Mojave Water Agency
Water Supply Reliability and Groundwater Replenishment Program

CHAPTER 2: PROJECT PURPOSE AND NEED

2.1 Approach to Needs Analysis

Projects are a response to purposes and needs, and their evaluation must take place in the context of a well defined purpose and need. In analyzing the need for a proposed project, it is critical to:

- Define the goal of the project;
- Demonstrate that the goal of the project is not currently being met (if goals are being met, then there is no need for the project);
- Define the magnitude of the discrepancy between goal and the current condition (the importance of the project);
- Identify the factors that are responsible for not meeting the goal (the causes of the problem); and
- Based on these factors, define the criteria for formulation and evaluation of alternatives.

Following this logic, it is then possible to develop a series of alternatives to meet project needs and solve problem associated with these needs. The planning criteria provide a basis for initial screening of alternatives, selection of alternatives to carry forward for detailed evaluation, for refining alternatives, and for ensuring that a full range of feasible alternatives are considered.

The Water Supply Reliability and Groundwater Replenishment Project is intended to be a cooperative project, potentially involving a number of water agencies in water exchanges and water banking. In particular, MWA and the Metropolitan Water District of Southern California (Metropolitan) have undertaken a demonstration project to determine how Metropolitan's State Water Project (SWP) supplies may be delivered via Silverwood Lake to recharge areas in the Mojave River and to recharge facilities at Hodge, Lenwood, and Daggett. MWA and Metropolitan are cooperating in the development of data for this EIR. Assuming that Metropolitan would be one of MWA's potential partners, the EIR addresses MWA's purpose and needs and Metropolitan's purpose and needs. Because Metropolitan is an umbrella agency for its 27 member agencies, the discussion of Metropolitan's purpose and needs would be generally applicable to these individual agencies.

2.2 MWA

2.2.1 MWA Purposes

As noted in Chapter 1 (Introduction), MWA's fundamental goal is to manage declining groundwater levels in the Mojave Basin, Lucerne Valley, El Mirage Basin, and Morongo Basin/Johnson Valley. MWA is obligated under this mandate to attempt to reduce and/or reverse the regional long-term and unsustainable trend towards groundwater overdraft. Under its authorizing legislation, and California Water Code Section 79562.5(b), which outlines four elements of integrated water management planning, MWA is to manage to accomplish four general objectives:

- Water supply,
- Groundwater management,
- Ecosystem restoration, and
- Water quality

2.2.2 Existing Conditions and Constraints: Water Supply, Water Use in the Mojave Water Agency Service Area

2.2.2.1 Natural and Supplemental Water Supply

The Mojave Basin is a desert separated from the more temperate coastal environment of the Los Angeles Basin by the San Gabriel and San Bernardino mountains, which reach elevations near 10,000 feet above mean sea level. Storms approaching the California coast from the west drop most of their moisture on the western slopes of the mountains, and average annual precipitation at Victorville (about 10 miles north of the crest of the mountains) is about 6.9 inches, about 40% of the average annual precipitation falling in the Los Angeles Basin.

The MWA service area consists of two major drainage basins: the Mojave River Basin and the Morongo Basin/Johnson Valley area (Morongo Basin). The Mojave River Basin encompasses about 3,800 square miles, much of which receives less annual precipitation than Victorville. Hot, dry, and windy conditions create high evapotranspiration rates throughout the basin, and most of the about 800,000 to 1,000,000 acre-feet of annual precipitation in the basin evaporates directly or is taken up by plants and transpired. This is also true for the Morongo Basin. Given unreliable surface water supplies, producers in the MWA service area rely on groundwater, which is derived primarily from recharge via the Mainstem Mojave River, from local washes, and from groundwater migrating downslope from the mountains to the south and southwest (mountainfront recharge).

The Mojave River and the smaller drainages to the Morongo Basin are dry during most months of most years, and surface flow is an unreliable source of water except in infrequent intense storm periods. As a result, water users in the MWA service area rely almost entirely on groundwater, which since 1978 has been periodically supplemented by deliveries of water

from the State Water Project (SWP). The large regional aquifer which underlies and is adjacent to the Mojave River aquifer receives water via runoff that concentrates and infiltrates along local washes along the interfaces at the mountain front, but this constitutes only about 20% of total infiltration to the basin, or about 13,000 acre-feet per year on average (USGS 2001). This supply moves slowly through the basin and USGS (2001) notes that water in the regional aquifer under the Mojave River aquifer first entered the basin about 20,000 years ago. There is some documented recharge of the Regional Aquifer from the River Aquifer, and this has accelerated as Regional Aquifer overdraft has lowered water levels. Throughout the MWA service area, natural groundwater replenishment from sources other than the Mojave River is therefore slow and only about 20% of average annual replenishment. The regional aquifer receives replenishment from the Mojave River.

