost for expanding plant capacity from 1.2 MGD to 3.0 MGD is $4.8 Million (FY98). For a more detailed overview of the Town of Parker and CRIT master planning, see Appendix VII.

b) Existing Facilities

The Town of Parker and the Colorado River Indian Tribe have entered into a joint venture to share the burden of operating a wastewater treatment plant. This venture is known as the Colorado River Sewage System Joint Venture (CRSSJV). The CRSSJV operates a wastewater treatment plant that has a design capacity of 1.2 MGD. The plant uses a contact stabilization process. Table V-7 summarizes plant unit processes. Plant effluent is discharged to an irrigation canal that runs parallel to the Colorado River. The Town of Parker collection system is approximately 15,000 LF.

Table V-7. Unit Treatment Processes,
Colorado River Sewer System Joint Venture

TREATMENT PROCESSES		CSSJV
Bar Screen		**X**
Equalization Basin		
Grit Removal		
Primary Clarification		
Secondary Treatment		
	Activated Sludge	
	Oxidation Ditch	
	Contact Stabilization	**X**
	Nitrification/Denitrification	
	Sequencing Batch Reactors	
Secondary Clarification		**X**
Tertiary Filtration		
Disinfection		
	Chlorination	
	Chlorination/Dechlorination	
	Ultraviolet	**X**
Digestion		
	Aerobic	**X**
	Anaerobic	
Dewatering		
	Belt Filter Press	
	Drying Beds	**X**

According to an engineering assessment recently performed for CRSSJV, the plant services over 1,100 connections total (Town of Parker and CRIT together). The rest of the residents are on septic systems.

c) Population and Wastewater Flow Projections

Although information exists on population projections, wastewater flow projections for CRSSJV were not available. Currently, the average flow to the plant is 0.8 MGD. To service the new casino, it is projected that the existing plant capacity of 1.2 MGD will have to be expanded to 3.0 MGD to accommodate the additional flows.

d) Recommended Improvements

Table V-8 summarizes recommended improvements, by construction phase. These improvements only address expanding plant capacity from 1.2 MGD to 3.0 MGD to service the new casino. Figure V-7 shows projected capital cost, by construction phase, in FY98 dollars. The total projected improvements cost is $4.8 Million (FY98).

6. Fort Mojave Indian Tribe

a) Overview

The Fort Mojave Indian Reservation occupies approximately 64 square miles and is bounded by the Colorado River at the juncture of Arizona, California and Nevada (see Figure V-1). In 1989, the Fort Mojave Indian Tribe commissioned a master plan to

Table V-8. Summary of Recommended Wastewater Improvements by Phase, Colorado River Sewage System Joint Venture[1,2]

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	0					0
Plant Treatment Capacity, MGD	1.8					1.8

Note:
1) Existing information only addressed plant expansion to provide treatment capacity for a proposed casino
2) The Colorado River Sewage System Joint Venture is a joint venture between the Town of Parker, Arizona and The Colorado River Indian Tribe to operate wastewater facilities.

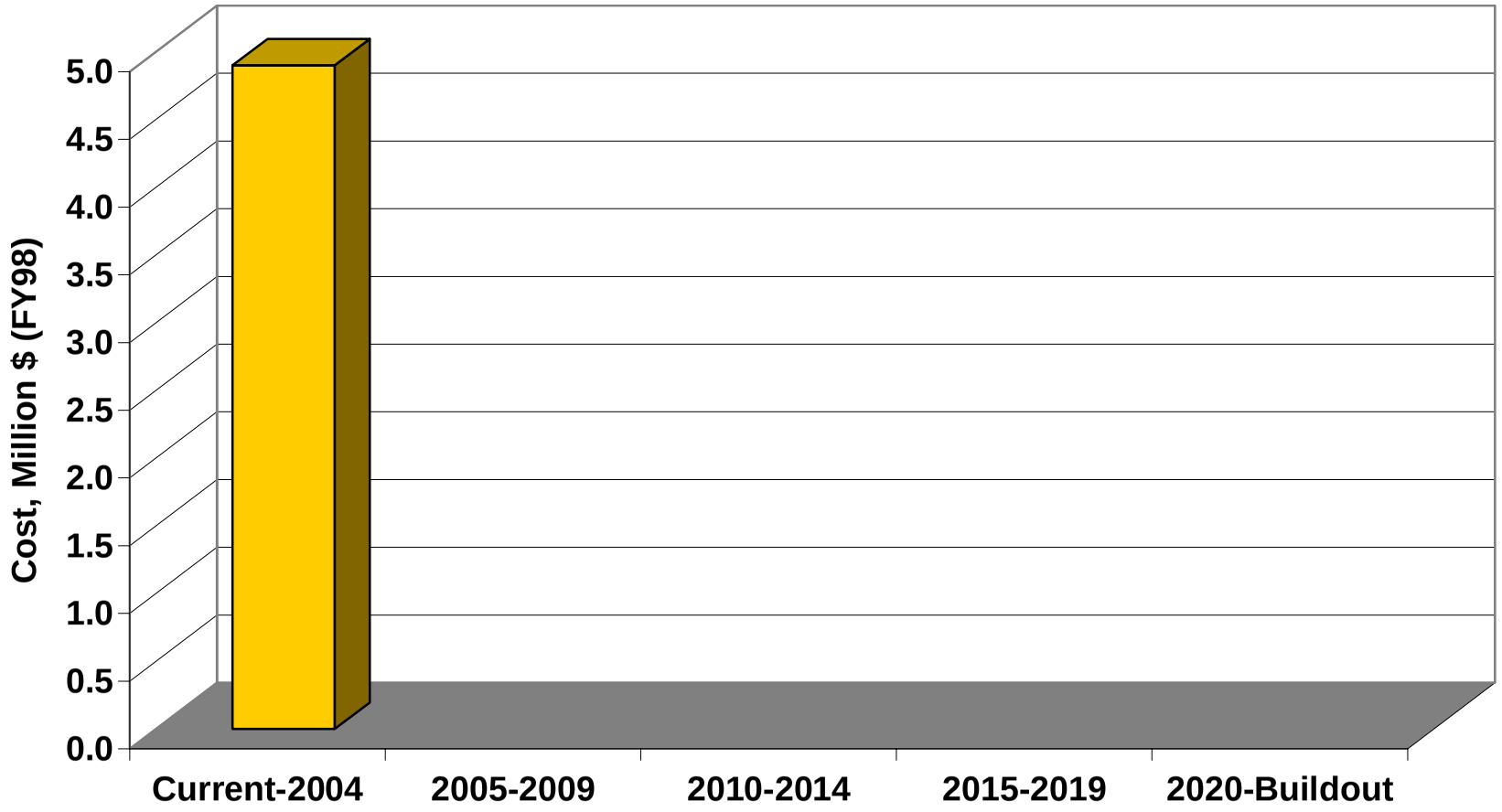


FIGURE V-7

Construction Costs (FY98) for Town of Parker, AZ / Colorado River Indian Tribe

examine constructing new wastewater facilities to meet projected needs for both the Indian Nation and the neighboring Mohave County areas. During the planning period (1990 to 2010), population was projected to be 9,677 in 1990, reaching 23,659 by the year 2010. The initial backbone collection system and new plant were constructed with additional improvements scheduled to occur as population grew. Two factors have influenced the situation since initial facilities construction: 1) projected growth did not occur; and 2) County residents were not required to connect to the existing system. This situation has resulted in an under-utilized plant and high per connection user fees.

During the development of the 1989 report, no explicit water quality issues were mentioned. A 1994 groundwater quality study conducted by the Arizona Department of Environmental Quality (ADEQ) revealed that approximately one-third of the 27 wells located within the Bond Feasibility Report study area tested high for nitrate levels (see Section III on Water Quality Issues in the Lower Colorado River). This is of growing concern to the Fort Mohave Tribal Utility Authority (FMTUA) which is the entity responsible for wastewater facilities operations.

b) Existing Facilities

Previous to the 1989 study, septic tanks were the primary means for sewage collection, treatment and disposal. The only existing facilities were the Fort Mojave Arizona Village collection and lagoon treatment system, servicing 110 homes.

The centralized collection and treatment wastewater facilities consist of over 500,000 LF of collection system, numerous pump stations and a 1.5 MGD treatment plant. Due to the unusually flat terrain (1 foot of fall per mile), pump stations are required at approximately 1-mile intervals. Table V-9 lists unit processes for the plant. The plant employs a biological oxidation ditch process. Plant effluent is used to irrigate non-food crops.

In addition to the FMTUA wastewater treatment facility, there are two private entities providing wastewater treatment services. Sunrise Vistas has a 200,000 gallon per day package treatment plant that services approximately two sections of land in Northern Mohave County. Sorenson Utility has a 250,000 gallon per day package treatment plant that also services approximately two sections of land in the mid-valley area, North of Topock.

c) Population and Wastewater Flow Projections

Figure V-8 summarizes population and flow projections from the year 2000 to the year 2020. Although population projections out to the year 2020 were available, flow projections were not. The trend for population growth from the year 2010 to the year 2020 is approximately linear; the same assumption was made to generate the corresponding flow projections.

Over the 1989 study's planning time period, flow was projected to increase from 0.26 MGD in 1990 reaching 1.47 MGD by the year 2010. As previously mentioned, growth and the

Table V-9. Unit Treatment Processes,
Fort Mojave Indian Tribe

TREATMENT PROCESSES		Plant
Bar Screen		**X**
Equalization Basin		**X**
Grit Removal		
Primary Clarification		
Secondary Treatment		
	Activated Sludge	
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	
	Sequencing Batch Reactors	**X**
Secondary Clarification		
Tertiary Filtration		
Disinfection		
	Chlorination	
	Chlorination/Dechlorination	**X**
	Ultraviolet	
Digestion		
	Aerobic	**X**
	Anaerobic	
Dewatering		
	Belt Filter Press	
	Drying Beds	**X**

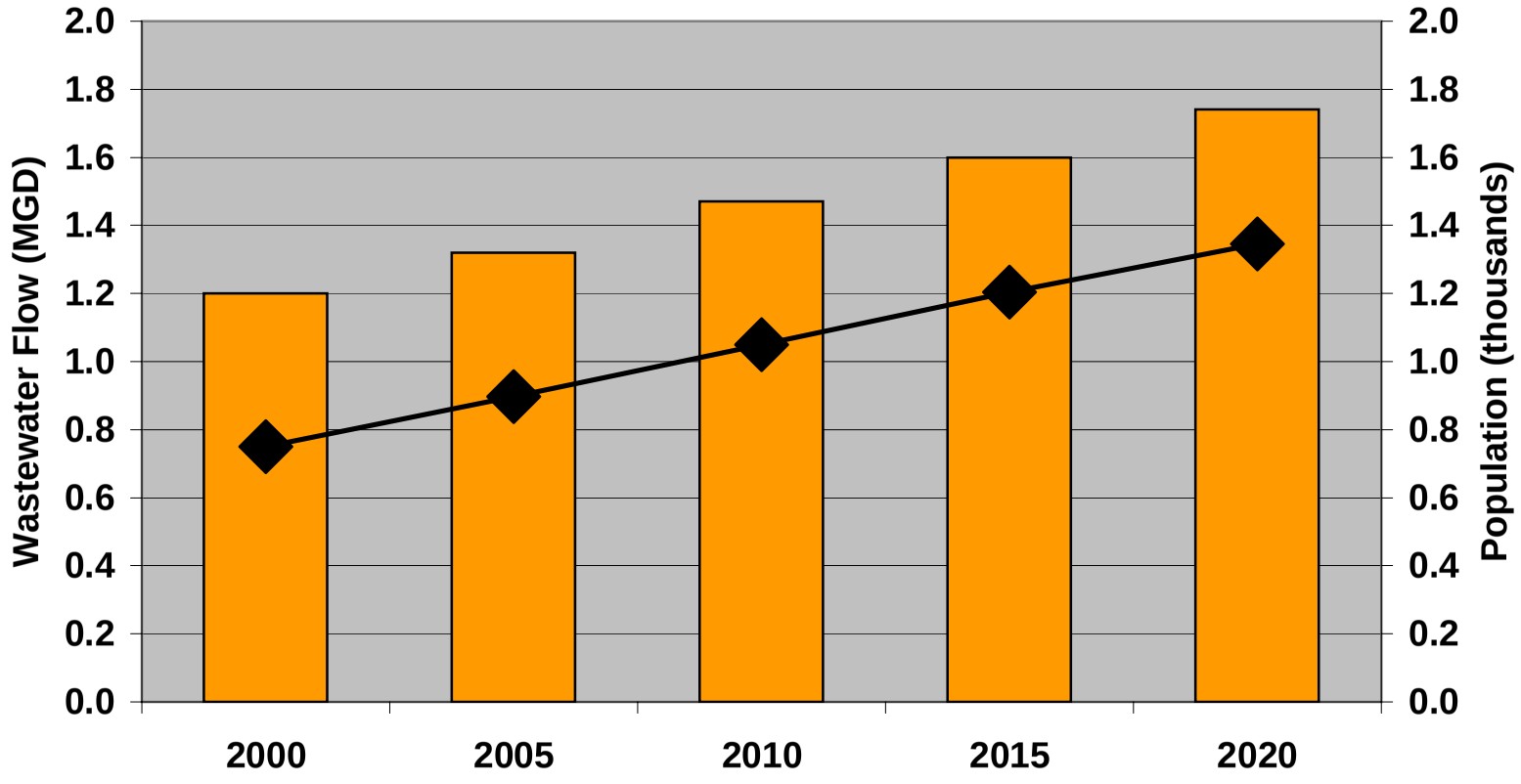


FIGURE V-8

Wastewater Flow and Population
Fort Mojave Indian Tribe

number of anticipated connections did not occur. Recent discussions with FMTUA indicate that as of ***1998***, average daily flows to the plant are only 220,000 gpd or approximately 15% of the plant's 1.5 MGD capacity.

d) Recommended Improvements

Given the issues surrounding growth and County connections, improvements that were not yet constructed per the 1988 plan have been put on hold. These include additional collection system and pump station facilities and a 1.5 MGD plant expansion.

7. Town of Quartzsite, Arizona

a) Overview

Referring to Figure V-1, the Town of Quartzsite, AZ is located in La Paz County, on Interstate 10 approximately 20 miles east of the California-Arizona border. The Town's planning area encompasses 36 square miles. The town recently built a centralized collection system and treatment facility to address significant groundwater nitrate contamination due to septic systems.

Planning area permanent population is projected to be just under 4,000 people in the year 2000 and is projected to grow to 6,000 by the year 2020. Over this same time period, due to Winter Visitors and an annual rock and gem show, the Town of Quartzsite's population is projected to grow to 25,000 people during the year 2000 and to almost 40,000 people during the year 2020. Projected costs to construct the required collection and treatment infrastructure to handle these flows is $2.6 Million (FY98). For a more detailed overview of the Town of Quartzsite's master planning, see Appendix VII.

b) Existing Facilities

Currently, the Town and its planning area are serviced by 83,000 lineal feet of collection system and a 0.45 MGD treatment plant. The plant uses a sequencing batch reactor process. Table V-10 summarizes plant unit processes. Plant effluent is discharged to a local wash that is tributary to the Colorado River. In addition to these facilities, during high Winter Visitor population, septage from RV's is accepted at the County landfill and privately operated dump stations. All septage eventually ends up in lined evaporation beds at the County landfill.

Table V-10. Unit Treatment Processes,
City of Quartzsite

TREATMENT PROCESSES		Plant
Bar Screen		**X**
Equalization Basin		**X**
Grit Removal		
Primary Clarification		
Secondary Treatment		
	Activated Sludge	
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	
	Sequencing Batch Reactors	**X**
Secondary Clarification		
Tertiary Filtration		
Disinfection		
	Chlorination	
	Chlorination/Dechlorination	**X**
	Ultraviolet	
Digestion		
	Aerobic	**X**
	Anaerobic	
Dewatering		
	Belt Filter Press	
	Drying Beds	**X**

c) Population and Wastewater Flow Projections

Although population projections are available, no flow projection data were available. As previous mentioned, Winter Visitor population has a significant impact on Town wastewater infrastructure. Over the next 20 years, permanent population is projected to increase from 3,850 to 6,050 people. Over this same time period, seasonal visitor population is projected to increase from 24,850 to 39,000 people. During the annual rock and gem show held in January, the Town will experience an influx of over 1,000,000 visitors.

d) Recommended Improvements

Table V-11 summarizes recommended improvements, by construction phase. Figure V-9 shows projected capital cost, by construction phase. The total projected improvements cost is $2.6 Million (FY98).

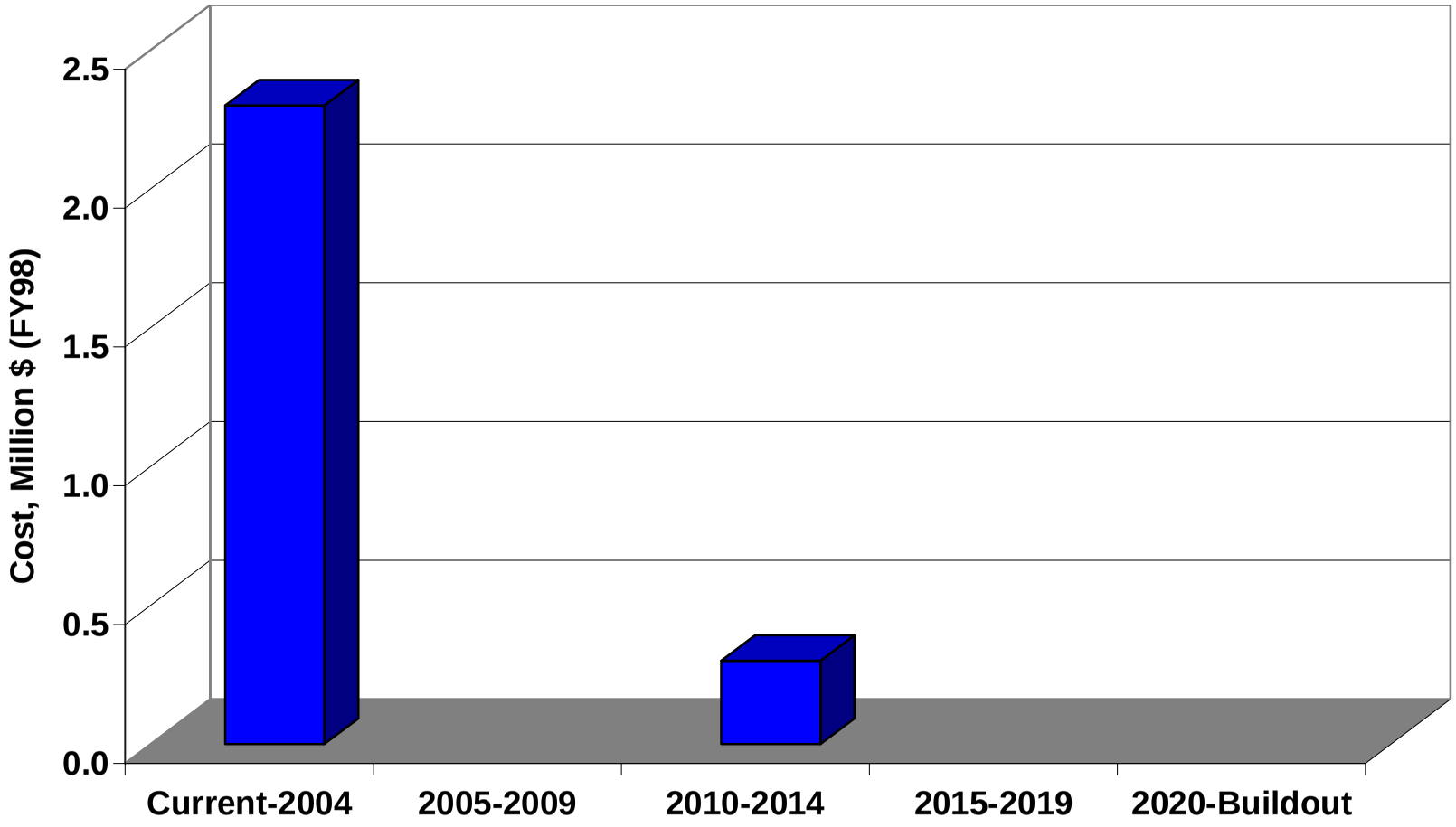
8. City of Yuma, Arizona

a) Overview

Referring to Figure V-1, the City of Yuma, AZ is located in southwestern Arizona, just across from the California-Mexico border. The City's planning area encompasses 432 square miles of which 68 square miles are served by the existing collection system. City population is just under 80,000 people and is projected to grow to 100,000 by the year 2020. Over this same time frame, flows are projected to increase from slightly below

Table V-11. Summary of Recommended Wastewater Improvements by Phase, City of Quartzsite

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	45,000					45,000
Plant Treatment Capacity, MGD			0.2			0.2



Burns & McDonnell 100 1898 • 1998

FIGURE V-9

Construction Costs (FY98) for Town of Quartzsite, Arizona

8.0 MGD to 16.3 MGD. Projected costs to construct the required collection and treatment infrastructure to handle these flows is $90 Million (FY98). For a more detailed overview of the City of Yuma's master planning, see Appendix VII.

