PREPARED FOR
COACHELLA VALLEY WATER DISTRICT

Coachella Valley Water Management Plan Update

FINAL REPORT

January 2012

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BUILDING A BETTER WORLD

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Engineering and Planning Consultants

COACHELLA VALLEY WATER MANAGEMENT PLAN 2010 UPDATE

Final Report

January 2012

Prepared for:

Coachella Valley Water District

Steve Robbins
General Manager-Chief Engineer

Patti Reyes
Planning and Special Program Manager

Prepared by:
MWH
618 Michillinda Ave., Suite 200
Arcadia, CA 91007

Water Consult
535 North Garfield Avenue
Loveland, CO 80537

Table of Contents

Section Name	Page Number

Table of Contents

Appendices

LIST OF TABLES

Table Name **Page Number**

LIST OF FIGURES

Figure Name **Page Number**

Executive Summary

Executive Summary

The Coachella Valley Water Management Plan was adopted by the Board of Directors, Coachella Valley Water District (CVWD) in September 2002. The goal of the Water Management Plan is to reliably meet current and future water demands in a cost-effective and sustainable manner. The Board recognized the need to update the Plan periodically to respond to changing external and internal conditions. This 2010 Water Management Plan Update (2010 WMP Update) meets that need. It defines how the goal will be met given changing conditions and new uncertainties regarding water supplies, water demands, and evolving federal and state laws and regulations.

ES-1 THE COACHELLA VALLEY

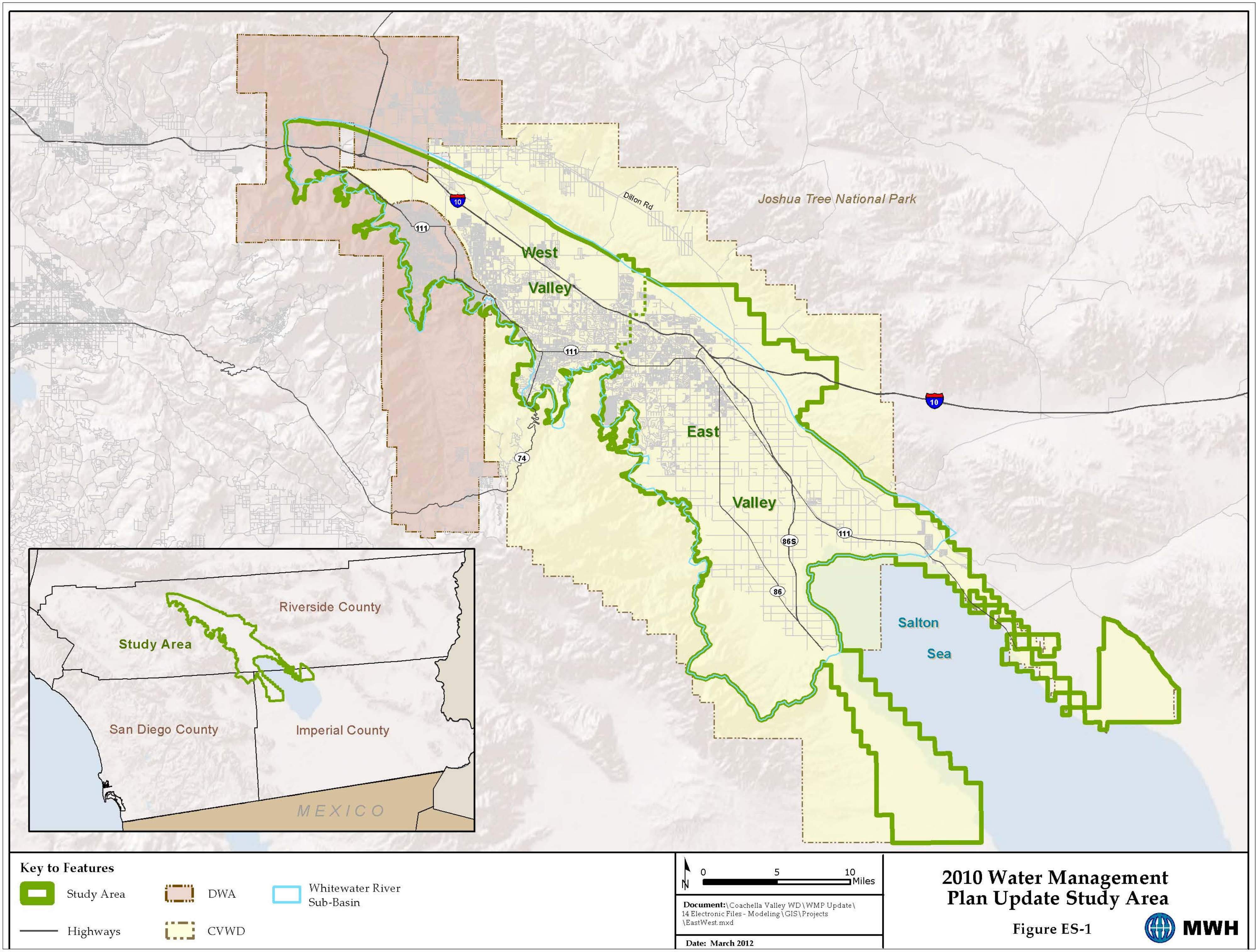
The Coachella Valley is located in the central portion of Riverside County. For purposes of this Water Management Plan, the Coachella Valley is divided into the West Valley and the East Valley. Geographically, the East Valley is southeast of a line extending from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street, and the West Valley is northwest of this line (**Figure ES-1**).

The West Valley includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells, and Palm Desert, a portion of the city of Indio, and the unincorporated communities of Sun City and Thousand Palms. The West Valley has a predominately resort/recreation-based economy. Water demand in the West Valley is supplied by several sources: groundwater, surface water from local streams, and recycled water. The East Valley includes the cities of Coachella, Indio, and La Quinta, and the unincorporated communities of Bermuda Dunes, Mecca, Oasis, Thermal, and Vista Santa Rosa. Historically, the East Valley has had an agricultural-based economy. Urban growth is occurring in the East Valley and is projected to continue in the future. East Valley water sources consist primarily of Coachella Canal water and groundwater, with a small amount of recycled fish farm effluent for agricultural uses.

The Coachella Valley's principal groundwater basin, the Whitewater River (Indio[1]) Subbasin, extends from Whitewater in the northwest to the Salton Sea in southeast. The basin has an estimated storage capacity of approximately 30 million acre-feet[2] (AF) (DWR, 1964). Water placed on the ground surface in the West Valley will percolate through the sands and gravels directly into the groundwater aquifer. In the East Valley, however, several impervious clay layers lie between the ground surface and the main groundwater aquifer. Water applied to the surface in the East Valley does not readily reach the lower groundwater aquifers due to these impervious clay layers. The only outlets for groundwater in the Coachella Valley are through subsurface outflow under the Salton Sea or through collection in drains and transport to the Salton Sea via the Coachella Valley Storm Channel (CVSC).

1 The California Department of Water Resources (DWR) assigned the name "Indio Subbasin" in its Bulletin 108. CVWD and Desert Water Agency use the designation "Whitewater River Subbasin."

2 One acre-foot (AF) is the amount of water that would cover one acre of land (approximately the size of a football field), one foot deep or about 326,000 gallons.



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Date: March 2012

2010 Water Management Plan Update Study Area

Figure ES-1

MWH

Source: DWR, ESRI, County of Riverside

ES-2 WATER MANAGEMENT IN THE COACHELLA VALLEY

Water management in the Valley began as early as 1915. With groundwater levels falling, the need for a supplemental water source was recognized for the Valley to continue to flourish.

The Coachella Valley Stormwater District was formed in 1915 followed by formation of CVWD in January 1918. CVWD's first directors quickly filed paperwork to secure rights to all unclaimed Whitewater River water, an important source for aquifer recharge. In 1918, a contract was awarded for construction of water spreading and recharge facilities in the Whitewater River northwest of Palm Springs.

CVWD next focused on obtaining imported Colorado River water. In 1934, negotiations with the federal government were completed, and plans were put in place for the construction of the Coachella Branch of the All American Canal. Construction of the Canal began in 1938, but was interrupted by World War II. The first deliveries of imported Colorado River water to East Valley growers began in 1949. The service area for Canal water delivery under the CVWD's contract with the U.S. Bureau of Reclamation (Reclamation) is defined as Improvement District No. 1 (ID-1). The impact of imported water on the Valley was almost immediate. By the early 1960s, water levels in the East Valley had returned to their historical high levels.

Although groundwater levels in the East Valley had stabilized, water levels in the West Valley continued to decline as growth occurred. Desert Water Agency (DWA) was formed in 1961 to import State Water Project (SWP) water into the Palm Springs and Desert Hot Springs areas. In 1962 and 1963 respectively, DWA and CVWD entered into contracts with the State of California for 61,200 acre-feet per year (AFY) of SWP water. To avoid the then estimated $150 million cost of constructing an aqueduct to bring SWP water directly to the Valley, CVWD and DWA entered into an agreement with the Metropolitan Water District of Southern California (Metropolitan) to exchange SWP water for Colorado River water.

Starting in 1973, the CVWD and DWA began exchanging their annual SWP allocation with Metropolitan for Colorado River water to recharge West Valley groundwater at the Whitewater River Recharge Facility. CVWD, DWA, and Metropolitan also signed an advance delivery agreement in 1984 that allows Metropolitan to store additional water in the Valley. Since 1973, the spreading facility had percolated in excess of 2.6 million AF of Colorado River water exchanged for SWP water.

By the 1980s, groundwater demand in the East Valley had again exceeded supplies, resulting in significant groundwater level decreases in some parts of the East Valley. Because relatively impervious clay layers in the Valley floor impede groundwater recharge in the East Valley, CVWD began looking for sites sufficiently far away from the main clay layer to allow groundwater recharge. In 1995, the CVWD began operating the Dike No. 4 pilot recharge facility located on the west side of the East Valley in La Quinta. The pilot successfully demonstrated the feasibility of East Valley groundwater recharge. The facility was expanded in 1998 to determine the ultimate recharge capacity at this location. In October 2009, the Thomas E. Levy Groundwater Replenishment Facility (Levy facility, formerly Dike 4) was dedicated. It has a current recharge capacity of 32,000 AFY, upgradable to 40,000 AFY.

Recycled water has been a priority water supply in the Valley since 1965. Currently, CVWD and DWA provide more than 14,000 AFY of recycled water for golf course and greenbelt irrigation purposes from four wastewater treatment facilities. While recycled water is available in the East Valley, it is not currently treated to sufficient levels for unrestricted reuse. Water conservation is also a key element of managing water demands.

ES-3 CURRENT CONDITION OF COACHELLA VALLEY GROUNDWATER BASIN

The demand for groundwater has annually exceeded the limited natural recharge of the groundwater basin. The condition of a groundwater basin in which the outflows (demands) exceed the inflows (supplies) to the groundwater basin over the long term is called "*overdraft.*" Overdraft has caused groundwater levels to decrease in significant portions of the East Valley. Groundwater levels in the West Valley have also decreased substantially, except in the areas near the Whitewater Recharge Facility where artificial recharge has successfully raised water levels.

Overdraft has serious consequences. The immediate and direct effect is increased groundwater pumping costs for all water users. With continued overdraft, wells will have to be deepened, pumps that are more powerful will have to be installed, and energy costs will increase as the pump lifts increase. The need for deeper wells and more powerful pumps will increase the cost of water for agriculture, municipalities, resorts, homes, and businesses. Continued decline of groundwater levels could result in a substantial and possibly irreversible degradation of water quality in the groundwater basin due to the intrusion of lower quality, high TDS water applied at the surface for irrigation and reduced drain flows carrying the salts out of the basin. Continued overdraft also increases the possibility of land subsidence. As groundwater is removed, the dewatered soil begins to compress from the weight of the ground above, causing subsidence. Subsidence can cause ground fissures and damage to buildings, homes, sidewalks, streets, and buried pipelines – all of the structures that make the Valley livable. Subsidence also reduces storage capacity in the aquifer. Continued overdraft would eventually stifle growth in the Valley, as it would not be possible to demonstrate that adequate water supplies exist to support growth.

The 2010 WMP Update uses a calculation of change in storage based on long-term local hydrology and imported water deliveries to estimate long-term overdraft. Since the local hydrology varies significantly from year to year, a long term average provides a better method for estimating the local inflows, which are dampened by the large storage volume of the basin. Because imported water recharge deliveries in the West Valley also vary widely from year to year, recharge is based on estimated long-term average SWP Exchange reliability rather than year-to-year values. Other inflows and outflows are estimated using the groundwater model. This approach dampens the variations in the annual change in storage and gives a more accurate indication of long-term overdraft. Based on these adjustments, the average annual overdraft for 2000 through 2009 is estimated to be 70,000 AFY. When the 2010 WMP Update was adopted in January 2012, CVWD and DWA experienced two years of very high recharge with nearly 461,000 AF recharged at Whitewater (including advanced deliveries).

ES-4 THE 2002 WATER MANAGEMENT PLAN

Continued decline of groundwater levels and ongoing overdraft is unacceptable. CVWD and DWA are charged with providing a reliable, safe water supply now and in the future. In order to fulfill obligations to Valley residents, these agencies must take action to prevent continuing decline of groundwater levels and degradation of water quality on a long-term basis. To meet responsibilities for ensuring adequate water supplies in the future, the CVWD and DWA initiated planning in the early 1990s. The comprehensive Water Management Plan developed in 2002 guides CVWD and DWA in efforts to eliminate overdraft, prevent groundwater level decline, protect water quality, and prevent land subsidence.

The 2002 Water Management Plan clearly identified the significant groundwater overdraft that had occurred over decades and, equally important, the threat of continued overdraft to the economy and quality of life in the Valley. It was based on then current projections of growth and corresponding water demand. The Plan identified the actions needed to eliminate overdraft while maintaining the quality of life and avoiding adverse impacts to the environment. The Plan area originally included the Whitewater River and Garnet Hill Subbasins. Portions of Desert Hot Springs Subbasin east of Indio and Coachella were added to the planning area for this Update, as shown in **Figure ES-1**.

ES-4.1 Goals and Objectives

The goal of the 2002 Water Management Plan is to reliably meet current and future water demands in a cost effective and sustainable manner. To meet this goal, four objectives were identified for the 2002 WMP:

1. Eliminate groundwater overdraft and its associated adverse impacts, including:
    - groundwater storage reductions
    - declining groundwater levels
    - land subsidence, and
    - water quality degradation,
2. Maximize conjunctive use opportunities,
3. Minimize adverse economic impacts to Coachella Valley water users, and
4. Minimize environmental impacts.

The 2002 WMP included five major elements:

- water conservation (urban, golf course, and agricultural),
- substitution of surface water supplies (Colorado River water, SWP water, recycled water) for urban, agricultural, and golf course uses in lieu of pumping groundwater,
- continued groundwater recharge at the Whitewater Recharge Facility and development of two new groundwater recharge facilities in the East Valley,

- increasing surface water supplies, and
- monitoring of groundwater production, levels, water quality and land subsidence.

Within each element, the 2002 WMP identified specific actions to aid in eliminating overdraft. Many of the elements of the 2002 WMP have been accomplished as described in **Section ES-4.2**.

ES-4.2 Accomplishments Since 2002

The actions to eliminate overdraft pursuant to the 2002 WMP taken by CVWD, DWA, other water agencies, municipalities, and tribes are summarized below.

ES-4.2.1 Water Conservation

A broad range of water conservation actions was included in the 2002 WMP. Most of those actions have been achieved, some ahead of schedule.

Urban Conservation

CVWD first passed a Landscape Ordinance in 2003. The ordinance was updated in 2007, and changes were made in 2009 for consistency with the State's updated model landscape ordinance. The ordinance has been adopted by nearly all Valley cities. The ordinance sets a maximum applied water allowance for new developments, requires efficient irrigation systems, specifies the use of climate appropriate plant materials, reduces applied water runoff and overflow, reduces non-recreational turf at golf courses, and mandates smart irrigation controllers on all new landscapes. The ordinance, in combination with other water conservation measures, results in a significant reduction in existing and new water use.

CVWD established an urban water conservation program in 1988. A water conservation coordinator was appointed in 2007, and the program now has a full-time staff of twelve employees. In 2009, CVWD established tiered domestic water pricing for customers based on individual water budgets. A turf buy-out partnership was established with the cities of Cathedral City, La Quinta, and Palm Desert. CVWD also provides weather-based irrigation controllers to eligible customers in participating cities. CVWD maintains water efficient demonstration gardens at the CVWD offices in Coachella and Palm Desert. CVWD sponsors well-attended semi-annual landscape workshops and tours, and creates displays for special events. CVWD produces the popular book, "*Lush & Efficient: Landscape Gardening in the Coachella Valley*," and various other publications. Analysis of water use for CVWD's 2011 Urban Water Management Plan shows water usage has declined by 18 percent compared to average usage from 1996 through 2005.

DWA offers large water users (condominiums, public parks, and businesses) comprehensive irrigation system water audits at no charge and assists in implementing recommended improvements. In partnership with CVWD and Cathedral City, DWA furnishes irrigation controllers at cost to customers. Free controllers are provided with new water meter installation. In addition, DWA recently installed artificial turf and recycled water drip-irrigation for xeriscaping at its operations center (DWA website, 2010). The City of Palm Springs also promotes water efficiency programs including landscape water training programs and rebates for water efficient toilets (City of Palm Springs website, 2010). Analysis of per capita water use for DWA's 2011 Urban Water Management Plan indicates a comparable 18 percent reduction in water use. Indio and Coachella have also implemented water conservation programs that are described in their respective Urban Water Management Plans. Their plans show 14 percent and 20 percent per capita demand reductions compared to their respective demand baselines.

Agricultural Conservation

The 2002 WMP established a goal of seven (7) percent agricultural water use reduction through conservation. Based on a comparison of the average water use per acre in the 2000 through 2002 period, agricultural water use has generally declined about 9.9 percent through 2008. While this estimate may be due in part to variations in weather conditions, crop water needs, and crop patterns, it represents a significant decrease in agricultural water use over the period. Agricultural water conservation measures included irrigation scheduling, salinity management, and irrigation uniformity evaluation programs for irrigators.

Golf Course Conservation

The 2002 WMP goal was to reduce water demand at existing courses by at least five percent by 2010 and for new courses by up to 25 percent compared to historical use by existing courses. Actual use per irrigated acre in the West Valley, where data are available, indicates a reduction of about 14 percent compared to the 2000 to 2002 average. Adoption of the 2009 Landscape Ordinance throughout the Valley is expected to reduce water use by new courses through turf limitations by about 22 percent compared to existing courses. CVWD initiated a program of monitoring golf course water use to ensure that maximum water allowances are not exceeded. A symposium for golf course operators to promote golf course water conservation is held each year.

Stakeholder Review and Input

In 2006, CVWD completed, with extensive stakeholder involvement, a Water Management Plan Implementation Program. This effort included review, evaluation, and prioritization of water conservation programs and other elements of the 2002 WMP by stakeholders with recommendations to the CVWD Board (Water Consult, 2006). The Board uses the recommendations in the Implementation Program to guide development of annual budgets.

ES-4.2.2 Additional Water Supplies

The 2002 WMP identified the need for CVWD and DWA to acquire additional water supplies to manage current and future groundwater overdraft. Supplies identified included the Colorado River, State Water Project, other transfers, recycled water, and desalinated drain water.

Quantification Settlement Agreement

In 2003, CVWD, IID, and Metropolitan, along with the State of California and Reclamation, successfully completed negotiation of the Quantification Settlement Agreement (QSA). The QSA quantifies the Colorado River water allocations of California's agricultural water contractors for 75 years and provides for the transfer of water between agencies. Under the QSA, CVWD has a base allocation of 330,000 AFY. In accordance with the QSA, CVWD has entered into water transfer agreements with Metropolitan and IID that increase CVWD supplies by an additional 159,000 AFY as shown in **Table ES-1**.

As of 2010, CVWD received 368,000 AFY of Colorado River water deliveries under the QSA. This includes the base allocation of 330,000 AFY, the Metropolitan/IID transfer of 20,000 AFY, 12,000 AFY of the IID/CVWD First transfer, and 35,000 AFY of Metropolitan/SWP transfer. CVWD's allocation will increase to 459,000 AFY of Colorado River water by 2026. After deducting conveyance and distribution losses, approximately 428,000 AFY will be available for CVWD use.

Table ES-1
CVWD Deliveries under the Quantification Settlement Agreement

Component	2010 Amount (AFY)	2045 Amount (AFY)
Base Allocation	330,000	330,000
1988 Metropolitan/IID Approval Agreement	20,000	20,000
Coachella Canal Lining (to SDCWA)	-26,000	-26,000
To Miscellaneous/Indian PPRs	-3,000	-3,000
IID/CVWD First Transfer	12,000	50,000
IID/CVWD Second Transfer	0	53,000
Metropolitan/SWP Transfer	35,000	35,000
Total Diversion at Imperial Dam	**368,000**	**459,000**
Less Conveyance Losses [1]	-31,000	-31,000
Total Deliveries to CVWD	**337,000**	**428,000**

Note:
1 Assumed total losses after completion of All-American and Coachella Canal lining projects

State Water Project

CVWD and DWA have made significant progress toward meeting the 2002 WMP goal of 140,000 AFY average delivery target (103,000 AFY to Whitewater Recharge Facility; 37,000 AFY via Mid-Valley Pipeline (MVP)) of SWP Exchange water in the Whitewater River Subbasin. CVWD's and DWA's SWP Table A Amounts[3] are used to replenish both the Upper Whitewater River and the Mission Creek subbasins. Per an interagency agreement, water for

[3] Each SWP contract contains a "Table A" exhibit that defines the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries. Table A Amounts are used by DWR to allocate available SWP supplies and some of the SWP project costs among the contractors.

recharge is allocated in proportion to pumping in each subbasin. CVWD's and DWA's Table A water is exchanged with Metropolitan for a like amount of Colorado River water from Metropolitan's Colorado River Aqueduct (CRA).

Under the 2003 Exchange Agreement, CVWD and DWA acquired 100,000 AFY (88,100 AFY and 11,900 AFY, respectively) of Metropolitan's SWP Table A water as a permanent transfer. In any given year, the agreement allows Metropolitan to call-back the 100,000 AFY and assume the entire cost of delivery if it needs the water. This transfer became effective in January 2005.

In 2004, CVWD purchased an additional 9,900 AFY of SWP Table A water from the Tulare Lake Basin Water Storage District (Tulare Lake) in Kings County, CA. In 2007, CVWD and DWA made a second purchase of 7,000 AFY of SWP Table A water from Tulare Lake: 5,250 AFY for CVWD and 1,750 AFY for DWA. In 2007, CVWD and DWA completed the transfer of 16,000 AFY of SWP Table A water (12,000 AFY and 4,000 AFY, respectively) from the Berrenda Mesa Water District (Berrenda Mesa), effective in January 2010. With these transfers, the combined SWP Table A Amounts for CVWD and DWA total 194,100 AFY, with CVWD's portion equal to 138,350 AFY and DWA's portion equal to 55,750 AFY. **Table ES-2** summarizes CVWD and DWA total allocations of SWP Table A water.

Table ES-2
State Water Project Sources

	Original SWP Table A (AFY)	Tulare Lake Basin 2004 Transfer (AFY)	Metropolitan 2003 Transfer[1] (AFY)	Tulare Lake Basin 2007 Transfer[2] (AFY)	Berrenda Mesa 2007 Transfer[2] (AFY)	Total (AFY)
CVWD	23,100	9,900	88,100	5,250	12,000	138,350
DWA	38,100	—	11,900	1,750	4,000	55,750
Total	61,200	9,900	100,000	7,000	16,000	194,100

Notes:
1 Transfer became effective on January 1, 2005.
2 Transfer became effective on January 1, 2010.

SWP supplies vary annually due to weather and runoff variations and regulatory limitations on exports from the Delta. When the 2002 WMP was prepared, average SWP supply reliability was estimated to be about 82 percent. Under current conditions, DWR estimates the SWP can only provide about 60 percent of the Table A Amounts indicated in CVWD's and DWA's contracts based on an 82-year hydrologic average (DWR, 2011). The current availability of SWP Table A Amounts is presented in **Table ES-3.** In the absence of state and federal actions in the Bay Delta to improve supply reliability and to protect and enhance the Delta ecosystem, it is anticipated that long-term average SWP reliability (deliveries) could decrease to 50 percent of the Table A Amounts over the next twenty years. Additionally, growth and associated groundwater production increases in the Mission Creek Subbasin will result in more SWP Exchange water being delivered to that subbasin reducing supplies for the Whitewater River.

Other Water Transfers

In March 2008, CVWD and DWA entered into separate agreements with DWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program. This program provides dry year supplies. The amount of water available for purchase in a given year varies and is based on DWR's determination of the Water Year Classification. The available water is allocated among participating SWP contractors based on their Table A Amounts. CVWD and DWA may be able to purchase up to 5,600 AFY, and 1,820 AFY, respectively. These agreements provide for the exchange of these supplies with Metropolitan for Colorado River water in accordance with the existing exchange agreements. CVWD and DWA received a total of 5,300 AF of water from this source in 2008 and 2009.

Table ES-3
Current (2010) SWP Supply Availability (60% Reliability)

SWP Components	AFY [1]
Table A Amount (Base)	194,100
Average Deliveries with Current SWP Reliability (60%) [2]	116,500
Less Average Metropolitan Callback [3]	(32,900)
Net Average SWP Supply [4]	83,600
Whitewater River Subbasin Recharge (93% of net) [5]	77,800
Mission Creek Subbasin Recharge (7% of net)	5,800

Notes:
1 Values shown are rounded to nearest 100 AFY.
2 Current reliability is based on California DWR's 2009 SWP Reliability Report.
3 Average supply conservatively assumes Metropolitan calls back its 100,000 AFY transfer in four wet years during a 10-year period.
4 Net supply is calculated by deducting the Metropolitan callback from the Table A Amount with current SWP Reliability.
5 Allocation of SWP water to Upper Whitewater River and Mission Creek subbasins is based on production in each basin.

In 2008, CVWD also executed an agreement with Rosedale-Rio Bravo Water Storage District (Rosedale) in Kern County for a one-time transfer of 10,000 AF of banked Kern River flood water that is exportable to CVWD. Deliveries to CVWD began in 2008 and will be completed by December 31, 2012.

Desalinated Drain Water

The 2002 WMP recommended that a drain water desalination facility commence operation between 2010 and 2015 with a 4,000 AFY facility to treat agricultural drainage water for irrigation purposes. The facility would be expanded to 11,000 AFY by 2025. Product water would be delivered to the Coachella Canal distribution system for non-potable use.

A brackish groundwater treatment pilot study and feasibility study was completed in 2008 (Malcolm-Pirnie, 2008a and 2008b). Reverse osmosis (RO) was recommended to meet water quality goals and provide additional flexibility in the level of water quality produced should the facility's objectives change in the future. The recommended approach to brine management was to convey the RO concentrate via pipeline to constructed wetlands located at the north shore of the Salton Sea. This study concluded that agricultural drainage water can be treated for reuse as non-potable water and potentially as new potable water.

Recycling of Municipal Effluent

CVWD and DWA currently deliver approximately 14,000 AFY of recycled water in the West Valley for golf course and other large irrigation uses. Wastewater generated in the West Valley that is not reused for irrigation is percolated into the groundwater basin. Current recycled water usage in the East Valley is approximately 700 AFY for agricultural irrigation. East Valley wastewater that is not reused is discharged to the CVSC.

ES-4.2.3 Source Substitution

Source substitution involves the delivery of alternative water supplies, such as Coachella Canal water or recycled water, to replace of groundwater pumping. Significant efforts have been made to implement source substitution projects in the Valley.