A comparison of average annual supply and current levels of consumptive use within MWA's service area (2004 PEIR Section 3.2) shows that year 2000 consumptive use exceeded average annual water supply from natural sources by 42,300 acre-feet. That is, under current conditions, MWA would need to import 42,300 acre-feet of supplemental water per year to ensure that consumptive uses for water were met without net groundwater overdraft.

MWA has access to various supplemental water supplies through the SWP. First, MWA has a fixed allocation of SWP supply under its contract with the Department of Water Resources. This so-called "Table A" allocation is 75,800 acre-feet per year. The actual amount of Table A water available in any year may be lower, depending on weather in Northern California. Average annual SWP supply is currently estimated at 58,400 acre-feet per year.

Second, MWA may purchase additional supplies from the SWP. These additional supplies, generally available only in wet years and in the winter-spring, become available in two ways. First, the Article 21 water program allows a contractor to take delivery of water over the approved and scheduled Table A amount. Second, SWP contractors that use carryover (re-scheduled) storage capacity at the SWP San Luis Reservoir near Los Banos must take delivery of these supplies (or lose them) if natural runoff into San Luis Reservoir causes the reservoir to fill or spill. Again, this generally occurs during wet years, and supplies are available for only a short term. Carryover supplies may be acquired via transfer or exchange.

Average water supply available from natural sources and MWA's Table A SWP allocation is 123,900 acre-feet per year for the period 2000-2020. If it is feasible to acquire, import, and recharge Article 21 and/or carryover (rescheduled) supplies in wet years during the next 15 years, an additional 100,000 to 150,000 acre-feet of supply might be realized over this period of time.

2.2.2.2 Current and Projected Consumptive Use

The 2004 Regional Water Management Plan and its 2004 PEIR document existing use of water supplies from all sources, by area and project use for the period from 2005 through 2020. These projections reflect several key trends:

- Population growth from 1990 to 2000, while substantial, was marginally lower than projected in the 1994 Regional Water Management Plan;
- During the same period, declines in agricultural water use more than offset increases in urban water use.

Population projections for 2000 through 2020 were based on actual 2000 populations and on data provided by the Southern California Association of Governments (SCAG). The potential for variable agricultural consumptive use was accounted for by assuming (a) no change in agricultural consumptive use as projected in 2000 (high estimate) and (b) a 5% per year decrease in agricultural consumptive use until a balance of production rights and available supply was reached. These projections show an annual increase in population of 2.7% in the Mojave Basin Area and 2.6% in the Morongo Basin Area. Based on these population projections, the 2004 Regional Water Management Plan projected water use for agriculture and urban purposes, using two agricultural use scenarios (Table 2-1).

Table 2-1. Current and Projected Consumptive Use of Water in MWA's Service Area, 2000-2020 under two different assumptions about agricultural consumptive use. (Source: 2004 Regional Water Management Plan).

DEMAND CATEGORY	AVERAGE ANNUAL DEMAND IN ACRE-FEET				
	2000	2005	2010	2015	2020
High Demand Estimate (Year 2000 Level Agricultural Water Use)					
Urban (Mojave Basin)	70,300	79,800	87,300	96,100	107,600
Urban (Morongo Basin)	2,700	3,100	3,200	3,700	4,000
Agricultural	34,900	34,900	34,900	34,900	34,900
TOTAL	107,900	117,800	125,400	134,700	146,500
Low Demand Estimate (5% per year Decline In Agricultural Demand until supply = production rights)					
Urban (Mojave Basin)	70,300	79,800	87,300	96,100	107,600
Urban (Morongo Basin)	2,700	3,100	3,200	3,700	4,000
Agricultural (low)	34,900	32,400	21,400	15,300	12,500
TOTAL	107,900	115,300	111,900	115,100	124,100

2.2.2.3 Supply Surplus and Deficit, 2000 - 2020

An estimate of supply surplus and deficit can be made under a set of relatively simple assumptions:

- Consumptive use would be as shown on Table 2-1;
- Consumptive use would be met with natural supply and SWP supplemental supply;

- MWA would import SWP supplemental supplies to the extent needed to achieve a balance of supply and demand;
- Average annual SWP supplies would be available over the period 2005 through 2020, although there would be some variation in supply availability, and
- No overdraft would occur.