b) Existing Facilities

Currently, the City and its planning area are serviced by 300 to 350 miles of collection system and a 12.0 MGD treatment plant. The plant uses an activated sludge process. Table V-12 summarizes plant unit processes. Plant effluent is discharged to the Colorado River. In addition to these facilities, Yuma has several package treatment plants all having a capacity less than 1.0 MGD.

c) Population and Wastewater Flow Projections

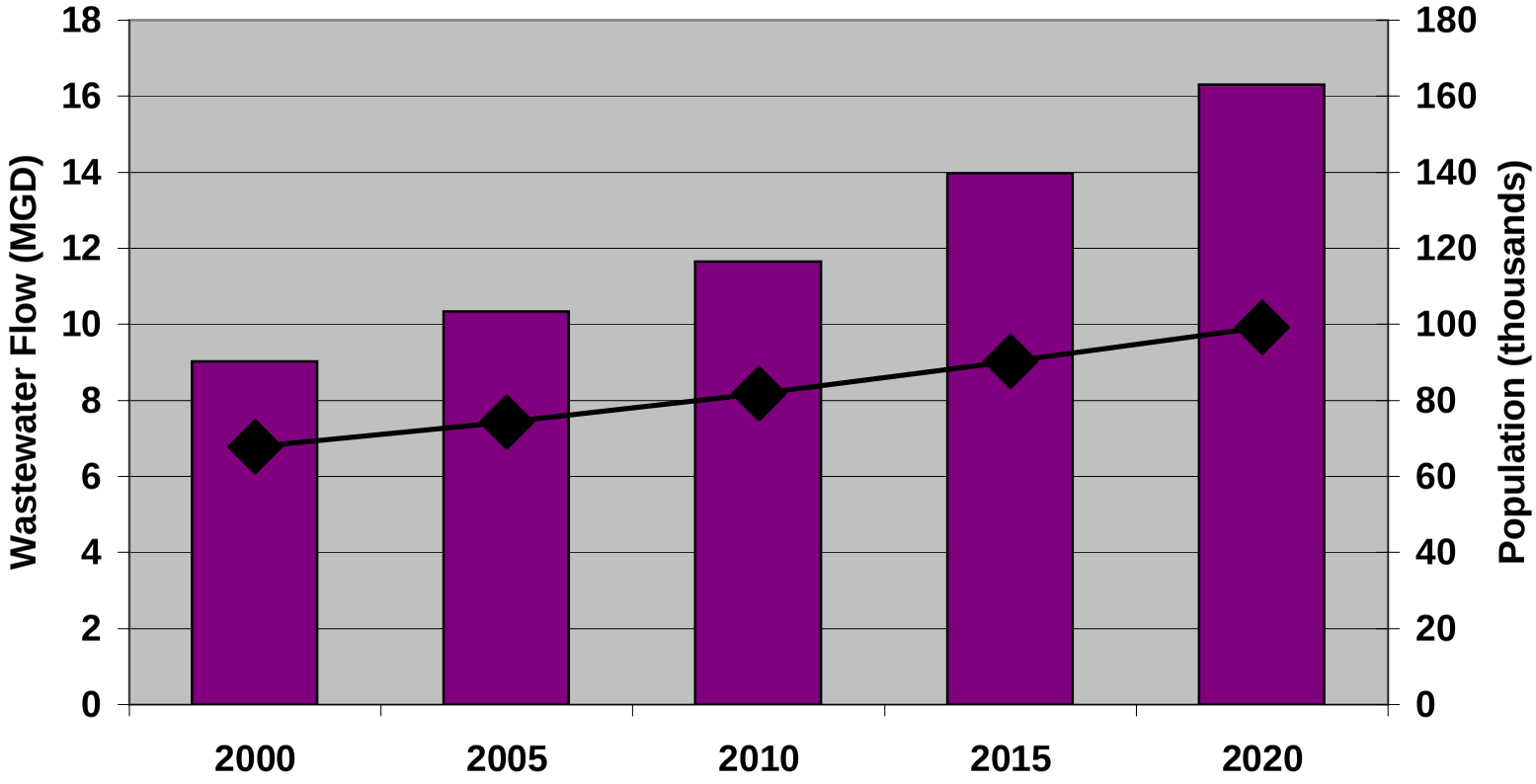
Figure V-10 shows population and wastewater flow projections for the planning area from the year 2000 to the year 2020. During this time, population increases from 80,000 people to 100,000 and flow increases from slightly below 8.0 MGD to 16.3 MGD.

d) Recommended Improvements

Table V-13 summarizes recommended improvements, by construction phase. Figure V-11 shows projected capital cost, by construction phase. The total projected improvements cost is $90 Million (FY98).

Table V-12. Unit Treatment Processes, City of Yuma

TREATMENT PROCESSES		Figueroa
Bar Screen		**X**
Equalization Basin		
Grit Removal		**X**
Primary Clarification		**X**
Secondary Treatment		
	Activated Sludge	**X**
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	
	Sequencing Batch Reactors	
Secondary Clarification		**X**
Tertiary Filtration		
Disinfection		
	Chlorination	**X**
	Chlorination/Dechlorination	
	Ultraviolet	
Digestion		
	Aerobic	
	Anaerobic	**X**
Dewatering		
	Belt Filter Press	
	Drying Beds	**X**



Burns & McDonnell 100 1898 · 1998

FIGURE V-10

Wastewater Flow and Population
City of Yuma, Arizona

Table V-13. Summary of Recommended Wastewater Improvements by Phase, City of Yuma

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	30,000	24,000	20,000	20,000	90,000	184,000
Plant Treatment Capacity, MGD	2.0	2.0			5.0	9.0

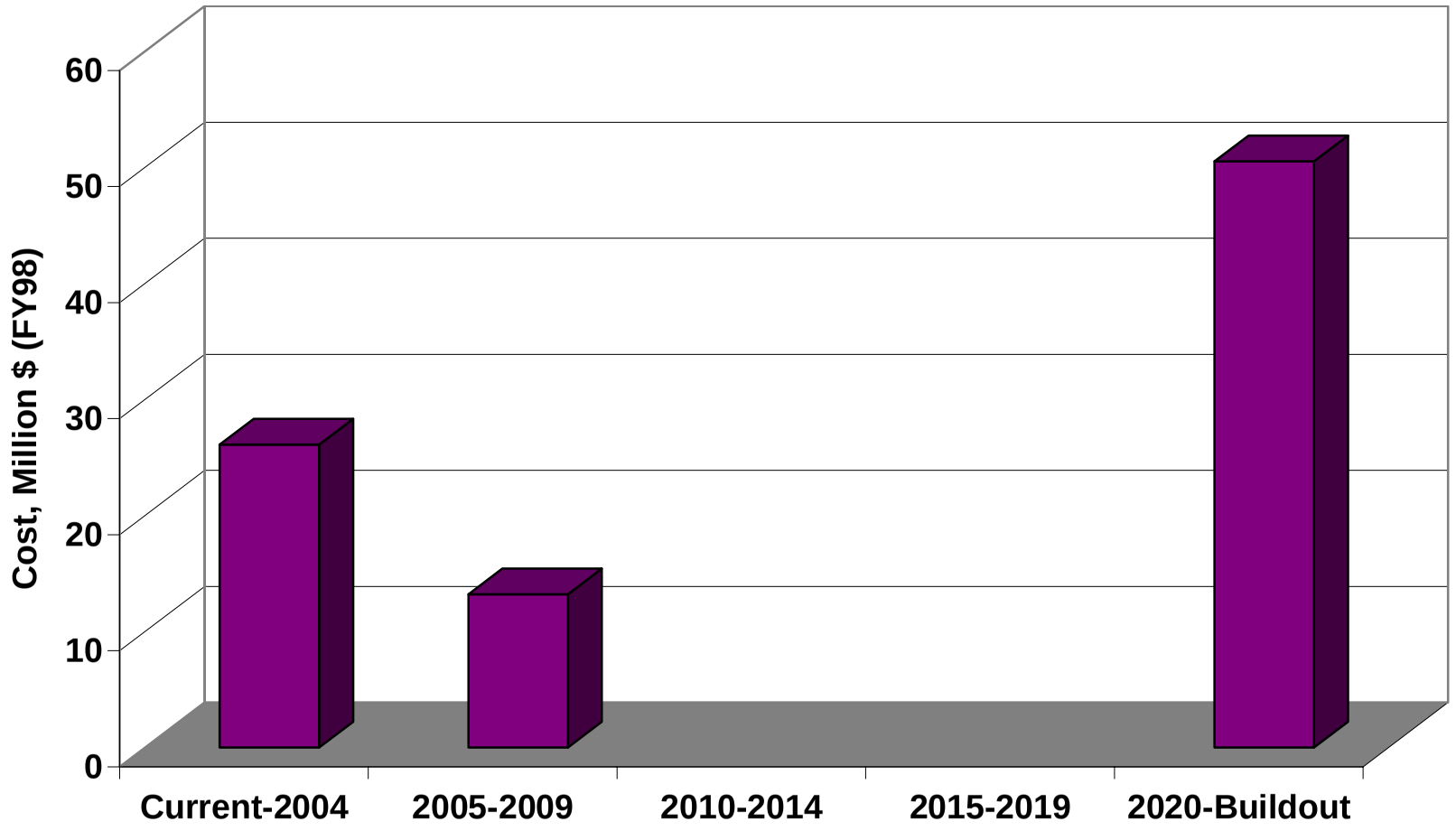


FIGURE V-11

Construction Costs (FY98) for City of Yuma, Arizona

9. Clark County Sanitation District, Nevada/Town of Laughlin, Nevada

a) Overview

Clark County Sanitation District is a Nevada county-owned special improvements district. As of the writing of this report, only the portion of Clark County Sanitation District serving the Town of Laughlin is being addresses. Referring to Figure V-1, the Town of Laughlin, NV is located just south of Davis Dam. The Town's planning area encompasses 80 square miles.

Population projections developed in 1991 show the Town of Laughlin growing from 5,600 people in 1990 to 35,000 by the year 2020. These projections were never realized. The current population is just under 9,000 people. Over the past few years, growth has been flat. The Town of Laughlin has excess collection and treatment capacity with a capacity to treat 8 MGD. Currently there are no plans for upgrading the wastewater infrastructure.

b) Existing Facilities

The Town is serviced by 75,000 lineal feet of collection system and an 8.0 MGD treatment plant. The plant uses an extended aeration activated sludge process. Table V-14 summarizes plant unit processes.

Table V-14. Unit Treatment Processes,
City of Laughlin

TREATMENT PROCESSES		Plant
Bar Screen		**X**
Equalization Basin		**X**
Grit Removal		
Primary Clarification		
Secondary Treatment		
	Activated Sludge	
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	**X**
	Sequencing Batch Reactors	
Secondary Clarification		**X**
Tertiary Filtration		**X**
Disinfection		
	Chlorination	
	Chlorination/Dechlorination	
	Ultraviolet	
Digestion		
	Aerobic	**X**
	Anaerobic	
Dewatering		
	Belt Filter Press	**X**
	Drying Beds	

Plant effluent is normally discharged to the Colorado River. The plant also has the capability to discharge effluent to an irrigation systems.

c) Population and Wastewater Flow Projections

As previously discussed, the projected growth in the Town of Laughlin was never realized. It is anticipated that even with the most growth projected, the existing 8.0 MGD plant will provide more than enough capacity for the foreseeable future. Therefore, no population or flow projections are presented.

d) Recommended Improvements

As of this time, there are no plans for improving existing collection and treatment facilities.

10. City of Blythe, California

a) Overview

Referring to Figure V-1, the City of Blythe, CA is located in Riverside County on Interstate Highway 10, just west of the California-Arizona border. The City's planning area encompasses 48 square miles of which 19 square miles are within the City Limit. By the year 2000, population is projected to be under over 20,000 people and is projected to grow to over 36,000 by the year 2020. Over this same time frame, flows are projected to increase from 2.8 MGD to 5.2 MGD. Projected costs to construct the required collection

and treatment infrastructure to handle these flows is $14.4 Million (FY98). For a more detailed overview of the City of Blythe's master planning, see Appendix VII.

b) Existing Facilities

The City proper is serviced by over 200,000 lineal feet of main sewer interceptor, four major pump stations and eight minor pump stations. The wastewater treatment is rated at 2.4 MGD. The plant uses an extended aeration activated sludge process. Table V-15 summarizes plant unit processes. Plant effluent is discharged to evaporation/ percolation basins.

The City is in the planning stages of annexing almost 38 acres of area surrounding the City Limits. This area is currently on septic systems. These septic systems treat 0.4 MGD. Of this 0.4 MGD, approximately 0.2 MGD comes from areas located on the Colorado shoreline. For a more detailed description of existing facilities, see Appendix VII.

c) Population and Wastewater Flow Projections

Figure V-12 shows population and wastewater flow projections for the planning area from the year 2000 to the year 2020. Over this period, population increases from just under 20,000 people to over 36,000 and wastewater flow increases from 2.8 MGD to 5.2 MGD. For a description of how flow projections were developed, see Appendix VII.

Table V-15. Unit Treatment Processes,
City of Blythe

TREATMENT PROCESSES		Plant
Bar Screen		**X**
Equalization Basin		
Grit Removal		
Primary Clarification		**X**
Secondary Treatment		
	Activated Sludge	**X**
	Oxidation Ditch	
	Contact Stabilization	
	Nitrification/Denitrification	
	Sequencing Batch Reactors	
Secondary Clarification		**X**
Tertiary Filtration		
Disinfection		
	Chlorination	
	Chlorination/Dechlorination	
	Ultraviolet	
Digestion		
	Aerobic	**X**
	Anaerobic	**X**
Dewatering		
	Belt Filter Press	
	Drying Beds	**X**

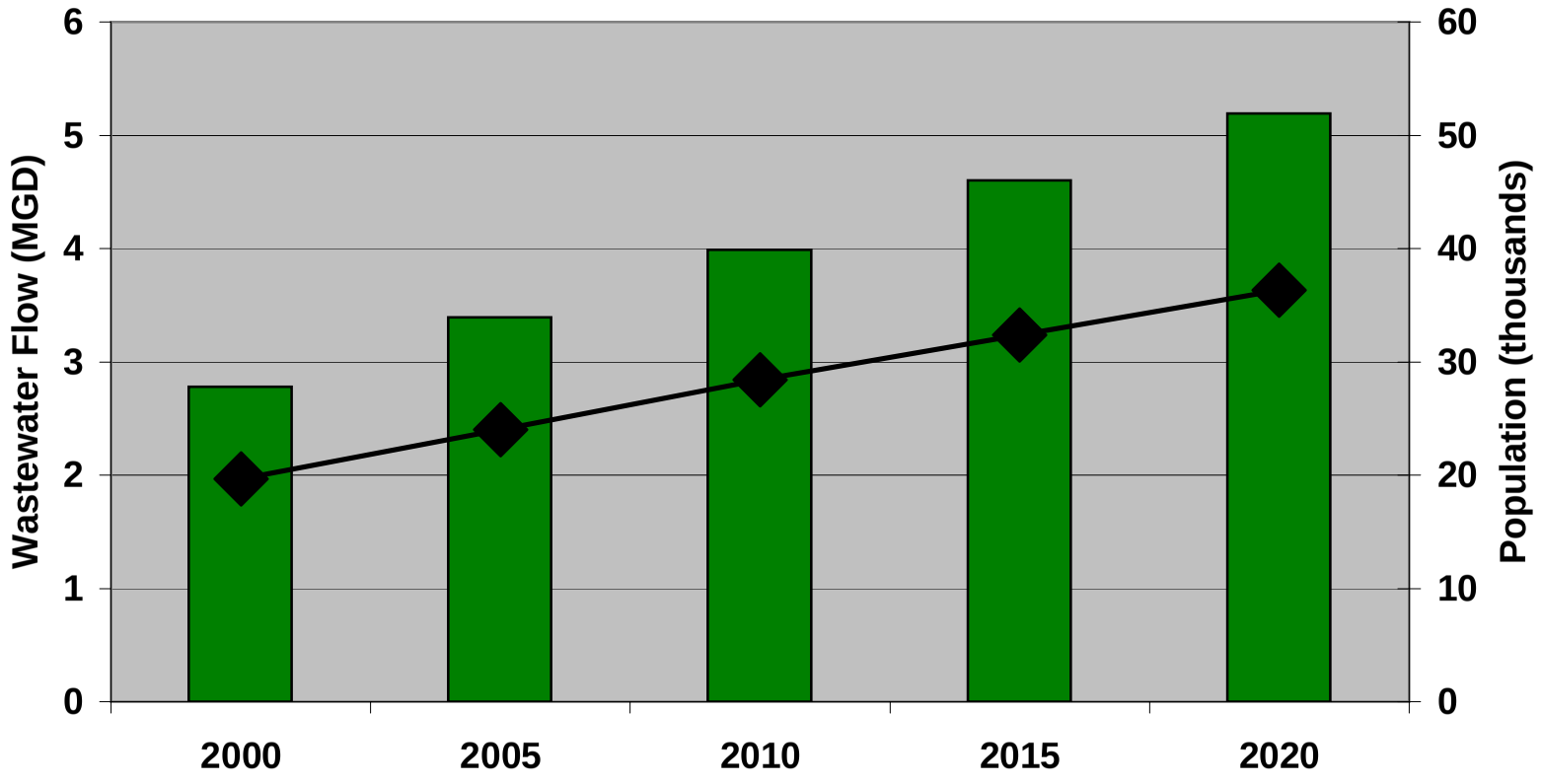


FIGURE V-12

Wastewater Flow and Population
City of Blythe, California

d) Recommended Improvements

Table V-16 summarizes recommended improvements, by construction phase. Improvements both within and outside of City Limits are shown. Figure V-13 shows projected capital cost, by construction phase, in FY98 dollars. The total projected improvements cost is $14.4 Million (FY98).

11. City of Needles, California

The City of Needles has developed an estimate of future wastewater needs that include over 100,000 LF of collection system and forcemain, 8 new pump stations and a new 1.2 MGD wastewater treatment facility. The total projected improvements cost is $41.3 Million (FY98).

C. Summary of Member Wastewater Needs

Based on recommended improvements contained in the documents and information reviewed to date, CRRSCo members will require approximately 3.8 Million lineal feet of new collection system and approximately 28 MGD of additional treatment capacity. Table V-17 summarizes recommended improvements for CRRSCo members, by phase.

Table V-16. Summary of Recommended Wastewater Improvements by Phase, City of Blythe

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	110,000	2,000		8,000		120,000
Plant Treatment Capacity, MGD				2.4		2.4

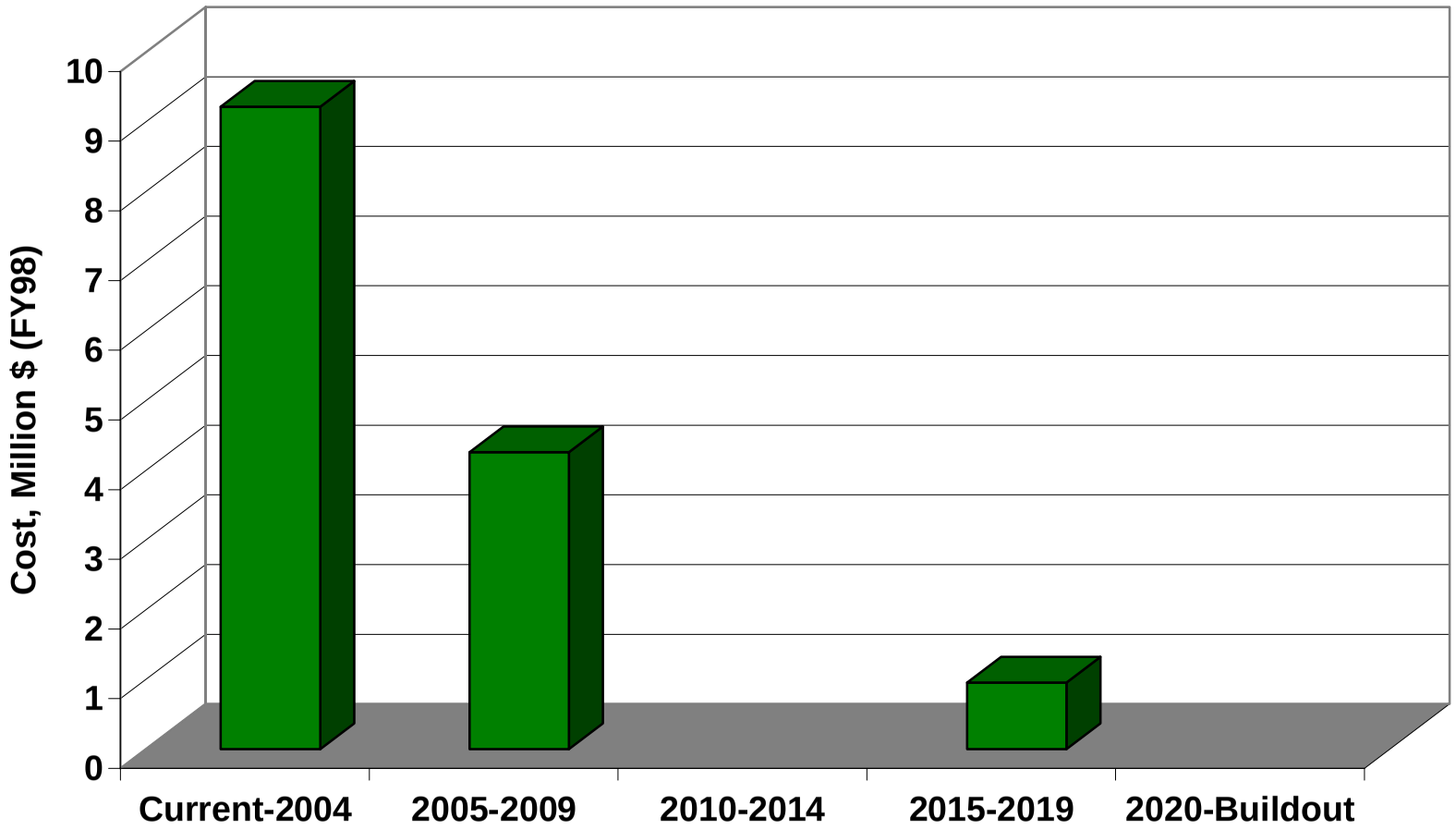


FIGURE V-13

Construction Costs (FY98) for City of Blythe, California

Table V-17. CRRSCo Member Wastewater Improvements by Phase

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	966,375	976,375	800,375	578,375	530,000	3,851,500
Plant Treatment Capacity, MGD	5.5	3.5	5.1	5.4	9.0	28.5

D. Non-Member Wastewater Needs Assessment

1. Approach

Currently, no master planning information exists for the non-CRRSCo members. For these entities, estimates of wastewater infrastructure needs had to be developed. For most of these entities where master planning does not exist, the wastewater infrastructure consists entirely of septic systems. However, where centralized collection and treatment facilities do exist, only the additional collection and treatment system needs were developed.