Mid-Valley Pipeline (MVP)

In the West Valley, the demand for non-potable water typically exceeds the available recycled water supply, especially in the summer months. Golf courses using recycled water currently must supplement that supply with local groundwater to meet their demands. This limits the amount of overdraft reduction that is possible to the available recycled water supply. Groundwater modeling shows a local pumping deficit (overdraft condition) that cannot be remedied by recharge at Whitewater. The MVP is a pipeline distribution system to deliver Colorado River water to the Mid-Valley area for use with CVWD's recycled water for golf course and open space irrigation. This source substitution project will reduce groundwater pumping for these uses. Construction of the first phase of the MVP from the Coachella Canal in Indio to CVWD's Water Reclamation Plant No. 10 (WRP-10) (6.6 miles in length) was completed in 2009.

At WRP-10, Canal water supplements recycled water for delivery to large irrigators. There are eight golf courses and five other users in the West Valley currently connected to the WRP-10 recycled water system that can receive both recycled water and Canal water via the MVP. If these courses meet at least 90 percent of their irrigation needs with non-potable water, 2,700 AFY of additional groundwater pumping will be eliminated. There are four golf courses adjacent to the MVP that can be connected to the system with minimal construction, thus making them ideal candidates to receive Canal water through the MVP. Construction of Phase 1 of the MVP included outlets along the pipeline to serve these courses. However, pipeline connections to deliver Canal water from the MVP to each course have yet to be constructed. When these four courses are connected, about 4,500 AFY of additional pumping could be eliminated. At least ten additional courses can be connected to the MVP downstream of WRP-10 with relatively simple pipeline connections, reducing pumping by another 11,200 AFY. When fully implemented, the MVP system will be capable of eliminating about 50,000 AFY of groundwater pumping.

Pilot Study of Canal Water Treatment for Urban Use

As projected growth occurs in the East Valley and farms are converted to urban land uses, agricultural demand for Canal water will decrease. To avoid increased urban groundwater pumping and to use the Valley's Colorado River water supply fully, there will be a need to treat Canal water for urban use. The 2002 WMP anticipated this need and proposed that treatment be provided beginning in the late 2020s with about 32,000 AFY being treated by 2035. Present projected domestic water demand coupled with reduced agricultural demand is expected to increase this amount substantially. Potable use will require Canal water treatment to meet drinking water standards. In anticipation of constructing potable water treatment facilities, CVWD completed a pilot treatability study for Canal water in 2008 (Malcolm-Pirnie, 2008c). This study investigated alternative approaches to treatment of Colorado River water delivered for urban use. The study recommended that blending treated Colorado River water with local groundwater be further evaluated to ensure customer satisfaction.

ES-4.2.4 Groundwater Recharge

Groundwater recharge is a critical component of basin management that involves putting water directly into the groundwater basin through surface percolation ponds. The 2002 WMP included continuing recharge at the existing Whitewater Recharge Facility in the West Valley, proposed recharge in the East Valley using Colorado River water at Dike 4, now the Thomas E. Levy Groundwater Replenishment Facility (Levy facility), and recommended another major recharge facility at Martinez Canyon.

Whitewater Recharge Facility – West Valley

The 2002 WMP established a future average annual recharge target at this facility of about 100,000 AFY. The Whitewater River Recharge Facility has a recharge capacity in excess of 300,000 AFY. Because this capacity is enough to capture the full SWP Table A amount with additional capacity for supplemental recharge, no recharge capacity expansion is required. The available capacity is valuable for conjunctive use operations by CVWD and DWA as well as Metropolitan or other interested parties. Currently, the SWP Exchange supply is expected to provide about 78,000 AFY for the Whitewater facility on average. Under future conditions, it is possible that average recharge at Whitewater could be limited to the available future supply of about 61,400 AFY of SWP Exchange, unless it is augmented with other supplies. To reach the 100,000 AFY recharge goal for the Whitewater facility, CVWD and DWA would need to acquire additional SWP Table A Amounts or other imported water sources.

Thomas E. Levy Groundwater Replenishment Facility - East Valley

Construction of the full-scale Levy facility was completed in mid-2009. Located on the west side of the Valley in La Quinta, this facility has an estimated average recharge capacity of 40,000 AFY. The current capacity may be limited by hydraulic, water delivery, and maintenance constraints within the Canal water distribution system to an average of about 32,000 AFY. Construction of an additional pipeline to the Levy facility and pumping station from Lake Cahuilla may be required in the future to reach the 40,000 AFY capacity on a consistent basis.

Martinez Canyon Pilot Recharge Facility Feasibility Assessment – East Valley

The Martinez Canyon pilot recharge facility began operation in 2005 and currently recharges about 3,000 AFY. When this project is expanded to full scale, it is expected to recharge up to 40,000 AFY.

ES-4.2.5 Groundwater/Subsidence Monitoring

CVWD maintains an extensive ongoing groundwater production, level, and water quality monitoring program throughout the Valley. The program includes monitoring of potential saltwater intrusion from the Salton Sea. The data are periodically reviewed to determine impacts of management actions on overdraft and water quality. The data are also applied to re-calibrate the groundwater model that assesses the impact of proposed management actions.

The United States Geological Survey (USGS), working with CVWD, completed subsidence monitoring reports for the Coachella Valley in 2001 and 2007. The reports indicated that subsidence was taking place in varying degrees throughout the Valley.

These studies to date have not confirmed the relationship between land subsidence and declining water levels. The USGS Scientific Investigation Report 2007-5251 states, "Although the localized character of the subsidence signals is typical of the type of subsidence characteristically caused by localized ground-water pumping, the subsidence may also be related to tectonic activity in the valley." This report also concludes additional monitoring is needed to permit meaningful interpretations of the aquifer-system response to water level changes. CVWD's Board of Directors has approved additional funding to continue these cooperative subsidence studies with the USGS. Future studies include additional monitoring designed to evaluate the potential relationship between declining water levels and land subsidence. Potential land subsidence caused by declining water levels was addressed by mitigation measures described in the 2002 Coachella Valley Water Management Plan Programmatic Environmental Impact Report (CVWMP PEIR).

ES-5 2010 WMP UPDATE

Significant actions have been taken since 2002 to alleviate overdraft in the long term. Changes in internal and external factors mandate new activities and increased levels of current activities to eliminate overdraft and assure reliable long term water supplies to the Valley. These new activities are identified in the 2010 WMP Update.

ES-5.1 Population and Water Demand

Since 2002, significant changes have occurred in projections of population and future water demands, including:

- Significantly increased population growth, mainly in the East Valley (**Figure ES-2**);
- Changes in land use from agricultural to urban land use and water demand in terms of both quantity and quality;

- Development on tribal lands and related water demands;
- Potential development located northeast of the San Andreas fault in the spheres of influence (SOI) of the cities of Indio and Coachella;
- Projected urban development outside the 2002 WMP study area and corresponding increases in water demands;
- Uncertainty in the timing of growth and water demands.

Figure ES-2 shows the difference in population projections used in the 2002 WMP and projections used in the 2010 WMP Update. The 2010 WMP Update provides water for approximately 500,000 more people in 2045 than the 2002 WMP.

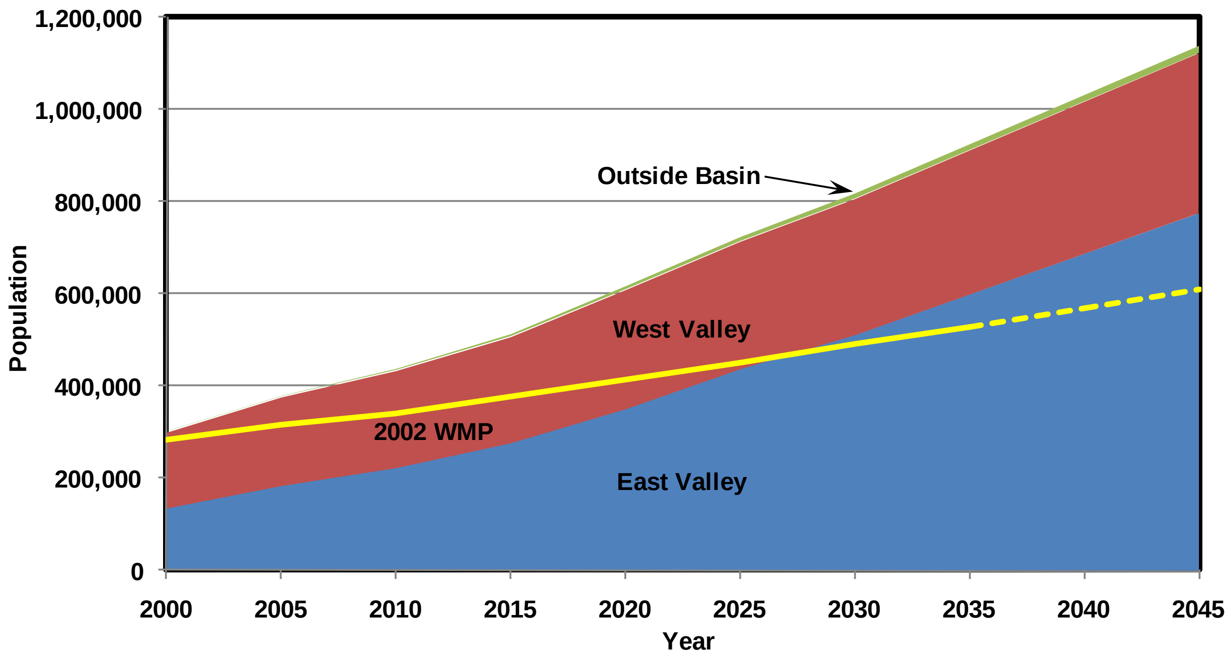

Figure ES-2
Comparison of Population Projections for the Coachella Valley

ES-5.1.1 Future Water Demands

Projected water demands for 2045 resulting from projected population growth and associated assumptions regarding land uses and water demands for land uses are shown by economic sector in **Table ES-4**. Water use by new development is expected to be more efficient due to plumbing code requirements and the Landscape Ordinance. Consequently, water demands are expected to be less than projected in the 2002 WMP. Factoring potential variations in future land use and growth forecasts into these demand projections, water demands in 2045 could range from 793,600 AFY to 971,500 AFY with a mid-range planning value of 885,400 AFY as shown on **Figure ES-3**. If the growth projection in the 2002 WMP, with assumed water conservation measures, were projected to 2045, the projected demand would be approximately 950,000 AFY.

The reduction in projected demand results primarily from the conversion of agricultural lands to urban use and increased water conservation factored into the 2010 WMP Update.

Table ES-4
2045 Baseline Water Demand Projection for the Coachella Valley

Component	2045
Agricultural	
Crop Irrigation	166,300
Total Agricultural Demand	**166,300**
Urban	
Municipal	537,000
Industrial	2,300
Total Urban Demand	**539,300**
Golf Course Demand	**169,500**
Fish Farms and Duck Clubs	
Fish Farms	8,500
Duck Clubs	2,000
Total Fish Farms and Duck Clubs	**10,500**
TOTAL DEMAND	**885,400**

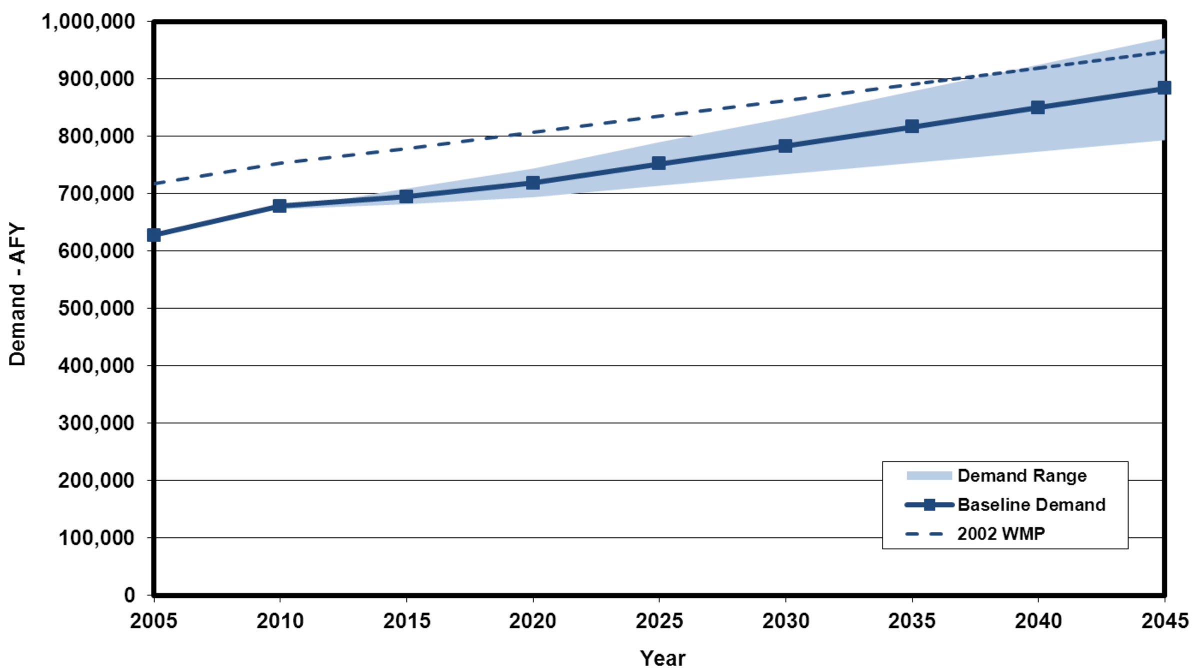

Figure ES-3
Projected Water Demands in the Study Area

ES-5.1.2 Demand Uncertainty

Future water demands are based on the latest approved population growth projections (2006) by Riverside County and assumptions regarding impacts of population growth on land uses, impacts of water conservation on water uses, and resulting water demand associated with each type of land use. There are a number of uncertainties inherent in the demand projections, including:

- Growth forecasts or rates of growth may be too high or too low
- Impacts of economic booms and busts
- Reductions in fish farm operations
- Rates of development on Tribal lands
- Rate of agricultural/vacant land conversion to urban use
- Future water demand factors for various land uses
- Growth outside the Whitewater River subbasin
- Number of future golf courses developed in the East Valley
- Acceptance and effects of water conservation measures

Figure ES-3 shows the range in potential future water demands for the study area.

ES-5.2 Future Water Supply Needs

In addition to changing water demands, changing external factors could affect Valley water supplies:

- SWP allocations fluctuate annually due to snowpack and runoff variations, and the environmental needs in the Bay-Delta.
- Recent environmental rulings have restricted the State's ability to move water through the Delta to the SWP, potentially decreasing supply reliability and deliveries. The degree to which the long-term supply of the SWP will be affected is uncertain.
- The outcome of efforts underway to prepare the Bay-Delta Conservation Plan (BDCP), which is intended to restore the Delta's ecosystem and improve water supply reliability, is uncertain.
- The QSA has been upheld in the appeals court but, as of plan adoption, environmental litigation is still pending, creating uncertainty in future Colorado River supplies.
- Climate change could affect the long term supplies of both the SWP and Colorado River and water demands within the Valley.

These changing conditions and uncertainties reinforce the need for a flexible long term Plan and for updating the Plan periodically.

Additional water supplies needed by 2045 are evaluated for four water supply scenarios that incorporate the uncertainties associated with current supply sources, with the exception of climate change. A 10 percent supply buffer addresses potential climate change impacts and other currently unforeseeable factors affecting future water supplies. **Table ES-5** shows the future water supply needs range from 300,000 to 461,000 AFY. The 2010 WMP Update identifies how this future need will be met through a combination of water conservation measures and new supply development. **Figure ES-4** presents the future water supply plan assuming Scenario 2 without the supply buffer.

Table ES-5
Water Supply Needs – 2045

Scenario	QSA Validated	Delta Conveyance Improvements	Demand (AFY)	Demand with 10% Buffer (AFY)	Available Supply (AFY) [1]	Additional Supply Required (AFY)
1	Yes	Yes	885,400	974,000	674,300	299,700
2	Yes	No	885,400	974,000	640,900	333,700
3	No	Yes	885,400	974,000	546,300	427,700
4	No	No	885,400	974,000	512,900	461,100

Note:
1 Available supplies consist of local runoff and streamflow, recycled water, returns from use, Canal water and SWP Exchange water minus anticipated drain flows and subsurface outflows from the basin as explained in Section 7.2.

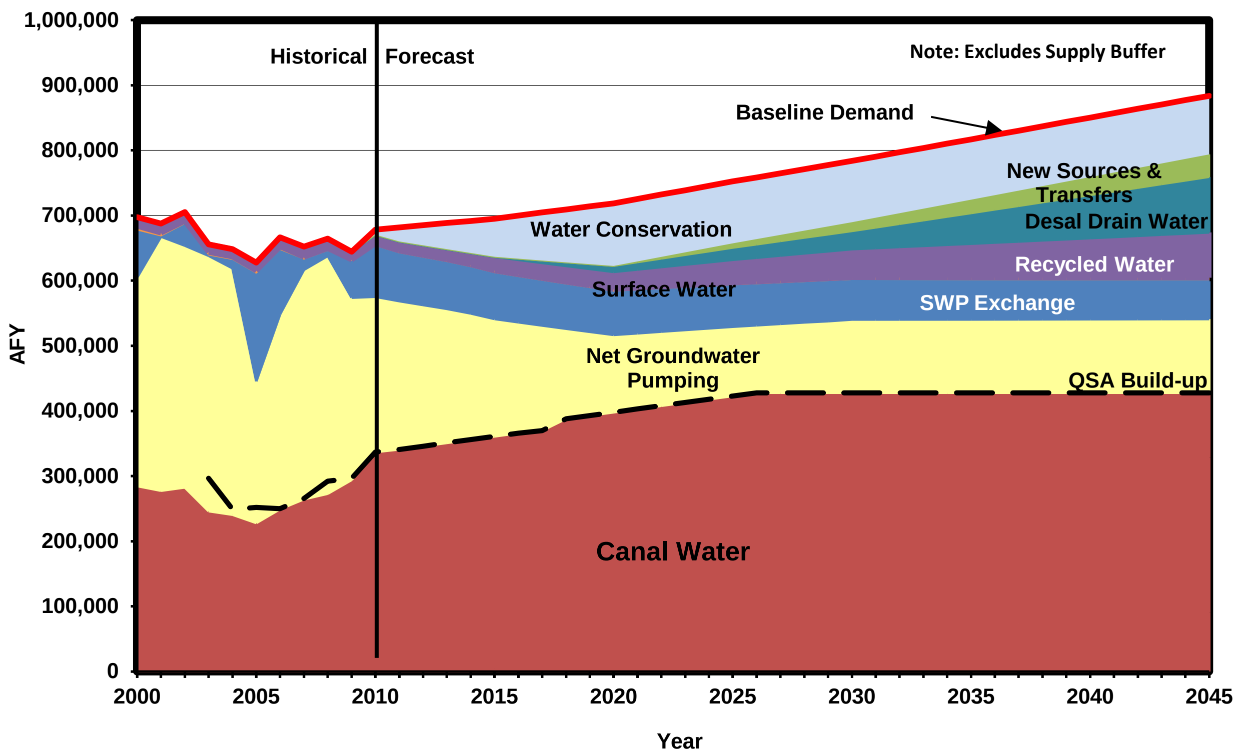

Figure ES-4
Water Supply Mix for 2010 WMP Update

ES-5.3 What is New in the 2010 WMP Update?

The 2010 WMP Update identifies proposed ways and means of meeting future water needs in light of changing conditions and uncertainties. To meet future needs, the 2010 WMP Update includes many new features in the areas of water conservation, source substitution, new supplies, and groundwater recharge. The 2010 WMP Update emphasizes enhanced cooperation in Plan implementation. The 2010 WMP Update incorporates a "bookends" approach to define target ranges for each major supply group and incremental "building blocks" of projects to deal with uncertainties in future demands and supplies.

Revised Goals: The basic goal of the WMP remains the same but has been modified to reflect a more holistic planning approach: "to reliably meet current and future water demands in a cost-effective and sustainable manner." The underlying objectives of the WMP have been refined as follows to reflect the water resources uncertainties facing the Valley:

- Meet current and future demands with a 10 percent supply buffer
- Eliminate long-term groundwater overdraft
- Manage and project water quality
- Comply with state and federal laws and regulations
- Manage future costs
- Minimize adverse environmental impacts

Bookends on Demands and Supplies: To account for the uncertainty and potential variability in demands, the 2010 WMP Update assigns bookend targets (ranges) for each of the major categories of water supplies (see **Section 6)**. The book-ends represent reasonable minimum and maximum amounts for potential supply and project development. Depending on the actual demands that are encountered in the future, the 2010 WMP Update elements can be implemented within these ranges to meet demands.

Building Block Approach: The 2010 WMP Update incorporates a flexible approach to meeting future needs that reflects uncertainties in supplies, demands and future circumstances by combinations of Plan elements. For example, the 2010 WMP Update includes an aggressive program of water conservation for urban, golf course and agricultural water users. However, there are limits in terms of cost, effectiveness, and acceptability of water conservation activities. As those limits are reached, other Plan elements for meeting future needs also can be adjusted. One source of supply is desalination of drain water, the most expensive alternative for providing new supplies. This source will only be implemented as other sources of supplies reach practical limits. Therefore, the Plan includes a range of 55,000 to 85,000 AFY for desalination of drain water. The actual amount of water from this source will depend upon how much can be obtained first from other, lower cost sources.

Enhanced Cooperation in Plan Implementation: The Plan emphasizes cooperation among municipalities, local water agencies and tribes in regional planning and implementation. This occurs through the implementation of activities described in the 2010 WMP Update, implementation of related planning activities (see **Section 1.0**), and the development of monitoring and data sharing programs among CVWD, other water agencies, cities, and tribes to better manage Valley water resources.

ES-5.4 2010 WMP Update Elements

In developing the 2010 WMP Update, CVWD evaluated the success of 2002 WMP elements and determined future needs, supplies, and uncertainties. Like the 2002 WMP, the 2010 WMP Update has the same five major elements:

- Water conservation (urban, golf course, and agricultural)
- Increasing surface water supplies for the Valley from outsides sources
- Substitution of surface water supplies for groundwater (source substitution)
- Groundwater recharge
- Monitoring and evaluation of subsidence and groundwater levels and quality to provide the information needed to manage the Valley's groundwater resources

Activities included in the 2010 WMP Update in each of these elements are described below.

ES-5.4.1 Water Conservation

New water conservation targets and actions are included for agriculture, urban, and golf course water users. In addition to the water conservation included in the baseline demand projections, the 2010 WMP Update includes a minimum water conservation target of 117,300 AFY by 2045 as shown in **Table ES-6**. This amount could increase to 147,000 AFY to provide a portion of the supply buffer.

Table ES-6
Ranges of Potential Water Conservation Savings – 2045

Type of Conservation	Low Range [1] (AFY)	High Range [2] (AFY)
Urban	82,400	106,200
Agriculture [3]	23,300	23,300
Golf Courses	11,600	17,400
Total	**117,300**	**146,900**

Notes:
1 The low range represents the minimum amount of demand reduction required assuming successful completion of the BDCP and provides a portion of the supply buffer.
2 The high range represents the amount of demand reduction required if the BDCP is not successful and provides a portion of the 10 percent supply buffer.
3 Agricultural savings decline over time as agricultural land is converted to urban uses.

Agricultural Conservation

The new agricultural conservation target is a 14 percent savings by 2020 utilizing a phased approach. The first phase will involve low cost voluntary programs. Depending on the success of those programs, more expensive and vigorous programs could be implemented, as needed. If the 14 percent target can be achieved, the agricultural conservation program is expected to save about 39,500 AFY of water in 2020, decreasing to 23,300 AFY by 2045 as agricultural land uses transition to urban uses. Progress toward meeting agricultural conservation goals will be evaluated and reported every five years.

Urban Conservation

The urban water conservation program will be expanded and enhanced in order to meet changing demands and to comply with the State's requirement of a 20 percent reduction in per capita water use by 2020 compared to average per capita usage for the period of 1995 through 2004. This program could save at least 39,700 AFY by 2020 and achieve a 39 percent reduction in per capita demand by 2030 as it is applied to new growth.

Achievement of the state's 20 percent conservation target in conjunction with on-going conservation programs could result in urban water savings of 82,400 to 106,200 AFY by 2045 depending on the water supply scenario. Progress toward achieving the urban water conservation goals will be reported in urban water management plans prepared on five year intervals.

Golf Course Conservation

The golf course conservation target is a savings of 11,600 to 17,400 AFY by 2045. For existing courses, the minimum target is a 10 percent reduction in water use through golf course irrigation system audit, and soil moisture monitoring services. The 2009 Landscape Ordinance will apply to all new golf courses with turf limitations of 4 acres of per hole and 10 acres for practice areas. Progress toward meeting golf course conservation goals will be evaluated and reported every five years.

ES-5.4.2 Additional Supplies

Table ES-7 summarizes the range of additional supplies that will be developed.

Acquisition of Imported Supplies

CVWD and DWA will continue to acquire additional imported SWP water supplies by transfer or lease where cost-effective, given Delta environmental restrictions and conveyance capacity limitations. For this update, a planning range of 50,000 to 80,000 AFY of average annual supply has been identified to meet future needs including the supply buffer. This amount includes about 35,000 AFY to meet estimated demand east of the San Andreas fault; the amount will be refined as planning proceeds for this area. Changes to the assumed call-back frequency for the MWD 100,000 AFY SWP transfer could provide up to 33,000 AFY of additional supply to the

Whitewater River Subbasin. Option-type contracts could be considered to meet a portion of the supply buffer.

Table ES-7
Range of Additional Supplies Through 2045

Action	Low Range (AFY)	High Range (AFY)
Bay-Delta Conveyance Improvements	0	33,400
Purchases and Transfers [1]	50,000	80,000
Changes to MWD Call-back Provisions [1]	0	32,700
Increased Recycled Water - East and West Valleys	14,000	63,000
Recycled Water Use East of San Andreas Fault	10,800	10,800
Canal Water Loss Reduction	0	10,000
Desalinated Drain Water	55,000	85,000
Stormwater Capture – East Valley	0	5,000
Groundwater for Non-potable Use East of San Andreas Fault	9,700	9,700
Total	**139,500**	**329,600**

Note:
1 High range represents potential supplies with Bay Delta conveyance improvements and no call-back.

Increased Recycled Water Use

Recycled water in the West Valley is currently used beneficially, either through direct non-potable use or percolation for wastewater disposal. At least 90 percent of all wastewater generated in the West Valley will be recycled for direct non-potable use. All wastewater generated by new growth in the East Valley will be recycled. All wastewater from development east of the San Andreas fault could be recycled for irrigation or groundwater recharge to meet demands in that area and reduce the need for additional imported water supplies. Up to 34,500 AFY of recycled water could be utilized in the West Valley, and 33,000 AFY of recycled water could be utilized in the East Valley. Up to 10,800 AFY of recycled water could be utilized in the new growth area east of the San Andreas fault for direct non-potable uses by 2045.

Canal Water Loss Reduction

Water losses in the All-American Canal in the first 49 miles of the Coachella Canal may be as high as 10,000 AFY. Reducing this loss could increase the amount of water delivered to the Valley. CVWD will determine water lost to leakage in the first 49 miles of the Coachella Canal, evaluate the feasibility of corrective actions to capture the lost water, implement cost-effective water saving measures, and work with IID to share losses.

Desalinated Drain Water

A demonstration scale facility will be constructed to gain operational experience in desalinating drain water and brine disposal. Between 55,000 and 85,000 AFY of drain water and shallow groundwater will be recovered, desalinated, and distributed for non-potable and potable uses in the East Valley. The amount of desalinated water needed will depend upon the resolution of Bay-Delta issues and the resulting amount of SWP water available.

Stormwater Capture

Stormwater capture has been identified as a potential method for increasing local water available for either groundwater recharge or direct use. CVWD will conduct a study to investigate the feasibility of additional stormwater capture in the East Valley. Feasible stormwater capture projects will be developed in conjunction with new flood control facilities as development occurs in the East Valley. For planning purposes, the potential yield is assumed to be 5,000 AFY based on a reduction in evaporation losses with more efficient capture and percolation.