The assumption of no overdraft is essential in determining the net supply versus consumptive use water balance. Overdraft is simply water that must be replaced at a later date; assuming no overdraft therefore assumes that available supplies would be applied to meet the goals and objectives of the 1996 adjudication, which is to bring the system into a sustainable balance. Given these assumptions, a net water balance for MWA's service area can be projected (Table 2-2). Table 2-2 reflects four different planning scenarios related to supply and consumptive use:

- Scenario 1: Average annual natural supply and average annual SWP supply, with high agricultural consumptive use;
- Scenario 2: Average annual natural supply and average annual SWP supply, with low agricultural consumptive use;
- Scenario 3: Average annual natural supply and reduced average annual SWP supply due to multiple drought years, with high agricultural consumptive use; and
- Scenario 4: Average annual natural supply and reduced average annual SWP supply due to multiple drought years, with low agricultural consumptive use.

These scenarios provide a good estimate of the potential range of supply-consumptive use relationship.

The water balance analysis (Table 2-2) suggests that, if MWA is able to take all of its average annual SWP supply, there is a potential for substantial annual surplus to be available between 2005 and 2020, if the current trend towards declining agricultural water use continues. Under all other basic supply-consumptive use scenarios, there is a net supply deficit, which must be addressed via (a) increased supply, (b) reduced consumptive use, or (c) continued groundwater overdraft.

Table 2-2. Water balance (supply versus projected consumptive use) for MWA's service area, 2005 through 2020, based on four planning scenarios. Consumptive use from Table 2-1.

ELEMENT	SUPPLY/CONSUMPTIVE USE IN ACRE FEET BY YEAR			
	2005	2010	2015	2020
Scenario 1: Average Annual Supply + High Agricultural Consumptive Use				
SWP Average Annual	58,400	58,400	58,400	58,400
Natural Supply	65,500	65,500	65,500	65,500
Consumptive use	-117,800	-125,400	-134,700	-146,500
SURPLUS (+) OR DEFICIT (-)	**+6,100**	-1,500	-10,800	-22,600
Scenario 2: Average Annual Supply + Low Agricultural Consumptive Use				
SWP Average Annual	58,400	58,400	58,400	58,400
Natural Supply	65,500	65,500	65,500	65,500
Consumptive Use	-115,300	-111,900	-115,100	-124,100
SURPLUS (+) OR DEFICIT (-)	**+8,600**	**+12,000**	**+8,800**	-200
Scenario 1: Drought Reduced Annual Supply + High Agricultural Consumptive Use				
SWP Drought Reduced Supply	43,200	43,200	43,200	43,200
Natural Supply	65,500	65,500	65,500	65,500
Consumptive use	-117,800	-125,400	-134,700	-146,500
SURPLUS (+) OR DEFICIT (-)	-9,100	-16,700	-26,000	-37,800
Scenario 1: Drought Reduced Annual Supply + Low Agricultural Consumptive Use				
SWP Drought Reduced Supply	43,200	43,200	43,200	43,200
Natural Supply	65,500	65,500	65,500	65,500
Consumptive Use	-115,300	-111,900	-115,100	-124,100
SURPLUS (+) OR DEFICIT (-)	-6,600	-3,200	-6,400	-15,400

Consistent with the Mojave Water Agency Act that established MWA, MWA's 2004 Regional Water Management Plan provides for the continued and expanded implementation of 14 water demand management measures:

- Water survey programs for single-family and multi-family customers,
- Residential plumbing retrofit,
- System water audits, leak detection, and repair,
- Metering and commodity rates for new connections and retrofit of existing connections,
- Large landscape conservation programs and incentives,
- High-efficiency washing machine rebate programs,
- Public information programs,
- School education programs,
- Conservation programs,
- Wholesale agency programs,
- Conservation pricing,
- Water conservation,
- Water waste prohibition,
- Residential ultra-low-flush toilet replacement programs

As noted in the 2004 Regional Water Management Plan, responsibility for implementation of these programs lies with the various purveyors of drinking water supplies within MWA's service area. To date, member agencies have implemented numerous aspects of the above programs. The potential reductions in consumptive demand associated with the full implementation of the 14 water demand management programs is not precisely predictable, but the goal of these programs is to reduce per capita consumptive use by 10 percent by 2010 and 15 percent by 2015 (5 percent in the Morongo Basin). Accomplishment of this goal would (a) substantially increase net surplus supply availability under Scenario 2 (Table 2-2) and (b) increase the potential for supply surplus under other operating scenarios. Sometime after 2020, however, available supply and consumptive use would be balanced even under the most favorable supply-consumptive use scenario (Scenario 2, Table 2-2).

As noted in the discussion of supplemental water supplies, MWA could have access to additional supplies from the State Water Project, including Article 21 supplies and supplies made available as a result of carryover (rescheduled) water in San Luis Reservoir. These supplies would be available intermittently.

2.2.3 Constraints on MWA's Water Supply

MWA's ability to obtain and use supplemental supplies from the SWP is affected by both cost and the ability to recharge supplies into the regional and Mojave River aquifer. These factors are discussed below.