The following approach summarizes development of the recommended wastewater improvements in areas:

1. Determine the entity's existing population.

2. Project population through the year 2020. This projection was based on individual community projections developed by the census or the population growth trend for the county in which the community resides.

3. Establish an estimated area based on population density (people per acre).

4. Estimate the required lineal feet of collection system at the end of each phase based on a regional-based lineal feet per acre values.

5. Estimate the required treatment capacity at the end of each phase based on per capita flow rates.

6. Determine the additional collection and treatment system requirements per phase by subtracting the existing capacities from the requirements calculated above.

7. Estimate the opinion of cost per phase based on cost per lineal foot and cost per MGD of treatment capacity values. These values include both design and construction of the recommended projects.

2. Assumptions for Developing Needs

Data from the Lake Havasu City's Phase II Wastewater Master Plan were used to develop collection system and treatment system projections for these entities. The following values were used to convert population into wastewater collection system and treatment plant improvements:

Population Density:	5 persons / acre.
Length of Sewer:	150 LF of collection system / acre to be sewered.
Per Capita WW Flow:	100 gallons / capita / day.
Collection System Costs:	$80 / LF for Conventional System (includes pump stations)
	$45 / LF for Alternative System (includes septic stations)
Treatment System Costs:	$6 Million / MGD for New Treatment Plants

$3 Million / MGD for Additional Treatment Capacity

(Based on advanced treatment with tertiary filtration)

3. Wastewater Needs

Based on the approach described above, wastewater needs for non-member entities have been developed for each of the following construction phases: 1) Phase I (2000-2004); 2) Phase II (2005-2009); 3) Phase III (2010-2014); and Phase IV (2015-buildout).

The proposed phased construction of the required collection system and required treatment improvements has been assumed as follows:

- Phase I: ¼ Required Collection System + ½ Required Treatment
- Phase II: ¼ Required Collection System
- Phase III: ¼ Required Collection System + ½ Required Treatment
- Phase IV: ¼ Required Collection System

Table V-18 summarizes CRRSCo Non-member Wastewater Improvements, by phase.

Table V-18. CRRSCo Non-Member Wastewater Improvements by Phase

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	341,114	341,114	341,114	341,114		1,364,457
Plant Treatment Capacity, MGD	3.0	0.0	3.0	0.0		6.1

Table V-19. CRRSCo Planning Area Wastewater Improvements by Phase

Item	PHASE					
	Current - 2004	2005 - 2009	2010 - 2014	2015 - 2019	2020 - Buildout	Total
Lineal Feet of Collection System	1,307,489	1,317,489	1,141,489	919,489	530,000	5,215,957
Plant Treatment Capacity, MGD	8.5	3.5	8.1	5.4	9.0	34.5

E. Summary of Non-Member Wastewater Needs

Referring to Table V-18, non-member entities within the planning area are projected to require over 1.3 Million lineal feet of new collection system and over 6 MGD of additional treatment capacity.

F. Summary of Regional Wastewater Needs

Table V-19 summarizes CRRSCo planning area wastewater improvements, by phase for all entities (member and non-member) within the planning area. The planning area is projected to need over 5 Million lineal feet of new collection system and over 34 MGD of additional treatment capacity.

VI. CRRSCo PLANNING AREA WASTEWATER IMPROVEMENTS COSTS

A. CRRSCo Member Costs

Figure VI-1 shows estimated construction cost (FY98), by construction phase, for CRRSCo member recommended improvements. The total estimated cost to construct the recommended improvements is approximately $480 Million (FY98). The actual dollars spent over the next 20 years, assuming an average inflation rate of 4 percent, is approximately $840 Million.

B. Non-member Costs

Figure VI-2 shows estimated construction cost (FY98), by construction phase, for recommended improvements of non-CRRSCo members within the planning area. The total estimated cost to construct the recommended improvements is approximately $170 Million (FY98). The actual dollars spent over the next 20 years, assuming an average inflation rate of 4 percent, is approximately $300 Million.

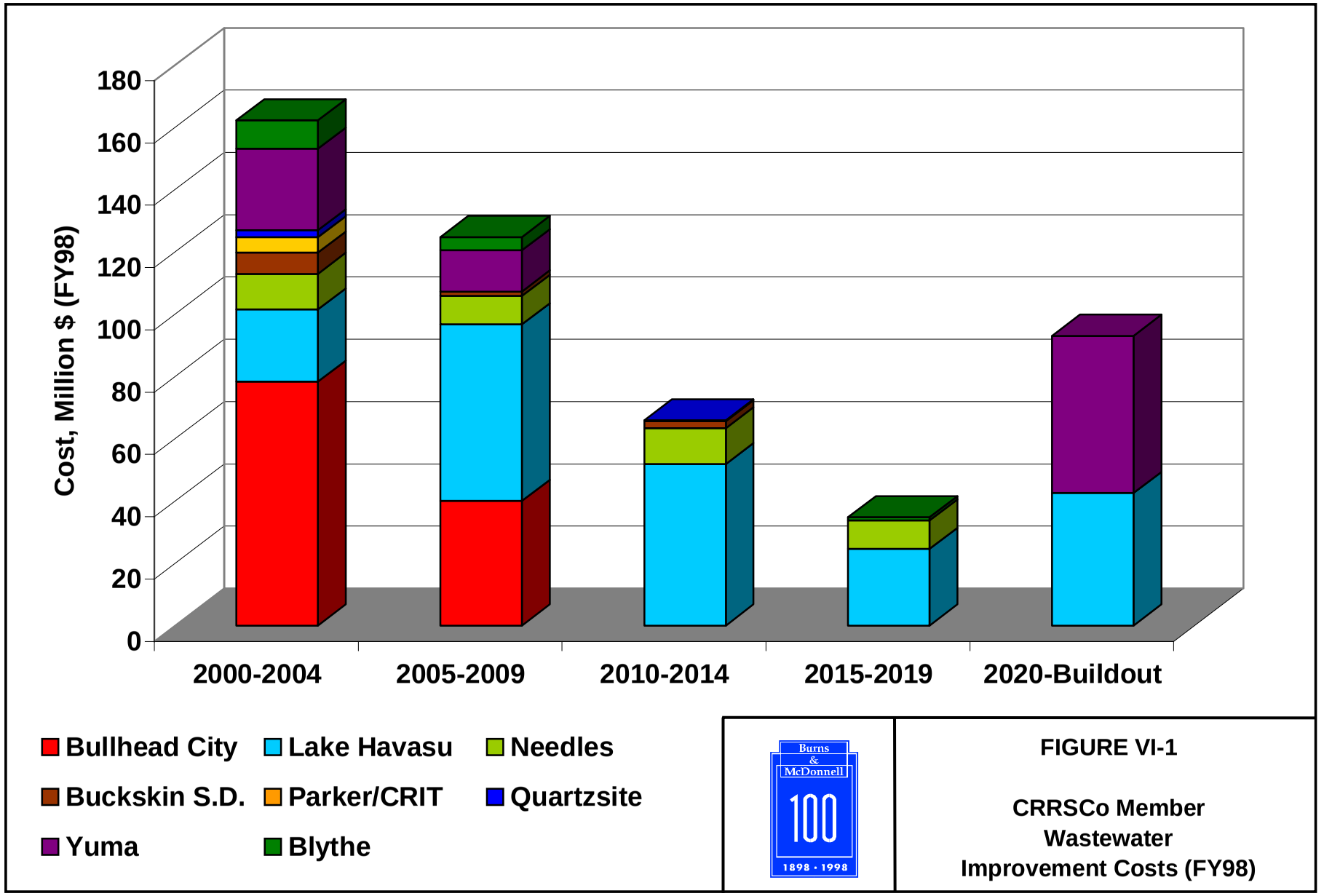


FIGURE VI-1

CRRSCo Member Wastewater Improvement Costs (FY98)

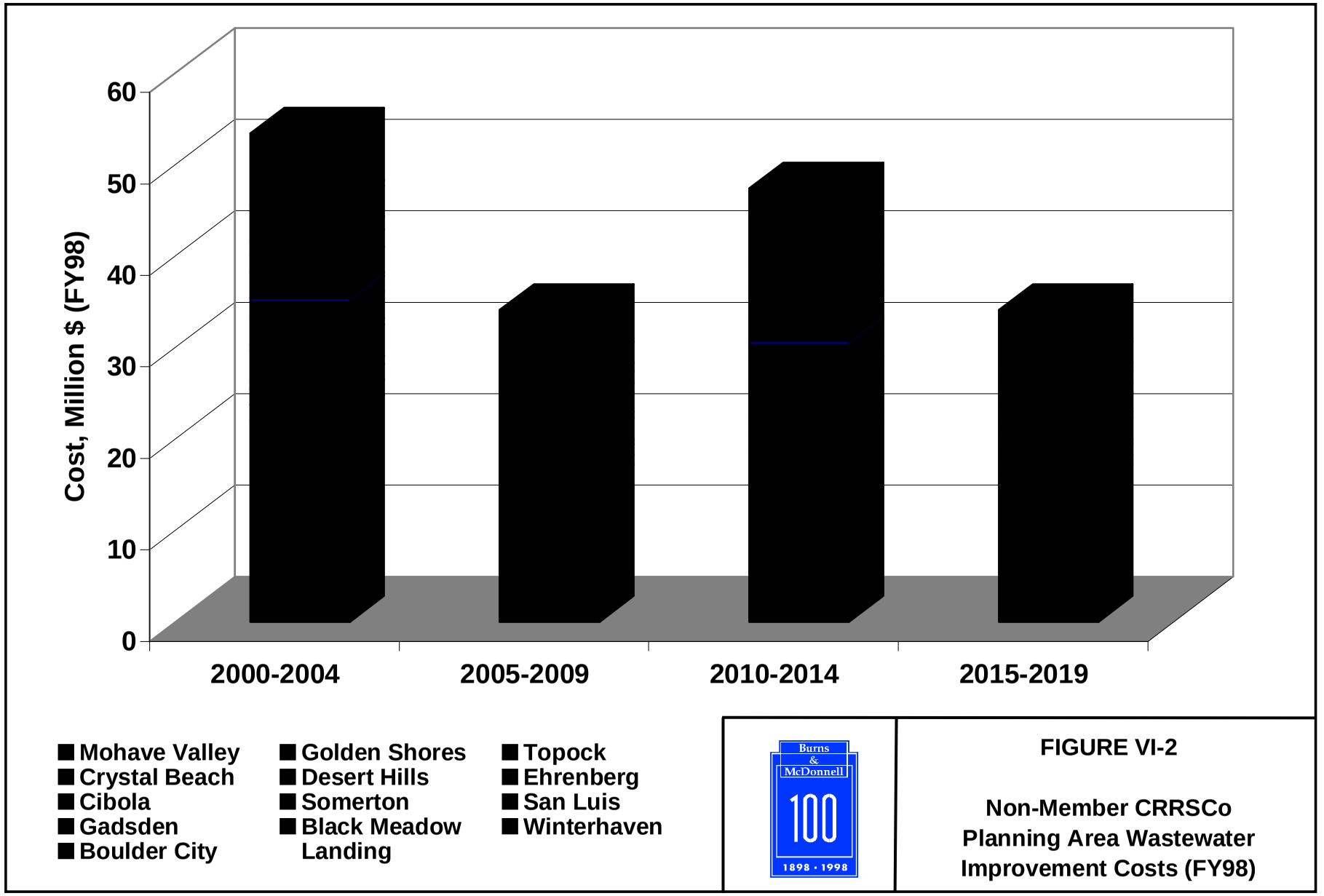


FIGURE VI-2

Non-Member CRRSCo Planning Area Wastewater Improvement Costs (FY98)

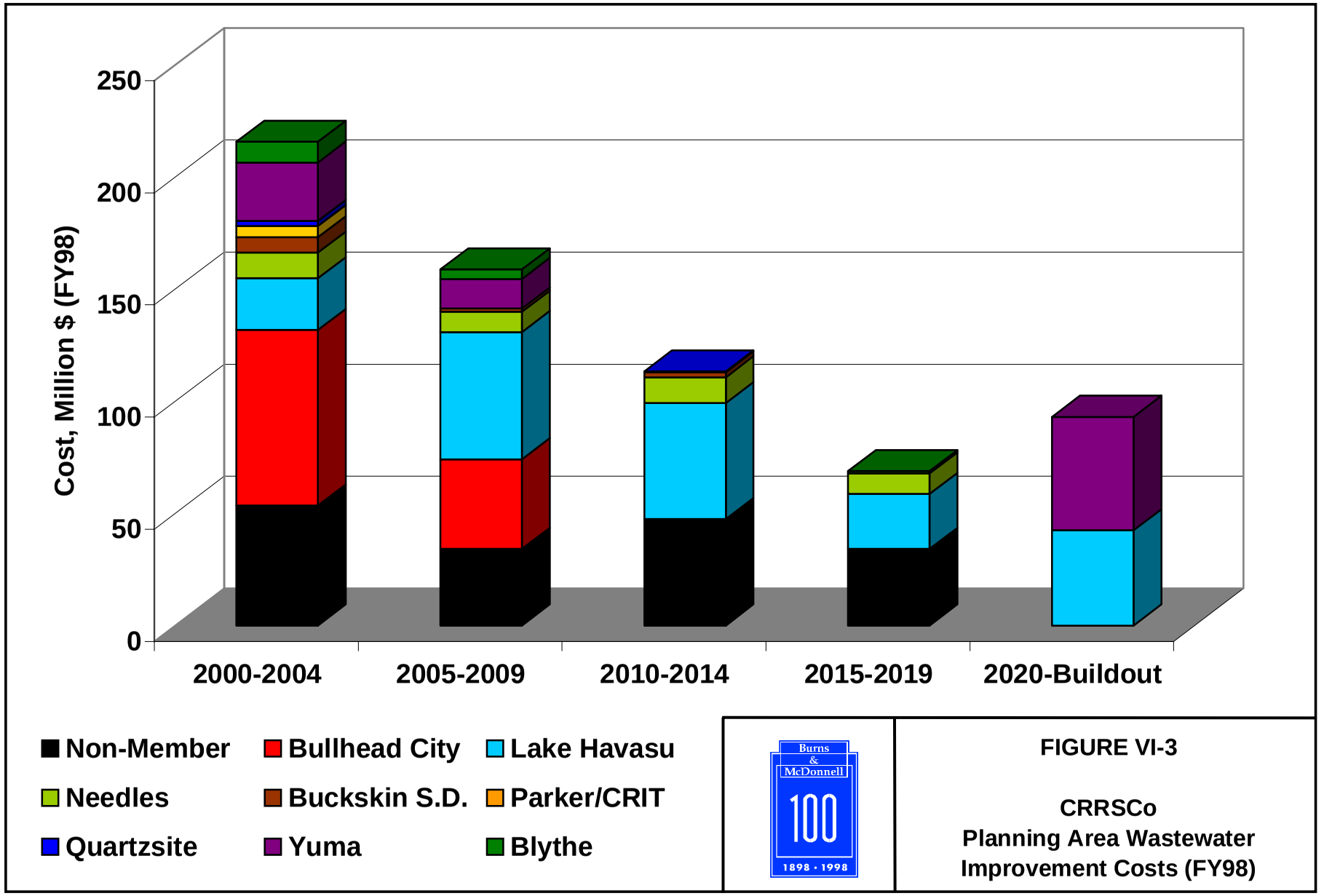


FIGURE VI-3

CRRSCo
Planning Area Wastewater
Improvement Costs (FY98)

C. Total Regional Costs

Figure VI-3 shows estimated construction cost (FY98), by construction phase, for recommended improvements for the CRRSCo the planning area. The total estimated cost to construct the recommended improvements is approximately $650 Million (FY98). The actual dollars spent over the next 20 years, assuming an average inflation rate of 4 percent, is approximately $1.1 Billion.

D. Wetlands Effluent Polishing System Costs

Preliminary land area requirements and constructed wetland treatment systems cost estimates are developed for buildout wastewater flows from select CRRSCo members. These use a wetland cost of about $35,000 per acre, coupled with a land cost range of $100/ac, $500/ac, or $1,000/ac to provide an idea of the construction cost for a treatment wetlands. Table VI-1 summarizes these costs, which at buildout condition are over $21 Million (FY98) or about an additional 3 percent to the wastewater collection and treatment costs reported above.

Table VI-1. Representative Wetland Disposal System Costs

Buildout Flows For Crrsco Entities

Entity	Buildout Flow (MGD)	Wetlands Acreage (ac)	Peripheral Acreage (ac)	Total Acreage (ac)	Wetlands Cost ($)	Wetlands Cost ($)	Wetlands Cost ($)
Bullhead City	5.00	40	30	70	$2,457,000	$2,485,000	$2,520,000
Lake Havasu City	13.80	100	80	180	$6,318,000	$6,390,000	$6,480,000
Buckskin Sanitary District	0.23	2	1	3	$95,000	$96,000	$98,000
Fort Mojave Indian Reservation	1.74	10	10	20	$702,000	$710,000	$720,000
Parker/Colorado Indian Reservation	3.00	20	20	40	$1,404,000	$1,420,000	$1,440,000
Town of Quartzsite	0.54	4	3	7	$246,000	$249,000	$252,000
City of Yuma	16.30	120	90	210	$7,371,000	$7,455,000	$7,560,000
City of Blythe	5.19	40	30	70	$2,457,000	$2,485,000	$2,520,000
				Cost/ac:	$35,100	$35,500	$36,000

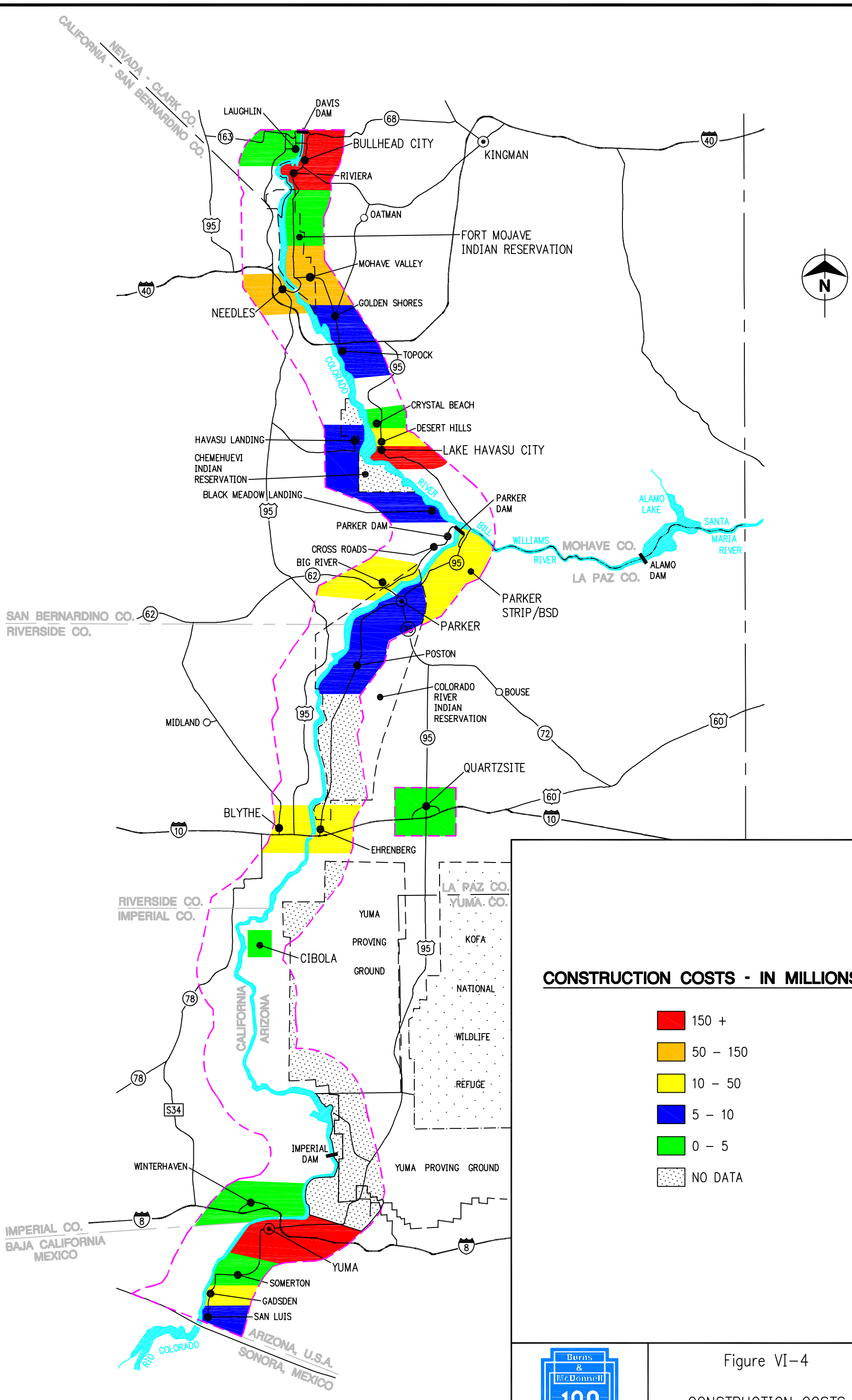


Figure VI-4

CONSTRUCTION COSTS
ACTUAL DOLLARS
CRRSCo PLANNING AREA

VII. PRIORITIZED IMPLEMENTATION PLAN

A. Overview

Development of a prioritized program for construction of wastewater improvements in the CRRSCo planning area consists of the following:

- Identify wastewater improvements for all entities in the CRRSCo planning area:
    - Summarize projects defined in existing master planning or facility planning efforts by collection and treatment improvements by phase.
    - Develop wastewater improvement projects (for entities where master planning does not exists) for each of four phases.