Development of Local Groundwater Supplies for Non-Potable Use

Growth in the areas northeast of the San Andreas fault will create additional demands for both potable and non-potable water. CVWD, the City of Coachella, and the City of Indio will jointly conduct an investigation of groundwater in Fargo Canyon Subarea of the Desert Hot Springs Subbasin to determine the available supply and suitability for use in meeting non-potable demands (outdoor irrigation) of development east of the San Andreas fault. Based on assumed development, up to 9,700 AFY of groundwater could be developed in this area.

ES-5.4.3 Source Substitution

Due to the expected changes in water use patterns from continued development, source substitution will receive increased emphasis in the future to eliminate overdraft and ensure full use of the Valley's available surface water supplies. The ranges of reduction in groundwater overdraft due to source substitution programs are shown in **Table ES-8**.

Table ES-8
Range of Groundwater Pumping Reductions Due To Source Substitution

Action	Low Range (AFY)	High Range (AFY)
Mid-Valley Pipeline	37,000	52,000
Agricultural Canal Water Conversion	5,300	32,000
Oasis Area Conversion to Canal Water	0	27,000
East Valley Golf Course Conversion	43,900	51,700
West Valley Golf Course Conversion	15,200	17,800
Canal Water for Indoor Urban Use – East Valley	48,000	90,000
Canal Water Use for Outdoor Use – East Valley	95,000	115,000
Total	**244,400**	**385,500**

Mid-Valley Pipeline

The MVP system delivers Canal water and recycled water to golf courses in lieu of their pumping groundwater. Activities to fully implement the MVP include preparing an MVP system master plan to lay out the future pipeline systems, near-term expansions to connect golf courses along the MVP alignment and extensions of the existing non-potable distribution system, and completion of construction of the remaining phases of the MVP system by 2020 to provide up to 37,000 AFY of Canal water and 15,000 AFY of WRP-10 recycled water on average to West Valley golf courses.

Conversion of Agricultural and Golf Course Use to Canal Water

It is expected that agricultural use of groundwater could decrease from about 66,000 AFY in 2009 to about 7,000 AFY by 2045, a decrease of 59,000 AFY or 89 percent. A large portion of this reduction could come from the Oasis area that does not currently have access to Canal water. The Oasis area distribution system feasibility study will be updated to include future conversion to serve urban non-potable water. Cost-effective facilities will be constructed. If conversion of the Oasis system is feasible, it could deliver up to 27,000 AFY of Canal and desalinated drain water for irrigation.

In the 2010 WMP Update, it is estimated that for existing East Valley golf courses having Canal water access, Canal water use will increase to 90 percent of demand by 2015. Conversion to Canal water by East Valley golf courses will reduce groundwater use by 43,900 AFY or more.

Colorado River Water for Urban Use

In light of the projected increase in population and change of land use from agricultural to urban in the East Valley, treated Colorado River water for indoor residential use will be essential. In addition, untreated Colorado River water will be used in the future in large developments in the East Valley for outdoor purposes, i.e., lawn and park irrigation. These measures are necessary to reduce overdraft and to insure continued full use of the Valley's Colorado River water supplies.

This program will offset the reduced Canal water use by agriculture as agricultural land use transitions to urban development in the East Valley. Canal water will be treated to meet future indoor urban water demands in the East Valley. The target for urban indoor use of Canal water ranges from 48,000 and 90,000 AFY by 2045.

Dual source plumbing systems will be a feature of new development in the East Valley to provide outdoor use of untreated Canal water. Untreated canal water should provide 67 percent to 80 percent of the landscape demand for new development. This will result in the utilization of 95,000 to 115,000 AFY of non-potable Canal water by 2045. Where found to be cost-effective, existing developments will be retrofitted with distribution systems to provide for outdoor use of untreated Canal water.

ES-5.4.4 Groundwater Recharge

Groundwater recharge will be expanded to reduce overdraft. The ranges of groundwater recharge operations at various facilities under the 2010 WMP Update are shown in **Table ES-9**.

Table ES-9
Range of Groundwater Recharge

Facility	Low Range (AFY)	High Range (AFY)
Whitewater	61,000 [1]	100,000
Levy	40,000	40,000
Martinez Canyon [2]	20,000	40,000
Indio	0	10,000
Total	**121,000**	**190,000**

Notes:
1 Recharge is limited by available supply.
2 High range will depend on overdraft conditions and implementation of East Valley source substitution projects.

Whitewater Recharge Facility

Operation of the Whitewater Recharge Facility will continue with the goal of recharging an average of at least 100,000 AFY of SWP exchange water over the long-term. Unused SWP water and available desalinated drain water from the QSA will be transferred to the Whitewater Recharge Facility. Additional water acquired by transfer or lease will augment the existing SWP exchange water.

Thomas E. Levy Recharge Facility

The Levy facility will recharge 40,000 AFY on average. A second pumping station and pipeline will be constructed if needed to achieve and sustain 40,000 AFY of deliveries for recharge.

Martinez Canyon Recharge

Siting studies, land acquisition, environmental compliance, design, and construction will be conducted for the full-scale Martinez Canyon facility. The project will be implemented in phases with an initial capacity of 20,000 AFY with potential future expansion to as much as to 40,000 AFY based on groundwater overdraft conditions and implementation of East Valley source substitution projects.

Groundwater Recharge in Indio

The City of Indio will evaluate the feasibility of a nominal 10,000 AFY groundwater recharge project in Indio and construct if feasible. The final capacity will be based on pilot studies conducted by Indio.

Investigation of Groundwater Storage Opportunities with IID

CVWD will work with IID to identify options for storing Colorado River water on behalf of IID with currently planned Valley recharge facilities or additional facilities, including facilities to recover the stored water for use by Canal water users if necessary when IID calls for its stored water.

ES-6 WATER QUALITY MANAGEMENT

ES-6.1.1 Additional Groundwater Treatment for Arsenic

CVWD will work with other agencies to assist communities having high levels of arsenic in groundwater supplies to connect to the potable water system. As needed, CVWD will expand its arsenic treatment facilities to allow treatment of additional wells and construct water transmission pipelines as needed to meet future demands.

ES-6.1.2 Development of Salt/Nutrient Management Plan

The State Water Resources Control Board (SWRCB) requires preparation of a salt/nutrient management plan by 2014 as part of the 2009 State Recycled Water Policy. As stated in the Policy, its purpose is to "establish uniform requirements for recycled water use and to develop sustainable water supplies throughout the state" (SWRCB, 2009). CVWD will work with other Valley water agencies, tribes, and stakeholders to develop a salt/nutrient management plan that meets the State requirements and allows the cost-effective recycling of municipal wastewater in the Valley.

ES-6.1.3 Drainage Control

For both basin management (groundwater level and salt export), as well as the prevention of adverse impacts, the existing drainage system should be maintained, replaced as needed, or expanded as urban development occurs. CVWD will investigate alternative methods for funding the drainage system, conduct an investigation of the improvements needed to continue system operation in the future, and maintain and expand the drainage system.

ES-7 MONITORING AND DATA MANAGEMENT

Monitoring and data management programs aid in evaluating the effectiveness of the water management programs and projects identified in the Plan and to identify needed changes in management strategy and/or implementation.

The existing hydrologic monitoring program of weather data, streamflow data, well data (drilling logs, production, water levels), surface and ground water quality monitoring, and subsidence monitoring should be maintained and expanded. Key features of the expanded program are described below.

ES-7.1 Water Quality

CVWD will work with water agencies, tribes and cities to develop a coordinated water quality monitoring program to ensure that local water quality concerns and state/federal regulatory issues are addressed.

ES-7.2 Subsidence

CVWD will continue the USGS subsidence monitoring/reporting program and construct additional extensometers at critical locations to monitor subsidence, as needed.

ES-7.3 Water Resources Database

CVWD will work with water agencies, cities and tribes to develop a shared water resources database. The database could include well ownership data, well logs, groundwater production, water level and water quality data.

ES-7.4 Groundwater Model Update and Recalibration

Prior to the next Plan update, the CVWD groundwater model will be updated, recalibrated and peer reviewed.

ES-7.5 Water Quality Model

CVWD will initiate development of a model capable of simulating the water quality changes in coordination with preparation of the salt/nutrient management plan.

ES-7.6 Water Demand and Conservation Monitoring

Water purveyors will monitor and report demands by water use sector and correlate demands with implementation of water conservation measures to determine the effectiveness of water conservation measures in achieving goals and the need for additional measures.

ES-8 PLAN COSTS

The cost of not eliminating overdraft would be far more than the cost of the actions needed for eliminating overdraft identified in the 2010 WMP Update. Cost of overdraft includes increased subsidence with its impacts on individual homes, commercial structures, and infrastructure (streets, highways, water and sewer lines, and other utilities), water quality degradation, and increased pumping costs. Colorado River supplies would go unused as agricultural land is converted to urban land, and groundwater pumping would increase without alternative sources of supplies. At some point, it would not be possible to demonstrate the availability of water supplies to support new growth.

The estimated cost to implement the 2010 WMP Update is shown in **Table ES-10** for the period 2011 through 2045. Capital, operation and maintenance cost, total cost, and average annual cost are shown for each Plan element in 2010 dollars. These are total costs, not incremental costs, and include the costs of many current activities such as groundwater pumping, acquisition of Colorado River water, current levels of recycling and water conservation, and groundwater recharge. The costs shown are the total costs for the entire Valley.

Table ES-10
Cost by Plan Component
2011-2045

Component	Total Capital Cost $millions	Total O&M Cost $millions	Total Cost $millions	Average Annual Cost[1] $millions
Water Conservation	$ 1	$ 230	$ 231	$ 6.6
Recycled Water	161	153	314	9.0
Colorado River Water		409	409	11.7
SWP Water		1,907	1,907	54.5
Delta Conveyance		472	472	13.5
Desalinated Drain Water	462	277	739	21.1
Groundwater Pumping and Treatment	135	1,950	2,085	59.6
Water Transfers	0	282	282	8.1
Other New Water		262	262	7.5
Source Substitution	1,142	782,	1,924	55.0
Recharge	48	181	229	6.5
Total Cost	**$1,949**	**$6,907**	**$8,856**	**$253.0**
Average Annual Cost [1]	$56	$197	$253	

Note:
1 Average annual cost is the total cost divided by 35 years.

The total estimated capital cost through 2045 is $1.95 billion. Total O & M cost is $6.91 billion bringing the total cost of the Plan implementation to $8.86 billion over 35 years. The average annual cost is $253 million. This annual cost does not reflect the amortized cost of capital projects that may be bond-funded over several decades, thus increasing the annual cost of capital projects.

ES-9 IMPLEMENTATION AND IMPLEMENTATION COSTS

In developing the 2010 WMP Update, CVWD relied on the latest population projections developed by Riverside County. CVWD does not develop population growth projections for use in water management planning. The 2006 Riverside County projections were prepared before the recent recession, which has slowed growth and is expected to have negative effects on growth in the near term. Over the long term, growth will continue. Future population projections will be adjusted in terms of the timing and magnitude of growth. These realities necessitate adjustment of Plan implementation to meet actual near term needs and continued updates of the Water Management Plan in the future to reflect revised population projections.

Near Term Projects to Meet Water Management Needs

Even with the current recession and lack of growth, continuation of existing projects and a few new projects are needed to reduce overdraft and its adverse affects. Ongoing projects that will be continued include:

- Whitewater Recharge with SWP Exchange Water and SWP purchases
- Implementation of the QSA
- Levy Recharge operating at current level of 32,000 AFY
- Martinez Pilot Recharge at current level of 3,000 AFY
- Water conservation programs at current levels, including implementation of the Landscape Ordinance
- Recycling in the West Valley
- Increased use of Canal water by golf courses with Canal water connections
- Conversion of East Valley agriculture to Canal water as opportunities arise
- Groundwater production/level/quality monitoring
- Cooperative subsidence monitoring with USGS

Assuming that growth remains relative low during the next five years, CVWD will focus on three new or expanded activities to reduce overdraft and comply with state regulations:

- Increased use of the Mid-Valley Pipeline project to reduce overdraft in the West Valley by connecting golf courses and reducing groundwater pumping by those courses.
- Implementation of additional water conservation measures, including the Landscape Ordinance, to meet the State's requirement of 20 percent conservation by 2020.
- Preparation of a salt/nutrient management plan for the Valley by 2014 to meet SWRCB Recycled Water Policy requirements

Long Term Projects

Projects to eliminate and control overdraft that are likely to be needed as future growth occurs are described in the 2010 WMP Update. These projects include:

- Additional water conservation.
- Desalinated drain water.
- Additional water transfers.
- Additional recycled water.
- Canal water treatment for urban indoor use.
- Canal water treatment for urban outdoor irrigation.
- Recharge in the Indio area.

As growth ramps up, the projects will be implemented based on cost effectiveness and need.

Implementation Costs

In 2010, Valley water agencies expended approximately $414 million on all water and wastewater management activities. This total cost includes approximately $106 million per year on activities associated with eliminating overdraft. Since 2002, CVWD and DWA have invested over $240 million in water conservation, supply acquisition and facilities to reduce overdraft. During the next five years (2011-2015), it is estimated that Valley water agencies will expend an additional $5.4 million on activities to eliminate overdraft, assuming growth remains slow.

As growth occurs, additional projects to control overdraft will be needed. Ultimately, costs associated with growth to eliminate and control overdraft could approach an additional $100 million per year in capital project and annual operations and maintenance costs.

Much of the future costs, both capital and operation and maintenance, will not be borne by CVWD. These costs will be borne by developers, other water organizations, and Valley municipalities. Capital costs and operation and maintenance costs associated with new growth will be paid by new growth. For example, the entire cost of systems for treating and delivering Colorado River Canal water for indoor use in East Valley developments and development of dual plumbing systems to provide untreated water to those developments for outdoor use will be paid for by new development.

ES-10 CONCLUSION

Groundwater overdraft is a significant problem in the Coachella Valley. The 2002 Water Management Plan was developed to identify and guide the long term implementation of measures to eliminate groundwater overdraft in the Valley. Since completion of the 2002 Water Management Plan, much has been accomplished by Valley water agencies and agricultural, municipal/residential, and golf course water users to reduce overdraft. Water conservation efforts have expanded, out-of-basin water supplies have increased, surface water and recycled water use is being used in lieu of groundwater, and new groundwater recharge facilities are online and an additional facility is being developed.

However, changing future demands and water supply uncertainties require additional actions to eliminate groundwater overdraft in the future, which are identified in the 2010 WMP Update. Continued implementation of the Water Management Plan will result in unavoidable costs for water users and water agencies alike. Each agency, including CVWD, will consider costs, available resources, funding mechanisms and priorities to eliminate overdraft in a timely manner. The success of the Plan to date indicates broad support for eliminating overdraft and the threats to the economy and quality of life in the Coachella Valley.

The CVWD Board of Directors certified the Supplemental Program EIR and adopted the 2010 WMP Update on January 24, 2012.

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Section 1

Section 1
Introduction

The Coachella Valley Water District (CVWD, District) initiated a planning process in the early 1990s to meet its responsibilities for securing and protecting Coachella Valley water supplies into the future. The process initially addressed the East Valley, but was expanded to include the entire Coachella Valley in 1995. In September, 2002, the CVWD Board of Directors adopted the "Coachella Valley Final Water Management Plan" (2002 WMP) (Water Consult and MWH, 2002) and certified the final program environmental impact report (PEIR) (MWH, 2002). The Board recognized the need to update the Plan periodically to respond to changing external and internal conditions. This 2010 WMP Update meets that need.

1.1 PURPOSE AND NEED FOR WATER MANAGEMENT PLAN UPDATE

The Coachella Valley groundwater basin has been the principal source of water for the Valley since the early 1900s. As land was developed for agricultural and urban uses, demand on the groundwater basin increased. Groundwater levels in the East Valley began to decline and artesian wells ceased flowing. Recognizing the need for a supplemental water source, CVWD contracted with the federal government for Colorado River water from the All-American and Coachella Canals in 1934. With the completion of the Coachella Canal in 1949, supplemental water deliveries began and the groundwater levels began to recover. Groundwater levels stabilized in the 1970s and early 1980s near historical levels. With increased growth, groundwater levels once again began to decline as demand exceeded the available supply. Groundwater levels have shown a steady decline since the mid 1980s.

In the West Valley, resort and urban development relied solely on groundwater. Recognizing the need for additional water supplies, Desert Water Agency (DWA) and CVWD entered separate agreements with the State of California to purchase water from the State Water Project (SWP) in 1962 and 1963, respectively. To avoid the estimated $150 million cost to construct a pipeline to the Valley at that time, CVWD and DWA signed a water exchange agreement with the Metropolitan Water District of Southern California (Metropolitan) to deliver an equivalent amount of Colorado River water from Metropolitan's aqueduct in exchange for the Valley's SWP water. Deliveries of SWP Exchange water to the Whitewater River Spreading Facility commenced in 1973. Groundwater levels near the recharge facility showed a response to the recharge. However, in the central portions of the Valley, a steady decline continued. CVWD and DWA also signed an advanced delivery agreement with Metropolitan to store excess Colorado River water in the West Valley basin. This stored water represents a pre-delivery of the Valley's SWP supply. In the mid-1980s Metropolitan stored up to 600,000 AF of water in the basin. Even with this additional water, groundwater levels in the West Valley declined.

In 1994, CVWD with DWA commenced preparation of a water management plan to eliminate groundwater overdraft. The goal of the 2002 WMP is to assure adequate quantities of safe, high-quality water at the lowest cost to Coachella Valley water users. To meet this goal, four objectives must be met:

1. Eliminate groundwater overdraft and its associated adverse impacts, including:
   - Groundwater storage reductions,
   - Declining groundwater levels,
   - Land subsidence, and
   - Water quality degradation.
2. Maximize conjunctive use opportunities,
3. Minimize adverse economic impacts to Coachella Valley water users, and
4. Minimize environmental impacts.

Since the adoption of the 2002 WMP, the Coachella Valley has experienced a number of changes affecting water demands in the Valley that are projected to continue for the foreseeable future. These changes include:

- rapid population growth,
- changes in land use from agricultural or vacant to urban and corresponding changes in water demand in terms of both quantity and quality,
- development on tribal lands and related water demands, and
- projected urban development outside the 2002 WMP study area and corresponding increases in water demands.

External factors have also affected or may affect Valley water supplies:

- SWP supplies fluctuate annually due to hydrology and environmental needs in the Sacramento-San Joaquin Delta (Delta).
- Recent environmental rulings have restricted the State's ability to move water through the Delta to the SWP decreasing supply reliability. The degree to which the long term supply of the SWP will be affected is uncertain.
- Efforts are underway to prepare the Bay-Delta Conservation Plan (BDCP), which is intended to restore the Delta's ecosystem and improve water supply reliability.
- The Quantification Settlement Agreement (QSA) has been overturned by the Superior Court, creating uncertainty in future Colorado River supplies.
- Climate change could affect the long term reliability of SWP and Colorado River supplies.

These changing conditions reinforce the need for a long term Plan and for updating the Plan in response to changing conditions. Consequently, the goal and objectives for the 2010 WMP Update have been refined to reflect the significant changes in projected water demands and water supplies that have occurred in recent years. The basic goal of the WMP remains essentially the same: "to reliably meet current and future water demands in a cost-effective and sustainable manner." However, the underlying objectives have been refined based on the uncertainties facing water resources managers throughout California. The programs and projects identified in the 2010 WMP Update are based on the following objectives:

1. Meet current and future water demands with a 10 percent supply buffer,
2. Eliminate long-term groundwater overdraft,
3. Manage and protect water quality,
4. Comply with state and federal laws and regulations,
5. Manage future costs, and
6. Minimize adverse environmental impacts.

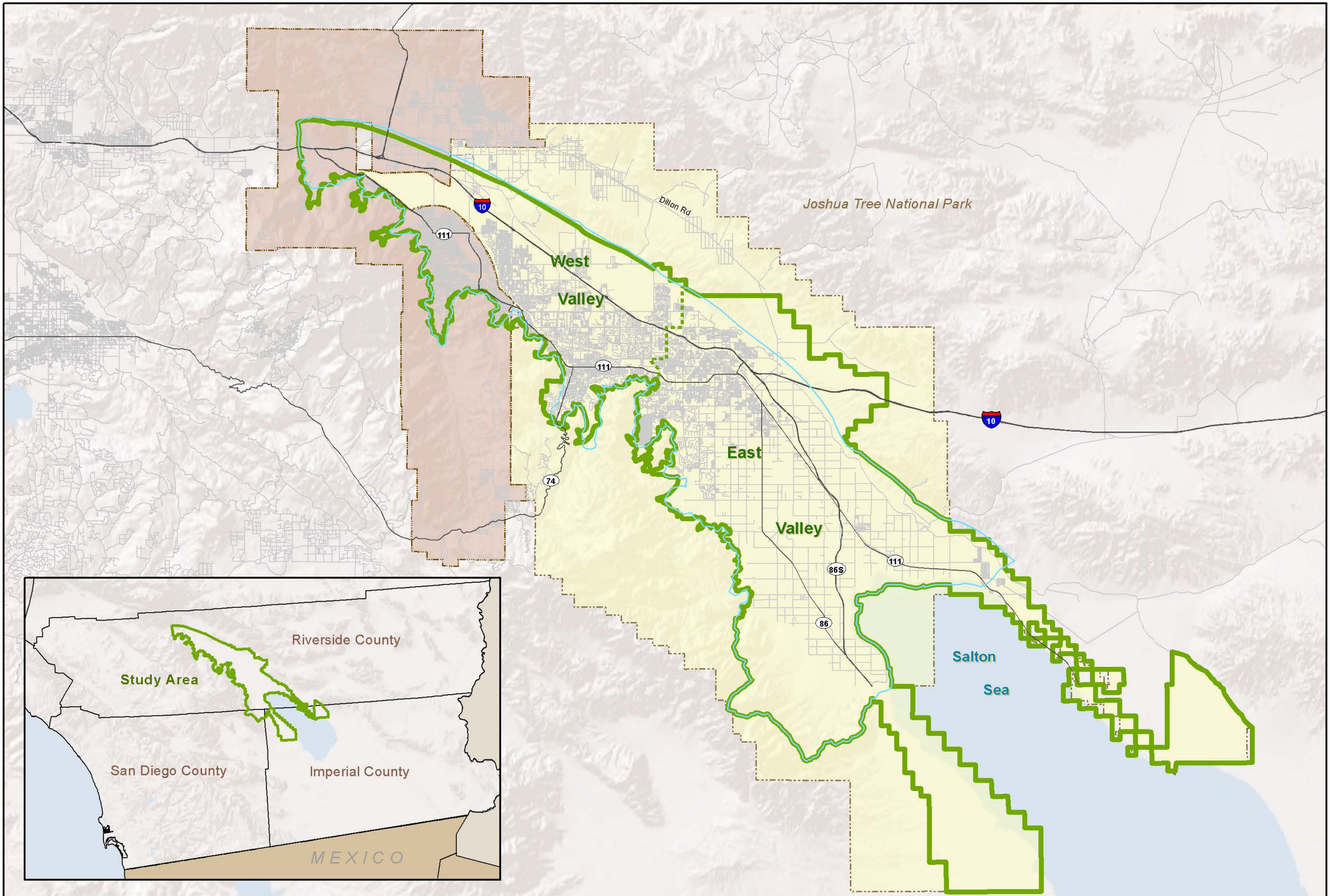
These objectives are described in more detail in Section 6. Each objective contributes to improved water supply reliability for the Coachella Valley by ensuring adequate supplies to meet current and future demands, eliminating the long-term depletion of groundwater storage and ensuring that basin water quality is protected from degradation due to brackish return flows.

1.2 STUDY AREA DESCRIPTION

The Coachella Valley lies in the northwestern portion of a great valley, the Salton Trough, which extends from the Gulf of California in Mexico northwesterly to the Cabazon area as shown on **Figure 1-1**. The Colorado River intersects this trough about midway, and its delta has formed a barrier between the Gulf of California and the Coachella and Imperial valleys. The Coachella Valley is ringed with mountains on three sides. On the north and west sides are the San Bernardino Mountains, San Jacinto, and Santa Rosa, which rise more than 10,000 feet above mean sea level (MSL). To the northeast and east are the Little San Bernardino Mountains, which attain elevations of 5,500 feet above MSL.

The Coachella Valley is geographically divided into the West Valley and the East Valley. Generally, the West Valley, which includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells and Palm Desert, has a predominately resort/recreation-based economy that relies on groundwater as its principal water source. The East Valley, which includes the cities of Coachella, Indio and La Quinta and the communities of Mecca and Thermal, has an agricultural-based economy utilizing groundwater and Colorado River water imported via the Coachella Canal. The East Valley is southeast of a line generally extending from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street, and the West Valley is northwest of this line as shown in **Figure 1-1**. The WMP study area also included CVWD's domestic water service area along the western and eastern shores of the Salton Sea which relies on groundwater pumped from the Whitewater River Subbasin. The 2010 WMP Update includes expanded areas of potential development located east of the San Andreas Fault along Dillon Road. This area falls within the spheres of influence of the cities of Coachella and Indio. Additional discussion of this expanded service area is presented in **Section 3**.

The Coachella Valley Groundwater Basin encompasses much of the Valley floor. Geologic faults and structures divide the basin into five subbasins: San Gorgonio Pass, Whitewater River (Indio), Garnet Hill, Mission Creek, and Desert Hot Springs subbasins. The largest of these is the Whitewater River Subbasin, which lies between the San Andreas Fault on northeast and the surrounding San Jacinto and Santa Rosa Mountains on the southwest. The subbasin extends from Whitewater in the northwest to the Salton Sea in southeast.



Key to Features

- Study Area
- Highways
- DWA
- CVWD
- Whitewater River Sub-Basin

N
0 5 10 Miles

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Date: March 2012

2010 Water Management Plan Update Study Area

Figure 1-1

MWH

Source: DWR, ESRI, County of Riverside

The California Department of Water Resources (DWR) refers to the Whitewater River subbasin as the Indio Subbasin which is designated Basin No. 7-21.01 in DWR's Bulletin 118 (DWR, 2003a). The basin has a storage capacity of approximately 30 million acre-feet[1] (AF) (DWR, 1964). The geology of the basin varies with coarse-grained sediments located in the vicinity of Whitewater and Palm Springs, gradually transitioning to fine-grained sediments near the Salton Sea. Water placed on the ground surface in the West Valley will percolate through the sands and gravels directly into the groundwater aquifer. However, in the East Valley, several impervious clay layers lie between the ground surface and the main groundwater aquifer. Water applied to the surface in the East Valley does not easily reach the East groundwater aquifers due to these impervious clay layers. The only outlet for groundwater in the Whitewater River Subbasin is through natural subsurface outflow to the Salton Sea or through collection in drains and transport to the Salton Sea via the Coachella Valley Stormwater Channel (CVSC).

Although the study area of 2002 WMP and the 2010 WMP Update includes the Garnet Hill Subbasin[2], this subbasin is evaluated in detail the Mission Creek/Garnet Hill WMP which is under preparation (see **Section 1.4.3**.) The study area also includes the Fargo Canyon subarea of the Desert Hot Springs Subbasin; however, little to no groundwater is currently produced from this subarea. This area has been included in the study area because it is expected to undergo urban development during the planning period and may rely on the same water supplies as the rest of the Valley.

The water users in the Coachella Valley receive water service from six water agencies: CVWD, DWA, Mission Springs Water District (MSWD), Indio Water Authority (IWA), Coachella Water Authority (CWA) and Myoma Dunes Mutual Water Company. Several isolated communities are supplied by small private water companies or by tribal water systems. The service area boundaries of Valley water purveyors along with city boundaries are presented in **Figure 1-2**. Wastewater service is provided by CVWD, DWA, the City of Palm Springs, Coachella Sanitary District and Valley Sanitary District (portions of Indio). Portions of the planning area that are not served by one of these agencies rely on individual septic systems for wastewater treatment and disposal.

1.3 APPROACH TO THE PLAN UPDATE

The 2010 WMP Update presents materials needed by an informed public to understand the goal, objectives, purposes and need for the Update. Changed conditions affecting Plan implementation and modifications to the 2002 WMP to meet changing conditions in the future are clearly defined.