2.2.3.1 Cost

The SWP variable cost (the cost to transport water from the SWP facilities in the Sacramento-San Joaquin Delta at Tracy to MWA) is approximately $160 per acre-foot (2004 Regional Water Management Plan). This is the cost of energy and operations only. Not including costs for recharge facility operations and management, the actual SWP supplemental supply delivered to subarea producers in 2000 was 11,362 acre-feet, at a cost of $2,274,400. The cost to fully offset the year 2000 deficit of 42,300 acre feet (consumptive use minus natural supply) would have been $8,460,000. The cost to convey 100% of MWA's 75,800 acre-foot SWP contract supply (if it were available) would be $12,128,000.

The costs associated with addressing balance of supply and consumptive use pales when compared to the cost of restoring groundwater levels to pre-1940 levels. This would require the import of about 2.5 million acre-feet of water in excess of consumptive use. Over a 25-year period, this would mean that MWA would need to import 100,000 acre-feet per year in excess of the 42,300 acre-feet per year needed to meet current consumptive uses. Even if adequate supply and recharge capacity was available, the cost to address long-term overdraft, at an energy cost of $160/acre-foot, would be $16,000,000 per year for 25 years or a total of $400,000,000.

2.2.3.2 Limitations on recharge

Assuming that supplies could be purchased and transported to MWA, MWA's ability to recharge them for later use is further constrained by the limited pipeline and recharge facilities. MWA has two existing primary systems for transport and recharge: The Mojave River Pipeline and the Morongo Basin Pipeline. Capacities of these existing MWA facilities are shown on Table 2-3. Because much of the active recharge at existing facilities is associated with recharge to the Mojave River itself, these nominal capacities are affected by flow in the river. For example, in 2005, flows in the Mojave River would have reduced MWA's ability to recharge at Hodge and Daggett, where recharge facilities were inundated by natural flows. Artificial recharge may therefore be constrained during the years when it is wet in both northern California and southern California, as it was in 2005. Wet conditions in northern California do not necessarily correspond to wet conditions in southern California, and recharge is likely to be available in the MWA service area at many times when there are wet conditions in the north.

The magnitude of the existing facility constraints on MWA ability to transport and recharge supplemental supplies in a above-normal year can be illustrated using data from the California Department of Water Resources for the year 2000 (DWR Operations 2005). In 2000, SWP Table A allocations were about 90% of the nominal Table A allocation. Also, 308,257 acre-feet of Article 21 water were made available. In addition, about 220,000 acre-feet of extended carryover and carryover supply was stored in San Luis Reservoir. An estimate of MWA facility constraints can be made making the following assumptions (Table 2-2):

- MWA would take its full Table A allocation (0.90 x 75,800 = 68,220 af) in 12 equal monthly deliveries of 5,685 acre-feet per month;
- MWA would purchase and take delivery of 10% of the Article 21 water available, in three fall-winter months at a rate of 10,000 acre-feet per month. Article 21 water is not absolutely tied to Table A allocations and it is reasonable to assume that in a 75% year, MWA could have access to this water;
- San Luis would be filled and MWA and/or its partner Metropolitan would have substantial carryover at San Luis, to be delivered in a period of 2 winter months at a rate of 11,000 acre-feet per month;
- Deliveries to the Mojave River Mainstem via release from Lake Silverwood would be constrained by the need to protect the endangered arroyo toad, and releases from Lake Silverwood would be limited to the five months from September 15 through February 15; and
- Actual ability to deliver supplies to recharge would be approximately 80% of the rated facility capacity shown on Table 2-3 due to maintenance and repair, and further reduced by 1,000 acre-feet per month in winter months when surplus Article 21 and/or carryover water might be available.

Table 2-3. Existing MWA facilities for transport and recharge of water (monthly capacity calculated as annual capacity in 2004 Regional Water Management Plan divided by 12.

FACILITY AND DESCRIPTION	MONTHLY CAPACITY
Transport-Recharge System 1: Mojave River Pipeline (94 cfs)	
AVEK Recharge, Recharge basin for power plant	115 acre-feet
Hodge Recharge Basin	750 acre-feet
Lenwood Recharge Basin	750 acre-feet
Daggett Recharge Basin	1400 acre-feet
Subtotal for Mojave River Pipeline	**3015 acre-feet**
Transport-Recharge System 2: Morongo Basin Pipeline (110 cfs)	
Rock Springs Recharge Basin, recharge directly to the Mojave River	3,333 acre-feet
Warren Valley, recharge in Morongo Basin	290 acre-feet
Subtotal for Morongo Basin Pipeline	**3,623 acre-feet**
Mojave River Mainstem; Releases from Lake Silverwood	
Recharge directly to the Mojave River Mainstem, September 15 through February 15, with ramping of flows in 50 cfs increments, average 250 cfs, estimated 25,000 acre-feet per 5 month period.	**5,000 acre-feet**
TOTAL (Maximum)	**11636 (Sept 15 -Feb 15) 6636 (Mar - Sep)**

Table 2-4. Estimated potential SWP supplemental supply for the year 2000.