- Develop an "equitable" approach to prioritize wastewater improvement projects:
    - Develop evaluation criteria and weighted "scoring" function.
    - Assign projects to a "Large" cost group or a "Small" cost group.
    - Prioritize each group separately to provide more equitable allocation of funding between large and small communities in the CRRSCo planning area.

Allocate available CRRSCo funding:

- Allocate available funding to the "Large" cost group and the "Small" cost group.
- Allocate available funding to individual projects within each cost group.
- Decide percentage of project cost to receive CRRSCo funding.

This last item is a function of available funding and events and conditions at the time of funding distribution. CRRSCo shall be responsible for making these decisions.

Development of Wastewater Improvements Projects

The CRRSCo planning area covers approximately 7,000 square miles from Davis Dam south to the US/Mexico border. To address the wide disparity in available planning data and the magnitude of area being considered, the concept of "project" had to be modified to make the task of prioritization tractable.

For this analysis, "project" is defined as having two components: 1) a collection system component; and 2) a treatment system component. Furthermore, a "project" consists of all collection system needs and treatment system needs that are scheduled to be built within a given construction phase. Four construction phases have been defined: 1) Phase I (2000-2004); 2) Phase II (2005-2009); 3) Phase III (2010-2014); and Phase IV (2015-buildout). Therefore, each entity in the planning area has one project per phase or four "projects" in the prioritized wastewater improvements program. This definition of "project", coupled with a reasonable number of evaluation criteria, provides a balance between number of projects to assess, number of criteria to evaluate and any inconsistencies in the data throughout the planning area.

For entities with detailed master planning where multiple projects are identified, projects are "packaged" together as one "project" per construction phase. For entities where no master planning has been performed, "projects packages" were defined as follows:

- Phase I: ¼ Required Collection System + ½ Required Treatment
- Phase II: ¼ Required Collection System
- Phase III: ¼ Required Collection System + ½ Required Treatment
- Phase IV: ¼ Required Collection System

B. Evaluation Ranking Criteria

Five different evaluation criteria have been weighted and included in a decision matrix used to prioritize the projects. Table VII-1 lists the evaluation criteria together with their allowable values and corresponding weighting factor. In addition, a project cost separation between "Large" and "Small" projects is shown, by construction phase.

A project "score" is computed based on the assigned value (0-10) for each criterion, multiplying this value by the weighting factor (1-5) and summing up all the weighted criteria. The five criteria used to rank projects are as follows: 1) compliance agreement; 2) groundwater contamination; 3) available collection & treatment capacity; 4) opportunities for regionalization; and 5) total cost. Each of these criteria is now discussed by stepping through the scoring and ranking procedure. Refer to Table VII-1 for a summary of the evaluation criteria and the values assigned for various conditions.

TABLE VII-1. Evaluation Criteria and Category Weight

Category	Value	Weight
Total Cost	See Ranking	3
Compliance Agreement		4
Exists	10	
Does Not Exist	0	
Groundwater Contamination (Septic Tanks)		5
> 5,000	10	
2,000 - 5,000	8	
1,000 - 2,000	6	
500 - 1,000	4	
< 500	2	
Groundwater Contamination (Nitrate Concentration)		5
> 10	10	
7 - 10	7	
3 - 7	5	
0 - 3	3	
Available Collection & Treatment Capacity		3
>80% Capacity	10	
65-80% Capacity	5	
<65% Capacity	1	
Opportunities for Regionalization		1
Give (i.e., convey flow to regional plant)	10	
Receive (i.e., treat flow at regional plant)	5	
none (i.e., no opportunity)	0	
Large/Small Project Cutoff:		
Phase I	$2,250,000	NA
Phase II	$2,250,000	NA
Phase III	$2,250,000	NA
Phase IV	$1,000,000	NA

NOTE: Groundwater Contamination Score equal to maximum of score based on number of septic tanks or nitrate concentrations.

Compliance Agreement

Table VII-2 summarizes communities with compliance agreements in effect. This criterion is straightforward; if an agreement exists (i.e., denoted by "Yes"), the project receives a score of 10. If an agreement doesn't exist (i.e., denoted by "No"), the project receives a score of 0.

Groundwater Contamination

Table VII-3 summarizes the groundwater contamination criterion. This criterion includes not only an area with documented high groundwater nitrogen contamination, but also flags areas at risk for high groundwater nitrogen contamination. This criterion was scored first based on the total number of septic systems (to determine risk) and then, where data were available, it was scored based on groundwater analysis (to determine actual contamination concentration). The higher of the two scores was used in project prioritization. Septic tank numbers shown in Figure IV-12 were used to indicate "at risk" areas.

Available Collection & Treatment Capacity

Available collection and treatment capacity measures how close an entity is to its current capacity. Treatment capacity is measured as a function of plant capacity or MGD. Collection capacity is measured as a function of acres sewered. Referring to Table VII-1, the value assigned to the criterion is based on the percentage of capacity being used and depending on which of the three ranges this percentage falls between, assigning the corresponding value.

TABLE VII-2. Summary of Communities with Compliance Agreements in Effect

City/Town/Reservation	Compliance Agreements (Y/N)			
	Phase I	Phase II	Phase III	Phase IV
Bullhead City*	Yes	Yes	Yes	Yes
Lake Havasu City*	Yes	Yes	Yes	Yes
Ft. Mojave Indian Reservation*	No	No	No	No
Mohave Valley	No	No	No	No
Golden Shores	No	No	No	No
Topock	No	No	No	No
Crystal Beach	No	No	No	No
Desert Hills	No	No	No	No
Parker/CRIT*	No	No	No	No
Quartzsite*	No	No	No	No
Parker Strip - BSD*	Yes	Yes	Yes	Yes
Poston (CRIT)	No	No	No	No
Ehrenberg	No	No	No	No
Cibola	No	No	No	No
Yuma*	No	No	No	No
Somerton	No	No	No	No
San Luis	No	No	No	No
Gadsden	No	No	No	No
Needles*	No	No	No	No
Blythe*	No	No	No	No
Black Meadow Landing	No	No	No	No
Big River / Earp	No	No	No	No
Winterhaven	No	No	No	No
Laughlin*	No	No	No	No
Boulder City	No	No	No	No

TABLE VII-3. Estimation of Groundwater Contamination Based on Number of Existing Septic Tanks

City/Town/Reservation	Total Estimated Number of Septic Systems				Est. Groundwater Nitrate Concentration (mg/L)			
	Phase I	Phase II	Phase III	Phase IV	Phase I	Phase II	Phase III	Phase IV
Bullhead City*	6,000	4,500	3,000	1,500	7	7	7	7
Lake Havasu City*	24,600	27,200	27,800	32,700	10	10	10	10
Ft. Mojave Indian Reservation*	3,500	3,500	3,500	3,500	10	10	10	10
Mohave Valley	6,000	4,500	3,000	1,500	10	10	10	10
Golden Shores	450	337	225	112	--	--	--	--
Topock	450	337	225	112	--	--	--	--
Crystal Beach	250	188	125	63	--	--	--	--
Desert Hills	1,500	1,125	750	375	--	--	--	--
Parker/CRIT*	0	0	0	0	--	--	--	--
Quartzsite*	300	225	150	75	10	10	10	10
Parker Strip - BSD*	1,542	1,156	771	386	--	--	--	--
Poston (CRIT)	158	119	79	40	--	--	--	--
Ehrenberg	750	563	375	188	--	--	--	--
Cibola					4	4	4	4
Yuma*	500	375	250	125	15	15	15	15
Somerton	0	0	0	0	--	--	--	--
San Luis	0	0	0	0	--	--	--	--
Gadsden	500	375	250	125	--	--	--	--
Needles*	875	656	437	219	--	--	--	--
Blythe*	1,750	1,312	875	437	--	--	--	--
Black Meadow Landing	350	263	175	88	--	--	--	--
Big River / Earp	1,000	750	500	250	--	--	--	--
Winterhaven	0	0	0	0	--	--	--	--
Laughlin*	12	9	6	3	--	--	--	--
Boulder City	0	0	0	0	--	--	--	--

NOTE: The larger of the two score generated for Groundwater Quality using estimated number of septic systems or known nitrate concentrations was us

* denotes with master planning

Table VII-4 summarizes treatment and collection system requirements at the end of each construction phase and the anticipated treatment and collection system capacities at the beginning of each phase. A comparison of these values is shown in Table VII-5, which contains the projected wastewater flow requirements / existing treatment capacity and the projected collection system requirements / existing areas sewered. The maximum of these two values is compared to the values is Table VII-1. For example, a value of greater than 80% indicates that, without additional improvements during the phase, the treatment plant and/or collection system will exceed 80% of its available capacity. At greater than 80% capacity, the community should be planning, if not constructing, additional facilities to meet the projected needs.

Opportunities for Regionalization

Referring to Table VII-1, there are three values for this criterion: 1) none (i.e., no opportunity); 2) receive (i.e., treat flow); and 3) give (i.e., convey flow). Entities conveying flow to an outside supplier of treatment services reduce the number of treatment plants, taking advantage of the "economy of scale" and improving the overall environment. "Receiving" entities receiving flow provide the service, allowing the "giving" entities the opportunity to help improve the environment. Although both entities are required for regionalization, we believe it is the "give" entity that should receive the higher score. Table VII-6 summarizes existing and potential opportunities for regionalization among entities in the planning area.

TABLE VII-4. Estimated Treatment & Collection Capacity at the Beginning of Each Phase

City/Town/Reservation	Treatment Required by:				Treatment Capacity (MGD) at Beginning of Each Phase				Collection Area (Acres) Required by:				Collection Capacity at Beginning of Each Phase: Area Sewered (Acres)			
	2005	2010	2015	2020	Phase I	Phase II	Phase III	Phase IV	2005	2010	2015	2020	Phase I	Phase II	Phase III	Phase IV
Bullhead City*	3.59	4.19	4.82	5.38	1.10	2.00	3.50	3.7	3,705	4,933	4,933	4,933	1,400	2,867	4,400	4,933
Lake Havasu City*	8.60	8.60	8.60	8.60	3.60	7.10	8.00	8.60	9,913	17,801	25,380	36,000	4,300	12,225	20,150	28,075
Ft. Mojave Indian Reservation*	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000
Mohave Valley	1.48	1.67	1.85	2.03	0.00	1.01	1.01	2.03	2,957	3,342	3,708	4,053	203	1,165	2,128	3,090
Golden Shores	0.11	0.13	0.14	0.15	0.00	0.08	0.08	0.15	222	251	278	304	0	76	152	228
Topock	0.11	0.13	0.14	0.15	0.00	0.08	0.08	0.15	222	251	278	304	0	76	152	228
Crystal Beach	0.06	0.07	0.08	0.08	0.00	0.04	0.04	0.08	123	139	155	169	0	42	84	127
Desert Hills	0.22	0.25	0.28	0.30	0.00	0.15	0.15	0.30	444	501	556	608	0	152	304	456
Parker/CRIT*	3.00	3.00	3.00	3.00	1.20	1.20	3.00	3.00	2,088	2,224	2,382	2,509	2,509	2,509	2,509	2,509
Quartzsite*	0.28	0.37	0.47	0.55	0.45	0.45	0.45	0.57	23,040	23,040	23,040	23,040	2,304	2,487	2,487	2,487
Parker Strip - BSD*	0.22	0.22	0.22	0.22	0.18	0.20	0.20	0.22	1,500	1,618	1,800	1,800	1,200	1,350	1,500	1,650
Poston (CRIT)	0.06	0.07	0.09	0.10	0.00	0.00	0.00	0.00	128	150	175	195	0	49	98	147
Ehrenberg	0.18	0.21	0.24	0.27	0.00	0.13	0.13	0.27	355	415	480	534	0	134	267	401
Cibola	0.11	0.12	0.13	0.14	0.00	0.07	0.07	0.14	227	246	264	283	0	71	142	212
Yuma*	16.30	16.30	16.30	16.30	8.00	9.55	11.50	13.70	48,432	52,253	52,253	61,337	43,520	47,974	52,429	56,883
Somerton	0.75	0.82	0.90	0.99	0.80	0.89	0.89	0.99	1,495	1,645	1,800	1,974	1,974	1,974	1,974	1,974
San Luis	1.49	1.70	1.85	2.05	0.75	1.40	1.40	2.05	2,979	3,395	3,692	4,103	4,103	4,103	4,103	4,103
Gadsden	0.12	0.14	0.15	0.17	0.00	0.08	0.08	0.17	243	272	301	335	0	84	167	251
Needles*	3.00	3.00	3.00	3.00	1.80	2.40	2.40	3.00	1,440	1,560	1,680	1,800	1,350	1,463	1,575	1,688
Blythe*	5.19	5.19	5.19	5.19	2.40	2.78	2.78	3.99	21,729	21,925	21,925	23,000	12,554	15,166	17,777	20,389
Black Meadow Landing	0.09	0.10	0.11	0.12	0.00	0.06	0.06	0.12	180	200	220	240	0	60	120	180
Big River / Earp	0.24	0.26	0.28	0.30	0.00	0.15	0.15	0.30	480	520	560	600	0	150	300	450
Winterhaven	0.12	0.13	0.14	0.15	0.00	0.08	0.08	0.15	235	257	280	302	302	302	302	302
Laughlin*	1.06	1.18	1.29	1.39	8.00	8.00	8.00	8.00	2,130	2,360	2,571	2,783	2,783	2,783	2,783	2,783
Boulder City	1.71	1.83	1.95	2.07	1.33	1.70	1.70	2.07	3,423	3,661	3,900	4,138	2,464	2,883	3,301	3,720

Note:
* denotes with master planning

TABLE VII-5. Estimated Treatment & Collection Requirements as Percentage of Existing Capacity at the Beginning of Each Phase

City/Town/Reservation	PHASE I: 2005 Requirements / Existing Capacity			Phase II: 2010 Requirements / Capacity at End of Phase I			Phase III: 2015 Requirements / Capacity at End of Phase II			Phase IV: 2020 Requirements / Capacity at End of Phase III		
	Treatment	Collection	Maximum	Treatment	Collection	Maximum	Treatment	Collection	Maximum	Treatment	Collection	Minimum
Bullhead City*	327%	265%	327%	209%	172%	209%	138%	112%	138%	146%	100%	146%
Lake Havasu City*	239%	231%	239%	121%	146%	146%	108%	126%	126%	100%	128%	128%
Ft. Mojave Indian Reservation*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Mohave Valley	†	1459%	1459%	165%	287%	287%	183%	174%	183%	100%	131%	131%
Golden Shores	†	†	100%	165%	330%	330%	183%	183%	183%	100%	133%	133%
Topock	†	†	100%	165%	330%	330%	183%	183%	183%	100%	133%	133%
Crystal Beach	†	†	100%	165%	330%	330%	183%	183%	183%	100%	133%	133%
Desert Hills	†	†	100%	165%	330%	330%	183%	183%	183%	100%	133%	133%
Parker/CRIT*	250%	83%	250%	250%	89%	250%	100%	95%	100%	100%	100%	100%
Quartzsite*	62%	1000%	1000%	82%	926%	926%	104%	926%	926%	96%	926%	926%
Parker Strip - BSD*	122%	125%	125%	110%	120%	120%	110%	120%	120%	100%	109%	109%
Poston (CRIT)	†	†	100%	†	307%	307%	†	179%	179%	†	133%	133%
Ehrenberg	†	†	100%	155%	311%	311%	180%	180%	180%	100%	133%	133%
Cibola	†	†	100%	174%	347%	347%	187%	187%	187%	100%	133%	133%
Yuma*	204%	111%	204%	171%	109%	171%	142%	100%	142%	119%	108%	119%
Somerton	93%	76%	93%	92%	83%	92%	101%	91%	101%	100%	100%	100%
San Luis	199%	73%	199%	121%	83%	121%	132%	90%	132%	100%	100%	100%
Gadsden	†	†	100%	163%	325%	325%	180%	180%	180%	100%	133%	133%
Needles*	167%	107%	167%	125%	107%	125%	125%	107%	125%	100%	107%	107%
Blythe*	216%	173%	216%	187%	145%	187%	187%	123%	187%	130%	113%	130%
Black Meadow Landing	†	†	100%	167%	333%	333%	183%	183%	183%	100%	133%	133%
Big River / Earp	†	†	100%	173%	347%	347%	187%	187%	187%	100%	133%	133%
Winterhaven	†	78%	78%	170%	85%	170%	185%	93%	185%	100%	100%	100%
Laughlin*	13%	77%	77%	15%	85%	85%	16%	92%	92%	17%	100%	100%
Boulder City	129%	139%	139%	108%	127%	127%	115%	118%	118%	100%	111%	111%

NOTES:

* Entities with master planning.

† Locations with no existing treatment and/or collection systems. Therefore, community is at greater than 100% of existing capacity.

TABLE VII-6. Summary of Existing and Potential Wastewater Treatment Regionalization Efforts

City/Town/Reservation	Opportunities for Regionalization (To Give Flow/To Receive Flow/None)				
	Phase I	Phase II	Phase III	Phase IV	Comments
Bullhead City*	None	None	None	None	Currently, nothing planned w/Laughlin, NV
Lake Havasu City*	Receive	Receive	Receive	Receive	Collect flows from Desert Hills & Crystal Beach
Ft. Mojave Indian Reservation*	Receive	Receive	Receive	Receive	Collect flows from Mohave Valley
Mohave Valley	Give	Give	Give	Give	Convey Flow to Fort Mohave Tribal Utilities
Golden Shores	Give	Give	Give	Give	Convey Flow to Fort Mohave Tribal Utility
Topock	Give	Give	Give	Give	Convey Flow to Fort Mohave Tribal Utility
Crystal Beach	Give	Give	Give	Give	Convey Flow to Lake Havasu City, AZ
Desert Hills	Give	Give	Give	Give	Convey Flow to Lake Havasu City, AZ
Parker/CRIT*	Receive	Receive	Receive	Receive	CRSSJV - Town of Parker and Portions of CRIT
Quartzsite*	None	None	None	None	
Parker Strip - BSD*	None	None	None	None	
Poston (CRIT)	Give	Give	Give	Give	CRSSJV - Town of Parker and Portions of CRIT
Ehrenberg	None	None	None	None	
Cibola	None	None	None	None	
Yuma*	Receive	Receive	Receive	Receive	Collects flows from other cities and towns
Somerton	Give	Give	Give	Give	Potential Regionalization for Somerton, San Luis,
San Luis	Give	Give	Give	Give	Gadsden, Cocopah and Ft. Yuma Indian
Gadsden	Give	Give	Give	Give	Reservation.
Needles*	None	None	None	None	
Blythe*	None	None	None	None	
Black Meadow Landing	None	None	None	None	
Big River / Earp	None	None	None	None	
Winterhaven	Give	Give	Give	Give	Convey Flow to Yuma, AZ
Laughlin*	None	None	None	None	Has capacity to collect flow from other towns
Boulder City	None	None	None	None	

Note:
* entities with master planning

Total Cost

Total cost is assigned a value between 1 and 10, depending on which project group a project group is in (i.e., "Large" or "Small") and depending on where within that group the cost of the project falls. A higher total construction cost within a project group is assigned a higher value of total cost value. Referring to Table VII-8a, Phase I project total cost for "Large" projects reveals a cost ranking value of 10 for Bullhead City and a value of 8 for Lake Havasu City.