Section 2 provides a brief overview of the 2002 WMP to put changes in perspective. Section 3 describes changes in population and land use projections and corresponding changes in water demand projections. Section 4 describes available water supplies. Section 5 identifies issues

[1] One acre-foot (AF) is the amount of water that would cover one acre of land (approximately the size of a football field), one foot deep, or about 326,000 gallons.

[2] DWR Bulletin 118 (2003) considers the Garnet Hill Subbasin to be part of the Whitewater River (Indio) Subbasin. However, the USGS has indicated the Garnet Hill to be a separate subbasin (Tyley, 1974). This plan adopts the USGS interpretation.

that have emerged since the 2002 WMP. Section 6 describes the 2010 WMP Update elements needed to meet currently forecast future needs. Section 7 describes the evaluation of plan components and selection of those components for inclusion in the 2010 WMP Update. Section 8 provides a revised implementation plan and programmatic cost estimates for Plan elements.

1.4 RELATIONSHIP TO OTHER PLANNING EFFORTS

Since completion of the 2002 WMP, a number of related, compatible planning efforts have been initiated in the Valley. These are described below.

1.4.1 Integrated Regional Water Management Plan

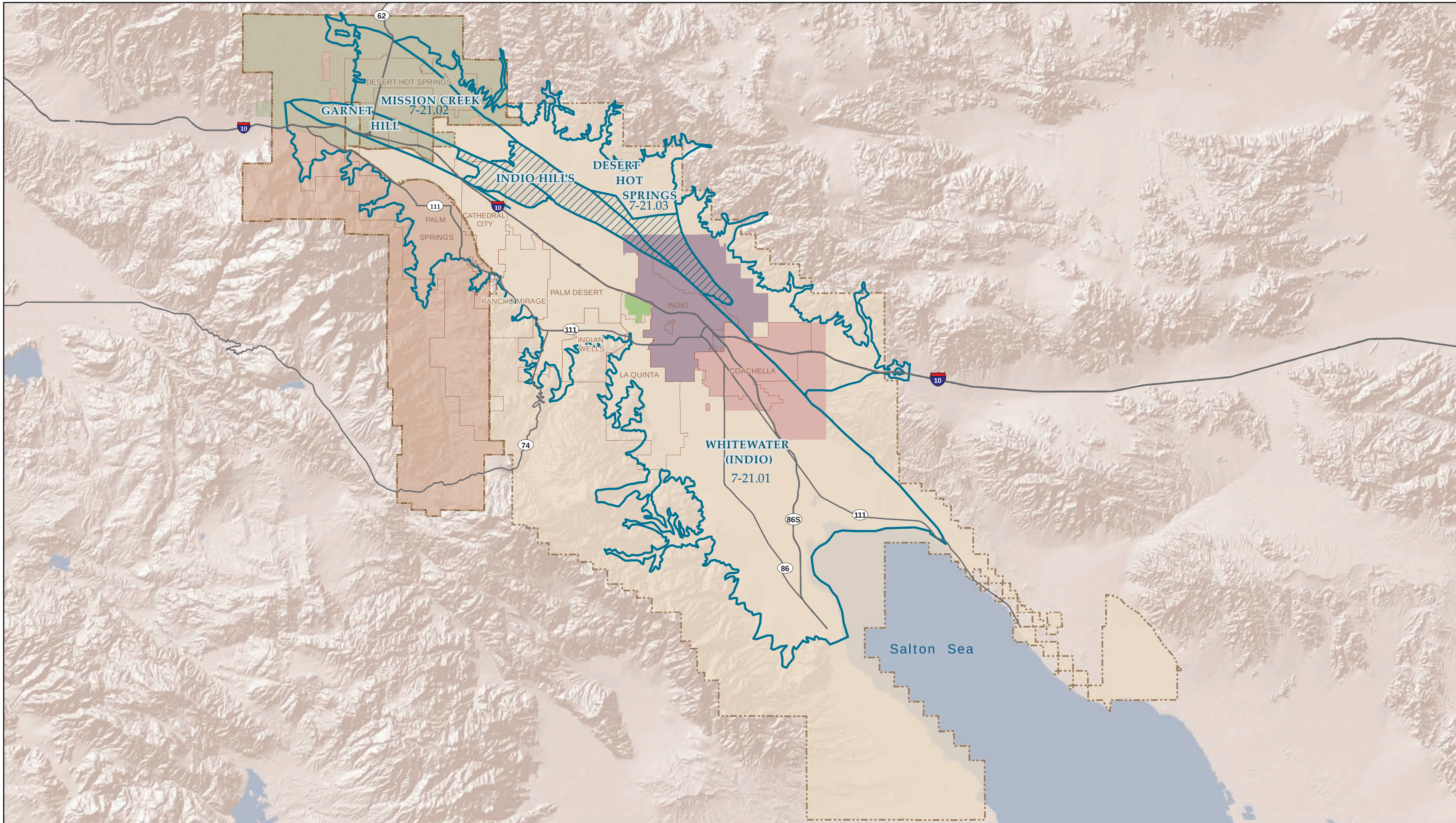
In 2002, the California legislature enacted the Integrated Regional Water Management (IRWM) Planning Act (Division 6 Part 2.2 of the Water Code §10530 et seq.), amended in 2008. The act encourages local agencies to develop integrated regional strategies for management of water resources and work cooperatively to manage their available local and imported water supplies to improve the quality, quantity and reliability of those supplies. The California Department of Water Resources (DWR) reviews all IRWM plans. DWR provides funding for water management projects through competitive planning and implementation grant programs.

In 2008, CWA, CVWD, DWA, IWA, and MSWD formed the Coachella Valley Regional Water Management Group (CVRWMG) and signed a Memorandum of Understanding (MOU) for development of an Integrated Regional Water Management Plan (IRWMP). In 2009, the CVRWMG established a planning region boundary and submitted an application for region acceptance to DWR, which was approved.

The CVRWMG completed the Coachella Valley IRWMP in December 2010 (CVRWMG, 2010). The CVIRWMP qualifies the region for DWR grants under proposition 84, Division 43: *The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006*, and Proposition 1E, *Article 1.699: Disaster Preparedness and Flood Prevention Bond Act of 2006*. The 2002 WMP was a significant source of information for the Coachella Valley IRWMP. The 2010 WMP Update is expected to be a significant component of future updates to the CVIRWMP.

1.4.2 Urban Water Management Plan

In 1983, the California Legislature enacted the Urban Water Management Planning (UWMP) Act (Division 6 Part 2.6 of the Water Code §§10610 - 10656). This act requires that every urban water supplier providing water to 3,000 or more customers, or more than 3,000 AF of water annually, should ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The act describes the contents of the UWMP as well as how urban water suppliers should adopt and implement the plans. Every five years (in years ending in five and zero), plans are prepared and adopted that define the supplier's current and future water use, sources of supply, source reliability, and existing conservation measures. DWR reviews plans for compliance and provides a report to the California legislature one year after plans are due to DWR.



Key to Features

City Boundaries	Groundwater Subbasin	CVWD	City of Coachella (including Sphere of Influence)
Highways	Groundwater Subarea	DWA	City of Indio (including Sphere of Influence)
		MSWD	Myoma Dunes Mutual Water Company
			Semi Waterbearing Rocks

0 2.5 5 10 Miles

N

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Date: February 2013

Coachella Valley City Boundaries and Groundwater Subbasins

Figure 1-2

MWH

Source: Modified from DWR, USDA, ESRI, USGS, County of Riverside

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In compliance with state requirements, CVWD prepare the 2010 UWMP for its service area. The deadline for the 2010 plan was extended by Senate Bill (SB) x7-7 (2009) that mandated the development and implementation of plans to decrease per capita urban water usage 20 percent by the year 2020. The plan documents CVWD's projected water demands, its plans for delivering water supplies to its customers, and its plans for complying with SB x7-7. The 2010 WMP Update was a primary source document for CVWD's 2011 UWMP, which was adopted on July 12, 2011.

The City of Coachella, DWA, IWA, and MSWD each prepared and submitted a 2010 UWMP. Most of the MSWD service area is outside the 2010 WMP Update planning area but is within the Coachella Valley IRWMP region.

1.4.3 Mission Creek and Garnet Hill Water Management Plan

The Mission Creek and Garnet Hill subbasins of the Coachella Valley Groundwater Basin lie north of the Banning Fault and outside the area included in the 2010 Water Management Plan Update. CVWD and MSWD have public water systems that rely on groundwater from the Mission Creek and Garnet Hill Subbasins. CVWD and DWA have statutory authority to impose replenishment assessments on water produced from portions of the subbasins within their service areas that benefit from replenishment activities. MSWD was annexed to DWA in 1963. Since that time, land owners within MSWD's and DWA's boundaries have paid a SWP tax assessment for the capital and certain fixed operating costs of the SWP. As early as 1984, MSWD, CVWD and DWA held discussions about recharging the Mission Creek Subbasin and the facilities that would be required. In 2002, DWA completed construction of spreading basins and a turnout from the Metropolitan Colorado River Aqueduct (CRA) and water deliveries began. CVWD and DWA executed the Mission Creek Groundwater Replenishment Agreement in April 2003, which also allowed for storage of advanced deliveries from Metropolitan.

In October 2003, MSWD filed action in the Superior Court of the State of California against DWA and CVWD seeking a writ of mandate, declaratory relief for prescriptive and appropriative water rights, and declaratory and injunctive relief for a physical solution of a groundwater basin. MSWD sought adjudication of the subbasin and questioned the quality of the imported water. In December 2004, MSWD, DWA and CVWD reached a settlement agreement to work jointly to manage the subbasin. The agreement included provisions regarding payment of Replenishment Assessment Charges (RAC), shared costs for basin studies and development of a Water Management Plan for the Mission Creek and Garnet Hill Subbasins. Development of the Mission Springs and Garnet Hill Water Management Plan was initiated in August 2009 and is expected to be completed in late 2012.

The development of the Mission Creek/Garnet Hill WMP is being closely coordinated with the 2010 WMP Update to ensure consistent planning assumptions and analyses.

1.4.4 Coachella Valley Multiple Species Habitat Conservation Plan

The purpose of the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is to provide a regional approach to balanced growth that will help conserve the Coachella Valley's natural heritage and allow for economic development by providing comprehensive compliance with federal and state laws to protect endangered species. The CVMSHCP permanently conserves 240,000 acres of open space and 27 threatened plant and animal species across the Coachella Valley. It allows for more timely construction of infrastructure essential to improving the Coachella Valley. The CVMSHCP was prepared by the Coachella Valley Association of Governments (CVAG) and the Coachella Valley Mountains Conservancy. Current signatories to the CVMSHCP include Riverside County, the cities of Cathedral City, Coachella, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, Rancho Mirage, CVWD and Imperial Irrigation District (IID). The Coachella Valley Conservation Commission (CVCC), a joint powers authority of elected representatives, oversees and manages the CVMSHCP. The CVCC has no regulatory powers and no land use authority. Its primary purpose is to buy land from willing sellers in the conservation areas and to manage that land. The Plan will provide 75 years of habitat mitigation for CVWD activities. For participation in the Plan, CVWD will conserve lands in areas designated for conservation, and will also create additional habitat acreage.

Mitigation requirements for the creation of replacement habitat in the 2002 WMP PEIR have been incorporated into the CVMSHCP. The conservation areas defined in the CVMSHCP have been considered in developing the growth forecasts and water demand projections for the planning area of the 2010 WMP Update. In addition, the habitat replacement commitments have been included in the implementation program for the 2010 WMP Update.

1.5 GROUNDWATER MANAGEMENT PLANNING ACT

The Groundwater Management Planning Act (California Water Code Part 2.75, §10753), originally enacted as Assembly Bill (AB) 3030 (1992) and amended by Senate Bill (SB) 1938 (2002), provides the authority to prepare groundwater management plans. The intent of AB 3030 is to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions. SB 1938, signed into law in 2002, requires any public agency seeking State funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components. Requirements include establishing basin management objectives, preparing a plan to involve other local agencies in a cooperative planning effort, and adopting monitoring protocols that promote efficient and effective groundwater management. The requirements applies to both agencies that have already adopted groundwater management plans as well as agencies that do not overlie groundwater basins identified in Bulletin 118 and its updates.

CVWD and DWA manage groundwater in the Coachella Valley under legal authority established in the California Water Code (CVWD – Water Code §31630-31639; DWA – Water Code Appendix Chapter 100). The Coachella Valley Water Management Plan and this 2010 Update were prepared independently from the Groundwater Management Act. However, the Plan does cover many of the same topics that are required for a groundwater management plan. **Table 1-1** shows a list of GWMP requirements and the location those topics are discussed in the 2010 WMP Update.

Table 1-1
Components of a Groundwater Management Plan

Plan Component	Recommended by AB 3030	Required by SB 1938	WMP Section
Control of saline water intrusion	✓		Not applicable
Identification and management of wellhead protection and recharge areas	✓		6.8.1
Regulation of the migration of contaminated water	✓		Not addressed
Administration of a well abandonment and well destruction program	✓		6.8.1¸ 8.2.2
Mitigation of conditions of overdraft	✓		8
Replenishment of groundwater extracted by water producers	✓		8.1.1.3, 8.1.2.2
Monitoring of groundwater levels and storage	✓	✓	8.2.1, App. C
Facilitation of conjunctive use operations	✓		8.1.1.2
Identification of well construction policies	✓		6.8.1, 8.2.2
Financing groundwater management projects	✓		8.5
Development of groundwater management partnerships	✓		8.1.1.2, 8.1.2.3
Coordination of land use planning and groundwater management to prevent groundwater contamination	✓		Not addressed
Description of participation by interested parties		✓	8.2.3
Plan to involve agencies overlying the basin		✓	1.4.1, 8.2.3
Basin management objectives		✓	6.1, 8.1
Basin management entity(ies) and area map		✓	1.1, Fig. 1-1 and 1-2

1.6 PLAN ADOPTION

A Draft Subsequent Program Environmental Impact Report (SPEIR) on the 2010 WMP Update was released for a 45-day public review period on August 8, 2011. A public meeting on the SPEIR was held on September 7, 2011 at CVWD's Palm Desert offices. The formal comment period concluded on September 22, 2011. On January 24, 2012, the CVWD Board of Directors certified the Final SPEIR and adopted the 2010 WMP Update.

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Section 2

Section 2
The 2002 Water Management Plan

Adoption of the 2002 WMP represented a major change in water management for the Coachella Valley. While past water management practices had been vital for the economic growth of the Valley, the 2002 WMP provided a road map for meeting future water needs. CVWD, DWA, and the other Coachella Valley agencies have been successful in implementing many of the recommendations and projects included in the 2002 WMP. The primary successes have been in the areas of urban water conservation, acquisition of additional State Water Project (SWP) supplies, construction of the initial phase of the Mid-Valley Pipeline (MVP) and construction of the Thomas E. Levy Groundwater Replenishment Facility (Levy facility). CVWD has worked cooperatively with Riverside County, the Coachella Valley cities and water agencies and the Coachella Valley Association of Governments (CVAG) to develop a Valley-wide landscape ordinance to conserve water. Many of the local governments in the Valley have adopted the ordinance. CVWD also implemented a replenishment assessment charge (RAC) on pumping for the lower Whitewater River subbasin which generates funds for groundwater replenishment activities. Although much remains to be done to eliminate groundwater overdraft, significant progress has been and continues to be made. This section describes the 2002 WMP and the implementation status of that Plan.

2.1 ALTERNATIVES

The goal and objectives of the 2002 WMP are stated in Section 1. During preparation of the 2002 WMP, CVWD and its consultants identified a wide range of potential management elements that could potentially be included in a plan. These elements were organized in six categories: pumping restrictions, demand reduction (conservation), local water sources, imported water sources, water management actions, and water quality. Following evaluation for ability to reduce overdraft, technical feasibility, potential environmental impacts, costs, legal and regulatory factors and regional economic impacts, the elements were screened and combined into four management alternatives. A preferred alternative was selected that best met the 2002 WMP goal and objectives.

Alternative 1 – No Project: The No Project Alternative assumed continuation of water management actions at 2002 levels by CVWD including groundwater recharge in the West Valley; supplying Canal water to existing golf courses and agricultural users and to all new agricultural users and new golf courses within ID-1; supplying excess recycled wastewater effluent beyond percolation capacity to area golf courses; and domestic, golf course, and agricultural water conservation.

Alternative 2 – Pumping Restriction by Adjudication: Alternative 2 assumed court-ordered restrictions that allotted water to individual groundwater pumpers. The allocation would require groundwater pumping be drastically reduced throughout the Coachella Valley. West Valley pumping would be reduced by approximately 35 percent, while in the East Valley pumping would be reduced by approximately 75 percent.

Alternative 3 – Management of Demand and Maximization of Local Resources: Alternative 3 maximized the use of available local water resources and managed water demand while maintaining imported water usage at 2002 levels. Demand would be managed, to the extent practical, by maximizing water conservation for both urban and agricultural uses and by the increased use of recycled water.

Alternative 4 – Combination Alternative: Alternative 4 included conservation, groundwater recharge, and source substitution, including many new actions. The most feasible and cost effective management elements were combined to include:

- Urban, golf course, and agricultural conservation measures,
- Additional surface water supplies,
- Groundwater recharge in the West and East Valleys, and
- Numerous source substitution elements to reduce groundwater pumping, including:
  - Canal water to agricultural groundwater users within Improvement District 1 (ID-1),
  - Canal water for golf course irrigation within ID-1,
  - Additional recycled water to West Valley golf courses,
  - Desalted agricultural drain water for agricultural irrigation outside ID-1,
  - Recycled water for agricultural irrigation in East Valley,
  - Treated Canal water for urban uses within ID-1, and
  - Direct delivery of SWP exchange water for West Valley golf course irrigation.

Alternatives 1, 2, and 3 were found to have significant adverse social, economic, and environmental impacts to the Coachella Valley. Alternative 4 best met the 2002 WMP goal and objectives with the least adverse impacts and was selected as the preferred alternative.

2.2 RECOMMENDED PLAN

The 2002 WMP included water conservation, additional supply, source substitution, and groundwater recharge elements. These are described below.

2.2.1 Water Conservation

The primary focus of water conservation was on urban use, agricultural irrigation, and golf course irrigation. As shown in **Table 2-1**, water conservation measures were expected to decrease total water demand by approximately seven percent by 2015. Water conservation activities included in the Plan are described below.

Urban Conservation: Under the preferred alternative, the target was to reduce urban water demand by a minimum of 10 percent by 2010 and maintain this level of reduction through 2035, the 2002 WMP planning period. Existing and potential new water conservation measures to be evaluated included water efficient landscaping, water efficient plumbing, tiered or seasonal water pricing, public information and education programs, and policies to incorporate water conservation measures into future general plan updates and development policies adopted by Valley municipalities.

Table 2-1
Minimum Water Conservation Assumptions for the 2002 Preferred Alternative

Water Use Category	Minimum Conservation Target (Reduction from No Project Demand)
Urban (municipal/residential)	10 percent by 2010
Golf Courses:	
Existing in 1999	5 percent by 2010
Built after 1999 [1]	Case-by-Case
Industrial	Case-by-Case
Crop Irrigation	7 percent by 2015
Fish Farms	Case-by-Case
Duck Clubs	Case-by-Case
Greenhouses	Case-by-Case
Total Demand	7 percent

[1] Future golf courses were assumed to implement water conservation measures under No Project

Agricultural Conservation: Agricultural water conservation included evaluation of existing and new agricultural conservation measures, including efficient irrigation practices and on-farm water audits consisting of field-by-field review of practices with a confidential report to each irrigator on practices and recommendations for improving efficiency.

Golf Course Conservation: Proposed golf course water conservation included improved irrigation practices, golf course turf restrictions and establishing a maximum water allowance.

District Operating Policies: The 2002 WMP included an ongoing process to identify CVWD operating policies resulting in additional water savings or to make the use of Canal water more attractive to groundwater users.

Evaluation of Water Conservation Programs: CVWD's water conservation programs would be evaluated to determine the effectiveness of voluntary programs. Recommendations would be developed for improvement in specific areas, such as public education, ordinances, etc. Based on evaluation results, additional conservation measures would be considered by the CVWD Board.

2.2.2 Additional Water Supplies

The 2002 WMP proposed that CVWD and DWA obtain additional water supplies to help eliminate current and future overdraft. Sources of additional water included the Colorado River, the State Water Project, the Whitewater River, recycled water, water exchanges and transfers, dry year purchases, water development projects, and desalination.

Colorado River Water: CVWD, IID and Metropolitan, along with the State of California and the U. S. Department of the Interior (Interior), agreed on a formal Quantification Settlement Agreement (QSA) regarding their respective shares of Colorado River water. The QSA is described in more detail in **Section 4**.

The QSA was signed in October 2003, giving CVWD a total diversion of 459,000 AFY at Imperial Dam. After deducting conveyance losses, about 428,000 AFY was expected to be available for use in the Valley by 2026.

SWP 100,000 AFY Transfer: Prior to adoption of the 2002 WMP, CVWD and DWA had contracts with the State of California for a combined Table A Amount[1] of 61,200 AFY of SWP water. Under the SWP Transfer Project, CVWD and DWA would acquire 100,000 AFY of Metropolitan's SWP Table A Amount as a permanent transfer. Water obtained through this transfer would be exchanged for Colorado River water.

Additional Water Purchases: During wet years, CVWD and DWA would continue their current practice of purchasing Pool A, Pool B and interruptible water as available from other SWP contractors. In addition, CVWD and DWA would evaluate the purchase of water during dry years from programs like the Governor's Drought Water Bank based on supply availability and costs. The objective of these purchases and acquisitions along with the SWP Transfer was to achieve long-term average deliveries of 140,000 AFY from the SWP.

Recycled Treated Municipal Wastewater Effluent: Municipal effluent recycling would continue and increase by an additional 16,000 AFY by 2035.

Desalinated agricultural drain water: Agricultural drain water from the CVSC would be desalted to a quality equivalent to Canal water for irrigation use with an initial rate of 4,000 AFY by 2013, increasing to 11,000 AFY by 2023.

Recycled fish farm effluent: Recycling would continue at fish farms providing about 5,000 AFY for use by duck clubs and agriculture irrigation.

2.2.3 Source Substitution

Source substitution is the delivery of an alternate source of water to users pumping groundwater. Alternative sources of water in the Coachella Valley include recycled water from municipal wastewater treatment plants, Canal water, desalinated agricultural drain water, and SWP Exchange water delivered through the Coachella Canal.

Source substitution projects included conversion of existing and future golf courses from groundwater to Canal water, recycled water, or SWP Exchange water, and conversion of agricultural irrigation and municipal use from groundwater to Canal water. A major project envisioned was the MVP that would convey SWP Exchange water from the Coachella Canal to golf courses in the Rancho Mirage-Palm Desert-Indian Wells area.

Approximately 30 percent of the municipal demand in the East Valley would receive treated Canal water from one or more water treatment plants. Total municipal usage of treated Canal water was projected to be about 32,000 AFY and would be phased in during the late 2020s and early 2030s.

2.2.4 Groundwater Recharge

Overall, groundwater recharge under the preferred alternative would increase. CVWD and DWA would initially recharge an average of 140,000 AFY SWP Exchange water the Whitewater

[1] Each SWP contract contains a "Table A" exhibit which defines the maximum annual amount of water each contractor can receive, excluding certain interruptible deliveries. Table A Amounts are used by DWR to allocate available SWP supplies and some of the SWP project costs among the contractors.

River Recharge Facility. This volume would gradually be reduced to 103,000 AFY of SWP water as a portion of the SWP Exchange water is delivered to golf courses in the West Valley through the MVP for source substitution.

Approximately 80,000 AFY of Canal water would be recharged on average in the East Valley. This amount will be phased in over time at recharge facilities anticipated to be located near Dike No. 4 and in the Martinez Canyon area.

An ongoing groundwater monitoring program would continue to play an integral role in CVWD's understanding of the basin's response to different plan elements. CVWD/ U. S. Geological Survey (USGS) land subsidence studies would continue and include the construction of additional monitoring wells. CVWD would use groundwater data to assess individual plan elements and effectiveness in meeting the goal of the 2002 WMP.

2.3 ENVIRONMENTAL COMPLIANCE

Adoption of the 2002 WMP by the Board of Directors was an action subject to compliance with the California Environmental Quality Act (CEQA). CEQA compliance was achieved by preparing a Program Environmental Impact Report (PEIR). The PEIR presented the results of the technical and environmental analyses of the preferred alternative (Proposed Project) and other alternatives, and on-going input from stakeholders during development of the PEIR.

A programmatic approach was taken because the Proposed Project resulted in implementation of a set of policies and actions in a large geographic area over a 35-year period. The PEIR identified the environmental setting, environmental impacts of the Proposed Project (described at a program level), and mitigation measures included in the Proposed Project to reduce adverse effects.

The PEIR identified project impacts on the physical environment, surface water resources, groundwater resources, human or built environment, biological resources, including federal and state listed threatened and endangered species, and growth inducing impacts (MWH, 2002).

As a result of the review, impacts were classified as follows:

- Beneficial,
- Potentially significant,
- Less than significant with mitigation incorporated (identified in PEIR),
- Less than significant, and
- no impact

Almost all of the 2002 WMP impacts were determined to be less than significant with mitigation. Some impacts were considered beneficial, such as impacts on groundwater and surface water resources, land subsidence, and local water supply. The following potentially significant impacts also were identified in the PEIR:

- A potential increase in selenium in agricultural drains exceeding aquatic life criteria (to be monitored and mitigated, if required, in the future by creating replacement habitat with low selenium water).
- Groundwater quality impacts from recharge with Colorado River water were identified as significant and not mitigable; primarily (health-based) drinking water quality impacts on individual wells near recharge areas, including Indian Trust assets, would be addressed by providing alternative water supplies.
- Increase in the rate of Salton Sea salinization and the timing of fisheries impacts (to be mitigated by others as part of the Salton Sea Restoration Project).

The PEIR also identified cumulative impacts, i.e., impacts that result from implementation of the WMP and other ongoing planned projects, to surface waters, groundwater, the Salton Sea, and biological resources. Most cumulative impacts were determined to be less than significant, less than significant with mitigation, or beneficial.

It was recognized in the PEIR that implementation of certain WMP elements would be subject to additional CEQA compliance as those activities proceeded. This would include site-specific impacts of construction and operation of pipelines, pumping stations, recharge basins, wastewater treatment facilities, etc.

In September 2002, the CVWD Board of Directors certified the PEIR and adopted findings of fact that included a statement of overriding considerations and a Mitigation Monitoring and Reporting Plan (MMRP). Mitigation measures contained therein still stand.

2.4 WATER MANAGEMENT PLAN IMPLEMENTATION PROGRAM

In early 2004, CVWD initiated development of the Water Management Plan Implementation Program (Water Consult, 2006). The Implementation Program was developed by CVWD staff, consultants, and a Stakeholder Task Force. The objective was to identify and prioritize projects, both ongoing and new, that were needed to achieve the goal and objectives of the 2002 WMP.

Stakeholders were involved in all aspects of development of the Program. The Stakeholder Task Force was made up of representatives from a broad cross-section of interests in the Coachella Valley including agriculture, golf courses, municipalities, homeowners associations, tribes, Riverside County, California Regional Water Quality Control Board – Colorado River Basin Region (Regional Board) CVAG, building industry, Salton Sea Authority, and League of Women Voters. The Task Force developed recommendations and priorities for implementation of urban, agriculture, and golf course conservation and special projects. Project summaries and detailed project descriptions were reviewed by the stakeholders, including staffing and cost estimates.

Stakeholder recommendations formed the basis of the Implementation Program. A summary of the stakeholder recommendations is provided below:

1. The stakeholders recommended initiation, continuation, or expansion of 53 short-term projects to achieve the goals of the 2002 WMP.

2. In the event that the Program cannot be fully implemented in the near-term, the CVWD Board should implement the Program in accordance with priorities recommended by the Task Force.
3. The CVWD Board should consult with the four stakeholder teams and the Task Force as a whole as it evaluates the recommendations of the Task Force.