MONTH	SOURCE AND SUPPLY (ACRE-FEET)			TOTAL	RECHARGE CAPACITY (at 80% of rated capacity)	CAPACITY DEFICIT
	Table A	Article 21	San Luis Carryover			
JAN	5,685	10000	0	15,685	8309	7,376
FEB	5,685	0	11000	16,685	8309	8,376
MAR	5,685	0	11000	16,685	4308	12,337
APR	5,685	0	0	5,685	5308	377
MAY	5,685	0	0	5,685	5308	377
JUN	5,685	0	0	5,685	5308	377
JUL	5,685	0	0	5,685	5308	377
AUG	5,685	0	0	5,685	5308	377
SEP	5,685	0	0	5,685	5308	377
OCT	5,685	0	0	5,685	9309	0
NOV	5,685	10000	0	15685	9309	6,376
DEC	5,685	10000	0	15685	8309	7,376
TOTAL	68,220	**30,000**	**22000**	**120,220**	**79,701**	**44,103**

Under a reasonably conservative set of operations assumptions, lack of recharge facilities alone would therefore limit MWA's ability to import and recharge about 37% of the potentially available SWP supply in a marginally above-normal. In a wet year, with SWP Table A allocations of 75,800 acre-feet (6,316 acre-feet per month) the deficit would be more

substantial. In short, additional recharge capacity is necessary for MWA to fully utilize its SWP Table A allocations, in addition to using available Article 21 water and other available supplies.

2.2.4 Historic Groundwater Overdraft

The natural groundwater recharge for the MWA service area is highly variable, and responds to year-to-year variation in precipitation and to longer-term trends in regional precipitation. Wet-dry cycles create periods of high and low recharge in the Mojave River aquifer. For example, the wet decade of 1940-1950 resulted in natural recharge somewhat in excess of water use but the subsequent 50 years have been dryer with the exception of brief wet periods, and natural recharge has generally been lower than water use (USGS 2001). As a result, net groundwater storage in the MWA storage area declined by about 2.5 million acre-feet from 1950 to 2000 (USGS 2001), with the greatest overdraft occurring in the Centro and Baja portions of the MWA service area (USGS 2001), where the largest cities have been developed (Victorville, Hesperia, Adelanto, and Apple Valley). Overdraft has resulted in declining groundwater levels. Since the 1940's, water levels have declined by from 50 to 75 feet in the Alto subarea and in the Centro and Baja subareas by about 100 feet (USGS 2001).

2.2.5 Geology and the Interconnections of Groundwater Basin Subareas

The Mojave Basin is a seismically active area adjacent to the San Andreas Fault and associated smaller fault zones. As a result, the subareas of the groundwater basins in the MWA service area are affected by a complex of local fault zones, rock intrusions, and areas of uplift. These affect the slow migration of groundwater from subarea to subarea, but there is general connectivity of subarea regional groundwater basins. Given that infiltration rates to the regional aquifer are relatively low and movement of groundwater within the regional aquifer is slow, it is thus the Mojave River aquifer that provides the major natural connection among basin subareas. Flow in this aquifer is forced to the surface at the Narrows in Victorville, becomes surface flow for a short reach, becomes groundwater flow again below the Lower Narrows, and the resurfaces at Afton Canyon. Since 1895, July streamflow at the USGS stream gauge at the Lower Narrows has declined from about 30-40 cfs in the early 20th century to about 2-7 cfs in 1995-2004 (2004 PEIR, Section 3.2-4).

2.2.6 1996 Mojave Basin Area Adjudication

MWA was formed to manage the declining groundwater levels in its service area, with its primary tool for management being the import of supplemental water supplies from the State Water Project. From 1978 to 2001, MWA imported approximately 150,000 acre-feet of SWP supply, equivalent to about 1.4 years of year 2000 total consumptive use. As noted in the 2004 PEIR, the native waters of the Mojave River and underlying groundwater are insufficient to meet current and projected future consumptive uses. Local agency concerns related to this fundamental water management issue led to a 1996 water rights adjudication, which established local water rights and defined MWA responsibilities in terms of acquisition

and delivery of supplemental water supplies. A "Physical Solution" to the problem was established as "a fair and equitable basis for satisfaction of all water rights in the Mojave Basin Area."