C. Project Scoring System

A project "score" is computed based on the assigned value (0-10) for each criterion, multiplying this value by the weighting factor (1-5) and summing up all the weighted criteria.

D. Phased Prioritization Plan

Upon identification of the recommended wastewater improvement projects for each entity by phase, the projects were evaluated to create a prioritized list for the recommended improvements.

Table VII-7 summarizes the results of the prioritization process, by phase, for Large and Small projects. Individual steps in the scoring and prioritization process taken to arrive at this summary are included in Tables VII-8-10 a-d.

TABLE VII-7. Prioritized Wastewater Improvements Program, Phases I-IV

City/Town/Res.	Phase I			City/Town/Res.	Phase II			City/Town/Res.	Phase III			City/Town/Res.	Phase IV		
	Total Score	Ranking	Cost ($M)		Total Score	Ranking	Cost ($M)		Total Score	Ranking	Cost ($M)		Total Score	Ranking	Cost ($M)
Large Projects				**Large Projects**				**Large Projects**				**Large Projects**			
Bullhead City*	150	1	78.3	Lake Havasu City*	155	1	52.0	Lake Havasu City*	155	1	51.0	Lake Havasu City*	155	1	66.0
Lake Havasu City*	149	2	22.8	Bullhead City*	134	2	40.0	Parker Strip - BSD*	126	2	2.7	Yuma*	112	2	43.9
Parker Strip - BSD*	135	3	8.5	Yuma*	106	3	16.5	Mohave Valley	104	3	18.9	Desert Hills	105	3	2.3
Yuma*	112	4	30.2	Mohave Valley	98	4	14.4	Desert Hills	102	4	2.9	Needles*	101	4	9.1
Mohave Valley	111	5	22.0	Needles*	95	5	9.1	Needles*	101	5	11.5	Mohave Valley	99	5	14.4
Needles*	98	6	11.5	Desert Hills	93	6	2.3	San Luis	99	6	2.8	Gadsden	99	5	1.3
Blythe*	98	6	15.1	Boulder City	92	7	6.3	Boulder City	98	7	7.9	Boulder City	98	7	6.3
Desert Hills	96	8	3.4	Blythe*	89	8	4.2	Big River / Earp	92	8	2.9	Big River / Earp	95	8	2.3
Parker/CRIT*	94	9	4.9	Big River / Earp	83	9	2.3	Ehrenberg	83	9	2.6	Ehrenberg	92	9	2.0
Boulder City	92	10	7.9									Golden Shores	90	10	1.1
San Luis	90	11	2.8									Topock	90	10	1.1
Big River / Earp	86	12	3.4									Blythe*	89	12	1.7
Ehrenberg	83	13	3.0									Cibola	55	13	1.1
			213.8				147.1				103.2				152.6
Small Projects				**Small Projects**				**Small Projects**				**Small Projects**			
Gadsden	117	1	1.88	Parker Strip - BSD*	147	1	1.75	Gadsden	120	1	1.62	Poston (CRIT)	120	1	0.73
Golden Shores	111	2	1.71	Gadsden	114	2	1.26	Golden Shores	117	2	1.47	Crystal Beach	117	2	0.63
Topock	111	2	1.71	Golden Shores	111	3	1.14	Topock	117	2	1.47	Black Meadow Landin	110	3	0.90
Crystal Beach	105	4	0.95	Topock	111	3	1.14	Crystal Beach	111	4	0.82	Somerton	90	4	0.00
Poston (CRIT)	102	5	0.73	Ehrenberg	110	5	2.00	Poston (CRIT)	108	5	0.73	San Luis	90	4	0.00
Black Meadow Landin	95	7	1.35	Poston (CRIT)	105	6	0.73	Somerton	105	6	0.41	Winterhaven	90	4	0.00
Somerton	96	6	0.41	Crystal Beach	105	6	0.63	Black Meadow Landin	104	7	1.16	Parker/CRIT*	85	7	0.00
Quartzsite*	95	7	2.20	Black Meadow Landin	98	8	0.90	Winterhaven	102	8	0.33	Parker Strip - BSD*	80	8	0.00
Winterhaven	84	9	0.57	Winterhaven	90	9	0.00	Parker/CRIT*	85	9	0.00	Laughlin*	80	8	0.00
Ft. Mojave Indian Res	75	10	0.00	Somerton	90	9	0.00	Yuma*	85	9	0.00	Ft. Mojave Indian Res	75	10	0.00
Cibola	73	11	1.59	San Luis	90	9	0.00	Quartzsite*	83	11	0.42	Quartzsite*	65	11	0.00
Laughlin*	65	12	0.00	Parker/CRIT*	85	12	0.00	Laughlin*	80	12	0.00	Bullhead City*	60	12	0.00
				Laughlin*	80	13	0.00	Blythe*	80	12	0.00				
				Ft. Mojave Indian Res	75	14	0.00	Cibola	79	14	1.37				
				Cibola	73	15	1.06	Ft. Mojave Indian Res	75	15	0.00				
				Quartzsite*	65	16	0.00	Bullhead City*	70	16	0.00				
			13.10				10.61				9.80				2.26

Note:* entities with master planning

Tables VII-8a through Table VII-8d summarize evaluation criteria values assigned to each project, by construction phase, for Large and Small projects. Projects are assigned as either Large or Small based on the Large/Small Project total cost cutoff values specified in Table VII-1.

Referring again to Tables VII-8a through Table VII-8d, each project is shown twice: once in the top portion of the spreadsheet under the Large Projects heading and a second time midway down the spreadsheet under the Small Projects heading. Group designation is determined by inspection of the Total Cost column. For example, referring to Table VII-8a, the numeric value for the Total Cost cell for the Phase I Bullhead City project under Large Projects indicates that this project is "Large", or greater than $2.25 Million. Inspection of the Total Cost cell for the Phase I Bullhead City project under Small Projects shows the value "--". This is the same for all projects. A project can be either a "Large" project or a "Small" project but not both.

Tables VII-9a through Table VII-9d summarize project scores, based on evaluation criteria scores shown in Tables VII-8a through Table VII-8d and the corresponding weighting factors. The "Total" Column contains the project score used for project ranking for each phase.

TABLE VII-8a. Phase I Evaluation Criteria Values

TABLE VII-8b. Phase II Evaluation Criteria Values

City/Town/Reservation	Phase I						Phase II					
	Total Cost	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalitation	Total Cost	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalitation
Large Projects												
Bullhead City*	78,300,000	10	10	10	10	0	40,000,000	8	10	8	10	0
Lake Havasu City*	22,800,000	8	10	10	10	5	52,000,000	10	10	10	10	5
Ft. Mojave Indian Reservation*	--	--	--	8	10	5	--	--	--	8	10	5
Mohave Valley	22,000,000	7	--	10	10	10	14,400,000	6	--	8	10	10
Golden Shores	--	--	--	10	10	10	--	--	--	10	10	10
Topock	--	--	--	10	10	10	--	--	--	10	10	10
Crystal Beach	--	--	--	10	10	10	--	--	--	10	10	10
Desert Hills	3,400,000	2	--	10	10	10	2,300,000	1	--	10	10	10
Parker/CRIT*	4,900,000	3	--	10	10	5	--	--	--	10	10	5
Quartzsite*	--	--	--	7	10	0	--	--	--	7	10	0
Parker Strip - BSD*	8,500,000	5	10	10	10	0	--	--	10	10	10	0
Poston (CRIT)	--	--	--	10	10	10	--	--	--	10	10	10
Ehrenberg	3,000,000	1	--	10	10	0	--	--	--	10	10	0
Cibola	--	--	--	5	10	0	--	--	--	5	10	0
Yuma*	30,200,000	9	--	10	10	5	16,500,000	7	--	10	10	5
Somerton	--	--	--	10	10	10	--	--	--	10	10	10
San Luis	2,800,000	0	--	10	10	10	--	--	--	10	10	10
Gadsden	--	--	--	10	10	10	--	--	--	10	10	10
Needles*	11,500,000	6	--	10	10	0	9,100,000	5	--	10	10	0
Blythe*	15,100,000	6	--	10	10	0	4,200,000	3	--	10	10	0
Black Meadow Landing	--	--	--	10	10	0	--	--	--	10	10	0
Big River / Earp	3,400,000	2	--	10	10	0	2,300,000	1	--	10	10	0
Winterhaven	--	--	--	10	5	10	--	--	--	10	10	10
Laughlin*	--	--	--	10	5	0	--	--	--	10	10	0
Boulder City	7,900,000	4	--	10	10	0	6,300,000	4	--	10	10	0
	13						9					
Small Projects												
Bullhead City*	--	--	10	10	10	0	--	--	10	8	10	0
Lake Havasu City*	--	--	10	10	10	5	--	--	10	10	10	5
Ft. Mojave Indian Reservation*	0	0	--	8	10	5	0	0	--	8	10	5
Mohave Valley	--	--	--	10	10	10	--	--	--	8	10	10
Golden Shores	1,710,000	7	--	10	10	10	1,140,000	7	--	10	10	10
Topock	1,710,000	7	--	10	10	10	1,140,000	7	--	10	10	10
Crystal Beach	950,000	5	--	10	10	10	630,000	5	--	10	10	10
Desert Hills	--	--	--	10	10	10	--	--	--	10	10	10
Parker/CRIT*	--	--	--	10	10	5	0	0	--	10	10	5
Quartzsite*	2,200,000	10	--	7	10	0	0	0	--	7	10	0
Parker Strip - BSD*	--	--	10	10	10	0	1,750,000	9	10	10	10	0
Poston (CRIT)	730,000	4	--	10	10	10	730,000	5	--	10	10	10
Ehrenberg	--	--	--	10	10	0	2,000,000	10	--	10	10	0
Cibola	1,590,000	6	--	5	10	0	1,060,000	6	--	5	10	0
Yuma*	--	--	--	10	10	5	--	--	--	10	10	5
Somerton	410,000	2	--	10	10	10	0	0	--	10	10	10
San Luis	--	--	--	10	10	10	0	0	--	10	10	10
Gadsden	1,880,000	9	--	10	10	10	1,260,000	8	--	10	10	10
Needles*	--	--	--	10	10	0	--	--	--	10	10	0
Blythe*	--	--	--	10	10	0	--	--	--	10	10	0
Black Meadow Landing	1,350,000	5	--	10	10	0	900,000	6	--	10	10	0
Big River / Earp	--	--	--	10	10	0	--	--	--	10	10	0
Winterhaven	570,000	3	--	10	5	10	0	0	--	10	10	10
Laughlin*	0	0	--	10	5	0	0	0	--	10	10	0
Boulder City	--	--	--	10	10	0	--	--	--	10	10	0
	12						16					

NOTE: Large Project/Small Project Split at $2250000

TABLE VII-8c. Phase III Evaluation Criteria Values

TABLE VII-8d. Phase IV Evaluation Criteria Values

City/Town/Reservation	Phase III						Phase IV					
	Total Cost	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalitation	Total Cost	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalitation
Large Projects												
Bullhead City*	--	--	10	8	10	0	--	--	10	6	10	0
Lake Havasu City*	51,000,000	10	10	10	10	5	66,000,000	10	10	10	10	5
Ft. Mojave Indian Reservation*	--	--	--	8	10	5	--	--	--	8	10	5
Mohave Valley	18,900,000	8	--	8	10	10	14,400,000	8	--	7	10	10
Golden Shores	--	--	--	10	10	10	1,100,000	0	--	10	10	10
Topock	--	--	--	10	10	10	1,100,000	0	--	10	10	10
Crystal Beach	--	--	--	10	10	10	--	--	--	10	10	10
Desert Hills	2,900,000	4	--	10	10	10	2,300,000	5	--	10	10	10
Parker/CRIT*	--	--	--	10	10	5	--	--	--	10	10	5
Quartzsite*	--	--	--	7	10	0	--	--	--	7	10	0
Parker Strip - BSD*	2,700,000	2	10	10	10	0	--	--	10	10	10	0
Poston (CRIT)	--	--	--	10	10	10	--	--	--	10	10	10
Ehrenberg	2,600,000	1	--	10	10	0	2,000,000	4	--	10	10	0
Cibola	--	--	--	5	10	0	1,100,000	0	--	5	10	0
Yuma*	--	--	--	10	10	5	43,900,000	9	--	10	10	5
Somerton	--	--	--	10	10	10	--	--	--	10	10	10
San Luis	2,800,000	3	--	10	10	10	--	--	--	10	10	10
Gadsden	--	--	--	10	10	10	1,300,000	3	--	10	10	10
Needles*	11,500,000	7	--	10	10	0	9,100,000	7	--	10	10	0
Blythe*	--	--	--	10	10	0	1,700,000	3	--	10	10	0
Black Meadow Landing	--	--	--	10	10	0	--	--	--	10	10	0
Big River / Earp	2,900,000	4	--	10	10	0	2,300,000	5	--	10	10	0
Winterhaven	--	--	--	10	10	10	--	--	--	10	10	10
Laughlin*	--	--	--	10	10	0	--	--	--	10	10	0
Boulder City	7,900,000	6	--	10	10	0	6,300,000	6	--	10	10	0
	9						13					
Small Projects												
Bullhead City*	0	0	--	8	10	0	0	0	--	6	10	0
Lake Havasu City*	--	--	--	10	10	5	--	--	--	10	10	5
Ft. Mojave Indian Reservation*	0	0	--	8	10	5	0	0	--	8	10	5
Mohave Valley	--	--	--	8	10	10	--	--	--	7	10	10
Golden Shores	1,470,000	9	--	10	10	10	--	--	--	10	10	10
Topock	1,470,000	9	--	10	10	10	--	--	--	10	10	10
Crystal Beach	820,000	7	--	10	10	10	630,000	9	--	10	10	10
Desert Hills	--	--	--	10	10	10	--	--	--	10	10	10
Parker/CRIT*	0	0	--	10	10	5	0	0	--	10	10	5
Quartzsite*	420,000	6	--	7	10	0	0	0	--	7	10	0
Parker Strip - BSD*	--	--	--	10	10	0	0	0	--	10	10	0
Poston (CRIT)	730,000	6	--	10	10	10	730,000	10	--	10	10	10
Ehrenberg	--	--	--	10	10	0	--	--	--	10	10	0
Cibola	1,370,000	8	--	5	10	0	--	--	--	5	10	0
Yuma*	0	0	--	10	10	5	--	--	--	10	10	5
Somerton	410,000	5	--	10	10	10	0	0	--	10	10	10
San Luis	--	--	--	10	10	10	0	0	--	10	10	10
Gadsden	1,620,000	10	--	10	10	10	--	--	--	10	10	10
Needles*	--	--	--	10	10	0	--	--	--	10	10	0
Blythe*	0	0	--	10	10	0	--	--	--	10	10	0
Black Meadow Landing	1,160,000	8	--	10	10	0	900,000	10	--	10	10	0
Big River / Earp	--	--	--	10	10	0	--	--	--	10	10	0
Winterhaven	330,000	4	--	10	10	10	0	0	--	10	10	10
Laughlin*	0	0	--	10	10	0	0	0	--	10	10	0
Boulder City	--	--	--	10	10	0	--	--	--	10	10	0
	15						11					

NOTE: Large Project/Small Project S[NOTE: Large Project/Small Project Split at $2250000

TABLE VII-9a. Phase I Project Scores

TABLE VII-9b. Phase II Project Scores

City/Town/Reservation	Phase I						Phase II					
	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalization	Total	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalization	Total
Large Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	30	40	50	30	0	150	24	40	40	30	0	134
Lake Havasu City*	24	40	50	30	5	149	30	40	50	30	5	155
Ft. Mojave Indian Reservation*	--	--	--	--	--	--	--	--	--	--	--	--
Mohave Valley	21	--	50	30	10	111	18	--	40	30	10	98
Golden Shores	--	--	--	--	--	--	--	--	--	--	--	--
Topock	--	--	--	--	--	--	--	--	--	--	--	--
Crystal Beach	--	--	--	--	--	--	--	--	--	--	--	--
Desert Hills	6	--	50	30	10	96	3	--	50	30	10	93
Parker/CRIT*	9	--	50	30	5	94	--	--	--	--	--	--
Quartzsite*	--	--	--	--	--	--	--	--	--	--	--	--
Parker Strip - BSD*	15	40	50	30	0	135	--	--	--	--	--	--
Poston (CRIT)	--	--	--	--	--	--	--	--	--	--	--	--
Ehrenberg	3	--	50	30	0	83	--	--	--	--	--	--
Cibola	--	--	--	--	--	--	--	--	--	--	--	--
Yuma*	27	--	50	30	5	112	21	--	50	30	5	106
Somerton	--	--	--	--	--	--	--	--	--	--	--	--
San Luis	0	--	50	30	10	90	--	--	--	--	--	--
Gadsden	--	--	--	--	--	--	--	--	--	--	--	--
Needles*	18	--	50	30	0	98	15	--	50	30	0	95
Blythe*	18	--	50	30	0	98	9	--	50	30	0	89
Black Meadow Landing	--	--	--	--	--	--	--	--	--	--	--	--
Big River / Earp	6	--	50	30	0	86	3	--	50	30	0	83
Winterhaven	--	--	--	--	--	--	--	--	--	--	--	--
Laughlin*	--	--	--	--	--	--	--	--	--	--	--	--
Boulder City	12	--	50	30	0	92	12	--	50	30	0	92
Small Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	--	--	--	--	--	--	--	--	--	--	--	--
Lake Havasu City*	--	--	--	--	--	--	--	--	--	--	--	--
Ft. Mojave Indian Reservation*	0	--	40	30	5	75	0	--	40	30	5	75
Mohave Valley	--	--	--	--	--	--	--	--	--	--	--	--
Golden Shores	21	--	50	30	10	111	21	--	50	30	10	111
Topock	21	--	50	30	10	111	21	--	50	30	10	111
Crystal Beach	15	--	50	30	10	105	15	--	50	30	10	105
Desert Hills	--	--	--	--	--	--	--	--	--	--	--	--
Parker/CRIT*	--	--	--	--	--	--	0	--	50	30	5	85
Quartzsite*	30	--	35	30	0	95	0	--	35	30	0	65
Parker Strip - BSD*	--	--	--	--	--	--	27	40	50	30	0	147
Poston (CRIT)	12	--	50	30	10	102	15	--	50	30	10	105
Ehrenberg	--	--	--	--	--	--	30	--	50	30	0	110
Cibola	18	--	25	30	0	73	18	--	25	30	0	73
Yuma*	--	--	--	--	--	--	--	--	--	--	--	--
Somerton	6	--	50	30	10	96	0	--	50	30	10	90
San Luis	--	--	--	--	--	--	0	--	50	30	10	90
Gadsden	27	--	50	30	10	117	24	--	50	30	10	114
Needles*	--	--	--	--	--	--	--	--	--	--	--	--
Blythe*	--	--	--	--	--	--	--	--	--	--	--	--
Black Meadow Landing	15	--	50	30	0	95	18	--	50	30	0	98
Big River / Earp	--	--	--	--	--	--	--	--	--	--	--	--
Winterhaven	9	--	50	15	10	84	0	--	50	30	10	90
Laughlin*	0	--	50	15	0	65	0	--	50	30	0	80
Boulder City	--	--	--	--	--	--	--	--	--	--	--	--

TABLE VII-9c. Phase III Project Scores

City/Town/Reservation	Phase III					
	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalization	Total
Large Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	--	--	--	--	--	--
Lake Havasu City*	30	40	50	30	5	155
Ft. Mojave Indian Reservation*	--	--	--	--	--	--
Mohave Valley	24	--	40	30	10	104
Golden Shores	--	--	--	--	--	--
Topock	--	--	--	--	--	--
Crystal Beach	--	--	--	--	--	--
Desert Hills	12	--	50	30	10	102
Parker/CRIT*	--	--	--	--	--	--
Quartzsite*	--	--	--	--	--	--
Parker Strip - BSD*	6	40	50	30	0	126
Poston (CRIT)	--	--	--	--	--	--
Ehrenberg	3	--	50	30	0	83
Cibola	--	--	--	--	--	--
Yuma*	--	--	--	--	--	--
Somerton	--	--	--	--	--	--
San Luis	9	--	50	30	10	99
Gadsden	--	--	--	--	--	--
Needles*	21	--	50	30	0	101
Blythe*	--	--	--	--	--	--
Black Meadow Landing	--	--	--	--	--	--
Big River / Earp	12	--	50	30	0	92
Winterhaven	--	--	--	--	--	--
Laughlin*	--	--	--	--	--	--
Boulder City	18	--	50	30	0	98
Small Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	0	--	40	30	0	70
Lake Havasu City*	--	--	--	--	--	--
Ft. Mojave Indian Reservation*	0	--	40	30	5	75
Mohave Valley	--	--	--	--	--	--
Golden Shores	27	--	50	30	10	117
Topock	27	--	50	30	10	117
Crystal Beach	21	--	50	30	10	111
Desert Hills	--	--	--	--	--	--
Parker/CRIT*	0	--	50	30	5	85
Quartzsite*	18	--	35	30	0	83
Parker Strip - BSD*	--	--	--	--	--	--
Poston (CRIT)	18	--	50	30	10	108
Ehrenberg	--	--	--	--	--	--
Cibola	24	--	25	30	0	79
Yuma*	0	--	50	30	5	85
Somerton	15	--	50	30	10	105
San Luis	--	--	--	--	--	--
Gadsden	30	--	50	30	10	120
Needles*	--	--	--	--	--	--
Blythe*	0	--	50	30	0	80
Black Meadow Landing	24	--	50	30	0	104
Big River / Earp	--	--	--	--	--	--
Winterhaven	12	--	50	30	10	102
Laughlin*	0	--	50	30	0	80
Boulder City	--	--	--	--	--	--