The CVWD Board accepted the stakeholder's recommendations in January 2006. Priorities recommended by the stakeholders for these projects are considered in developing annual and long range budgets. CVWD conducts ongoing reviews of the staffing and costs of the various projects recommended by the stakeholders. Schedule and budgets for projects are adjusted by CVWD management and the Board each year based on available funds.

2.5 STATUS OF 2002 WMP IMPLEMENTATION

The 2002 WMP incorporated many ongoing activities, expanded those activities, and added a number of new activities to insure achievement of the 2002 WMP goal and objectives. The 2002 WMP set forth time frames for achievement of the goal, objectives, and activities. Major accomplishments are summarized below. A detailed listing of activities and accomplishments is provided in **Table 2-2** below.

Water Conservation: Urban water use in 2009 was 14 percent less per customer than in 2003 and has shown a steady downward trend since 2003. Based on a review of available water usage data, Coachella Valley urban water users appear to have exceeded the 10 percent objective established in the 2002 WMP. CVWD's implementation of tiered water rates in conjunction with a valley-wide landscape ordinance in 2009 will likely contribute to exceeding this target in the future.

The 2002 WMP established a target of 7 percent agricultural water use reduction through conservation. In order to comply with the QSA and the U. S. Bureau of Reclamation's (Reclamation) Inadvertent Overrun and Payback Policy (IOPP), Coachella Valley farmers implemented a number of extraordinary water conservation measures. Based on a comparison with 2000-2002 average water use per acre, agricultural water usage has varied from 2003 to 2008, but has generally declined about 9.9 percent. While this estimate may be high due to weather variations, crop water needs, accuracy of reported groundwater production, and variation in cropping patterns, it does indicate a significant decrease in agricultural water use over the period. Implementation of these measures allowed CVWD to complete its IOPP 72,000 AF payback requirement two years early.

Actual golf course water use per irrigated acre in the West Valley appears to have declined about 14 percent compared to the 2000-2002 average. Available data for East Valley courses is not adequate to determine the conservation level achieved.

CVWD has appointed an urban/golf course water conservation coordinator and centralized its conservation staff. Twelve staff members are assigned to this substantial effort.

Additional Water Supplies: The QSA was signed in 2003 and provides substantial guarantees regarding existing water sources and substantial additional supplies to CVWD. A number of agreements to implement the QSA have been completed, resulting in transfer of substantial qualities of water to CVWD (see **Table 2-2**). CVWD and DWA continue to develop additional supplies through purchase of SWP water from other contractors. Since 2002, those purchases have provided an additional 32,900 AFY for a total Table A Amount of 194,100 AFY. Other purchases are implemented on a short term basis as opportunities arise. Municipal wastewater treatment plant recycling is currently 14,000 AFY and is expected to increase substantially in the future. A pilot study for use of desalinated agricultural drain water for agricultural purposes was completed in 2008.

Source Substitution: Canal water use on East Valley golf courses increased from 6,100 AFY in 1999 to 14,900 AFY in 2009. Phase 1 of the MVP has been completed and plans are underway for completion of additional phases to deliver 37,000 AFY of Canal water and 15,000 AFY of recycled water to West Valley golf courses in lieu of groundwater pumping. A treatability study for municipal use of Canal water was completed in 2007. Agreements were reached with several developers regarding installation of non-potable water systems for landscape irrigation. Plans are being developed for conversion of additional East Valley agriculture to Canal water where feasible.

Groundwater Recharge: Recharge continues with available SWP Exchange water deliveries at the Whitewater River Recharge Facility in the West Valley. In the East Valley, the Thomas E. Levy Groundwater Replenishment (Levy) Facility at the Dike 4 site was completed in 2009 with 18,500 AFY of recharge accomplished. The facility can currently recharge about 32,500 AFY and will have a capacity of 40,000 AFY with construction of additional water conveyance facilities. A pilot project was completed for the Martinez Canyon Recharge Facility in 2008 and about 3,000 AFY of recharge is underway at that facility.

Groundwater/Subsidence Monitoring Program: Monitoring of stream flow, groundwater production, groundwater levels, and water quality continues. The USGS completed subsidence reports in 2001 and 2007. Monitoring for subsidence is ongoing.

Numerous activities are being conducted to assure achievement of the 2002 WMP goal and objectives and many of these activities have made substantial progress since 2002. Details of these activities are provided in **Table 2-2.**

Table 2-2
Status of the 2002 Water Management Plan Implementation

1. WATER CONSERVATION	
A. Municipal Conservation	
Large Landscape Customers	**Has This Program or Project Been Implemented?**
Low-Interest Loans to Implement Water Conservation Programs	No – A CVWD Board resolution was adopted but no applications received.
Initiate Professional Landscaper Certification Program	Yes – Semi-annual seminars are conducted.
Water Audits for Large Water Users	Yes
Adoption of Water Efficient Landscape Ordinance by Valley Cities	Yes - Most cities adopted 2007 CVWD ordinance or something more stringent. Revised ordinance adopted by CVWD Board in 2009. All cities and the County are expected to adopt 2009 ordinance.
Large Landscape Weather-Based Irrigation Controller Rebate Program	Yes – 97 customers. This represents about 10% of CVWD customers.
Large Site Curbside Sprinkler Retrofit Rebate Program	Yes – Two pilot projects. New development complies with 2009 Landscape Ordinance.
Plan Check Compliance Inspections of All Approved Landscape Irrigation Plans	Yes
Residential Customers	**Has This Program or Project Been Implemented?**
Generate Residential ETo Zone Map	Yes – Used for tiered water rates and maximum applied water allowance in Landscape Ordinance.
Residential Weather-Based Irrigation Controller Rebate Program	Yes – Existing customers. Required for all new development via Landscape Ordinance.
Residential Curbside Sprinkler Retrofit Rebate Program	Yes - A pilot project consisting of 10 houses on a cul-de-sac. Reduced street runoff by a total of 55 gpm when sprinklers were running.
Generic Landscape Irrigation Schedule Sticker Program	Yes
Website Turf Grass Irrigation Scheduling Program	Yes
Turf buyout partnership with cities of La Quinta and Palm Desert	Yes – new program not included in 2002 WMP.
Water Efficient Plumbing	**Has This Program or Project Been Implemented?**
Water efficient plumbing is installed in all new homes.	Yes – Implemented via building codes.
Retrofit of existing fixtures with water efficient fixtures	Yes – CVWD has an on-going program to provide free indoor conservation kits and offer high-efficiency toilet rebates on a first-come-first-served basis.
Tiered or Seasonal Water Pricing	**Has This Program or Project Been Implemented?**
Tiered water pricing will be reviewed as part of the 2008 Water Management Plan update.	Yes– Implemented in 2009.

Table 2-2 (continued)
Status of the 2002 Water Management Plan Implementation

1. WATER CONSERVATION (continued)	
Municipal Development Policies	**Has This Program or Project Been Implemented?**
Adoption of Water Efficient Landscape Ordinance by Valley Cities	Yes - Most cities and Riverside County adopted 2007 ordinance or something more stringent. Revised ordinance adopted by CVWD Board in 2009. All cities and the County are expected to adopt 2009 ordinance.
Maximum Water Allowance	**Has This Program or Project Been Implemented?**
Establish new and enforce existing annual maximum applied water allowances for parks, playgrounds, sports fields, school yards, and other recreational areas.	Yes - Program is implemented through adoption of the Water Efficient Landscape Ordinance by local municipalities. It is enforced/monitored via the tiered rate program which establishes customized water budgets for customers.
Conservation Coordinator	**Has This Program or Project Been Implemented?**
Hire a full-time water conservation coordinator and support staff to develop and coordinate water conservation plans.	Yes - A full time coordinator has been hired with twelve full time staff. Staff has been reorganized to centralize urban and golf course water conservation activities.
Public Information and Education Program	**Has This Program or Project Been Implemented?**
Lush and Efficient: Guide to Coachella Valley Landscape Gardening	Yes – available on CVWD website and at the CVWD Water Service counter.
Demonstration Garden	Yes – 2 at CVWD, 1 at City of Palm Desert.
Landscape Workshops	Yes – 2 per year for home gardeners and landscape professionals.
Educate staff and public regarding Water Management Plan	Yes. Via WMP Update process.
Expanded Water Education Program for Residential Users	Yes – Landscape workshops and self audit form on website, publication: “Water Wise at Home”; “Ask Dave” conservation video series.
Add Water Conservation Page(s) to District Website	Yes - www.cvwd.org/conservation/conservation.php
School Education Program	Yes – The Water Wheel has been published 2-3 times per year since 2005, providing educators with water science information. Water Fun 4 Kids Website: http://www.waterfun4kids.org/
B. Agricultural Conservation	
Activity	**Has This Program or Project Been Implemented?**
Scientific Irrigation Scheduling	Yes
Scientific Salinity Management	Yes
Farm Uniformity Evaluations	Yes
On-Farm Audits – Confidential field reviews	No. Not required to achieve conservation target.

Table 2-2 (continued)
Status of the 2002 Water Management Plan Implementation

1. WATER CONSERVATION (continued)	
C. Golf Course Conservation	
Activity	**Has This Program or Project Been Implemented?**
Apply 2009 Landscape Ordinance to new golf courses. Reduce demand at new courses by 25%.	Yes - 2007 and 2009 Landscape Ordinances apply turf limits to new golf courses.
Soil Moisture Monitoring Services	No
Plan Checking: Adjust Recreational Turf Grass Plant Factor/Develop Turf Grass Prescriptive Criteria	Yes
Inspect New Golf Courses for Plan Check Compliance following construction	Yes – However, no new golf courses have been constructed since implementation.
Monitoring of Maximum Water Allowance Compliance	Yes – CVWD staff is evaluating monthly water use and developing monthly water budgets based on reported groundwater pumping.
Annual Golf Symposium to promote golf course water conservation	Yes – 2008 and 2009
D. District Operating Policies	
Activity	**Has This Program or Project Been Implemented?**
Review and identify policies that 1) result in additional water savings, and 2) make the use of Canal water more attractive to groundwater users	Replenishment assessment charge (RAC) established in the East Valley to recover replenishment costs. The RAC provides an economic incentive to use Canal water.
E. Evaluation of Water Conservation Programs	
Activity	**Has This Program or Project Been Implemented?**
Evaluate Water Conservation Programs	Yes - In 2006-2007, CVWD staff and stakeholders representing cities, tribes, water agencies, resource agencies, agriculture, golf, homeowners, and other interest groups reviewed and prioritized all water conservation programs and prepared a recommended Implementation Program (I. P.) to guide project development. The Board adopted the I. P. as a guideline in March 2006. The I. P. is used to help formulate annual budgets. Most of the programs are either underway or complete, as indicated in this report.
2. ADDITIONAL WATER SUPPLIES	
A. Colorado River Water	
Activity	**Has This Program or Project Been Implemented?**
Maintain 330,000 AFY base allotment	Yes
1988 Metropolitan/IID Approval Agreement for 20,000 AFY	Yes

Table 2-2 (continued)
Status of the 2002 Water Management Plan Implementation

2. ADDITIONAL WATER SUPPLIES (continued)	
IID Transfer of 50,000 AFY to CVWD	Agreement completed in 2003. 12,000 AFY to be transferred in 2010.
IID Transfer of additional 53,000 AFY to CVWD	Agreement completed in 2003.
Metropolitan SWP Transfer: 35,000 AFY to CVWD	Agreement Completed in 2003. Water is available for use anywhere in the Valley.
B. SWP Exchange Water	
Activity	**Has This Program or Project Been Implemented?**
Utilize existing SWP Table A Amount of 61,200 AFY (average supply of about 50,000 AFY)	Yes – Ongoing but current SWP reliability has declined to 60% (average supply = 36,700 AFY).
Use spot purchases of Pool A, B, and Interruptible water as available	Yes -Implemented as opportunities arise. Purchased more than 15,000 AF since 2002.
Maintain level of SWP Exchange water at 140,000 AFY (excluding the 35,000 AFY SWP transfer under the QSA)	No. Total deliveries averaged 91,100 AFY since 2002 due to California drought. However, re-charge in 2005 and 2010-2011 averaged 208,700 AFY.
C. SWP Transfer Project	
Activity	**Has This Program or Project Been Implemented?**
Acquire 100,000 AFY of Metropolitan's SWP Table A Amount as a permanent transfer and exchange for Colorado River water	Yes. Transfer completed in 2003 and effective in 2005.
D. Future Water Acquisitions	
Activity	**Has This Program or Project Been Implemented?**
Develop additional supplies that could include other SWP water acquisitions, other water transfers, or participation in out-of basin water development projects	Implemented as opportunities arise. Completed: • Tulare Lake (2004): 9,900 AFY • Berrenda Mesa WD (2007): 16,000 AFY • Tulare Lake (2007): 7,000 AFY • Rosedale Rio Bravo: 10,000 AF (one time)
Purchase water during dry years from programs like the Governor's Drought Water Bank	Implemented as opportunities arise. • Yuba Accord Dry Year Water Purchase Program – 1,836 AF in 2008, 3,482 AF in 2009
E. Recycled and Desalinated Drain Water	
Activity	**Has This Program or Project Been Implemented?**
Treated Municipal Effluent	Yes – Municipal recycling for non-potable use is currently 13,100 AFY from four plants: DWA Water Reclamation Plant, WRP 10, WRP 9, and WRP 7. About 9,000 AFY is percolated.
Desalinated Agricultural Drain Water	Yes – Pilot treatment study completed in 2008

Table 2-2 (continued)
Status of the 2002 Water Management Plan Implementation

3. SOURCE SUBSTITUTION	
Activity	**Has This Program or Project Been Implemented?**
Conversion of East Valley golf courses to Canal water use to serve additional golf courses in ID-I	Yes - Ongoing - Use has increased from 6,100 AFY in 1999 to 14,900 AFY in 2009.
West Valley golf course conversion to recycled water and Canal water	Phase 1 of MVP completed in 2008. Additional phases planned to deliver 37,000 AFY of Canal water and 15,000 AFY of recycled water to up to 50 golf courses. Delivered 9,000 AFY in 2009.
Conversion of existing East Valley agriculture to Canal water	Developing two irrigation system expansion projects which will be funded by assessment districts; will deliver 5,300 AFY of Canal water when complete.
Conversion of municipal use to Canal water	Pilot treatability study completed in 2008.
4. GROUNDWATER RECHARGE	
Activity	**Has This Program or Project Been Implemented?**
Whitewater River Recharge Facility: The recharge objective is 140,000 AFY in the West Valley, reducing to 103,000 AFY with implementation of the MVP.	Yes - The ability to meet the recharge objective has improved by additional purchases of Table A water but is limited by current SWP supply reliability. Recharge operations ongoing.
East Valley Recharge Facilities: Thomas E. Levy Groundwater Replenishment Facility (formerly Dike 4)	Yes - Project completed in 2009 and recharged 18,600 AFY. Currently recharging 32,000 AFY on average. May need additional pumping station and pipeline to achieve full capacity of 40,000 AFY capacity.
East Valley Recharge Facilities: Martinez Canyon Recharge	Pilot project completed in 2005. Recharging 2,500 AFY on average since 2005.
5. GROUNDWATER/SUBSIDENCE MONITORING PROGRAM	
Activity	**Has This Program or Project Been Implemented?**
Monitoring of groundwater production, levels and water quality in the valley	On-going
Monitoring of potential salt water intrusion from the Salton Sea, including construction of additional multi-level wells	On-going
CVWD/USGS land subsidence monitoring program in the valley	On-going – Initial USGS subsidence report in 2001; follow up report in 2007; monitoring ongoing.
Periodic review of monitoring data to determine impacts of Water Management Plan; status of basin levels and quality	On-going - Too early to see significant regional change. Local changes observed in vicinity of La Quinta due to Levy facility operations.
Incorporation of new information into the groundwater model to enhance the model in predicting trends and impacts of management actions	No – Changes in water level data did not justify recalibration of model. Future activity.

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Section 3

Section 3
Water Demand Projections

Water resources planning requires reasonably accurate estimates of future water needs. Many factors can affect the amount of water required in the future including climate, existing water use patterns, population growth, employment, economic trends, environmental needs and water conservation efforts, to name a few. To provide an adequate long-range view of future water needs, the 2010 WMP Update uses a 35-year planning period from 2010 through 2045. This section also describes the changes in the study area for this 2010 WMP Update since the adoption of the 2002 WMP and presents the projected water demands through 2045 for the Coachella Valley.

3.1 FACTORS AFFECTING FUTURE WATER DEMANDS

Since the adoption of the 2002 WMP, the Coachella Valley has experienced a number of changes that will affect future water demands. These changes include:

- Rapid population growth,
- Changes in land use,
- Development on Tribal land,
- Potential development outside the 2002 WMP Study Area, and
- Effects of the economic recession.

These changes are discussed below.

3.1.1 Revised Growth Forecasts

In 2005, Riverside County was experiencing rapid growth. Recognizing the need for more accurate growth forecasts, the Riverside County Center for Demographic Research (RCCDR) was established under the joint efforts of the County of Riverside, the Western Riverside Council of Governments (WRCOG), the Coachella Valley Association of Governments (CVAG), and the University of California Riverside for the development of demographic data and related support products to serve all of Riverside County. The RCCDR was tasked with developing the Riverside County Projections 2006 (RCP-06) growth forecasts.

The RCP-06 was developed to provide County agencies and departments, the councils of governments, the universities and other entities with a consistent and standard set of population, housing and employment forecasts. In addition, a major objective for developing RCP-06 was to provide the Southern California Association of Governments (SCAG) with a set of projections for inclusion in their regional growth forecasts. The RCP-06 was approved by the Executive Committee of WRCOG on December 4, 2006, the Executive Committee of CVAG on January 29, 2007, and by the Riverside County Board of Supervisors on March 14, 2007.

The forecast was prepared in five-year increments for the period of 2005 through 2035. Because the RCP-06 is the primary source of growth forecasts for the Valley, the 2010 WMP Update uses these forecasts for estimating future water demands as discussed in **Section 3.2**.

3.1.2 Land Use Changes

Although the revised growth forecasts indicated significant future growth for the Coachella Valley, these forecasts were based on potential development that had not yet been approved by the cities and the County. The Riverside County Integrated Plan (RCIP), the County's General Plan, was adopted in 2003 (Riverside County, 2003). The original intent of the RCIP was to conduct a formal review and update every five years. The Riverside County Planning Department is updating the General Plan (Riverside County, 2010). The General Plan Update includes an examination of land use policies for the Vista Santa Rosa (located in City of Indio, west of Highway. 86 around 58th Avenue) and South Valley Regions (area between Salton Sea and City of Coachella) of the Eastern Coachella Valley. These areas are subjected to substantial development pressure, transitioning from agricultural to urban land uses.

As agricultural land converts to urban uses, the characteristics of its water demands and infrastructure will change. The 2010 WMP Update therefore reflects these changes in its water demand projections and the ways that water is used in this area. As urban development occurs, land that currently is irrigated with untreated Coachella Canal water could begin using groundwater, increasing future overdraft, or could use treated Canal water for indoor use and untreated Canal water for outdoor use, reducing future overdraft.

3.1.3 Development on Tribal Land

There are over 56,000 acres of Tribal land in the Coachella Valley. While much Tribal land in the West Valley has been developed to varying degrees, a substantial amount of Tribal land in the East Valley is largely undeveloped. Total tribal land ownership in the East Valley is approximately 26,400 acres. An understanding of the timing and degree of development on Tribal lands is important. All of the Coachella Valley tribes have developed one or more casinos, which have provided them important economic opportunities. As development continues in the Valley, it is expected that additional growth will occur on the remaining Tribal lands. For example, the Torres-Martinez Tribe has prepared a land use plan that projects residential, commercial, industrial, agricultural, aquacultural, recreational, and wetlands land uses (Torres-Martinez, 2010). This development in the Torres-Martinez plan is not currently included in the Riverside County growth forecasts. The Torres-Martinez tribe conducted a water and wastewater feasibility study in 2007, which indicated an existing potable water demand of 740 AFY and a projected potable water demand of 2,500 AFY in 2027 (Torres-Martinez, 2007).

In the incorporated portions of the Valley, development of Tribal land is closely coordinated with the cities in which those lands are located. Consequently, Riverside County growth forecasts are assumed to include development of these lands as part of the growth forecasts for the cities. It is assumed that development occurring on Tribal land lying outside of city boundaries will be at the same rate as for the Valley as a whole and land uses will be proportional to the land uses that occurs on non-Tribal land in the East Valley.

3.1.4 Development Outside the 2002 WMP Study Area

The original study area for the 2002 WMP was the land area on the valley floor that overlies the Whitewater River and Garnet Hill subbasins and lands that receive water supply from this area. The San Andreas fault was the northeasterly boundary of the study area. The water demands of CVWD service areas in Riverside and Imperial Counties on either side of the Salton Sea (Area 23 and Improvement District 11) were included in the original study area since these areas were already being served by groundwater from the Whitewater River Subbasin. These areas are similarly included in the 2010 WMP Update study area.

In 2002, there were no plans for significant development northeast of the San Andreas fault prior to 2035, except in the Desert Hot Springs area that overlies the Mission Creek Subbasin and is the subject of a separate water management plan. Consequently, the 2002 WMP assumed that any development outside the study area would provide additional water supplies needed to meet the additional demands and would not add to the overdraft of the Whitewater River Subbasin.

In recent years, the cities of Indio and Coachella have both annexed land and expanded their spheres of influence (SOI) to include land northeast of the San Andreas fault. Several large developments have been proposed for this area including Citrus Ranch, Dillon Trails, Inner Beauty (Indio Hills) and Stonewater within the Indio SOI and Desert Lakes and Lomas del Sol within the City of Coachella. Planning efforts are underway to define appropriate land uses in these areas.

Agreements have been developed among CVWD, Indio and Coachella regarding water service within these areas. Citrus Ranch is a 1,200 acre development located west of Dillon Road located within the City of Indio's SOI but outside of the Whitewater River Subbasin. The development includes several residential neighborhoods with up to 3,100 dwelling units, a hotel, golf course and community center. In October 2008, CVWD and the City of Indio agreed to settlement terms of a lawsuit regarding the potential impact that the proposed Citrus Ranch development would have on groundwater supplies in the Coachella Valley. The settlement agreement provides for the developer to pay $5.6 million to mitigate the impact of the development on groundwater supplies (CVWD-Indio, 2008). In August 2009, CVWD and the City of Coachella signed a Memorandum of Understanding (MOU) regarding developments within that city's SOI that are located outside the Whitewater River Subbasin (CVWD-Coachella, 2009). Under the terms of the MOU, the City of Coachella will participate in funding CVWD's acquisition of supplemental supplies to offset the demands associated with the newly approved development within the City's SOI. Under an August 2009 settlement agreement (Replenishment Assessment Charge litigation), CVWD and the City of Indio agreed to work cooperatively to mitigate impacts on water supplies associated with new developments within the Indio Water Authority (IWA) service area (CVWD-Indio, 2009).

Based on these settlement agreements and MOUs, the 2010 WMP Update study area has been expanded to include those portions of the SOIs and corporate boundaries of Indio and Coachella that lie northeast of the San Andreas fault. In addition, any land within this area that is not within the current SOIs of Indio and Coachella, but outside of the designated CVMSHCP conservation areas, will be included in the study area for demand projections. However, the areas currently within the service areas of CVWD and Mission Springs Water District (MSWD) that are northeast of the San Andreas/Banning fault are not included in the 2010 WMP Update study area. These areas are included in the Mission Creek and Garnet Hill Water Management Plan that is under development.

3.1.5 Effects of Recession on Growth Forecasts

As described earlier, the 2010 WMP Update uses population estimates developed by the RCCDR (RCP-06) for long term planning. There was a rapid population increase in the Coachella Valley in the early 2000s; the population in the Valley has increased by 35 percent since 2000. The RCP-06 estimates that the annual growth rate for Riverside County as a whole will be four percent per year between 2005 and 2035.

Since late 2007, Riverside County has been negatively affected by the current economic recession and has experienced some of the highest rates of foreclosures and unemployment in the country. Due to this economic downturn, growth in the County has significantly moderated over the last two years. The RCP-06 growth forecasts were developed and adopted in late 2006 and early 2007, before the onset of the widespread recession. Therefore, the slowdown in the housing market, which was one of the primary components of the recession, is not accounted for in the RCP-06 forecasts.

Some economists and real estate professionals who have been studying the effects of the recession on Riverside County predict that economic recovery in the County will be slow paced over the next five years (Beacon-UCR, 2010). This could result in lower than projected growth rate for the Valley in the near term. The timing and extent of this reduced growth rate cannot be accurately predicted. Because the planning period for the 2010 WMP Update is 35 years (through 2045), it is expected that the effect of the recession on growth in the Valley will attenuate over the long term. Changes in the growth forecast will be reflected in future plan updates. For the purpose of this Update, it is assumed that the RCP-06 growth forecasts are applicable. However, implementation of some plan elements may be deferred until growth resumes.

3.2 POPULATION AND LAND USE FORECASTS

The RCP-06 population forecast forms the basis for urban land use and water demand projections used in the 2010 WMP Update. A detailed description of the population projection used for the 2010 WMP Update is presented below.

3.2.1 Population Forecasts

The 2002 WMP was based on growth forecasts developed by SCAG for the Coachella Valley in 1998. From 2000 through 2007, the Coachella Valley experienced rapid growth and corresponding conversion of agricultural land and vacant desert land to residential and urban development. Growth has occurred predominantly in the cities of La Quinta, Palm Desert, Indio and Coachella with additional development in unincorporated portions of the Valley. The following observations are made regarding growth in Valley cities from 2000 to 2010 based on the 2010 California Department of Finance (DOF) population estimates:

- The lowest growth rate of about 14 percent was observed in the City of Palm Springs.
- The highest growth of approximately 88 percent from 2000 to 2010 was observed in the cities of La Quinta and Coachella.
- The City of Indio experienced a 73 percent growth from 2000 to 2010.

According to RCP-06 estimates, there were approximately 366,500 permanent residents living in over 175,500 households in the Valley in 2005 (Riverside County, 2006). Approximately 49 percent of the population was located within the East Valley (from Indio to the Salton Sea) and 51 percent was located in the West Valley (Palm Springs to Indio). About 91 percent of Valley residents lived in one of the nine incorporated cities, while the other nine percent lived in unincorporated portions of the Valley. Cathedral City and Indio were the two largest cities, each with a population exceeding 50,000 residents.

The RCP-06 population projections for the Coachella Valley extend to 2035. These projections were extrapolated to 2045 for the 2010 WMP Update based on the growth rate presented in the RCP-06 projection. The resulting projection is presented in **Table 3-1**. **Figure 3-1** presents a comparison of population projections by source. As shown on the figure, the extrapolated RCP-06 population projection for 2045 is about 80 percent higher than the projection used in the 2002 WMP as extrapolated to 2045.

The RCP-06 population estimates for the area outside the Whitewater River Subbasin boundary are shown in **Table 3-1**. As seen in the table, the RCP-06 does not identify significant growth in this area. A section-by-section analysis was performed to estimate the amount of potentially developable land outside the Whitewater River Subbasin boundary. Based on this analysis, about 20,000 acres of land outside the Whitewater River Subbasin boundary was identified as potentially developable. Water demand projections based on this estimate are presented in **Section 3.3**. The estimated area of developable land and the RCP-06 population estimate for this area outside the Whitewater River Subbasin boundary are not in agreement. Consequently, water demand projections presented in **Table 3-2** would be much lower if they were based solely on the RCP-06 population. For planning purposes, the water demands for this area are calculated on the basis of potentially developable land, which results in a conservatively higher demand. CVWD, Indio and Coachella will monitor growth in this area and make necessary adjustments to the projections in future WMP updates as needed.