The physical solution divided water producers in the Mojave Basin Area into five subareas; each subarea and producer was then allocated a "Free Production Allowance" derived from historic production which was to decline by 5% per year until the available production in each subarea was in balance with the available water supply. If a producer within a subarea utilized more than its share of the Free Production Allowance, the producer would incur a "Replacement Obligation," which would be met through the purchase of supplemental water from the Watermaster (initially designated as MWA). MWA was then obligated to provide supplemental supplies at a reasonable cost. The physical solution further provided for phasing in of the monetary obligations necessary to obtain supplemental water. The effect of the 1996 water rights adjudication is thus to provide a mechanism by which, at some point in the future:

Consumptive use = Natural supply + Supplemental supply

At some point in the future, then, the 1996 water rights adjudication may help eliminate on-going overdraft through conservation and the purchase of supplemental supplies; but there is no provision for addressing the long-term deficit/overdraft of about 2.5 million acre-feet.

2.2.7 Distribution of Supply

MWA is obligated under the 1996 water rights adjudication to provide supplemental water to help subarea producers meet Replacement and Makeup Obligations. The adjudication allows MWA to pre-purchase supplies and place them in groundwater subareas for subsequent use. It is thus necessary for MWA to have facilities for distribution and recharge that allow deliveries to groundwater in proportion to consumptive use for supplies to meet Replacement and Makeup Obligations.

2.2.8 Appropriately-Sited Facilities for Extraction of Groundwater

Although there is substantial capacity for groundwater recharge in the Mojave River Mainstem between Silverwood Lake and the Narrows, routine recharge in this reach is constrained by limited extraction capacity. Water recharged into this reach of the river percolates into the shallow Mojave River Aquifer and spreads downstream as an underground river before it reaches the Narrows, where an area of uplifted rock forces the water to the surface. The river then flows downstream through the Narrows before percolating again into groundwater.

Because MWA is obligated under the 1996 adjudication to supply water in proportion to the demands for water to meet "Replacement and Makeup Obligations," it is important that recharge be managed in a way that ensures a balanced distribution of recharged supplies, and

that MWA member agencies be able to extract supplies in proportion to their water supply needs. In addition, it is important for MWA to ensure that water purchased under MWA Ordinance 9 of the Improvement District "M" Agreement by its member agencies is available to them.

In the Mojave River reach south of the Narrows, there is inadequate extraction capacity along the river. Thus, water recharged in this reach will eventually spill through the Narrows, creating an uneven distribution of supply. In addition, if supplemental water is provided by an outside agency such as Metropolitan as part of a water banking and water exchange program, the loss of this water to reaches downstream would mean that return of the water would require costly wells and pipelines between downstream sites and the California Aqueduct which would be used to return banked supplies to Metropolitan. Without additional extraction facilities south of the Narrows to provide for return of banked water, MWA's ability to use this reach of the river for on-going recharge would be limited and the net difference between available supply and MWA's capability of importing and recharging this supply would increase from the level shown on Table 2-4.

2.2.9 Local Issues of Concern

In addition to issues related to cost and the equitable distribution of the benefits of water exchange and banking programs, there is strong local concern regarding export of groundwater from the MWA service area, even if it is water previously provided by another agency under a water banking/exchange agreement. Because of prohibitions against export within the Mojave Basin Area Judgment, it will be necessary to review the program with the Presiding Judge. Pumping of groundwater for export to another basin is a concern for a number of reasons. First, such pumping may occur in a dry period and result in locally-lowered groundwater levels, resulting in higher local pumping costs. Second, use of groundwater for exchange may result in changes in groundwater quality. If water recharged to the groundwater basin is of poorer quality than then the indigenous groundwater, and a mix of this water is pumped to provide returns from a groundwater bank, then there may be a net degradation of local groundwater. For these and other reasons, there is a need to design banking and exchange programs that minimize the use of pumped groundwater as a part of banking and exchange.

2.2.10 Ecological Restoration

The 1996 adjudication recognizes a need to address declining groundwater levels and their effects on riparian vegetation and the wildlife communities that depend on them. This is particularly an issue in the mainstem north of Mojave Forks Dam, the Narrows, and Lower Narrows, where declining water levels have affected the quality of riparian habitats.