TABLE VII-9d. Phase IV Project Scores

City/Town/Reservation	Phase IV					
	Cost Ranking	Compliance Agreement	Groundwater Contamination	Available Capacity	Opportunity for Regionalization	Total
Large Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	--	--	--	--	--	--
Lake Havasu City*	30	40	50	30	5	155
Ft. Mojave Indian Reservation*	--	--	--	--	--	--
Mohave Valley	24	--	35	30	10	99
Golden Shores	0	--	50	30	10	90
Topock	0	--	50	30	10	90
Crystal Beach	--	--	--	--	--	--
Desert Hills	15	--	50	30	10	105
Parker/CRIT*	--	--	--	--	--	--
Quartzsite*	--	--	--	--	--	--
Parker Strip - BSD*	--	--	--	--	--	--
Poston (CRIT)	--	--	--	--	--	--
Ehrenberg	12	--	50	30	0	92
Cibola	0	--	25	30	0	55
Yuma*	27	--	50	30	5	112
Somerton	--	--	--	--	--	--
San Luis	--	--	--	--	--	--
Gadsden	9	--	50	30	10	99
Needles*	21	--	50	30	0	101
Blythe*	9	--	50	30	0	89
Black Meadow Landing	--	--	--	--	--	--
Big River / Earp	15	--	50	30	0	95
Winterhaven	--	--	--	--	--	--
Laughlin*	--	--	--	--	--	--
Boulder City	18	--	50	30	0	98
Small Projects	**(3)**	**(4)**	**(5)**	**(3)**	**(1)**	**(16)**
Bullhead City*	0	--	30	30	0	60
Lake Havasu City*	--	--	--	--	--	--
Ft. Mojave Indian Reservation*	0	--	40	30	5	75
Mohave Valley	--	--	--	--	--	--
Golden Shores	--	--	--	--	--	--
Topock	--	--	--	--	--	--
Crystal Beach	27	--	50	30	10	117
Desert Hills	--	--	--	--	--	--
Parker/CRIT*	0	--	50	30	5	85
Quartzsite*	0	--	35	30	0	65
Parker Strip - BSD*	0	--	50	30	0	80
Poston (CRIT)	30	--	50	30	10	120
Ehrenberg	--	--	--	--	--	--
Cibola	--	--	--	--	--	--
Yuma*	--	--	--	--	--	--
Somerton	0	--	50	30	10	90
San Luis	0	--	50	30	10	90
Gadsden	--	--	--	--	--	--
Needles*	--	--	--	--	--	--
Blythe*	--	--	--	--	--	--
Black Meadow Landing	30	--	50	30	0	110
Big River / Earp	--	--	--	--	--	--
Winterhaven	0	--	50	30	10	90
Laughlin*	0	--	50	30	0	80
Boulder City	--	--	--	--	--	--

One of the decisions CRRSCo will need to make is what to do with projects that, due to their lower ranking within a construction phase, are not funded and not constructed during a given construction phase. Do these projects get pushed to the top of the list for the next funding phase or do they get dropped from the list? Are they added to the next phase list and re-scored? This is an important issue that will need to be addressed as part of the overall prioritized program development.

Referring to Total Cost in Table VII-8a, it should be noted that neither the Fort Mohave Indian Reservation nor the Town of Laughlin show construction costs in any of the construction phases. Both entities have extensive collection systems and excess treatment capacity. Discussions with these entities indicate that no additional wastewater improvements are currently planned. None the less, they show up in the spreadsheet; the "projects" were scored and ranked. Since "zero" dollars worth of construction are scheduled to take place, these entries can be ignored.

E. Phased Prioritization Funding Requirements

Dollar values discussed are in terms of "actual dollars", or a sum of 2005 dollars for Phase I, 2010 dollars for Phase II, 2015 dollars for Phase III and 2020 dollars for Phase IV. To account for uncertainty these areas where master planning has not been performed, an additional 25 percent has been added to the construction costs.
Figure VII-1 shows the total actual construction cost opinion for the recommended wastewater improvements, for entities with master planning and entities without master

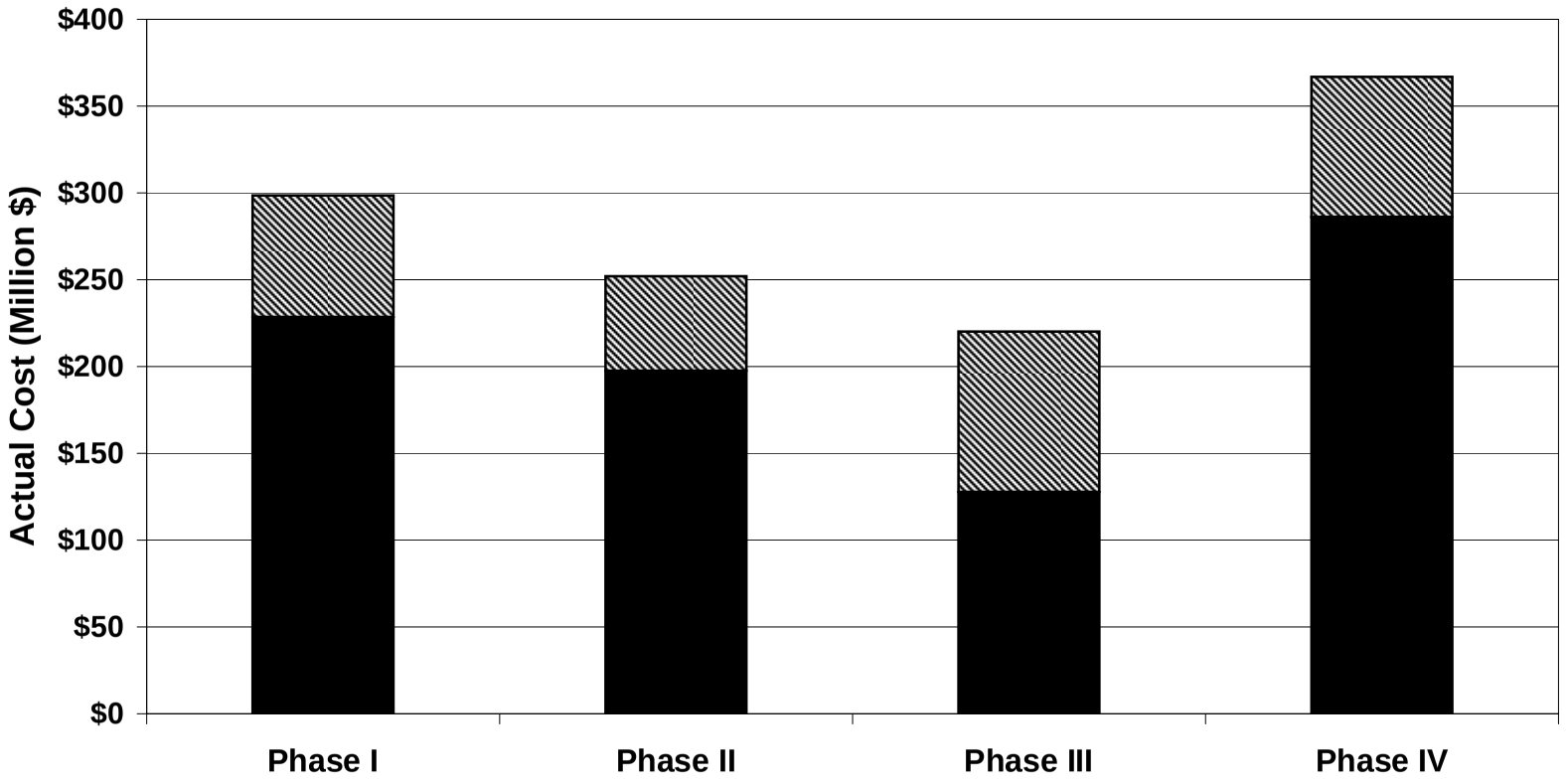


FIGURE VII-1

Actual Cost by Phase for Communities with and without Existing Facility Plans

planning. The total actual cost opinion for constructing the improvements program is estimated at 1.1 Billion Dollars.

VIII. FUNDING PLAN

A. Overview

Given the magnitude of costs to construct the recommended wastewater improvements, the development of a detailed financial and rate structure plan to secure the required funding is not feasible at this time, nor is it an effective use of CRRSCo resources. What is warranted at this time is to identify the different types of funding resources available and outline a financing framework to communicate CRRSCo needs to potential funding entities. The financing framework also needs to demonstrate to potential funding entities CRRSCo member's willingness to take responsibility for an equitable portion of the improvements costs.

Although a mix of different types of financial resources will be required, the greatest potential for significant funding lies in federal sources and philanthropic foundations. Federal funding mechanisms which include federal agencies, specific program designation initiatives (e.g., Great Lakes Water Quality Initiative), multi-state financing and funding through Congressional Act (e.g., Salton Sea Reclamation Act of 1998) have the potential to significantly offset the cost burden of entities residing within the CRRSCo planning area. This information together with the rationale and needs assessment already presented in this report will be funneled into the lobbying process for the purpose of targeting federal level funding opportunities. Philanthropic foundations also have a great potential for easing CRRSCo member improvements cost burden. Foundations donate over $1 Billion annually to various causes. Many of the top 100

foundations have either environment or public health and safety categories whose projects and program are eligible for financial awards. The CRRSCo financial framework also needs to target this potential financial resource.

This section presents an overview of the types of funding sources available, followed by an examination of the three basic alternatives: 1) local fees; 2) individual funding sources (i.e., SRF Programs; and 3) regional funding sources (i.e., federal programs). Recommendations for implementing a framework for funding the improvements are presented.

1. Local Assessed Fees

Local assessed fees cover the traditional mechanisms for funding wastewater infrastructure. These mechanisms include user charges, property taxes, sales taxes, development impact fees and customer connection fees. Given the population in the CRRSCo planning area, it is clear that these mechanisms alone will not be able to produce the required revenue to construct the recommended improvements. What these fees do show is a willingness of entities within the planning area to take financial responsibility that is commensurate with their available financial resources and bonding capabilities.

2. State/Federal Grants, Loans and Programs

The grants and loans program will play an integral part in the overall financing framework of the wastewater improvements program. The primary source of funding from this category will most likely be the Clean Water State Revolving Loans Program (CWSRF). This program provides subsidized loans at below market rates and finances 100 percent of eligible planning, design and construction of wastewater collection and treatment infrastructure.

In addition to SRF programs, CRRSCo members will have access to other sources for public infrastructure improvement loans. Two such programs are: 1) the Greater Arizona Development Authority (GADA); and 2) the California Infrastructure and Economic Development Bank.

At the federal level, the Environment Protection Agency (EPA) grants funding programs will play a major role in funding the improvements. Although the grants program has tapered off since its beginning in the 70's, funding is still available but on a more restricted basis. Most of these programs have eligibility criteria that include population limitations, economic hardship areas and economically distressed areas along the United States-Mexico border. Other federal programs that fund wastewater infrastructure projects include:

- The Economic Development Administration Program (EDA - Department of Commerce);

- The Community Development Block Grants Program (CDBG - Department of Housing and Urban Development);
- The Rural Utility Service (RUS - Department of Agriculture).

Virtually all of the programs associated with these agencies have eligibility criteria that include population limitations and/or economic hardship areas.

In addition to funding wastewater collection system and treatment system improvements, several federal agencies fund wastewater projects associated with water reclamation and water reuse. The Bureau of Reclamation (BOR) sponsors a Reclamation and Water Reuse Program that provides for funding for demonstration projects as they relate to water reclamation and water reuse. As previously discussed, the City of Bullhead City is currently involved in a wetlands demonstration project being partially funded by BOR. The EPA Wetlands Division sponsors both SRF loans and grants programs to assist state, tribal and local government agencies in wetlands protection, management, development and restoration.

The potential also exists for developing new programs at the federal and congressional levels. The Great Lakes Water Quality Initiative (GLI) is an example of a special initiatives program designation by EPA that was developed as the result of a grass roots movement of lake stakeholders who, working with EPA, helped create the program. An example of a Congressional Act to establish funding for an environmental project is the Salton Sea Reclamation Act of 1998. This Act directs the Secretary of the Interior, acting

through the Bureau of Reclamation, to conduct a feasibility study to identify options and construction costs for reclaiming the Salton Sea. Federally funded projects like the Great Lakes Water Quality Initiative and the Salton Sea Restoration Project provide a precedence and a model for how CRRSCo might proceed to secure funding for the required wastewater improvements.

3. Private Funding Sources

Philanthropic Foundation grants are another potential revenue source for CRRSCo. The different types of foundations include the following:

Private Operating Foundations

Private Independent Foundations

Public Foundations

Corporate Foundations

Community Foundations

Family Foundations

There are over 100,000 U.S. foundations that are grantmaking institutions. In 1997, the top ten U.S. foundations awarded between $97 Million and $400 Million. As will be discussed under the section entitled implementation, the amount of money available should prompt CRRSCo to allocate resources to begin investigating the submittal/ eligibility process and identifying candidate projects for submittal. An important point to

keep in mind is that this type of resource may have certain requirements attached that may or may not be acceptable.

B. Alternatives

1. Local Fees

a) Improvements Funding

The local fee structure that assigns an equitable portion of the improvements costs to CRRSCo planning area residents is an essential part of the overall financial framework. In addition to providing for existing operations, maintenance, replacement (OMR) and debt service costs, these fees will also have to cover capital and OMR costs of the new infrastructure.

Typical mechanisms available to generate local revenues include user charges, property taxes, sales taxes, development impact fees and customer connection fees. Other local-type mechanisms available to CRRSCo entities include river/lake protection fees and groundwater protection fees. In addition to the local residents, the large influx of seasonal visitors provides additional potential for revenue generation. Hotel taxes, restaurant taxes and river usage taxes are just a few of the potential mechanisms available. As with any increase in tax or charge, tourism-driven economies like those in the CRRSCo planning area need to balance revenue generation from tourism and revenue loss due to tourism discouragement because of high costs.

b) Local Fees To Fund CRRSCo

Examination of successful efforts to generate financial support at multiple levels for environmental concerns points to a grass roots organization that is properly staffed and funded. There is reason to believe that this will be the same for CRRSCo.

CRRSCo is a grass roots *association* of entities in the Lower Colorado River Basin. Members donate personnel time to help run the organization. This level of effort has been successful in developing the Regional Watershed Planning Document to identify required wastewater improvements and opinion of construction costs. To become a grass roots *organization*, CRRSCo needs to have dedicated personnel available to take the next, time-consuming steps towards procuring the required funding. To these ends, we believe that a special assessment fee or tax should be crafted among members to fund the CRRSCo organization. As part of this process, CRRSCo must determine the type of organization it wants to be, the number of people and cost to run the organization and the potential for local revenue from members to support organization costs. Local fees are not the only funding mechanism running CRRSCo. As will be discussed later, certain grants programs fund organizational and public outreach costs for non-profit organization such as CRRSCo.

2. Individual Member/Non-member Funding Sources

a) State Revolving Fund Programs

Working in cooperation with the Office of Management and Budget (OMB), EPA's Office of Water has developed a plan to capitalize the Clean Water and Drinking Water State Revolving Fund (CWSRF and DWSRF) programs at an annual level of $2 Billion for CWSRF and $500 Million for DWSRF. The proposed capitalization schedule, which extends through fiscal year 2003 for each program, represents efforts to fund the CWSRF and DWSRF so that they will provide a perpetual source of financial assistance to high-priority water quality and public health projects.

The primary source of SRF loans to finance CRRSCo wastewater improvements will be the CWSRF Program. Currently, the program has over $27 Billion in assets. For the CRRSCo planning area, the Arizona, California and Nevada agencies responsible for administering the CWSRF programs are as follows:

Arizona: Water Infrastructure Financing Authority (WIFA)
California: State Water Resources Control Board (SWRCB)
Nevada: Division of Environmental Protection (NDEP)

Given the magnitude of cost for the required improvements, the loan capacity of the individual state CWSRF programs could become an issue. For example, in 1998 WIFA had over $800 Million in requests but only $50 Million in low interest rate loan capacity.

The potential for re-allocation of unused funds throughout the entire CWSRF program should be examined.

The CWSRF has three major categories: 1) publicly owned wastewater treatment facilities; 2) Nonpoint Source projects (publicly or privately owned); and 3) Estuary Management projects (publicly or privately owned). The Nonpoint Source and Estuary Management *Grants* Programs are funded through a reallocation of 20% of CWSRF *loan* funds. The intended purpose of this initiative is to provide states with more flexibility in funding agricultural and other non-point source projects. Any category or area that a state has identified in its Nonpoint Source Management Plan is eligible for this grant funding. Wetlands projects, including constructed wetlands to treat wastewater effluent typically fall under the category of non-point source projects. Up to 60% of project cost may be covered by the grant.

In addition to dispensing loans, CWSRF also provides hardship grants for rural communities having 3,000 or fewer residents. This program is currently funded at $50 Million annually. To qualify, communities must meet the following criteria:

- The community lacks access to centralized wastewater treatment or collection systems, or needs improvements to on-site wastewater treatment systems;
- The proposed project will improve public health or reduce environmental risk;

The community's per capita income rate is less than 80 per cent of the national average; and;

- Its unemployment rate exceeds the national average by one percentage point or more.

Up to 97% of funds for programs can be paid for by these grants. In 1998, Buckskin Sanitary District, La Paz County was scheduled to receive a CWSRF hardship grant.

Another potential that CRRSCo should investigate is the possibility to apply for DWSRF. Individual states may elect to allocate a portion of their funds to emphasize source protection of surface water and groundwater. Improvements programs that address needs identified in both the CWSRF and DWSRF programs may receive higher priority than a program applying exclusively to either CWSRF or DWSRF.

b) Other State Loan Programs

In addition to SRF loans, CRRSCo members have other sources for obtaining public infrastructure improvement loans. Two such programs are: 1) the Greater Arizona Development Authority (GADA); and 2) the California Infrastructure and Economic Development Bank.

The Greater Arizona Development Authority (GADA) provides loans for public infrastructure as well as technical services in support of public infrastructure projects. GADA funding is desirable for the following reasons:

- Borrows at lower rates than those of a community borrowing on its own;

- Pools several loans made to communities into one bond issue;
- Spreads transaction costs over several participants which lowers the costs to the individual communities;
- Provides access to loans for communities with a low investment grade rating.

The criteria for GADA loan eligibility are as follows:

- The applicant is either a political subdivision or an Indian tribe;
- The financial assistance requested is for an infrastructure project;
- The application is administratively complete;
- The applicant demonstrates that the financial assistance can be repaid;
- The applicant demonstrates that the project is ready for construction and the applicant is ready to proceed;
- The applicant provides evidence that the project has public support;
- The applicant provides evidence that the project is part of an adopted comprehensive plan; for example, a capital improvement plan, local strategic plan, or similar planning document;
- The applicant has the capacity to manage, construct, and operate the infrastructure project.

The California Infrastructure and Economic Development Bank provides public infrastructure loans to help meet the growth challenges being experienced in California. The program is a reserve fund leveraged loan program capitalized by a state budget

appropriation of $50 Million for FY98/99. The Governor has proposed to increase the capitalization of the bank by $425 Million in FY1999/2000.

The Bank's leveraging goal is 3:1 meaning that from the original capitalization of $50 Million, the Bank will issue $150 Million in loans. Loans will be funded in amounts ranging from $250,000 to $5 Million. Loans will be made on a fixed-rate basis, at 70% of the Bond Buyer's Revenue Bond Municipal Market Yield Index for an "A" bond.

Eligibility criteria include the following:

- Borrower, type of infrastructure project, and cost are eligible;
- Project promotes economic development and conservation of natural resources;
- Project develops and enhances public infrastructure in a manner that will attract create, and sustain long-term employment opportunities;
- Project is consistent with applicant's General Plan and any existing Economic Development Plan;
- Applicant has a demonstrated need for the Bank's financing;
- Project financing includes a minimum of 10% of funding from sources other than the Bank;
- Project impacts distressed communities;
- Project can begin construction within 18 months following the date of the Bank's approval;

- Applicant demonstrates ability to repay the loan and comply with credit criteria required of the rating agencies.

c) Bond Programs

Three types of bond are typically used to finance wastewater infrastructure projects:

- General Obligation Bonds
- Revenue Bonds
- Lease Rental Bonds

The most common types of bonds issued to fund wastewater infrastructure projects are general obligation bonds and revenue bonds. General obligation bonds are secured by the full faith and credit of an issuer with taxing power (e.g., property taxes or sales taxes) and are typically repaid from either property taxes or sales taxes. General obligation bonds can also be secured with property taxes or sales taxes and repaid with projected project revenue. Before the sale can take place, the general bond issue needs to be approved by the voters through a bond election. Revenue bonds are secured from the projected revenue of the project (e.g., user charges) and not from property taxes or sales taxes. Generally, no voter approval is required prior to a revenue bond issue. Either one of these options will tend to have higher interest rates than an SRF-provided loan. Like SRF loans, general obligation bonds and revenue bonds are tax-exempt.