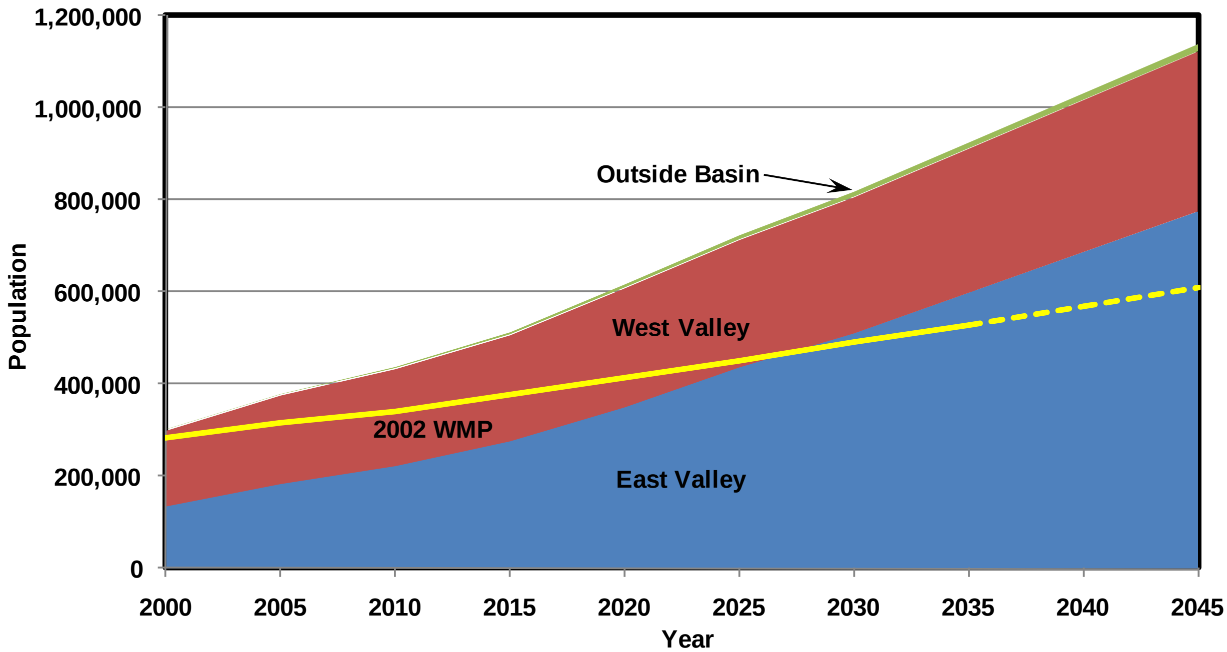
3.2.2 Land Use Forecasts

As described earlier, Riverside County is currently preparing a major update to the General Plan, designated General Plan Amendment 960 (GPA 960). GPA 960 will update planning policies for the Vista Santa Rosa and South Valley Policy Areas in the Eastern Coachella Valley Area Plan and land use inventories in the Thousand Palms area in the Western Coachella Valley Area Plan (Riverside County, 2008). The 2010 WMP Update growth assumptions may need to be revisited in light of the updated County General Plan and EIR and adjustments made as needed. Any adjustments will be reflected in projected water demands in future WMP updates.

Table 3-1
Population Projections for the Coachella Valley

City	2000	2005	2010	2015	2020	2025	2030	2035	2040 [1]	2045 [1]
East Valley										
Bermuda Dunes	3,474	4,167	5,590	6,302	8,138	8,292	9,153	10,021	10,890	11,759
Coachella	22,781	33,267	45,448	57,708	70,864	83,663	96,571	110,195	123,818	137,442
Indio	49,116	69,479	77,967	86,887	93,115	99,477	105,873	112,019	118,166	124,313
La Quinta	23,929	37,564	45,272	50,049	52,923	54,788	56,439	57,937	59,435	60,933
Mecca	5,402	6,107	7,341	8,855	18,490	44,674	63,367	77,243	91,119	104,995
Unincorporated	22,475	24,107	29,538	52,381	91,512	130,275	163,111	215,140	267,169	319,197
Imperial County Area [2]	8,986	9,977	12,311	15,003	15,685	16,137	16,373	16,411	16,581	16,718
Sub-Total	**136,163**	**184,668**	**223,467**	**277,184**	**350,726**	**437,306**	**510,886**	**598,966**	**687,178**	**775,357**
West Valley										
Bermuda Dunes	2,630	3,138	4,125	4,761	5,997	6,071	6,606	7,304	8,003	8,701
Cathedral City	42,647	51,302	55,746	60,293	65,221	69,431	74,052	76,837	79,622	82,407
Indian Wells	3,992	4,864	5,309	5,708	6,026	6,311	6,524	6,712	6,900	7,088
Palm Desert	44,265	49,842	54,437	59,588	64,860	67,204	70,303	73,131	75,959	78,787
Palm Springs	42,807	46,416	49,182	52,349	56,228	60,440	65,343	70,796	76,250	81,763
Rancho Mirage	13,249	16,686	18,984	22,585	26,764	32,096	32,541	32,846	33,150	33,455
Thousand Palms	5,103	5,722	6,695	7,028	11,753	13,202	16,224	18,518	20,812	23,107
Unincorporated	9,323	13,824	15,552	17,300	20,983	21,089	23,201	25,737	28,272	30,808
Sub-Total	**164,016**	**191,793**	**210,030**	**229,611**	**257,834**	**275,844**	**294,794**	**311,881**	**328,968**	**346,115**
Area Outside Whitewater River Subbasin Boundary [3]	491	636	2,201	4,172	6,379	8,476	10,585	12,146	13,706	15,267
TOTAL	**300,670**	**377,097**	**435,698**	**510,967**	**614,938**	**721,626**	**816,266**	**922,994**	**1,029,912**	**1,136,739**

1. Growth forecasts for 2040 and 2045 are extrapolated based on growth rate trends through 2035.
2. Imperial County population from SCAG 2008 Regional Transportation Plan projections for Imperial County by census tract.
3. Population for the area outside the Whitewater River Subbasin is based on an evaluation of population growth by census tract using the RCP-06 projection.



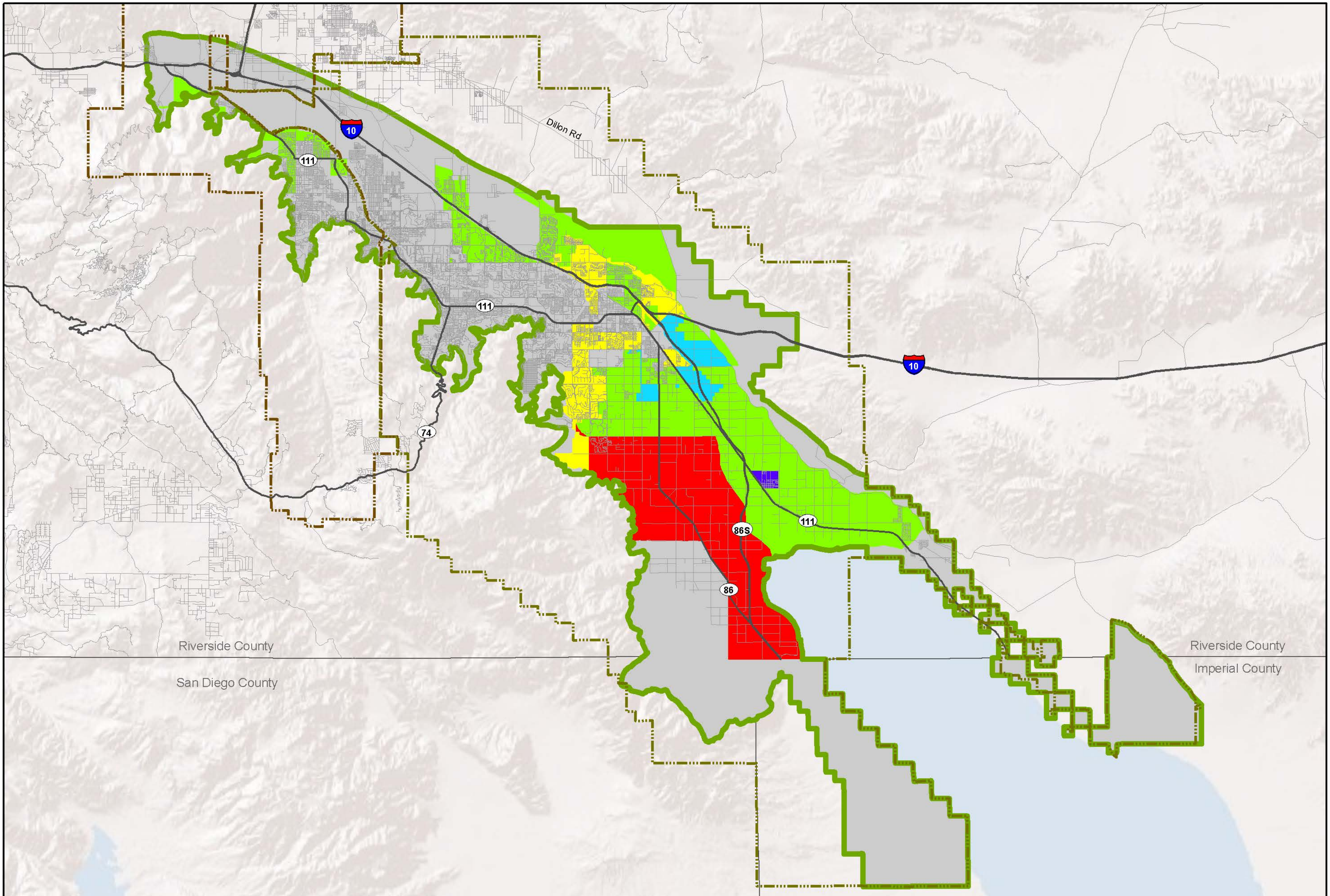
2002 WMP – Coachella Valley Water Management Plan completed in 2002 – projections based on 1998 SCAG data. Data beyond 2020 are extrapolated.
2010 WMP Update – Riverside County Center for Demographic Research population projections adopted by CVAG in 2006. Data beyond 2035 are extrapolated.

Figure 3-1
Comparison of Population Projections
for the Coachella Valley

Lacking an updated county land use plan, the 2010 WMP Update incorporates the following assumptions to apply growth forecasts to projected land use changes:

1. Urban growth in the East Valley will occur equally (50 percent each) on agricultural and vacant parcels.
2. A total of 75 new golf courses (based on **Section 3.3.1.4**) are projected to be constructed by 2045. If fewer courses are constructed, it is expected that the land area will be developed for urban uses.
3. The Riverside County growth forecast (RCP-06) includes growth on Tribal lands. Land development on Tribal lands will occur at the same rate and in the same patterns as growth on non-Tribal lands.
4. The RCP-06 population growth forecast is used (with the water demand factors) to project future municipal water demands.

The geographical distribution of population growth within the Valley projected by RCP-06 is presented in **Figure 3-2**.



Key to Features

- County Boundary
- DWA Boundary
- CVWD Boundary
- Study Area

Population Growth Through 2045 (by tract)

- 0 - 5,000
- 5,001 - 10,000
- 10,001 - 20,000
- 20,001 - 40,000
- 40,001 - 100,000
- 100,001 - 300,000

0 4 8 Miles

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Date: March 2012

Location of Projected Population Growth within Coachella Valley

Figure 3-2

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3.3 WATER DEMAND PROJECTIONS

Water demand projections form the basis for water supply planning in the Coachella Valley. This section describes the principal assumptions and the resulting water demand projections that are used for the 2010 WMP Update. These baseline water demands serve as a starting point for water supply and demand management planning in the Update.

3.3.1 Assumptions

A number of assumptions have been made in the development of the future baseline water demands, as described below.

3.3.1.1. Water Conservation

Water conservation is a major component of future water management. A significant focus of urban water conservation activities is on landscape irrigation water use. Adoption of the Coachella Valley Landscape Ordinance[1] along with water budget-based rates is expected to have a significant impact on water use by both existing and future development. Consequently, the baseline urban water demands resulting from growth incorporate the reduced water use associated with the landscape ordinance. Similarly, water demands associated with future golf courses assume the turf restrictions contained in the landscape ordinance. Baseline agricultural water demands do not include additional water conservation. Instead, agricultural conservation is evaluated as part of the water management elements considered in the 2010 WMP Update.

3.3.1.2. Urban Water Demand Assumptions

The average urban water use in the Coachella Valley by CVWD customers was 1,173 gallons per day per connection (gpd/conn) for all customer categories during the period 1995-2004. Water usage for all Valley urban customers for the same period was estimated to be about 1,400 gpd/conn, based on reported production data and CVAG population estimates.

The 2003 CVWD Landscape Ordinance required 25 percent reduction in outdoor water use for new development. Future urban water use is further reduced with the implementation of 2007 and 2009 Landscape Ordinances to an average of 800 gpd/conn. Consequently, the water demand factor used to calculate urban demands within the Whitewater River Subbasin boundary associated with growth is estimated to be 800 gpd/conn. The RCP-06 population projections and assumptions regarding the population densities per connection are used with the water demand factor to project future urban demands.

The following assumptions are made for demands outside the Whitewater River Subbasin boundary:

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[1] CVWD adopted a valley-wide model ordinance for water efficient landscaping in 2003. This ordinance established a maximum applied water allowance (MAWA) equal to 60 percent of the reference evapotranspiration (ETo). The ordinance was revised in 2007 to reduce the MAWA to 50 percent of ETo and established limits on the amount of turf at new gold courses. CVWD and CVAG revised the ordinance again in 2009 to meet new State requirements and provide a model ordinance for all Valley cities to adopt.

1. An average residential density of 4 dwelling units per acre is assumed, except for three sections (about 1,920 acres) previously subdivided as 5 acre lots where a density of 1 dwelling unit per 2 acres may be allowed.
2. Urban water use is based on an average of 5 water connections per acre (less golf acreage) and an average water use of 800 gpd/conn. This demand is an overall average of residential, commercial, institutional and irrigation use (excluding golf courses).
3. Build-out of vacant parcels is assumed to take place by 2050 with initial development beginning in 2020.

3.3.1.3. Agricultural Water Demand Assumptions

The 2002 WMP assumed that agricultural land use would be displaced as growth occurs, but that vacant land would be developed for agricultural purposes, keeping agricultural demands more or less constant. The 2010 WMP Update assumes that agricultural demand will reduce in proportion to the increase in urban demands. The agricultural demands are based on the assumption that urban growth in the East Valley will occur equally (50 percent each) on agricultural and vacant parcels. A water usage factor of 6.27 AFY/acre of agricultural land is used for calculating agricultural demands through 2045 based on the 2005 demands adjusted for conservation and evapotranspiration (ET). This number accounts for increased water use on land which is double- or triple-cropped but excludes additional conservation.

3.3.1.4. Golf Course Water Demand Assumptions

The golf industry represents a significant water demand sector in the Coachella Valley and is expected to remain so in the future. Estimates developed for the 2010 WMP Update indicate that up to 75 new golf courses could potentially be constructed within the Whitewater River Subbasin boundary area by 2045. Since most of the future growth is anticipated to occur in the East Valley, this estimate is based on a ratio of the total number of existing golf courses in the East Valley to the total East Valley population. This ratio is then applied to future population growth in the Valley. This method assumes that the existing pattern of development (golf course acres per acre of urban development) within the Valley will continue into the future.

Implementation of the Landscape Ordinance and improved irrigation efficiency (proposed as part of the 2002 WMP) will result in reduced demands at new golf courses. For the purpose of this Update, it is expected that water demand for new golf courses or for any rehabilitation of existing golf courses will be 700 AFY per 18 holes (reduced from 900 AFY in 2002 WMP) based on the ordinance.

Water demand for new golf courses located outside the Whitewater River Subbasin is also assumed to be 700 AFY per course based on a typical 125-acre course. The ratio of golf courses per developed acre is similar to that of the six major identified developments. Based on this ratio, up to 14 golf courses are assumed for area outside the Whitewater River Subbasin.

3.3.1.5. Fish Farm and Duck Club Water Demand Assumptions

For the 2010 WMP Update, it is assumed that the fish farm and duck club water use will be much lower than projected in the 2002 WMP. Some of the large fish farm owners have moved away from the traditional fish farming business. The replacement use at these farms is expected to have significantly lower water demands. Based on information available at this time, future fish farm demand of 8,500 AFY and duck club demand of 2,000 AFY are assumed. A more detailed discussion on this subject is presented in **Section 3.4** Demand Uncertainty.

3.3.1.6. Tribal Demand Assumptions

There is very little specific information available about future growth on Tribal lands in the East Valley. It is assumed that the growth that occurs on Tribal land located within the cities is accounted for in the RCP-06 projection. It is assumed that growth on Tribal lands outside the cities will be at the same rate as for the Valley as a whole and will be proportional to the growth that occurs on non-Tribal land in the East Valley. Corresponding water demands are calculated based on these assumptions.

3.3.2 Water Demand Projections

Table 3-2 presents the updated water demand projections. The total demand projected for the year 2045 using the assumptions described above is 883,915 AFY. Projected water demand in the Update for the year 2035 is about 73,600 AFY lower than that projected in the 2002 WMP. A comparison of historical (pre-Landscape Ordinance) and projected future water use (2010 WMP Update) on a per acre basis is presented in **Figure 3-3** for different user types. The reduction in projected per acre water use is mainly due to:

1. Lower net demand (per acre of land) resulting from conversion of agricultural farm land to urban development and
2. Increased golf course and municipal conservation with implementation of the Landscape Ordinance.

Without the inclusion of demands outside the Whitewater River Subbasin boundary (i.e. using the same study area considered in 2002 WMP), the projected demands in the Update for 2035 are about 108,000 AFY lower than that projected in the 2002 WMP.

As previously discussed, the CVAG projection shows rapid population growth within the Valley. This growth translates directly into increased urban water demand. As shown in **Table 3-2**, the total projected urban demand more than doubles between 2010 and 2045. Agricultural demand is projected to decrease in proportion to the increase in population. As agricultural land is converted to urban development, there is a shift in water demand from agricultural to urban uses. The result is a projected 48 percent decline in agricultural demand between 2010 and 2045.

3.4 DEMAND UNCERTAINTY

This section summarizes the uncertainties associated with water demands within the Valley. A sensitivity analysis of water demands associated with these uncertainty factors is also presented to indicate a possible range of demands. There are several factors that could affect future Valley water demands.

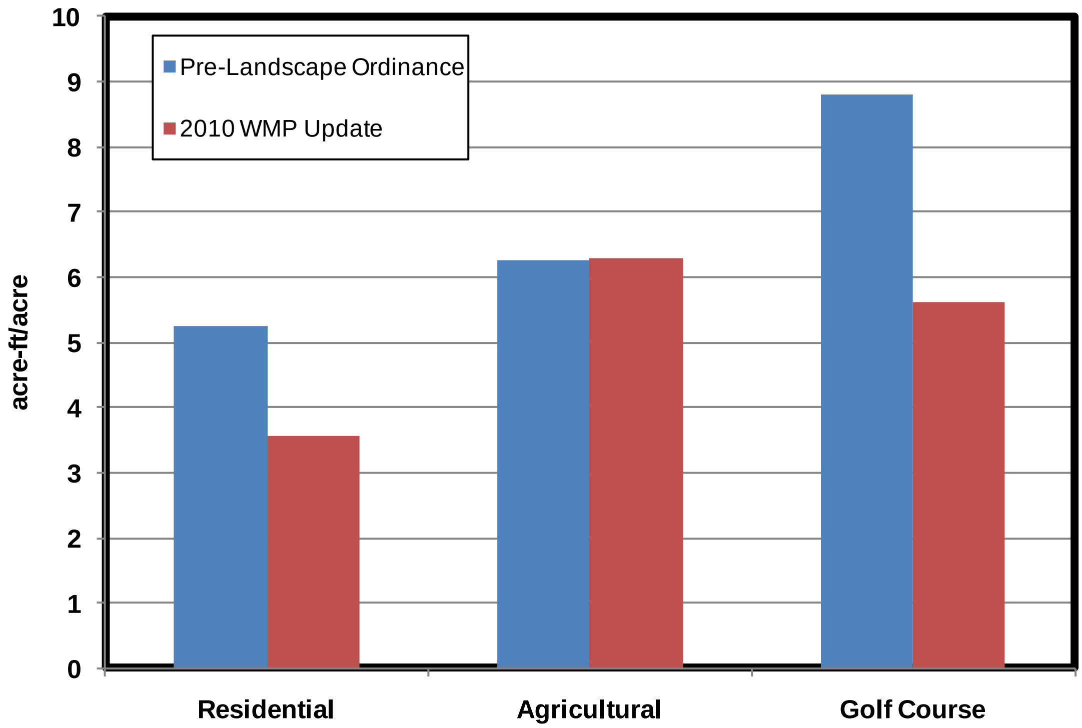


Figure 3-3
Pre-Landscape Ordinance and Future Water Usage per Acre by User Type

Growth forecasts are too high: If the actual growth in the Valley is less than forecasted, the resulting water demands will be lower than anticipated. This lower demand in turn would reduce or delay the need to implement certain elements incorporated in the Update**.**

Growth forecasts are too low: If the actual growth in the Valley exceeds the forecasted growth, it will result in higher than anticipated water demands. This would increase or advance the need to implement certain Plan elements.

Economic recession: Although there is no way to accurately predict the long-term impact of the recent economic downturn on growth in the Valley, the current recession is expected to slow projected growth. Given the 35-year planning horizon of this Update, this deferral is not expected to have a significant long-term impact on the Plan beyond the next three to five years. Consequently, the recession would result in delay the need to implement certain elements of the Update.

Reduction in fish farm operations: Fish farm operations in the East Valley are declining. Owners of these fish farms are either shutting down their facilities or replacing their use. One of

Table 3-2
Water Demand Projections for the Coachella Valley

Component	2005 [1]	2010	2015	2020	2025	2030	2035	2040	2045
Agricultural									
Crop Irrigation	283,100	317,400	302,900	282,300	258,500	238,100	213,900	189,700	166,100
Total Agricultural Demand	**283,100**	**317,400**	**302,900**	**282,300**	**258,500**	**238,100**	**213,900**	**189,700**	**166,100**
Urban									
Municipal	205,400	234,600	260,900	298,100	346,600	390,000	438,500	487,300	537,000
Industrial	1,700	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
Total Urban Demand	**207,100**	**236,900**	**263,200**	**300,400**	**348,900**	**392,300**	**440,800**	**489,600**	**539,300**
Golf Course Demand	**109,800**	**113,800**	**118,800**	**125,900**	**134,600**	**142,400**	**151,900**	**160,700**	**169,500**
Fish Farms and Duck Clubs									
Fish Farms	23,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500
Duck Clubs	4,600	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Fish Farms and Duck Clubs	**28,100**	**10,500**	**10,500**	**10,500**	**10,500**	**10,500**	**10,500**	**10,500**	**10,500**
TOTAL DEMAND	**628,100**	**678,600**	**695,400**	**719,100**	**752,500**	**783,300**	**817,100**	**850,500**	**885,400**

1. Demands shown are actual demands for 2005 excluding the extra-ordinary agricultural conservation of 18,491 AFY. For demand projection purposes, the 2005 actual demands were adjusted upwards for wet weather effect by a factor of 8.7%.

the largest fish farm owners in the East Valley is moving away from their traditional fish farming business and venturing into the business of growing algae in their ponds for use as a biofuel. This shift in operations has reduced their water demands. This has led to a significant decrease in groundwater pumping near the Salton Sea, which in turn has reduced the groundwater overdraft in this area. Future plans of other large fish farms in the East Valley are not known at this time. The amount of groundwater pumping required in the future, and the resulting overdraft in this area of the East Valley will be affected by the replacement use at these fish farms. If fish farm demands are further reduced, the need for some management elements would be delayed or reduced.

Higher rate of Tribal land development: Data available on projected or planned Tribal land development is limited, so it is assumed that growth on Tribal lands will be similar in mix to the growth in other parts of the Valley. If actual growth on Tribal lands exceeds forecasted growth, it would result in higher water demands than projected. This would result in higher groundwater pumping or would require more imported water supplies to meet the higher demands.

Rate of agricultural/vacant land conversion: For the purpose of demand projections, it is assumed that urban growth within the Valley will occur equally on agricultural and vacant parcels. Vacant parcels are assumed to have little or no current water demand. Thus, development occurring on vacant land results in a higher net change in demand as compared to development occurring on agricultural land. If more growth occurs on vacant land, this would also result in higher than projected agricultural demands. Higher agricultural demand would make less Colorado River water available for urban and recharge uses in the East Valley.

Future water demand factors: The water demand factors used for demand projections in this Update might be affected by the effectiveness of water conservation within the Valley. If conservation measures are less effective than expected, demands would be higher and more supplies would be needed. If conservation effectiveness is better, then lower demands and a decreased need for supplies would result.

Growth outside the Whitewater River Subbasin: As described above, there are plans for future growth in areas which lie in the SOI of the cities of Coachella and Indio. This growth will result in increased water demand that has been included in this Plan Update. Development of these areas will be affected by economic factors and might lag behind the rest of the Valley. In addition, development restrictions based on flood control and seismic safety could limit potential growth. Additional supplies will be required to meet the demand arising from this growth.

Sensitivity Analysis: A sensitivity analysis was performed on the water demand projections to determine the effects of the uncertainties described above. Results of this analysis are presented on **Figure 3-4**.

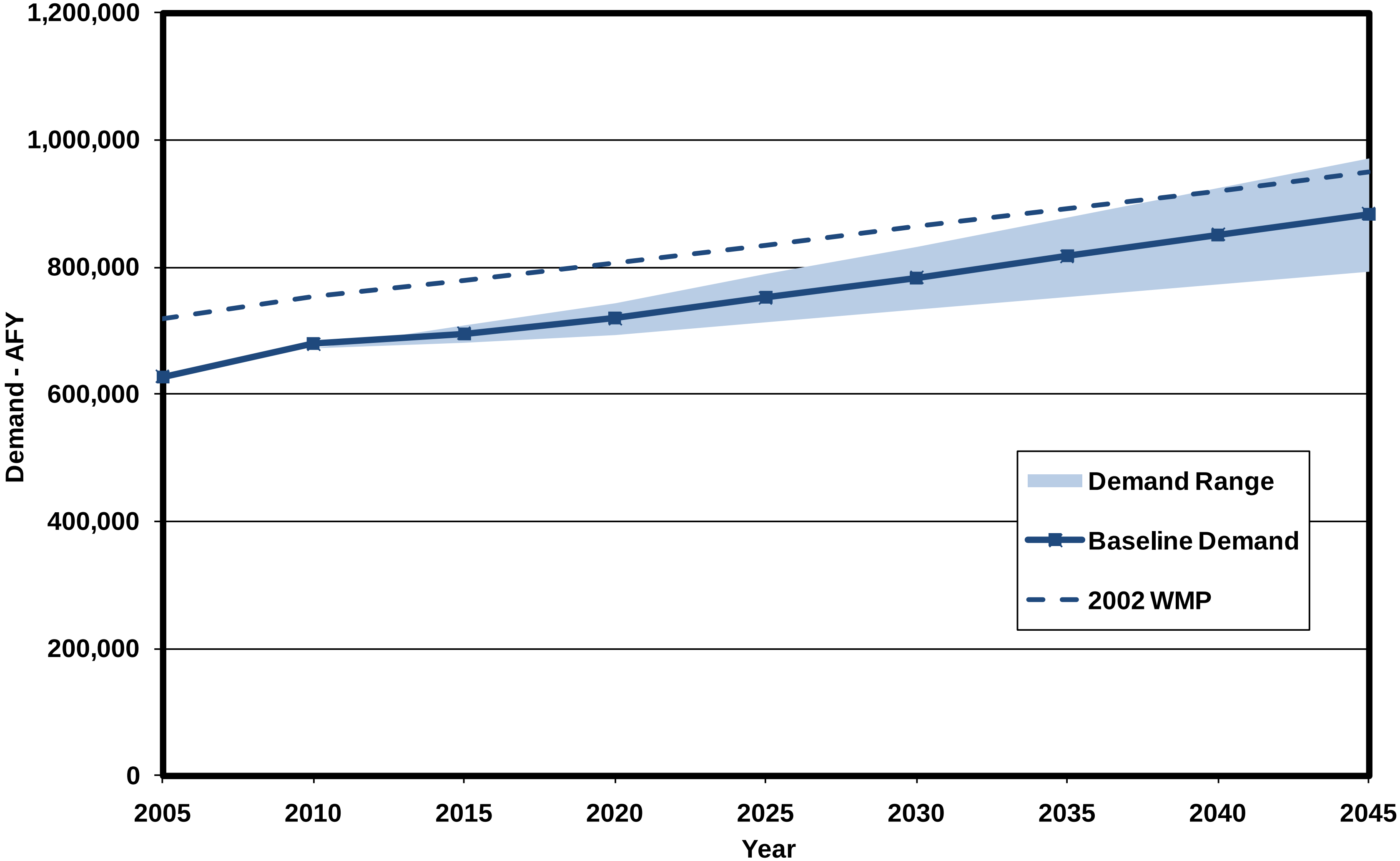
The 2002 WMP water demands are linearly extrapolated beyond 2035 for comparison with the 2045 demand projections developed as part of the 2010 WMP Update. Projections are tested by changing variables such as number of projected golf courses, and agricultural/vacant land conversion. The two extreme conditions tested in this analysis are:

1. **High Demands** - Increase in water demands associated with projected population growth with existing water use and 25 percent (instead of 50 percent) of East Valley growth on agricultural land (with 75 percent on vacant land), and
2. **Low Demands** - 75 percent (instead of 50 percent) of the growth in the East Valley occurs on agricultural land (with 25 percent on vacant land) and only 24 golf courses that are currently proposed in the East Valley get developed in the future.