2.2.11 Summary

The 1996 water rights adjudication provides several mechanisms by which local water producers and MWA may reduce the rate of overdraft and achieve a balance of water supply and consumptive use. However:

- Both funding and lack of off-river recharge facilities limit the potential to (a) import supplies from the SWP and (b) recharge them to replenish overdrafted groundwater. As a result, MWA has not historically imported its entire available Table A supply.
- Existing recharge in the MWA service area is focused on recharge of the Mojave River aquifer and the Warren Valley, and this may be constrained by (a) flood flows in the Mojave River during the wet years when supplemental SWP supplies are most readily available and (b) by lack of adequate extraction facilities.
- Even when supplemental SWP supplies are available, MWA may not be able to import them and utilize them because of these constraints.
- In addition, there is a need to minimize the use of pumped groundwater as a part of banking and exchange.
- Finally, there is a need to meet riparian enhancement goals in areas where declining groundwater levels have affected riparian forest along the river.

2.3 Metropolitan

~~Like MWA, Metropolitan's fundamental purpose is to provide supplemental water supplies to meet the needs of all customers within its service area. Metropolitan determines these overall needs and the need for storage options to provide supplemental dry-year supplies from programs such as water banking based on an analysis of demand, feasible conservation to reduce demand, and available supply from existing and projected sources. Metropolitan evaluates these issues using an integrated model that projects normal demand based on the most recent and reliable official demographic information from regional planning agencies. The model then accounts for projected conservation and rationing during drought to project dry-year demand. Metropolitan then evaluates existing, projected, and target supply from six major resource programs: (1) water recycling and groundwater recovery, (2) storage within the Metropolitan service area, (3) State Water Project, (4) Colorado River, (5) Central Valley transfers and groundwater banking, and (6) ocean desalination. Supply projections from each of these resources are based on historic data adjusted to reflect known trends. Three categories of supply are evaluated: firm existing supply; projected supply from currently planned programs, and target supplies from each resource area, based on the probability of developing programs in these areas in the future.~~

Like MWA, Metropolitan's fundamental purpose is to provide supplemental water supplies to meet the needs of all customers within its service area. Metropolitan determines these overall needs using a suite of planning models that evaluate projected demands, feasible conservation to reduce demands, and available supply from existing and projected sources. Metropolitan's demand projections are based on the most recent and reliable official

demographic information from regional planning agencies. Metropolitan evaluates supplies from six major resource programs: (1) water recycling and groundwater recovery, (2) storage within the Metropolitan service area, (3) State Water Project, (4) Colorado River, (5) Central Valley transfers and groundwater banking, and (6) ocean desalination. Supply projections are based on existing supplies; projected supplies from currently planned programs, and target supplies from each resource area, based on the probability of developing programs in these areas in the future.*

To ensure a reasonable probability of meeting minimal (post-conservation) demands, the sum of these projected supplies should equal or slightly exceed the post-conservation demand for defined future dates. From an urban perspective, enhanced management of wet-year supplies is also critical to ensuring that minimum needs are met during dry years.

To ensure a reasonable probability of meeting minimal (post-conservation) demands, the sum of these projected supplies should equal or slightly exceed the post-conservation demand for defined future dates. From an urban perspective, enhanced management of wet-year supplies is also critical to ensuring that minimum needs are met during dry years.

Metropolitan has focused attention on programs to better manage available wet-year supplies and better conserve supplies in all years, so that available supplies may be stretched and set aside for dry-year use. In recent years, Metropolitan has added 800,000 acre-feet of storage capacity at Diamond Valley Lake and is working with its 26 member agencies to enhance in-basin groundwater storage. Because this in-basin storage will be less than 60 percent of the needed additional storage, Metropolitan has also embarked on a number of groundwater banking projects, such as the Arvin Edison Water Bank and Kern Delta Water Banking Program. In addition, during the last decade, Metropolitan and its member agencies contributed about $190 million to conservation programs involving retrofitting more than 4 million plumbing fixtures, generating a permanent reduction in demand of about 560,000 acre-feet per year. Metropolitan projects that its programs will save an additional 500,000 acre-feet per year by year 2020. In calculating the need for additional dry-year supply, Metropolitan reduces gross projected future demand to reflect the additional conservation efforts that will be undertaken between now and 2020.

Since 1988, Metropolitan has conducted annual analyses of water supply and water quality reliability, reflecting changes in demand such as the 1987 to 1992 drought, which altered some patterns of water use in Southern California permanently. Using population projections from regional planning agencies and DWR, Metropolitan's annual demand projections take into account demographic projections (population growth and the distribution of population in the service area) and include consideration of the need to blend supplies from a variety of sources to meet water quality standards. Metropolitan reduces its estimates of demand based on trends in conservation and projected water savings from continued implementation of existing programs and implementation of new programs.

**. This simplification of Metropolitan's methods for projecting water demand and supply reflects the latest language from official Metropolitan sources.*

Based on this analysis, and projecting that demands will be reduced during dry years by an *additional* 13 percent *per capita* or 500,000 acre-feet per year over current levels of conservation, Metropolitan has determined that it will need approximately 4.6 million and 5.08 million acres feet of dry year supply in 2010 and 2020 (respectively). This includes municipal, industrial, and agricultural demands. Table 2-5 shows that current yield from all water supply sources, assuming full implementation of all programs, is approximately 3,494,000 acre-feet.