Lease rental bonds are secured by lease payments made by the party leasing the facilities financed (i.e., CRRSCo Member) to a private financing authority. Often the leasing entity is legally obligated to appropriate monies from its general tax revenues to make lease payments. In some cases, however, lease payments will be made only from revenues associated with the facility financed. As long as the municipality remains the owner of the wastewater facility and the agreement between the municipality and the private financing authority meets conditions allowed by IRS "management contract" rules, financing can remain tax-exempt.

As with any additional debt that would be incurred by a municipality, existing financial indebtedness needs to be evaluated. Members may or may not have a legal limit on the amount of general obligation bond or revenue bond indebtedness which they can incur or have outstanding. As part of the overall framework for financing the wastewater improvements, members will need to establish what their additional bonding capacity is.

3. Regional Funding Sources

a) Overview

A variety of regional funding opportunities exist at the federal level to fund wastewater infrastructure. The magnitude of wastewater improvements cost and member ability to pay for these improvements necessitate that CRRSCo develop additional revenue streams. The overall success of CRRSCo will most likely depend on the role regional financial resources play in overall program financing.

b) Federal Agencies and Programs

The federal government has adopted a watershed approach to protecting and restoring aquatic ecosystems and protecting human health. This approach emphasizes the targeting of priority problems, promoting a high level of stakeholder involvement and making use of expertise and authority of multiple agencies. Available funding sources for watershed protection include a multitude of agencies. The following is a list of funding sources that are applicable to wastewater improvements projects. A listing of the programs, by agency is as follows:

U.S. Department of Agriculture

- Water and Waste Disposal Systems for Rural Communities (USDA/RUS)

U.S. Department of Commerce

- Economic Development Authority

U.S. Department of the Housing and Urban Development

- Community Development Block Grants Program
- Indian Community Development Block Grants Program

U.S. Department of the Interior

- Reclamation and Water Reuse Grant Program (administered by the Bureau of Reclamation)
- Clean Vessel Act Grants Program

U.S. Environmental Protection Agency

- Nonpoint Source Implementation Grants (319 Program)
- Sustainable Development Challenge Grants
- Wetlands Protection and Development Grants
- Pollution Prevention Grants
- Environmental Education Grants Program
- U.S.-Mexico Border XXI Grants Program
- Clean Water Act Indian Set-Aside Grants Program
- Indian Environmental General Assistance Program
- Great Lakes Grants Program
- Hardship Grants Program for Rural Communities

For a brief description of each of these programs, see Appendix IX.

Many of these programs have eligibility criteria that include population limitations, economic hardship areas and economically distressed areas along the United States-Mexico border. Given the diversity in membership, CRRSCo should be able to qualify for several of these programs. The City of Bullhead City is currently involved in a

wetlands demonstration project being partially funded by the DOI/BOR Reclamation and Water Reuse Grants Program. As can be seen by examining the list, American Indian Nations have a variety of programs available for their needs. In addition, entities residing in the CRRSCo planning area near the U.S.-Mexico border may be able to qualify for these ear marked programs.

Of the programs listed, the most promising programs to address CRRSCo needs appear to be:

- EPA Nonpoint Source Implementation Grants (319 Program)
- EPA Sustainable Development Challenge Grants
- Wetlands Protection and Development Grants
- DOI/BOR Reclamation and Water Reuse Grant Program

The principle behind the 319 program is that individual states should have the flexibility to use these grants funds in a manner they see best fit to achieve the objectives of their Nonpoint Source Management Program. As part of the 319 program, any category or specific problem documented in state's Nonpoint Source Management Plan is eligible for funding consideration. The 319 Nonpoint Source and Estuary Management Grants Programs are capitalized through reallocation of 20% of CWSRF loans to CWSRF grants. Having beneficiaries work with the Arizona, California and Nevada state agencies responsible for Nonpoint Source Management Plan is encouraged. This way,

potential beneficiaries like CRRSCo have an opportunity to be a stakeholder and to help ensure their projects are eligible for grant funding.

The Sustainable Development Challenge Grant Program is designed to get communities to take an integrated approach to community well-being, economic prosperity and environmental protection with a view towards sustainable development. As mentioned previously in this report, the economic sustainability of the CRRSCo planning area communities is directly tied to the health of the Lower Colorado River and its alluvial wells. The program selection criteria of: 1) sustainability; 2) community commitment and contribution; and 3) measurable results and evaluation are congruent with CRRSCo objectives.

The Wetlands Protection and Development Grants offers CRRSCo a special incentive in that this program sets aside $1 Million in grants to fund meritorious projects that demonstrate significant partnership efforts between states, federal agencies, tribes, local governments and non-government entities. These monies are set aside at the headquarters level and require regional offices to sponsor perspective projects. Selection is on a competitive basis and is not intended to be distributed equally to all EPA regions.

The DOI/BOR Reclamation and Water Reuse Grant Program is obviously a good candidate program given that Bullhead City, a CRRSCo member, has already qualified for funding under this program.

In addition to programs that allocate funds directly to communities, grant monies are also made available from the federal government to various state administered programs for use as the state sees fit. Programs under this category include the following:

- Section 106 Water Pollution Control State and Interstate Program Support;
- Environmental Protection Agency's Pollution Prevention Incentives for States Grant Program;
- Capitalization Grants for State Revolving Funds.

These programs encourage potential beneficiaries like CRRSCo to work directly with their state agencies to help craft these programs to fit specific needs. This programmatic approach presents the following opportunities for CRRSCo: 1) potential for receiving funding; and 2) continued interaction with the different various agencies responsible for funding wastewater improvements projects.

In addition to funding capital cost projects, CRRSCo should also be looking at opportunities to fund a permanent CRRSCo staff. Some of the Grants Programs cover an organization's administration and coordination, public outreach and public education. The Nonpoint Source 319 Grants Program and Pollution Prevention Grants Program Grants name nonprofit organization as potential beneficiaries. The Sustainable Development Challenge Grants Program names nonprofit organization as potential beneficiaries and explicitly discusses an intention to fund opportunities to build community partnerships.

To summarize, a variety of programs exist at the federal level that provide funding for wastewater infrastructure. Part of the task facing CRRSCo is to begin making contact with the various federal agencies and programs, and together with the various state agencies lay the foundation for gathering program support to obtain program funding.

c) Specific Program Designation Initiative

Another funding option for CRRSCo to pursue the possibility for elevating the wastewater improvements program to the status of a federal program level. One of the precedents for this type of funding is the Great Lakes Water Quality Initiative (GLI). This program is pertinent to CRRSCo in that GLI was started at the grass roots level by states, tribes and stakeholders. In addition, the GLI organizational structure, which employs a Steering Committee, a Technical Work Group and a Public Participation Group, provides an organizational model that CRRSCo may choose to employ.

The Great Lakes Water Quality Initiative (GLI) was organized in 1989 by the United States Environmental Protection Agency (USEPA), at the request of the states, tribes and stakeholders in the affected watershed basins. The purpose of the GLI was to provide uniform pollution limits for all entities that discharge into the Great Lakes watershed basins, so that a greater degree of protection would be provided. Three entities within GLI were responsible for developing the technical content of the regulatory limits: the Steering Committee, the Technical Work Group and the Public Participation Group. The Steering Committee consisted of water program directors from each state and staff from the USEPA. This committee guided the efforts of the Technical Work Group, debated policy issues and

approved products for USEPA consideration. The Technical Work Group consisted of personnel from the water program agencies from each state, the USEPA, the US Fish and Wildlife Service and the US National Park Service. This group was responsible for developing and submitting provisions for the regulatory limits to the Steering Committee. The Public Participation Group consisted of representatives of local and state governments, industry, educational institutions and environmental groups. This group was responsible for advising the Steering Committee and Technical Work Group of public opinion and concerns during the process. Following the publishing of the "Water Quality Guidance for the Great Lakes System" (Guidance) in 1995 by the USEPA, the states and tribes were allowed two years to implement the provisions contained in the Guidance.

There were five provisions that the states and tribes were required to adopt into their existing water quality programs. These provisions were: 1) water quality criteria to protect human life, 2) water quality criteria to protect wildlife, 3) water quality criteria to protect aquatic life, 4) antidegradation requirements to maintain water quality where current water quality is better than minimum requirements, and 5) requirements to ensure a more consistent implementation through the basins.

In an effort to assist GLI participants in meeting the five provisions outlined in the Guidance, the Great Lakes Priorities and Funding Guidance (Funding Guidance) was established. This is an annual funding process that provides grants to non-profit organizations to support projects that protect and clean up the Great Lakes watershed. The criteria for approval are that the project must be all of the following: 1) action oriented, 2) not clearly the mission of other federal programs, 3) leveraged with other funding sources, 4) complementary of other

efforts without causing duplicity, and 5) developed through a collaborative partnership process such as Lakewide Management Plans. All applicants must either be public/non-profit entities, or be sponsored by a non-profit entity. Funding Guidance grants may not be used for construction grant projects, basic research, land acquisition, education/outreach or conferences (unless part of a larger project), or general operating expenses. The applicants must demonstrate a minimum non-federal matching requirement of 5% of the total project cost. Grants are awarded on a lump sum basis, so applicants requesting additional funding under existing projects must apply each year.

There are six categories under which organizations may apply for funds: contaminated sediments, pollution prevention, habitat protection and restoration, exotic species, assessment indicators and emerging issues. For fiscal year 1998 through 1999, the total available funding was $3,700,000. Of this total, $1,400,000 was available for contaminated sediments projects, $700,000 for pollution prevention projects, $1,100,000 for habitat protection and restoration projects, $300,000 for exotic species projects, $300,000 for assessment indicators projects and $300,000 for emerging issues projects.

d) Multi-State/Multi-Agency Financing

The most likely option for multi-state funding is through coordination of states' SRF programs. Precedent exists for this type of multi-state SRF Program coordination. The Kansas and Missouri CWSRF programs are currently negotiating joint funding of a wastewater treatment plant in Fort Smith, Kansas whose effluent will impact Missouri. As part of implementing the CRRSCo funding plan, we recommend that CRRSCo contact these

states' SRF programs to understand the issues associated with coordinating SRF programs. We also recommend that CRRSCo contact the capitalization program director at the federal level to identify other multi-state SRF Program coordination ventures for additional background.

Another option for multi-state financing is to adopt the idea of a regional capital financing board. Bodies like this have been proposed at County levels, specifically Kings County in Seattle. As part of the framework of implementing a regional capital financing, the key questions raised are:

How can the region's voters be provided with information that assures capital projects presented to them:

- meet local and regional policy goals;

are based on community needs;

- project their costs and tax impacts realistically within the context of current and anticipated debt; and
- are developed through open discussion between citizens and their representatives?

These are just a few of the issues that CRRSCo will have to address around multi-state approaches to financing the wastewater improvements in the planning area.

As previously mentioned, opportunities for multi-agency coordination between the CWSRF and the DWSRF exist. A watershed-based approach to wastewater problem solving coupled

with the DWSRF's consideration of fund allocation for source water protection presents an opportunity for the CWSRF Program and the DWSRF Program to work as a team. Part of CRRSCo's task is to inform the individual SRF programs of the situation and how a joint effort would benefit everyone.

As more agencies become aware of CRRSCo and its needs, the potential for inter-agency collaboration increases. Given the magnitude of the costs, inter-agency collaboration will be required for CRRSCo to achieve its programmatic goal to implement the prioritized improvements plan. Agencies themselves have recognized the need to facilitate joint funding of projects and have taken steps towards improving cooperation and coordination. In a joint memorandum dated April 3, 1997, the U.S. Department of Agriculture's Rural Utilities Service, the U.S. Environmental Protection Agency and the U.S. Department of Housing and Urban Development have agreed to formalize efforts to maximize benefit to perspective beneficiaries. These three agencies have agreed to:

- Coordinate definition and requirements on the necessary beneficiary planning efforts (e.g., strategic plans);
- Coordinate funding cycles and selection system;
- Agree on the necessary environmental review documents required;
- Coordinate with federal "cross-cutter" requirements on jointly funded projects;
- Encourage periodic meetings between agency program directors;
- Jointly fund projects when applications meet programmatic requirements of all agencies involved.

e) Program Designation by Congressional Act

Another funding option for CRRSCo to pursue is to have the wastewater improvements funded by Congressional Act. The precedent for this type of funding has been established with the Salton Sea project and the Salton Sea Reclamation Act of 1998. The Act called for the Secretary of the Interior to conduct a feasibility study to investigate options and develop opinions of costs for Salton Sea reclamation projects. Funding for the restoration of the Salton Sea was to be a combination of federal funding and matching non-federal funding.

The Salton Sea is located in the Salton Basin in southern California, southwest of the Orocopia Mountains and southeast of the Santa Rosa Mountains. This basin was originally dry until 1905, when an irrigation canal from the Colorado River broke and released flow into the basin. By the time the canal was restored, the Salton Sea was created.

Inflow to the Salton Sea primarily consists of agricultural runoff from the Imperial, Coachella and Mexicali Valleys. There is no outflow from the Salton Sea, and the only current route of water loss is through evaporation. Initially the Sea was a freshwater body. Fish were introduced into the Sea and it became a migratory stop for birds. However, the salinity in the sea has increased to levels greater than the ocean. Concentrations of chemicals have also increased due to agricultural chemicals from the valley runoff. In 1987, the first avian deaths were noticed at Salton Sea. For the next

eleven years, investigations were conducted to determine the causes of these deaths, and it was determined that the increasing concentrations of salt and other pollutants were to blame. As a result, the Salton Sea Reclamation Act of 1998 (Act) was passed by Congress.

The Act called for the Secretary of the Interior to complete a feasibility study by January 1, 2000. The purpose of the feasibility study was to investigate options and develop cost opinions for reclaiming the Salton Sea. Specifically, the Sea should be restored as a reservoir for irrigation drainage, the salinity should be lowered and subsequently stabilized, the elevation should be stabilized, the fish and wildlife habitats should be restored, and the recreational and economic uses of the Sea should be enhanced.

Funding for the restoration of the Salton Sea was to be a combination of federal funding and matching non-federal funding. To date, $900,000 was provided by the Bureau of Reclamation, $2.5 million was secured by the California voters in the form of a bond, $7 million was provided by the USEPA and $1 million was provided by the Fish and Wildlife service. It has not been determined who will provide the funding for either the construction or the operation and maintenance of the chosen reclamation option.

C. Implementation

1. Framework

Financing an improvements program of the magnitude presented for CRRSCo will require a financing framework that can deal effectively with the various member, state, federal, and possible private entities. To perform this task, it is recommended that CRRSCo proceed with hiring a full time equivalent person or persons who will be responsible for managing a permanently staffed CRRSCo Program office. Sources to fund this office include: 1) a special assessment fee or tax on CRRSCo member to fund the CRRSCo organization; and 2) grants from programs that promote grass roots organization and identify nonprofit organization as potential beneficiaries. In addition to coordinating among the various member, state and federal agencies, a permanently staffed CRRSCo office can begin the task of identifying private foundation funding available for wastewater improvements and what strings are attached to this funding. The current stock market boom has significantly increased foundation holding and subsequently its ability to fund projects.

In the meantime, existing CRRSCo members can begin the process of contacting their state SRF officials in both the CWSRF and DWSRF Programs. The purpose of this task is fourfold: 1) identify the key contacts for these programs; 2) determine the amount of funding available; 3) begin laying the foundation for multi-state SRF funding; and 4) begin laying the foundation for CWSRF - DWSRF Program coordination. This information, together with existing member bonding capacity begins the quantification of

what state SRF programs can provide and how much members can afford. With this data, CRRSCo can determine the levels of funding that will be required from federal grants programs and private foundations.

2. CRRSCo Member Bonding Capacity

An overview of CRRSCo members' bonding capacity is provided to give perspective on money available to entities for their infrastructure improvements relative to the recommended wastewater improvements cost. This presentation is not meant to be exhaustive but rather representative and illustrative of the situation in which planning area entities find themselves.

Bullhead City has just spent over $40 Million (FY98) on wastewater improvements. Existing debt service is well over 60 percent of the annual budget; the City has essentially no additional bonding capacity. Lake Havasu City has a bonding capacity of $74 Million Dollars with no bonds currently outstanding; projected costs to sewer the City are around $200 Million (FY98). Mohave County has a bonding capacity of $56 Million with no outstanding bond debt. Discussions with the Town of Parker indicate that the residents are weary of entering into additional bond debt. Recently the Fort Mojave Tribal Utility Authority (FMUTA) settled on payment on a bond issue, which financed the 1990 wastewater treatment plant construction, at a substantially reduced amount from the original price. This was due to the fact that the bonds were issued based on an assumption about the number of users which was never realized. FMUTA has expressed grave doubt

about voter willingness to bond any additional wastewater improvements. The Town of Quartzsite has just issued over $2 Million in general obligation bonds for drinking water improvements. Conversations with the Town indicate that until these existing obligations have been paid off, residents will most likely be skeptical of any additional bonds. The Clark County Sanitation District has indicated that it has no bonding capacity at this point in time.

To summarize, some planning area entities have existing bond capacity and some planning entities do not. Those entities with bonding capacity also have to contend with infrastructure needs other than wastewater infrastructure that have arisen due to growth in the area. Pressure to improve infrastructure to meet growth coupled with the pressure to improve existing wastewater treatment have placed planning area entities in a very tenuous position.

3. CRRSCo Member Expenditures on Wastewater Improvements

CRRSCo members are committed to upholding the CRRSCo charter to protect and enhance the Colorado River through the improvement of wastewater management practices which will help assure a high quality of water for all users. Since legally incorporating in July of 1997, CRRSCo members have spent over $50 Million (FY98) for planning and construction of required wastewater improvements.

Bullhead City has spent over $40 Million (FY98) on planning and construction of Phase I required improvements. Bullhead City will soon begin constructing Phase II improvements which may also approach an additional $40 Million (FY98). Lake Havasu City has spent almost $4 Million on planning and construction since CRRSCo's inception. Lake Havasu City is planning to embark on a five-year construction program from the year 2001 through the year 2005 which will spend $5 Million (FY98) per year in each of these five years. The Buckskin Sanitary District has spent $4 Million (FY98) constructing wastewater improvements. The City of Needles is also in the middle of a wastewater improvements program that is projected to cost over $40 Million (FY98).

In summary, entities within the CRRSCo planning area are beginning long term programs to construct the required wastewater improvements. The cost to fully implement these necessary programs is greater than entities' ability to pay and will require additional funding from additional sources.

REFERENCES

Appendices

Colorado River Regional Sewer Coalition By-laws and Articles of Incorporation

IX. Bureau of Reclamation & Colorado River Management

The Bureau of Reclamation was established in 1902, as a branch of the US Department of the Interior, to manage the water resources in 17 western states: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington and Wyoming. To date, the Bureau has constructed more than 600 dams and reservoirs to store water for distribution, provide flood control, and generate hydroelectric power. It is the nation's second largest wholesale water supplier. Approximately 31 million people are serviced, and approximately 10 million acres of land are irrigated by water provided by the Bureau. The reservoirs have a combined capacity of 245 million acre-feet. More than 40 billion kilowatt-hours of electricity are generated annually by the 58 hydroelectric plants it operates, the Bureau is the fifth largest electric utility in the region. The Bureau also manages 308 recreation sites which attract 90 million people from around the world each year.

Originally the Bureau achieved its objectives by constructing dams and reservoirs. With the passage of the Endangered Species Act of 1973, it was forced to reevaluate the environmental soundness of this method. As a result, the agency now emphasizes a shift from dam building to water resources management. Programs are now in place to increase migratory fish populations, use controlled flooding to stimulate ecosystems, and increase the water quality. The Bureau also promotes better water use by promoting conservation, recycling and reuse.

Lower Colorado Region

This total area is divided into five regions: Great Plains Region, Lower Colorado Region, Upper Colorado Region, Mid-Pacific Region and Pacific Northwest Region. The Lower Colorado (LC) Region consists of portions of five states: most of Arizona, southern California, west-central New Mexico, southern Nevada and southwestern Utah. The Region is responsible for managing the lower basin of the Colorado River, beginning at Lees Ferry and continuing to the US/Mexico border. This includes managing the distribution of water and power to all users.

The LC Region is home to several large Reclamation projects: Hoover Dam, All-American Canal, Central Arizona Project, and Yuma Project. These and other projects annually provide water for more than 20 million people, provide irrigation water for more than 2.7 million acres of agricultural land, and generate almost 10 billion kilowatt-hours of electricity annually. Some of these projects, such as Lake Mead, also generate tourism dollars through recreation areas. More than 12 million people visit these areas annually.

Although the UC and LC Regions both manage the Colorado River, the climate of the LC Region is more arid than that of the UC Region, and the population is growing at a faster rate. As a result, more emphasis is placed on conservation, recycling and reuse. A land fallowing/water banking program saved approximately 200,000 acre-feet of irrigation water that was redirected for municipal use. Older, high water consumption facilities are

being replaced with more water efficient facilities. Also, the Bureau has granted more than $75 Million to fund construction of facilities for reclamation and distribution of wastewater.