The resulting high and low ends of demands with the above two conditions are approximately 971,500 AFY to 793,600 AFY respectively. Along with these, other conditions are also tested, the results of which fall within the demand band shown on **Figure 3-4**. Depending on how, where, and when the actual growth occurs in the Valley in the future, the actual resulting water demands for 2045 are estimated to fall within this band.

To account for the above described uncertainty and variability in demands, the 2010 WMP Update utilizes a more flexible approach by assigning book-end targets (ranges) for each of the major program element as described in **Section 6**. The book-ends represent reasonable ranges of minimum and maximum amounts for potential project development. Depending on the actual demands that are encountered in the future, implementation the 2010 WMP Update elements can be adapted to meet these changed demands. The 2010 WMP Update also introduces the concept of a water supply buffer where supplies and conservation are planned to meet slightly more than the baseline demand and are sufficient to encompass the potential range of expected demands. The development of a water supply buffer is discussed further in **Sections 6** and **7**.

Figure 3-4
2010 WMP Update Demand Projections – Sensitivity Analysis



Section 4

Section 4
Existing Water Supplies

The Coachella Valley relies on a combination of local groundwater, Colorado River water, State Water Project (SWP) water, surface water, and recycled water to meet water demands. This section describes the existing water supplies available to the Coachella Valley. A detailed discussion of amounts, risks, and reliability associated with each supply source is also presented in the section. The section concludes with a discussion of the "No-Project" condition, which essentially evaluates what would happen if the 2002 Water Management Plan (WMP) were not updated to reflect new demands and changing supplies.

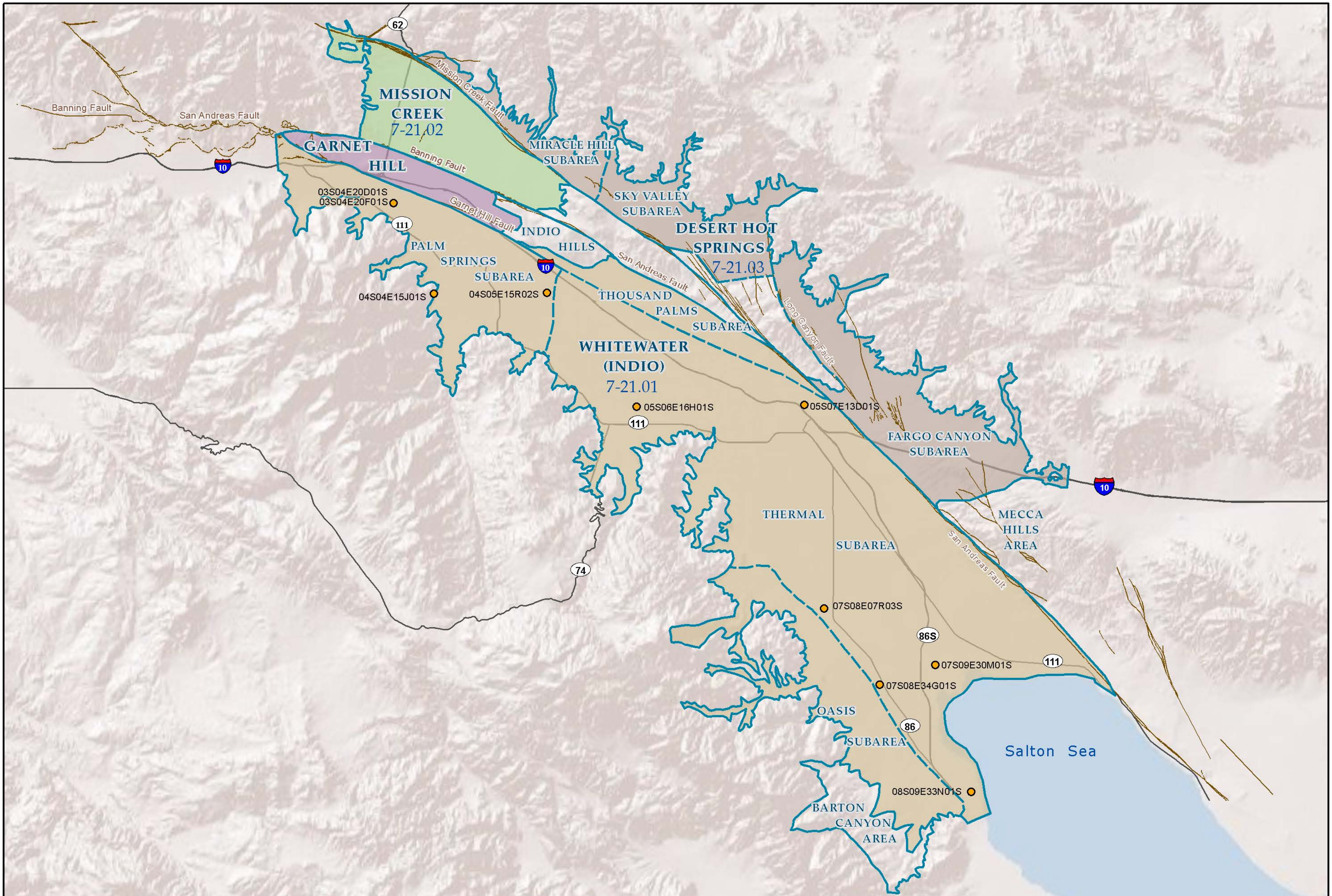
4.1 LOCAL GROUNDWATER

Groundwater has been the principal source of urban water supply in the Coachella Valley since the early part of the 20th century. Groundwater also supplies water for crop irrigation, fish farms, duck clubs, golf courses, greenhouses, and industrial uses in the Valley. The Coachella Valley Groundwater Basin (DWR Basin No. 7-21) encompasses the entire floor of the Coachella Valley and consists of five subbasins: San Gorgonio Pass, Whitewater (Indio), Garnet Hill, Mission Creek and Desert Hot Springs subbasins. **Figure 4-1** shows the subbasins included in the 2010 WMP Update study area as described in **Section 1.** These subbasins consist of the Whitewater River (Indio) Subbasin, Garnet Hill Subbasin, and the Fargo Canyon Subarea of the Desert Hot Springs Subbasin, as described below. The Garnet Hill Subbasin is included in this update as it was part of the original WMP; however, this subbasin with the Mission Creek Subbasin is the subject of a separate WMP (in preparation). The Mission Creek Subbasin is described briefly because it relies on a portion of the imported SWP supplies for replenishment.

4.1.1 Whitewater River Subbasin

The Whitewater River Subbasin, designated the Indio Subbasin (Basin No. 7-21.01) in DWR Bulletin No. 118 (DWR, 2003), underlies the major portion of the Valley floor and encompasses approximately 400 square miles. Beginning approximately one mile west of the junction of State Highway 111 and Interstate Highway 10, the Whitewater River Subbasin extends southeast approximately 70 miles to the Salton Sea. The Subbasin is bordered on the southwest by the Santa Rosa and San Jacinto Mountains and is separated from Garnet Hill, Mission Creek, and Desert Hot Springs Subbasins to the north and east by the Garnet Hill and San Andreas faults (CVWD, 2010a; DWR, 1964). The Garnet Hill fault, which extends southeastward from the north side of San Gorgonio Pass to the Indio Hills, is a relatively effective barrier to groundwater movement from the Garnet Hill Subbasin into the Whitewater River Subbasin, with some portions in the shallower zones more permeable. The San Andreas fault, extending southeastward from the junction of the Mission Creek and Banning faults in the Indio Hills and continuing out of the basin on the east flank of the Salton Sea, is also an effective barrier to groundwater movement from the northeast.

The subbasin underlies the cities of Palm Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, La Quinta, Indio, and Coachella, and the unincorporated communities of Thousand



Key to Features

- Fault
- Highway

Groundwater Subbasins

- Desert Hot Springs
- Garnet Hill
- Mission Creek
- Whitewater (Indio)

- Groundwater Well
- Groundwater Subbasin
- Groundwater Subarea

N 0 2 4 8 Miles

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Date: March 2012

Coachella Valley Groundwater Subbasins

Figure 4-1

MWH

Source: DWR, ESRI, USGS, County of Riverside. Note: DWR Subbasin 7-21.04 was modified based on latest information.

Palms, Thermal, Bermuda Dunes, Oasis, and Mecca. From about Indio southeasterly to the Salton Sea, the subbasin contains increasingly thick layers of silt and clay, especially in the shallower portions of the subbasin. These silt and clay layers, which are remnants of ancient lake beds, impede the percolation of water applied for irrigation and limit groundwater recharge opportunities to the westerly fringe of the subbasin.

In 1964, the DWR estimated that the five subbasins that make up the Coachella Valley groundwater basin contained a total of approximately 39.2 million acre-feet (AF) of water in the first 1,000 feet below the ground surface; much of this water originated as runoff from the adjacent mountains. Of this amount, approximately 28.8 million AF of water was stored in the Whitewater River Subbasin. However, the amount of water in the Whitewater River Subbasin has decreased over the years due to pumping to serve urban, rural and agricultural development in the Coachella Valley has withdrawn water at a rate faster than its rate of recharge.

The Whitewater River Subbasin is not adjudicated. From a management perspective, the subbasin is divided into two management areas designated the Upper Whitewater River Subbasin Area of Benefit (AOB) and the Lower Whitewater River Subbasin AOB. The dividing line between these two areas is an irregular trending northeast to southwest between the Indio Hills north of the City of Indio and Point Happy in La Quinta. The Upper Whitewater River Subbasin AOB is jointly managed by CVWD and DWA under the terms of the 1976 Water Management Agreement. The Lower Whitewater River Subbasin AOB is managed by CVWD. DWA and CVWD jointly operate a groundwater replenishment program whereby groundwater pumpers (other than minimal pumpers[1]) within designated areas of benefit pay a per acre-foot charge that is used to pay the cost of importing water and recharging the aquifer.

The Whitewater River Subbasin is divided into four subareas: Palm Springs, Thermal, Thousand Palms, and Oasis. The Palm Springs Subarea is the forebay or main area of recharge to the Subbasin and the Thermal Subarea comprises the pressure or confined area within the basin. The other two subareas are peripheral areas having unconfined groundwater conditions (CVWD, 2010a).

4.1.1.1 Palm Springs Subarea

The triangular area between the Garnet Hill Fault and the east slope of the San Jacinto Mountains southeast to Cathedral City is designated the Palm Springs Subarea, and is an area in which groundwater is unconfined. The Valley fill materials within the Palm Springs Subarea are essentially heterogeneous alluvial fan deposits with little sorting and little fine grained material content. The thickness of these water bearing materials is not known; however, it exceeds 1,000 feet (CVWD, 2010a). Although no lithologic distinction is apparent from well drillers' logs, the probable thickness of Recent deposits suggests that Ocotillo conglomerate underlies Recent fanglomerate in the Subarea at depths ranging from 300 to 400 feet.

Natural recharge to the aquifers in the Whitewater River and Garnet Hill subbasins occurs primarily in the Palm Springs Subarea. The major natural sources include infiltration of stream

[1] CVWD's enabling legislation defines a minimal pumper as any producer who produces 25 or fewer AF in any year. DWA's legislation defines a minimal pumper as any producer who produces 10 or fewer AF in any year.

runoff from the San Jacinto Mountains and the Whitewater River, and subsurface inflow from the San Gorgonio Pass and Mission Creek Subbasins. Deep percolation of direct precipitation on the Palm Springs Subarea is considered negligible as it is consumed by evapotranspiration.

4.1.1.2 Thermal Subarea

Groundwater of the Palm Springs Subarea moves southeastward into the interbedded sands, silts, and clays underlying the central portion of the Valley. The division between the Palm Springs Subarea and the Thermal Subarea is near Cathedral City. The permeabilities parallel to the bedding of the deposits in the Thermal Subarea are several times the permeabilities normal to the bedding and, therefore, movement of groundwater parallel to the bedding predominates. Confined or semi-confined groundwater conditions are present in the major portion of the Thermal Subarea. Movement of groundwater under these conditions is present in the major portion of the Thermal Subarea and is caused by differences in piezometric (pressure) level or head. Unconfined or free water conditions are present in the alluvial fans at the base of the Santa Rosa Mountains, as in the fans at the mouth of Deep Canyon and in the La Quinta area.

Sand and gravel lenses underlying this Subarea are discontinuous and clay beds are not extensive. However, two aquifer zones separated by a zone of finer-grained materials were identified from well logs. The fine grained materials within the intervening horizontal plane are not tight enough or persistent enough to restrict completely the vertical interflow of water, or to assign the term "aquiclude" to it. Therefore, the term "aquitard" is used for this zone of less permeable material that separates the Upper and Lower aquifer zones in the southeastern part of the Valley. Capping the Upper aquifer at the surface are tight clays and silts with minor amounts of sands. Semi-perched groundwater occurs in this capping zone, which is up to 100 feet thick.

The Lower aquifer zone, composed of part of the Ocotillo conglomerate, consists of silty sands and gravels with interbeds of silt and clay. It is the most important source of groundwater in the Valley Groundwater Basin, but serves only that portion of the Valley east of Washington Street. The top of the Lower aquifer zone is present at depths ranging from 300 to 600 feet below the surface. The thickness of the zone is undetermined, as the deepest wells present in the Valley have not penetrated it in its entirety. The available data indicate that the zone is at least 500 feet thick and may be in excess of 1,000 feet thick.

The aquitard overlying the Lower aquifer zone is generally 100 to 200 feet thick, although in small areas on the periphery of the Salton Sea it is in excess of 500 feet in thickness. North and west of Indio, in an curving zone approximately one mile wide, the aquitard is apparently lacking and no distinction is made between the Upper and Lower aquifer zones.

Capping the Upper aquifer zone in the Thermal Subarea is a shallow fine-grained zone in which semi-perched groundwater is present. This zone consists of Recent silts, clays, and fine sands and is relatively persistent southeast of Indio. It ranges from zero to 100 feet thick and is generally an effective barrier to deep percolation. However, north and west of Indio, the zone is composed mainly of clayey sands and silts and its effect in retarding deep percolation is limited. The low permeability of the materials southeast of Indio has contributed to the irrigation drainage problems of the area. Semiperched groundwater has been maintained by irrigation water applied to agricultural lands south of Point Happy. This condition causes waterlogged soils and the accumulation of salts in the root zone in agricultural areas. Surface drains were constructed in the 1930s to alleviate this condition. Subsurface tile drainage systems were installed in the 1950s to control the high water table conditions and to intercept poor quality return flows. The District operates and maintains a collector system of 166 miles of pipe, ranging in diameter from 18 inches to 72 inches, along with 21 miles of open ditches, to serve as a drainage network for irrigated lands. All agricultural drains empty into the Coachella Valley Stormwater Channel (CVSC) except those at the southern end of the Valley, which flow directly to the Salton Sea. This system serves nearly 38,000 acres and receives water from more than 2,293 miles of on-farm drain lines (Water Consult and MWH, 2002).

The Thermal Subarea contains the division between the upper and lower portions of the Whitewater River Subbasin and their respective groundwater tables. Primarily due to the application of imported water from the Coachella Canal, and an attendant reduction in groundwater pumpage, the water table in the area southerly from Point Happy (in La Quinta) rose until the early 1970s, while the water table in the area northerly of Point Happy was dropping. This division forms the lower (southern) boundary of the management area of the Management Agreement between CVWD and DWA. Water table measurements have shown no distinction between the Palm Springs Subarea and the Thermal Subarea. The only distinction is that in the Thermal Subarea at Point Happy the groundwater levels until recently were stabilized, neither rising nor falling significantly. As discussed elsewhere, this is changing, as increased pumpage is again lowering the groundwater levels in the lower portion of the Whitewater River Subbasin. CVWD recently completed a study to evaluate the entire groundwater basin. This led to the development and adoption of the Valley-wide Coachella Valley WMP in 2002.

4.1.1.3 Thousand Palms Subarea

The small area along the southwest flank of the Indio Hills is designated the Thousand Palms Subarea. The southwest boundary of the Subarea was determined by tracing the limit of distinctive groundwater chemical characteristics (CVWD, 2010a). Whereas calcium bicarbonate water is characteristic of the major aquifers of the Whitewater River Subbasin, water in the Thousand Palms Subarea is sodium sulfate in character.

These quality differences suggest that recharge to the Thousand Palms Subarea comes primarily from the Indio Hills and is limited in supply. The relatively sharp boundary between chemical characteristics of water derived from the Indio Hills and groundwater in the Thermal Subarea suggests there is little intermixing of the two waters.

The configuration of the water table north of the community of Thousand Palms is such that the generally uniform, southeast gradient in the Palm Springs Subarea diverges and steepens to the east along the base of Edom Hill. This steepened gradient suggests a barrier to the movement of groundwater, or a reduction in permeability of the water bearing materials. A southeast extension of the Garnet Hill Fault would also coincide with this anomaly. However, there is no surface expression of such a fault, and the gravity measurements taken during the 1964 DWR investigation do not suggest a subsurface fault. The residual gravity profile across this area supports these observations. The sharp increase in gradient is therefore attributed to lower permeability of the materials to the east. Most of the Thousand Palms Subarea is located within the upper portion of the Whitewater River Subbasin. Groundwater levels in this area show similar patterns to those of the adjacent Thermal Subarea, suggesting a hydraulic connectivity.

4.1.1.4 Oasis Subarea

Another peripheral zone of unconfined groundwater that differs in chemical characteristics from water in the major aquifers of the Whitewater River Subbasin is found underlying the Oasis Piedmont slope. This zone, named the Oasis Subarea, extends along the base of the Santa Rosa Mountains. Water bearing materials underlying the Subarea consist of highly permeable alluvial fan deposits. Although groundwater data suggest that the boundary between the Oasis and Thermal Subareas may be a buried fault extending from Travertine Rock to the community of Oasis, the remainder of the boundary is a change from the coarse fan deposits of the Oasis Subarea to the interbedded sands, gravel, and silts of the Thermal Subarea. Little information is available as to the thickness of water bearing materials, but it is estimated to be in excess of 1,000 feet. Groundwater levels in the Oasis Subarea have exhibited similar declines as elsewhere in the Subbasin due to increased groundwater pumping to meet agricultural demands on the Oasis slope.

4.1.2 Mission Creek Subbasin

Water-bearing materials underlying the Mission Creek upland comprise the Mission Creek Subbasin. This subbasin is designated number 7-21.02 in DWR’s Bulletin 118 (DWR, 2003). The subbasin is bounded on the south by the Banning fault and on the north and east by the Mission Creek fault. The subbasin is bordered on the west by non-waterbearing rocks of the San Bernardino Mountains. To the southeast of the subbasin are the Indio Hills, which consist of the semiwater-bearing Palm Springs Formation. The area within this boundary reflects the estimated geographic limit of effective storage within the subbasin. This subbasin is outside of the study area of the 2010 WMP Update; however, it relies on the same imported SWP Exchange water source for replenishment as does the Whitewater River Subbasin.

CVWD, DWA, and MSWD jointly manage this subbasin under the terms of the Mission Creek Settlement Agreement (CVWD-DWA-MSWD, 2004). This agreement and the 2003 Mission Creek Groundwater Replenishment Agreement between CVWD and DWA specify that the available SWP will be allocated between the Mission Creek and Whitewater River Subbasins in proportion to the amount of water produced or diverted from each subbasin during the preceding year (CVWD-DWA, 2003). In 2009, production from the Mission Creek Subbasin was about 7 percent of the combined production from these two subbasins.

More information on water supply within this subbasin can be found in “Engineer’s Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit” (CVWD, 2010d). CVWD, MSWD, and DWA are jointly developing a water management plan for this subbasin and the Garnet Hill Subbasin.

4.1.3 Garnet Hill Subbasin

The area between the Garnet Hill fault and the Banning fault, named the Garnet Hill Subarea by DWR (DWR, 1964), was considered a distinct subbasin by the USGS (Tyley, 1974) because of the effectiveness of the Banning and Garnet Hill faults as barriers to groundwater movement. This is illustrated by a difference of 170 feet in groundwater level elevation in a horizontal distance of 3,200 feet across the Garnet Hill fault, as measured in the spring of 1961. The fault does not reach the surface and is probably effective as a barrier to groundwater movement only below a depth of about 100 feet. Although some recharge to this subbasin may come from Mission Creek and other streams that pass through during periods of high flood flows, the chemical character of the groundwater plus its direction of movement indicate that the main source of recharge to the subbasin comes from the Whitewater River through the permeable deposits which underlie Whitewater Hill. Based on groundwater level measurements, this area is partially influenced by artificial recharge activities at the Whitewater Spreading Facilities at Windy Point. This subbasin is considered part of the Whitewater River (Indio) in DWR Bulletin 118 (2003); however, CVWD and DWA consider it a separate subbasin based on the USGS findings and water level observations.

4.1.4 Desert Hot Springs Subbasin

The Desert Hot Springs subbasin is bounded on the north by the Little San Bernardino Mountains and to the southeast by the Mission Creek and San Andreas faults. The San Andreas fault separates the Desert Hot Springs subbasin from the Whitewater River subbasin and serves as an effective barrier to groundwater flow. The subbasin has been divided into three subareas: Miracle Hill, Sky Valley, and Fargo Canyon. This subbasin is designated number 7-21.03 in DWR's Bulletin 118 (2003).

The Desert Hot Springs subbasin is not extensively developed except in the area of Desert Hot Springs. Relatively poor groundwater quality has limited the use of this subbasin for groundwater supply. The Miracle Hill subarea underlies portions of the City of Desert Hot Springs and is characterized by hot mineralized groundwater, which supplies a number of spas in that area. The Fargo Canyon subarea underlies a portion of the planning area along Dillon Road north of Interstate 10. This area is characterized by coarse alluvial fans and stream channels flowing out of Joshua Tree National Park. Based on limited groundwater data for this area, flow is generally to the southeast. Water quality is relatively poor with salinities in the range of 700 to over 1,000 mg/L (CVWD, 2010c). No specific WMP exists for the Desert Hot Springs subbasin.

4.1.5 Historical Groundwater Use

CVWD and other public water suppliers, including DWA, MSWD, the City of Coachella, the City of Indio, and the Myoma Dunes Mutual Water Company, share a common groundwater source – the Whitewater River Subbasin. Other groundwater users of this source include tribes, individual residents, farmers, golf courses, businesses, and commercial facilities.

The 2002 WMP and CVWD's and DWA's annual Engineer's Report on Water Supply and Replenishment Assessment for each of the groundwater basins review the historical use of groundwater in the Coachella Valley. In 1936, groundwater use was estimated to be 92,400 acre-ft/yr (AFY) and it increased steadily to about 376,000 AFY in 1999 (Water Consult and MWH, 2002). The groundwater use in 2009 dropped to about 358,700 AFY due to a combination of water conservation efforts, source substitution projects and the effects of the on-going economic recession.

Total production (including surface water diversions) within the Upper Whitewater River Subbasin was 199,149 AFY in 2009. The production within CVWD's Upper Whitewater River AOB for 2009 was 155,793 AF, of which CVWD pumped 96,576 AFY (CVWD, 2010a). Groundwater production in DWA's Upper Whitewater River AOB for 2009 was 41,913 AFY, of which DWA extracted 37,244 AFY (DWA, 2010). Surface water diversions in the DWA AOB accounted for 1,443 AFY in 2009. Total production within the Lower Whitewater River Subbasin was estimated to be 160,000 AFY in 2009, of which CVWD pumped 24,283 AFY (CVWD, 2010b).

The historical fluctuations of groundwater levels within the Whitewater River Subbasin indicate a steady decline in the levels throughout the Subbasin prior to 1949. With the use of Colorado River water from the Coachella Canal after 1949, groundwater demand on the groundwater basin declined in the East Valley (generally east and south of Washington Street) below Point Happy and the groundwater levels rose sharply. Water levels in the deeper aquifers rose from 1950 to 1980. However, since the early 1980s, water levels in this area have again declined, at least partly due to increasing urbanization and groundwater usage. Groundwater levels in wells across the Valley floor are presented in **Figure 4-2**. The location of these wells is shown on **Figure 4-1**.

4.1.6 Overdraft Status

The demand for groundwater has annually exceeded the limited natural recharge of the groundwater basin. The condition of a groundwater basin in which the outflows (demands) exceed the inflows (supplies) to the groundwater basin over the long term is called *"overdraft."* Overdraft has caused groundwater levels to decrease in significant portions of the East Valley. Groundwater levels in the West Valley have also decreased substantially, except in the areas near the Whitewater Recharge Facility where artificial recharge has successfully raised water levels.

Overdraft has serious consequences. The immediate and direct effect is increased groundwater pumping costs for all water users. With continued overdraft, wells will have to be deepened, pumps that are more powerful will have to be installed, and energy costs will increase as the pump lifts increase. The need for deeper wells and more powerful pumps will increase the cost of water for agriculture, municipalities, resorts, homes, and businesses. Continued decline of groundwater levels could result in a substantial and possibly irreversible degradation of water quality in the groundwater basin due to the intrusion of lower quality, high TDS water applied at the surface for irrigation and reduced drain flows carrying the salts out of the basin. Continued overdraft also increases the possibility of land subsidence. As groundwater is removed, the dewatered soil begins to compress from the weight of the ground above, causing subsidence. Subsidence can cause ground fissures and damage to buildings, homes, sidewalks, streets, and buried pipelines – all of the structures that make the Valley livable. Subsidence also reduces storage capacity in the aquifer. Continued overdraft would eventually stifle growth in the Valley, as it would not be possible to demonstrate that adequate water supplies exist to support growth.

The groundwater supply of the Whitewater River Subbasin consists of a combination of natural runoff, inflows from adjacent basins, returns from groundwater, recycled water, and imported water use. The supply is supplemented with artificial recharge with imported SWP Exchange and Colorado River water. The long-term average of natural inflow from mountain-front runoff is about 46,000 AFY. Runoff varies from about 8,000 AFY in very dry years to over 200,000 AFY in extremely wet years. For the ten-year period of 2000 through 2009, natural inflow from mountain-front runoff was below normal averaging about 29,000 AFY. Subsurface inflow from adjacent groundwater basins averages about 11,000 AFY and is relatively consistent from year to year. Returns from use vary with water demands. From the 2000 through 2009 period, returns from use are estimated to average about 240,000 AFY. During this same period, about 51,000 AFY of imported water was recharged in the basin. Total inflows for this period are estimated to be about 331,000 AFY as shown in **Table 4-1**.