Table 2-5 Existing and Target Annual Dry-Year Yield from All Sources Metropolitan Water District of Southern California Year 2020 Projections

YEAR	Existing Annual Yield (Acre-Feet)	New Program Annual Yield (Acre-Feet)	Net Annual Dry-Year Supply (Acre-Feet)	Dry Year Need	Net Dry-Year surplus or Deficit
2010	3,494,000	1,444,000	4,938,000	4,600,000	+338,000
2020	3,494,000	1,444,000	4,938,000	5,080,000	-144,000

* Sources include State Water Project, Colorado River, in-basin storage, groundwater recovery, Central Valley banking, local surface and groundwater, and the Los Angeles Aqueduct.

As Table 2-5 indicates, Metropolitan may meet all of its 2010 dry-year needs if it implements the proposed supply enhancement and storage/banking programs, but supply will fall slightly short of dry-year demands by 2020, even with all planned and projected programs implemented.

In addition to a projected dry-year supply deficit of 144,000 acre-feet by 2020, Metropolitan and its member agencies utilize local groundwater supplies in-lieu of SWP supplies, and there is often significant capacity to store groundwater within Metropolitan's service area. Metropolitan's ability to deliver water to groundwater storage is often constrained by pipeline capacity and utilization rates and by local agency use of recharge basins. As a result, member agencies may utilize local groundwater, with resulting declines in groundwater levels. Seasonally and annually fluctuating groundwater levels in, for example, the coastal basins of Los Angeles and Orange Counties often result in groundwater levels well below the level of adjacent sea water, with resulting seawater intrusion. Management of groundwater in Metropolitan's service area would therefore be enhanced by actions which would allow local agencies to take additional supplemental supplies and either (a) recharge them into groundwater or (b) use them in-lieu of extracting groundwater. Either of these options would (a) reduce seasonal and annual declines in groundwater and the costs of extracting groundwater from deeper levels and (b) reduce sea water intrusion and resulting degradation of coastal groundwater quality.

2.4 Project Planning Criteria

Potential projects must be formulated and evaluated in terms of their ability to meet the needs of the various entities involved in planning them. To meet the MWA needs identified above, potential projects should be formulated based on their ability to address:

- **Net enhancement of MWA ability to import and utilize SWP supplies.** Projects should, if feasible, result in the development of facilities and of water management agreements that will (a) increase MWA facility capacity to take and recharge SWP supplies and (b) result in an actual increase in the amount of water available for recharge.
- **Water cost.** Projects should be formulated to minimize MWA's costs for supplemental water.
- **Recharge capacity**. Projects should result in enhancements of recharge capacity, with an emphasis on off-stream capacity in areas where overdraft has been high and MWA deliveries to meet Makeup Obligations can be made.
- **Distribution of benefits.** Projects should be formulated to provide benefits throughout the MWA service area.
- **Extraction capacity.** Projects should provide appropriately-sited extraction capacity so that exchanged and banked water can be delivered to MWA users and/or returned to MWA exchange/banking partners in a timely and efficient manner.
- **Minimization of Groundwater Pumping.** To the extent feasible, exchange and banking programs should not rely heavily on pumping and transport of groundwater supplies from MWA to exchange/banking partners. MWA should use its SWP entitlements for exchange/banking to the extent feasible.
- **Riparian Restoration**. Projects should include components that will enhance the potential for historic riparian areas to recover.

To meet Metropolitan's needs in evaluating potential water exchange and water banking programs, potential projects should be formulated based on their ability to address:

- **Program reliability and magnitude.** Metropolitan's management of several million acre-feet of water per year using its massive infrastructure requires that (a) cooperative programs be reliable so that water exchanges and banking can be scheduled without affecting other operations and (b) programs be adequate in scope so that the difficulties of adjusting system management are offset by the level of benefits from the program.
- **Water quality**. Water for exchange and water returned from banking programs must be of high enough quality that it is suitable for its intended uses.
- **Recharge capacity**. For banking elements of projects, soils in the banking area must be suitable for rapid recharge of the basin when water is available in wet years.
- **Proximity to the California Aqueduct**. The cost of banking and water exchanges increases significantly for projects that require extensive new facilities because the

bank site is many miles from the California Aqueduct. Both capital costs and pumping costs increase with distance from the aqueduct.

- **Ability to return banked water**. For both water banking and water exchange elements of cooperative programs, it is important that both agencies participating in banking programs have the ability to guarantee that banked water may be returned in a timely manner.