In addition to conservation, reuse and recycling, the Region is now developing a program for interstate transfer of Colorado River water. Unused water from any states in the lower region would be combined and stored at designated storage sites. The water would then be redistributed to the states when needed, based on what was contributed.

The LC Region is also conscious of protecting the water quality of the Colorado River, and it built a new water quality research facility at Yuma, Arizona. This facility serves as a pilot plant for testing new water treatment technology, and the goal is to develop methods to improve the cost effectiveness of any water treatment pilot plant.

As with the remainder of the Bureau regions, the LC Region has added environmental preservation and restoration programs to their goals. The Bureau has acquired and reserved land for wildlife habitat, and funded research on several threatened species that are indigenous to the lower basin states. One of these species is the razorback suckers fish, which had been affected by the Bureau's water management practices. The Region has also investigated vegetation management to reduce water consumption and improve the natural habitat. Finally, a new collaborative program has been proposed which would

work to preserve the environment in the lower region while still allowing the full benefits of the river to be utilized.

X. Colorado River Law

Colorado River Compact

The Colorado River is an important source of water to the western and southwestern states. Due to the arid conditions in this region of the country, and the rapid population growth in this area, debate during this century over the distribution of this water has been heated. Several laws have been enacted concerning the River, and legal action has been taken. A summary of this complex relationship is provided below.

The Colorado River basin lies in seven states: Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming. Initially, water rights for the Colorado River consisted of the policy, Afirst in time, first in right.≅ The lower states, especially California and Arizona, were displaying much faster growth than the upper states, and the upper states were concerned with securing rights to the water for their future needs.

The first law concerning the distribution of the Colorado River water was the Colorado River Compact, which was enacted in 1922. This document divided the river into two basins, the upper basin and the lower basin, at Lees Ferry, Arizona. The upper basin states are Colorado, New Mexico, Utah and Wyoming, and the lower basin states are Arizona, California and Nevada. An average annual flow of 18 million acre-feet was assumed, and each basin was allocated 7.5 million acre-feet of water for use annually. In addition, the lower basin states were allowed to use an additional one million acre-feet in

any given year. The states in each basin were responsible for allocating the flow between themselves. Six of the seven states ratified the compact by 1923, but Arizona refused to agree to the terms. Until the consensus was unanimous, the compact would not be legally binding.

Boulder Canyon Project Act

The first groups to divert a significant amount of water from the Colorado River were private farmers in the Imperial Valley in southern California. The 60-mile long Alamo Canal was built using private funds. However, the majority of the canal lay in Mexico, and thus was subject to interference by the Mexican government. In 1919, the Imperial Irrigation District convinced the Bureau of Reclamation of the need for a new canal that was completely within the US borders.

The Boulder Canyon Project Act was proposed to allow the construction of Hoover Dam, Parker Dam, and the All-American Canal. This Act was first presented to Congress in 1922, but was not approved until 1928. In addition to authorizing the dam and canal construction, the Act also apportioned the water allotment to the lower basin among those three states. California was apportioned 4.4 million acre-feet, Arizona was apportioned 2.8 million acre-feet and Nevada was apportioned 0.3 million acre-feet. In addition to California's annual allotment, the state was given half of any available surplus.

Mexican Water Treaty

After leaving the United States, the Colorado River continues south into Mexico before discharging into the Gulf of California. After the Hoover and Parker Dams were built, the flood control provided allowed the Mexican people to use the land for agriculture. Previously, the seven states had been granting Mexico 750,000 acre-feet of water annually, which was meeting the Mexican needs. With the development of new agriculture, Mexico began consuming more water, and by 1941 they were averaging 1.5 million acre-feet per year. Mexico requested a larger allotment of water, but an agreement could not be met.

Meanwhile, Texas farmers were relying on water from the Rio Grande River for irrigation. Since the Rio Grande River begins forming in Mexico, the Mexican government used the water from the Rio Grande River as leverage in the negotiations over Colorado River water. In 1945, an agreement was reached and the Mexican Water Treaty was ratified. This treaty apportioned 1.5 million acre-feet of Colorado River water to Mexico in exchange for a favorable apportionment of the Rio Grande River water to Texas.

Upper Colorado River Basin Compact

The apportionment for the Colorado River Compact were based on an annual flow of 18 million acre-feet of water. However, there had been many years that the river did not meet this estimate. As a result, the upper basin states decided that apportioning their water based on set quantities was not the best method. In 1948, the Upper Colorado

River Basin Compact was signed into being to divide the upper basin water. This document apportioned the water among the states as percentages of the total annual flow. Colorado was given 52% of the annual allotment, Utah was given 23%, Wyoming was given 14% and New Mexico was given 11%. The only exception was that a set amount was apportioned to Arizona each year. Since Arizona has a small area of land that lies in the upper basin, the compact apportioned Arizona 50,000 acre-feet of water annually.

Colorado River Storage Project Act

As the population in the lower basin states continued to grow and dams were being built in the lower basin, the upper basin states became concerned that if they did not use their yearly apportionments, they would be lost to the lower basin states. In addition, because of the fluctuations in the annual total flow in the Colorado River, the upper basin states began lobbying for water storage facilities. In 1956, the Colorado River Storage Project Act was passed. This act authorized the construction of four storage dams in the upper basin: Glen Canyon Dam, Navajo Dam, Flaming Gorge Dam and Wayne N. Aspinall Storage Unit. These dams allow the upper basin states a surplus of water for use in dry weather flows, and provide a source from which distribution systems can be fed. These dams also are used to generate hydroelectric power which is used by the states.

Arizona vs. California and The Colorado River Basin Project Act

When the Colorado River Compact was passed in 1922, it was ratified by six of the seven states. Arizona was the only state to abstain from agreeing to the compact. By 1944,

Arizona's concern over the increasing quantity of water that California was using from the river caused the Arizona Legislature to approve legislation designed to protect their own water rights. First, Arizona approved a contract with the federal government for 2.8 million acre-feet annually. Second, Arizona ratified the Colorado River Compact. Third, the state budgeted $200,000 for survey of a proposed canal to distribute river water to Phoenix. In 1946, Arizona proposed the Central Arizona Project (CAP) to manage the distribution of Colorado River water through the canal.

The state of California disputed Arizona's right to the 2.8 million acre-feet of the lower basin allotment. Arizona was pulling approximately 2 million acre-feet of water annually from the Gila River, which is a tributary to the Colorado River. California argued that this amount should be considered part of Arizona's 2.8 million acre-feet apportionment. Arizona argued that it should be considered a separate source. California also argued that the additional one million acre-feet that was guaranteed to the lower basin states should be considered surplus and thus the state was entitled to half. Arizona also argued that this surplus was previously apportioned and should not be considered.

Arizona filed legal action against California, and the case eventually went before the US Supreme Court. In 1964, the court ruled in favor of Arizona. The water Arizona was taking from the Gila was not considered as part of their Colorado River apportion, and the court limited California to 4.4 million acre-feet annually. However, the court agreed with California on the status of the surplus water, and granted the state half of any water

surplus. Because Arizona needed congressional support from California in order to establish CAP, Arizona agreed to guarantee California's 4.4 million acre-feet as priority over the CAP entitlement. Thus, in 1968 Congress authorized the Colorado River Basin Project Act which allowed the formation of CAP.

Colorado River Basin Salinity Control Act

As use of the Colorado River increased, so did the salinity. In 1961, a canal was constructed just north of the Arizona/Mexico border to drain salty water from the Wellton-Mohawk Valley into the Colorado River. Mexico began complaining about the water quality and the effect it was having on Mexican agriculture. In 1965, the US and Mexico agreed that the saline water would be diverted to the border where Mexico could dispose of it into the Gulf of California. However, this proved to be insufficient, and in 1974 the Colorado River Basin Salinity Control Act was passed. This act authorized the construction of facilities to control the salinity in the Colorado River and ensure quality water for Mexico.

In summary, the water rights associated with the Colorado River are a complex relationship between seven states, the federal government and Mexico. Legislation passed over the past 80 years has attempted to devise a method for ensuring everyone involved receives a fair portion of the water for use. Below is a summary table listing this legislation.

Year	Legislation
1922	Colorado River Compact
1928	Boulder Canyon Project Act
1945	Mexican Water Treaty
1948	Upper Colorado River Basin Compact
1956	Colorado River Storage Project Act
1964	Arizona vs. California
1968	Colorado River Basin Project Act
1974	Colorado River Basin Salinity Control Act

XI. Major Colorado Water Users Outside CRRSCo Planning Area

A. Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (MWD) was established in 1928 to provide water to 240 cities and unincorporated areas in Southern California. MWD has a total of 27 customers, which consist of 14 cities, 12 municipal water districts and one county water authority. MWD does not service businesses, industries or direct connections to residential homes. MWD provides 60% of the total water supply to Southern California, and the total population served by the MWD is approximately 16 million people.

MWD obtains its water from the Colorado River via the Colorado River Aqueduct, and from Northern California via the Edmund G. APat≅ Brown California Aqueduct. The Colorado River Aqueduct consists of 242 miles of channels, tunnels, underground siphons and pump stations, and has a capacity of 1.3 million acre-feet of water. This aqueduct begins at Lake Havasu and ends at Lake Mathews near Riverside. There are 15 hydroelectric power plants located on the Colorado River Aqueduct, and they have a combined ability to produce 102 megawatts of energy. In order to provide quality water to its clients, MWD annually performs more than 300,000 water analyses to monitor the Aqueduct.

Due to the sensitive water issues connected to the use of Colorado River water, the MWD is developing alternative water sources to decrease the dependency on the Colorado River. One key component is the construction of a 260-billion-gallon reservoir to be used to store water. Another key component is the construction of the $2 Billion Eastside Reservoir Project. This project consists of three dams, and will be the largest earth and rock filled dam project in the world. Both of these projects will help the MWD store excess water in wet years and will provide a reliable source in dry years.

One of MWD=s clients is the County Water Authority for San Diego. There is a proposed water transfer agreement between San Diego and the Imperial Irrigation District (IID) which would transfer 200,000 acre-feet of Colorado River water from the IID to San Diego. The Authority has approached MWD about using the Colorado River Aqueduct for the transfer of this water. In addition to paying transfer costs, the Authority would support the MWD plans of storing water for future needs.

B. Central Arizona Project

Currently Arizona is consuming 2.5 million acre-feet more groundwater than is being recharged, thus causing the water table to decrease. In addition to water supply issues associated with this imbalance, there are other concerns as well. As the water table drops, the energy required to pump the groundwater, as well as the cost of pumping, increases. Deposits and other impurities are more concentrated toward the bottom of

aquifers, so the water quality decreases as the water table decreases. Finally, removal of water from underground pockets may cause earth fissures and land subsidence.

The Central Arizona Project (CAP) is a system of aqueducts, pump stations, pipelines and tunnels which diverts water from the Colorado River and distributes it to the Maricopa, Pima and Pinal counties in south-central Arizona. This system transports the water across 336 miles, starting at Lake Havasu and ending southwest of Tucson. CAP is the largest single renewable water resource in the state of Arizona. The purpose of CAP is to promote the conservation of groundwater in Arizona by increasing the use of surface water. Approximately 1.5 million acre-feet of CAP water is diverted from the Colorado River each year, with a maximum annual allotment of 2.8 million acre-feet. Approximately 53% of CAP water is used for irrigation, approximately 40% is used by municipal and industrial clients, and approximately 7% is used by the Indian communities. Overall, CAP services more than 80 clients.

Construction for CAP was authorized in 1968, began in 1973 and was completed in 1993. The total cost of the project was over $4 Billion. Of this total cost, $1.8 Billion must be repaid to the federal government. The Central Arizona Water Conservation District (CAWCD) was created to manage and operate CAP, and as a vehicle to repay the federal government the reimbursable construction costs. Repayment of the $1.8 Billion began in 1993 and the payments are scheduled over a 50-year period.

The CAP aqueduct averages 80 feet wide at the top, 24 feet wide at the bottom and 17 feet deep. 3.5-inch thick concrete panels line the aqueduct. The water is not covered, because of the prohibitive cost. As a result, approximately 7% of the total water is lost to evaporation or seepage. CAP water is not open for recreation purposes due to the security risks. To prevent terrorism, fences are in place to prohibit access to the water. Guard patrols and alarms, in addition to routine water quality testing, alert the CAWCD to any contamination.

There has been some concern as to the quality of CAP water when it was distributed in Tucson. CAP is not responsible for treating the river water, so it is not regulated by the 1974 Clean Water Act. CAP does conduct routine water quality testing to monitor the levels of total dissolved solids (TDS) in the water. Although the concentrations of TDS in CAP water varies with the season and with the amount of precipitation, they are consistent with other surface water sources.

C. Imperial Irrigation District

The Imperial Irrigation District (IID) is a community-owned utility that was formed in 1911 to distribute water for irrigation and electric power to the Imperial Valley in southern California. The IID obtains its water from the Imperial Dam on the Colorado River, the water travels 82 miles through the All-American Canal. 2.6 million acre-feet of water is allotted to the IID annually. Of this, 98% is used for agricultural irrigation in

the Imperial Valley, and the remaining 2% is used by nine Imperial Valley cities for drinking water. The IID is the largest irrigation district in the country.

Construction of the All-American Canal was authorized in the 1928 Boulder Canyon Project Act. The US Bureau of Reclamation constructed the canal, and in 1940 the canal first began delivering water to the Imperial Valley. The width of the canal varies from 150 to 200 feet, and the depth varies from 7 to 20 feet. Three main canals branch off of the All-American Canal: the East Highline, the Central Main and the Westside Main. Although the canal was constructed by the Bureau of Reclamation, the IID made semi-annual reimbursement payments on a 40-year contract to cover the cost of construction. The canal annual losses are estimated at 70,000 acre-feet as a result of seepage over a 23-mile section of the canal. Recently the US Congress authorized the Secretary of the Interior to line the canal to prevent this loss.

Overall, the state of California consumes more water from the Colorado River than it is allotted. The state is allowed a total diversion of 4.4 million acre-feet from the river, but it exceeds this value by approximately 20% each year. Because of this, the IID has agreed to transfer 200,000 acre-feet of water from the Imperial Valley to the San Diego County Water Authority (SDCWA). This water will be available as a result of conservation efforts of the IID. This agreement lasts for a minimum of 45 years, and does not transfer the water rights from IID to SDCWA. In addition to reducing California's overdraw of water from the Colorado River, this agreement will boost the

economy of the Imperial Valley, provide a stable, reliable source of water to San Diego, and reduce the amount of water taken from the Sacramento San Joaquin River Delta.

Another service of the IID is the furnishing of power to more than 90,000 people in the Imperial Valley. This service is a result of the 1928 Boulder Canyon Project Act. Since the Bureau required a guarantee of repayment of construction costs for the All-American Canal, IID constructed hydroelectric plants on the canal to finance these costs. A total of seven plants were constructed between 1941 and 1984.

Currently the electric power industry is undergoing deregulation. Investor-owned utilities are already undergoing deregulation, but community-owned utilities have not yet begun the process. IID predicts that by the year 2000 they will be deregulated and will be accepting direct customers.

XII. Federal Initiatives in the Colorado Basin

As a result of construction and water management practices in place on the Colorado River, several native species of plants and animals have declined and are now listed as endangered. This has resulted in new environmental initiatives that are designed to protect these species before they are lost. Both the upper and lower basins have been affected, and both have implemented programs which are designed to preserve the existing wildlife and habitat.

Four fish species which are native to the Colorado River have been placed on the endangered species list by the US Fish and Wildlife Service: Colorado squawfish, Razorback sucker, Bonytail chub and Humpback chub. The Colorado squawfish is the largest minnow in North America. This fish was once the top predator in the River, weighing up to 80 pounds and reaching 6 feet in length. The Razorback sucker is one of the largest suckers in North America. The Razorback's range once extended from Wyoming to Mexico, but it has declined and now only inhabits small ranges of the river. The Bonytail chub is the most endangered of the four fish. This chub is so scarce than no known wild reproductive populations exist. The Humpback chub can reach lengths of 30 inches and has a life span of approximately 30 years. This chub is now primarily found in the Grand Canyon.

In 1994, the US Fish and Wildlife designated areas along the Colorado River as critical habitat for these four endangered fish. In the upper basin, the majority of the river has

been designated critical habitat. In the lower basin, the Colorado River from Lees Ferry to Davis Dam, and from Parker Dam to Imperial Dam was designated critical habitat, as well as the Little Colorado River in the Grand Canyon. These areas were chosen regardless of the resulting economic impacts.

In order to help preserve these four fish species in the Colorado River, each basin implemented programs to better manage the natural resources. The upper basin implemented two programs: the Upper Basin Recovery Program and the San Juan River Recovery Program. These programs will not be discussed further. The lower basin implemented a number of programs, four of these are the Native Fish Program, a native riparian habitat program, multipurpose wetlands and the Multi-Species Conservation Program.

Native Fish Program

In 1989, the Native Fish Work Group (NFWG) was formed to preserve the Razorback sucker. The decline in the population of this fish was a result of the water management projects on the river and the introduction of highly predatory game fish. The effects of these factors has been so severe, that from 1989 to 1997 the population of Razorbacks in Lake Mohave decreased from approximately 60,000 adults to approximately 25,000 adults.

The NFWG consists of representatives from the Arizona Game and Fish Department, Arizona State University, the Biological Resources Division of the US Geological Survey, the Bureau of Reclamation, the Fish and Wildlife Service, the National Park Service and the Nevada Department of Wildlife. The goal of the NFWG is to introduce 50,000 young Razorbacks to Lake Mohave by the year 2000. To do this, native Razorback larvae were captured for use in a breeding program. This program uses facilities such as hatcheries to protect the fish from predation. As of 1997, the breeding program had produced more than 15,000 Razorbacks that could be released into Lake Mohave. These reintroduced fish will help boost the native population and ensure the continuation of the species.

Native Riparian Habitat

The Bureau of Reclamation, the National Park Service and the US Fish and Wildlife Service maintain nurseries for riparian plants native to the Colorado River basin. These plants may be used by these agencies to promote native riparian plant communities in the lower Colorado River basin. The Bureau and the Fish and Wildlife Service also maintain several research areas to study these plant species and what affects their growth.

Multipurpose Wetlands

With the help of the Bureau of Reclamation, multipurpose wetlands are being used in Arizona, California and Nevada. Approximately 25 acres in California have been converted to wetlands in order to treat wastewater and blend it with potable water for

irrigation and recreational purposes. The Boulder City Wetland Project was completed in Nevada in 1997 to demonstrate the use of wetlands for the treatment of wastewater. The treated water is then used to maintain habitats for threatened and endangered species.

Multi-Species Conservation Program

The Multi-Species Conservation Program is a combined effort by Arizona, California, Nevada, federal agencies, Native American tribes, and environmental groups. The goals of the Multi-Species Conservation Program are: 1) to preserve listed species in the lower basin and prevent the listing of any additional species, 2) to continue current water apportions and hydropower generation practices, and 3) to provide opportunities for future water and power development. This program is in the process of being implemented, and will run for 50 years.

The Lake Havasu Fisheries Improvement Program

The Lake Havasu Fisheries Improvement Program is designed to enhance fish habitats in 42 locations covering 875 aquatic acres and to develop 6 handicapped accessible fishing areas with docks, trails, parking and restrooms. This is a Bureau of Land Management-lead program whose members include the Arizona Game and Fish Department, Bureau of Reclamation, California Department of Fish and Game, U.S. Fish and Wildlife Service, Metropolitan Water District of Southern California and Anglers United. The project combines exotic sport fish restoration with endangered non-sport fish restoration.

XIII. Historical Lower Colorado River Water Quality Data

XIV. Wastewater Needs in the CRRSCo Planning Area

The following compendium summarizes wastewater master plans that were previously developed for CRRSCo members. Cities whose master plans were reviewed include: 1) Bullhead City, AZ; 2) Lake Havasu City, AZ; 3) Buckskin Sanitary District, La Paz County, AZ; 4) Town of Parker, AZ/Colorado River Indian Tribe; 5) Fort Mojave Indian Tribe; 6) Town of Quartzsite, AZ; 7) City of Yuma, AZ; 8) Clark County, NV/Town of Laughlin, NV; and 9) City of Blythe, CA.

XV. CRRSCo Member Rate Structures

XVI. Descriptions of Relevant Funding Programs

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

III. WATER QUALITY ISSUES IN THE LOWER COLORADO RIVER

V. CRRSCo PLANNING AREA WASTEWATER NEEDS ASSESSMENT

CRRSCo PLANNING AREA WASTEWATER IMPROVEMENTS COSTS

PRIORITIZED IMPLEMENTATION PLAN

LIST OF FIGURES

II. BACKGROUND

III. WATER QUALITY ISSUES IN THE LOWER COLORADO RIVER

IV. CRRSCo PLANNING AREA

V. CRRSCo PLANNING AREA WASTEWATER NEEDS ASSESSMENT

VI. CRRSCo PLANNING AREA WASTEWATER IMPROVEMENTS COSTS

PRIORITIZED IMPLEMENTATION PLAN