Outflows from the basin consist of pumping, flows to the agricultural drainage system, evapotranspiration by native vegetation and subsurface outflow to the Salton Sea. For the 2000-2009 period, groundwater pumping averaged about 389,000 AFY. Drain flows are estimated be about 48,000 AFY while evapotranspiration and subsurface outflow averaged about 4,000 AFY. Total basin outflows for this period averaged 441,000 AFY. Average net outflow from storage for this period was 110,000 AFY as shown in **Table 4-1**. The loss from storage would have been greater if drain flows from the basin had not declined due to lower groundwater levels in the Semi-perched aquifer.

Bulletin 108 (1964) and Bulletin 118 (2003) are the most DWR recent bulletins that characterize the condition of the Coachella Valley aquifer as a whole. In Bulletin 108, DWR noted that the amount of usable supply in the overdrafted aquifer was decreasing. CVWD estimates the annual overdraft in its Engineer's Reports on Water Supply and Replenishment Assessment. These reports estimated the annual loss of storage (overdraft) for the Coachella Valley to be 72,100 AFY in 2009. The 2009 loss in storage was lower than the historical loss due to increased SWP Exchange water deliveries at Whitewater River Recharge Facility and commencement of Canal water recharge at the Thomas E. Levy Groundwater Replenishment Facility (Levy facility) in the East Valley beginning in 2009.

The 2010 WMP Update estimates long-term overdraft using a calculation of change in storage based on long-term local hydrology and imported water deliveries. Since the local hydrology varies significantly from year to year, a long term average provides a better estimate of the local inflows, which are dampened by the large storage volume of the basin. Because imported water recharge deliveries in the West Valley can also vary widely from year to year, recharge is based on the estimated long-term average SWP Exchange reliability rather than actual year-to-year values. For example, CVWD and DWA experienced two years of very high recharge in 2010 and 2011 with nearly 461,000 AF recharged at Whitewater (including advanced deliveries). Other inflows and outflows are estimated using the groundwater model. This approach moderates the variations in the annual change in storage and gives a more consistent indication of long-term overdraft. Based on these adjustments, the average annual overdraft for 2000 through 2009 is estimated to be 70,000 AFY as shown in **Table 4-1**.

Table 4-1
Groundwater Balance for the Whitewater River Subbasin
2000-2009

Water Balance Component	2000-2009 Averages (AFY)	2045 With 2002 WMP (AFY)
Groundwater Inflows		
Mountain-front Runoff [1]	29,000	46,000
Subsurface Inflow from Adjacent Basins	11,000	11,000
Return flows from Use [2]	240,000	211,000
Imported Water Recharge [3]	51,000	137,000
Subtotal - Inflow	331,000	405,000
Groundwater Outflows		
Pumping	389,000	450,000
Drain flow [4]	48,000	42,000
Evapotranspiration & Net Subsurface Outflow [4]	4,000	3,000
Subtotal - Outflow	441,000	495,000
Average Basin Balance (Inflow-Outflow)	**-110,000**	**-90,000**
Groundwater Overdraft		
Long-term Runoff Adjustment [5]	+17,000	0
Long-term Imported Water Recharge Adjustment [6]	+23,000	0
Long-term Overdraft Estimate	-70,000	-90,000

Notes: The values presented in this table may differ from information presented in the relevant Engineer's Reports prepared by CVWD and DWA due to different methods of calculation. All values rounded to nearest 1,000 AFY.

1. Mountain-front runoff for 2000-2009 is estimated based on precipitation records. Runoff for 2045 is based on 1936-2009 average.
2. Return flows are based on estimates by usage type and include wastewater percolation.
3. The recharge amounts include recharge at Whitewater, Levy, and Martinez and reflect an estimated 2 percent loss for evaporation.
4. Groundwater model results are used to estimate drain flow, evapotranspiration, and net subsurface outflow.
5. The average overdraft amount for the 2000-2009 period is adjusted to reflect long-term natural runoff conditions (46,000 – 29,000 AFY).
6. The long-term imported recharge amount is adjusted to reflect the average annual SWP Table A Amounts for the 2000-2009 period (117,140 AFY) at an average delivery reliability of 60 percent. No adjustment is made to the Levy (4,300 AFY) and Martinez (1,200 AFY) recharge amounts.

The overdraft condition of the Coachella Valley has caused groundwater levels to decline in many portions of the East Valley from La Quinta to the Salton Sea, and has raised concerns about water quality degradation and land subsidence. To address declining water levels in the East Valley, the Thomas E. Levy Groundwater Replenishment (Levy) Facility was completed in 2009, as mentioned in **Section 2.5** of this update. Water levels are beginning to increase in the confined aquifer in the East Valley partly as a result of the increased hydraulic pressure provided by recharge from the Levy Facility. Groundwater levels in the West Valley from Palm Springs to La Quinta have also decreased substantially, except in areas adjacent to and down gradient of the Whitewater River Recharge Facility, where artificial recharge has successfully raised water levels. However, water levels in the mid-Valley area have continued to show declines. **Figure 4-2** shows historical water levels for selected wells in both the West and East Valleys. In 2009, the annual loss in storage in the Lower Whitewater River Subbasin was 23,912 AF (CVWD,

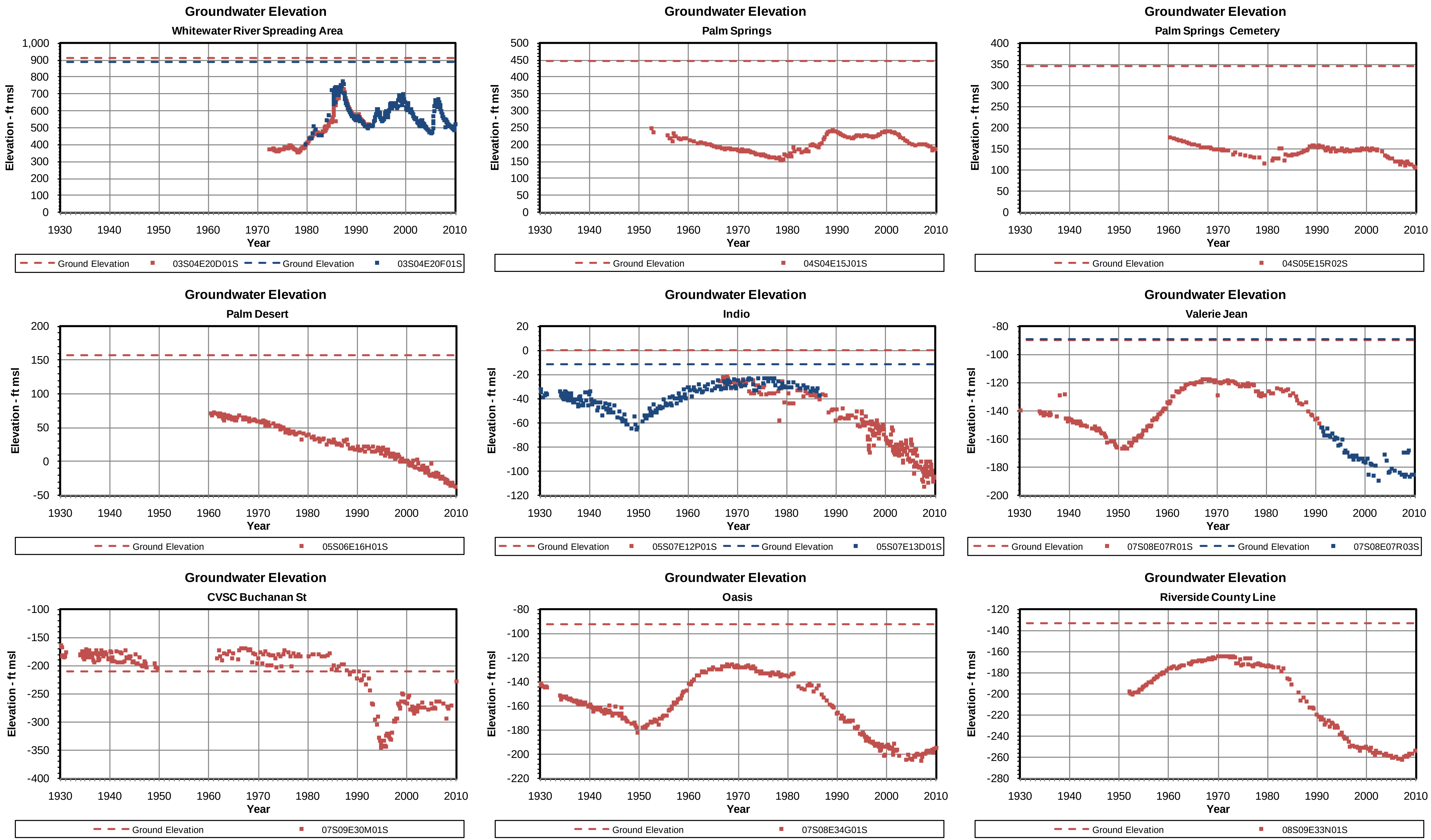

Figure 4-2
Representative Groundwater Levels

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2010b). The annual loss in storage in the Upper Whitewater River Subbasin was 48,139 AF in 2009 (CVWD, 2010a).

In the future as the 2002 WMP is fully implemented, the groundwater balance was expected to improve with increased recharge at the Whitewater, Levy and Martinez facilities, delivery of Canal water to golf courses and increased water conservation. However, since the preparation of the 2002 WMP, changes in water use patterns and growth coupled with reduced imported water reliability are expected to result in continued overdraft in the absence of plan modifications.

4.2 COLORADO RIVER

Colorado River water has been a major source of supply for the Coachella Valley since 1949 with the completion of the Coachella Canal. The Colorado River is managed and operated in accordance with the *Law of the River*, the collection of interstate compacts, federal and state legislation, various agreements and contracts, an international treaty, a U.S. Supreme Court decree, and federal administrative actions that govern the rights to use of Colorado River water within the seven Colorado River Basin states. The *Colorado River Compact*, signed in 1922, apportioned the waters of the Colorado River Basin between the Upper Colorado River Basin (Colorado, Wyoming, Utah, and New Mexico) and the Lower Basin (Nevada, Arizona, and California). The Colorado River Compact allocates 15 million AFY of Colorado River water: 7.5 million AFY to the Upper Basin and 7.5 million AFY to the Lower Basin, plus up to 1 million AFY of surplus supplies. The Lower Basin's water was further apportioned among the three Lower Basin states by the *Boulder Canyon Project Act* in 1928 and the 1964 U.S. Supreme Court decree in *Arizona v. California*. Arizona's basic annual apportionment is 2.8 million AFY, California's is 4.4 million AFY, and Nevada's is 0.3 million AFY. California has been diverting up to 5.3 million AFY in recent years, using the unused portions of the Arizona and Nevada entitlements. Mexico is entitled to 1.5 million AFY of the Colorado River under the *1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande*. However, this treaty did not specify a required quality for water entering Mexico. In 1973, the United States and Mexico signed Minute No. 242 of the International Boundary and Water Commission requiring certain water quality standards for water entering Mexico.

California's apportionment of Colorado River water is allocated by the 1931 *Seven Party Agreement* among Palo Verde Irrigation District (PVID), Imperial Irrigation District (IID), CVWD, and Metropolitan. The three remaining parties - the City and the County of San Diego and the City of Los Angeles - are now part of Metropolitan. The allocations defined in the *Seven Party Agreement* are shown in **Table 4-2**. In its 1979 supplemental decree in the *Arizona v. California* case, the U.S. Supreme Court also assigned "present perfected rights" to the use of river water to a number of individuals, water districts, towns, and Indian tribes along the river. These rights, which total approximately 2,875,000 AFY, are charged against California's 4.4 million AFY allocation and must be satisfied first in times of shortage. Under the 1970 *Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs* (Operating Criteria), the Secretary of the Interior determines how much water is allocated for use in Arizona, California, and Nevada and whether a surplus, normal, or shortage condition exists. The Secretary may allocate additional water if surplus conditions exist on the River (see **Section 4.7.1.2**).

Table 4-2
Priorities and Water Delivery Contracts
California Seven-Party Agreement of 1931

Priority	Description	AFY
1	Palo Verde Irrigation District gross area of 104,500 acres of valley lands	3,850,000
2	Yuma Project (Reservation Division) not exceeding a gross area of 25,000 acres within California	
3(a)	Imperial Irrigation District, Coachella Valley Water District, and lands in Imperial and Coachella Valleys to be served by the All American Canal	
3(b)	Palo Verde Irrigation District - 16,000 acres of mesa lands	
4	Metropolitan Water District of Southern California for use on coastal plain	550,000
	Subtotal – California's Basic Apportionment	**4,400,000**
5(a)	Metropolitan Water District of Southern California for use on coastal plain	550,000
5(b)	Metropolitan Water District of Southern California for use on coastal plain	112,000
6(a)	Imperial Irrigation District and lands in the Imperial and Coachella Valleys to be served by the All American Canal	300,000
6(b)	Palo Verde Irrigation District - 16,000 acres of mesa lands	
	Total	**5,362,000**[1]

1 – Priorities 5-6 would only receive water if there is water available in excess of the 7.5 MAFY available to the Lower Basin States or unused water within the Lower Basin.

California's Colorado River supply is protected by the 1968 Colorado River Basin Project Act, which provides that in years of insufficient supply on the main stream of the Colorado River, supplies to the Central Arizona Project shall be reduced to zero before California will be reduced below 4.4 million AF in any year. This assures full supplies to the Coachella Valley except in periods of extreme drought. As described further in **Section 4.7.1.2**, delivery analyses performed for the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lakes Powell and Mead indicated that that California would only experience shortages if the total shortage in the Lower Basin exceeds 1.7 million AFY.

The Coachella Canal (Canal) is a branch of the All-American Canal that brings Colorado River water into the Imperial and Coachella Valleys. Historically, CVWD received approximately 330,000 AFY of Priority 3A Colorado River water delivered via the Coachella Canal. The Canal originates at Drop 1 on the All-American Canal and extends approximately 122 miles, terminating in CVWD's Lake Cahuilla. The service area for Colorado River water delivery under CVWD's contract with Reclamation is defined as Improvement District No. 1 (ID-1) which encompasses most of the East Valley and a portion of the West Valley north of Interstate 10. Under the 1931 California Seven Party Agreement, CVWD has water rights to Colorado River water as part of the first 3.85 million AFY allocated to California. CVWD is in the third priority position along with IID.

4.2.1 Quantification Settlement Agreement

In 2003, CVWD, IID, and Metropolitan successfully completed negotiation of the Quantification Settlement Agreement (QSA). The QSA quantifies the Colorado River water allocations of California's agricultural water contractors for the next 75 years and provides for the transfer of water between agencies. Under the QSA, CVWD has a base allotment of 330,000 AFY. In accordance with the QSA, CVWD has entered into water transfer agreements with Metropolitan and IID that increase CVWD supplies by an additional 129,000 AFY as shown in **Table 4-3** and **Figure 4-3**.

Table 4-3
CVWD Deliveries under the Quantification Settlement Agreement

Component	2010 Amount (AFY)	2045 Amount (AFY)
Base Entitlement	330,000	330,000
1988 Metropolitan/IID Approval Agreement	20,000	20,000
Coachella Canal Lining (to SDCWA)	-26,000	-26,000
To Miscellaneous/Indian PPRs	-3,000	-3,000
IID/CVWD First Transfer	12,000	50,000
IID/CVWD Second Transfer	0	53,000
Metropolitan/SWP Transfer	35,000	35,000
Total Diversion at Imperial Dam	**368,000**	**459,000**
Less Conveyance Losses [1]	-31,000	-31,000
Total Deliveries to CVWD	**337,000**	**428,000**

1 – Assumed total losses after completion of canal lining projects.

As of 2010, CVWD receives 368,000 AFY of Colorado River water deliveries under the QSA (**Table 4-3**). This includes the base entitlement of 330,000 AFY, Metropolitan/IID Approval of 20,000 AFY, 12,000 AFY of IID/CVWD First transfer, and 35,000 AFY of Metropolitan/SWP transfer. It also includes the 26,000 AFY transferred to San Diego County Water Authority (SDCWA) as part of the Coachella Canal lining project and the 3,000 AFY transfer to Indian Present Perfected Rights (PPRs). CVWD's allocation will increase to 459,000 ac-ft/yr of Colorado River water by 2026 and remain at that level for the 75 year term of the QSA. After deducting conveyance and distribution losses, approximately 428,000 AFY will be available for CVWD use.

The Valley's Colorado River supply faces problems that could impact long-term reliability. Issues affecting Colorado River supply are the extended Colorado River Basin drought, Colorado River shortage sharing agreement, endangered species and habitat protection, climate change and lawsuits challenging the validity of the QSA. Due to both California's and CVWD's high priority position regarding Colorado River allocations, this supply is expected to be relatively reliable.

Although the QSA and related agreements were signed in 2003, a number of lawsuits challenging the agreements and transfers remain pending in state and federal courts. In January 2010, the QSA was rendered invalid in a state Superior Court decision along with eleven related agreements (Superior Court of California, 2010). CVWD and the other parties appealed the judgment. On March 9, 2010, the California Court of Appeal, Third Appellate District, issued a temporary stay of the judgment pending further briefing and order of the court regarding appellants' request for a stay during the pendency of the appeal. The Appellate Court reversed the Superior Court decision on December 7, 2011 and remanded the case to the trial court for further proceedings. As of the January 2012 adoption date for this WMP Update, these cases remained pending. A detailed discussion of these issues is presented in **Section 4.7.1**.

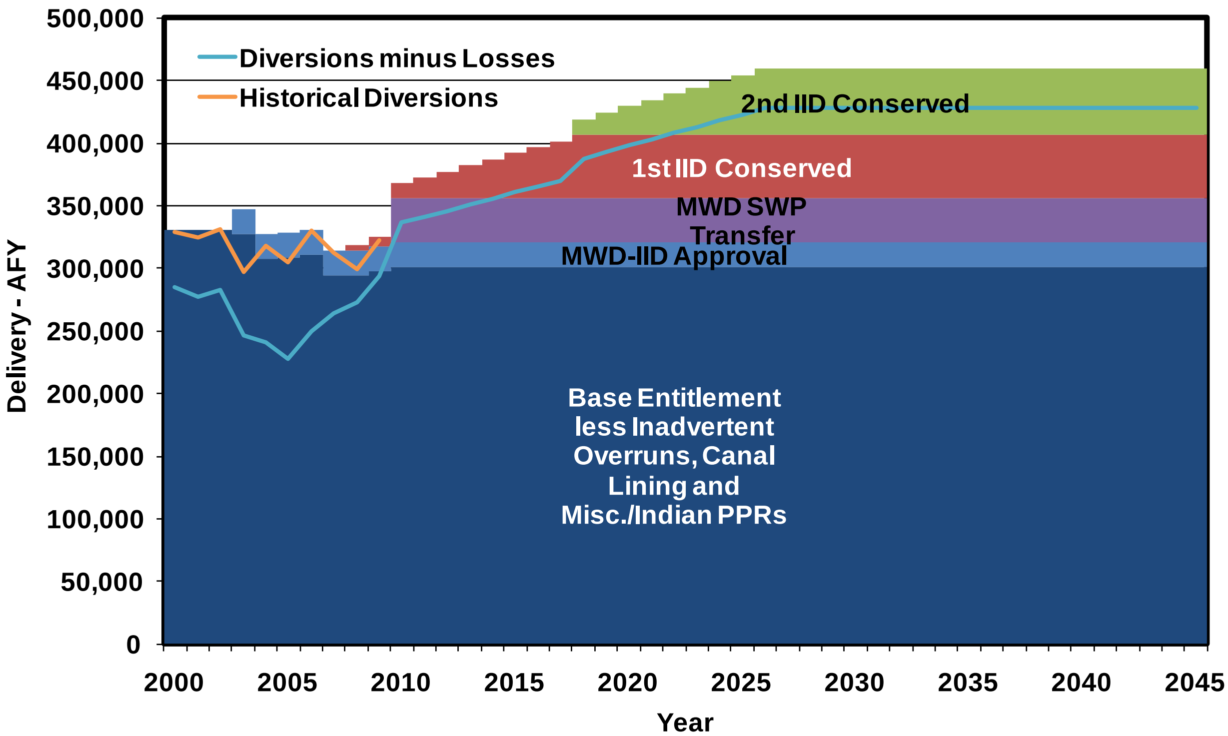


Figure 4-3
CVWD Colorado River Water Allocation Chart

4.3 State Water Project (SWP)

The SWP is managed by DWR and includes 660 miles of aqueduct and conveyance facilities extending from Lake Oroville in northern California to Lake Perris in the south. The SWP has contracts to deliver 4.172 million AFY to 29 contracting agencies. DWA and CVWD initially contracted for water from the SWP in 1962 and 1963, respectively. CVWD's original SWP water allocation (Table A Amount) was 23,100 AFY and DWA's original SWP Table A Amount[2] was 38,100 AFY for a combined Table A Amount of 61,200 AFY. Each year, DWR determines the amount of water available for delivery to SWP contractors based on hydrology, reservoir storage, the requirements of water rights licenses and permits, water quality, and

[2] Each SWP contract contains a "Table A" exhibit which defines the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries. Table A Amounts are used by DWR to allocate available SWP supplies and some of the SWP project costs among the contractors.

environmental requirements for protected species in the Sacramento-San Joaquin Delta. The available supply is then allocated according to each SWP contractor's Table A Amount.

There are no physical facilities to deliver SWP water to the Valley. CVWD's and DWA's Table A water is exchanged with Metropolitan for a like amount of Colorado River water from Metropolitan's Colorado River Aqueduct (CRA), that extends from Lake Havasu, through the Coachella Valley to Metropolitan's Lake Mathews. SWP Exchange water has been used to recharge the Whitewater River Subbasin at the Whitewater River Recharge Facility since 1973. Metropolitan, DWA and CVWD executed an advanced delivery agreement in 1985 that allowed Metropolitan to pre-deliver up to 600,000 AF of SWP water into the Coachella Valley. Metropolitan then has the option to deliver CVWD's and DWA's SWP allocation either from the CRA or from water previously stored in the basin. This agreement was subsequently amended to increase the pre-delivery amount to a maximum of 800,000 AF. The 2002 WMP established a goal of maintaining an average amount of SWP exchange water recharge at 140,000 AFY in the Whitewater River Subbasin.

4.3.1 Metropolitan 100,000 AFY Transfer

Metropolitan historically has not made full use of its SWP Table A Amounts in normal and wet years. Under the 2003 Exchange Agreement, CVWD and DWA acquired 100,000 AFY of Metropolitan's SWP Table A water as a permanent transfer (CVWD-DWA, 2003). The water would be exchanged for Colorado River water and either recharged at the existing Whitewater Spreading Facility or delivered via the Coachella Canal for golf course irrigation purposes in the Palm Desert-Rancho Mirage area of the West Valley. The transferred water may also be delivered from Metropolitan's Advance Storage account. CVWD and DWA would assume all SWP costs associated with this water except as described below.

The terms of the agreement provide that CVWD receives 88,100 AFY and DWA receives 11,900 AFY of Metropolitan's SWP Table A water. CVWD and DWA assume all capital costs associated with capacity in the California Aqueduct to transport this water and variable costs to deliver the water to Lake Perris. Metropolitan retains other rights associated with the transferred water including interruptible water service, carryover storage in San Luis Reservoir, and flexible storage at Castaic and Perris Reservoirs. Amendments to CVWD's and DWA's SWP contracts were executed in 2003 (DWR, 2003b and 2003c).

Metropolitan has the option to call back the water in years when needed. This option must be exercised no later than April 30 of each year. Metropolitan's callback options are to be exercised in two 50,000 AF blocks. To estimate the average supply from this transfer conservatively, the 2010 WMP Update assumes that Metropolitan would exercise its option to call back the 100,000 AFY in 4 wet years out of every 10 years. The actual frequency of callback would depend on the availability of Metropolitan's water supplies to meet its demands. Since 2003, Metropolitan has called back the transferred water only in 2005.

The environmental impacts of this transfer were evaluated in the PEIR for the WMP and SWP Transfer that was certified by the CVWD Board in October 2002. The Metropolitan Board certified the CVWMP PEIR as a responsible agency on October 14, 2003. Metropolitan's SWP contract was amended on October 24, 2003 (DWR, 2003d). CVWD's and DWA's SWP contracts were amended on October 10, 2003 and November 3, 2003, respectively (DWA, 2003b and 2003c). The transfer became effective on January 1, 2005.

4.3.2 Other SWP Transfers

In 2004, CVWD purchased an additional 9,900 AFY of SWP Table A water from the Tulare Lake Basin Water Storage District (Tulare Lake Basin) in Kings County (DWR, 2004). In 2007, CVWD and DWA made a second purchase of Table A SWP water from Tulare Lake Basin totaling 7,000 AFY (DWR, 2007a and 2007b). Also in 2007, CVWD and DWA completed the transfer of 16,000 AFY of Table A Amounts from the Berrenda Mesa Water District in Kern County (DWR, 2007c and 2007d). These latter two transfers became effective in January 2010. With these additional transfers, the total SWP Table A Amount for CVWD and DWA is 194,100 AFY, with CVWD's portion equal to 138,350 AFY. **Table 4-4** summarizes CVWD and DWA total allocations of Table A SWP water.

Table 4-4
State Water Project Sources

Agency	Original SWP Table A	Tulare Lake Basin Transfer #1	Tulare Lake Basin Transfer #2	Metropolitan Transfer	Berrenda Mesa Transfer	Total
CVWD	23,100	9,900	5,250	88,100	12,000	138,350
DWA	38,100	--	1,750	11,900	4,000	55,750
Total	61,200	9,900	7,000	100,000	16,000	194,100

All values expressed in AFY.

4.3.3 SWP Deliveries

SWP water contractors submit annual requests to the DWR for water allocations and DWR makes an initial SWP Table A allocation for planning purposes, typically in December of each year. Throughout the year, as additional information regarding water availability becomes available to DWR, its allocation/delivery estimates are updated. **Table 4-5** presents the historic reliability of SWP deliveries, including their initial and final allocations for the past 24 years (1988 through 2011). During this period, SWP allocations have ranged from 30 percent in 1991 to 100 percent and averaged 76 percent of the Table A Amounts.

Figure 4-4 presents the historical SWP Exchange water deliveries to the Coachella Valley. The dark area represents the combined Table A Amounts of CVWD and DWA in each year, which currently totals 194,100 AFY. The medium blue columns represent SWP water allocated to the Valley and delivered to Metropolitan. The green columns represent Advanced Delivery water. Interruptible SWP water and other water purchases are shown in orange. The pink line represents the total water delivered and recharged to the Valley. Deliveries to the Valley that are less than the SWP allocations and other water purchases are taken from the Advanced Delivery account.

During the mid-1980s, Metropolitan made significant advanced deliveries to the Valley. Some of this water was converted to regular SWP Exchange deliveries in later years. Significant advanced deliveries did not occur again until 2005 and 2010-2011 when wet years occurred. In the late 1990s, CVWD and DWA acquired interruptible SWP supplies and continued period acquisition of other supplies. CVWD also made a large purchase of SWP water from Metropolitan in 2011 under the terms of the QSA (three years at 35,000 AFY).

Table 4-5
Historical SWP Table A Allocations (1988-2011)

Year	Water Year Type[1]	Initial Allocation	Final Allocation
1988	Critical	100%	100%
1989	Dry	100%	100%
1990	Critical	100%	100%
1991	Critical	85%	30%
1992	Critical	20%	45%
1993	Above Normal	10%	100%
1994	Critical	50%	50%
1995	Wet	40%	100%
1996	Wet	40%	100%
1997	Wet	70%	100%
1998	Wet	40%	100%
1999	Wet	55%	100%
2000	Above Normal	50%	90%
2001	Dry	40%	39%
2002	Dry	20%	70%
2003	Above Normal	20%	90%
2004	Below Normal	35%	65%
2005	Above Normal	40%	90%
2006	Wet	55%	100%
2007	Dry	60%	60%
2008	Critical	25%	35%
2009	Dry	15%	40%
2010	Below Normal	5%	50%
2011	Wet	25%	80%
Average:		**46%**	**76%**

Source: DWR, Water Contract Branch within the State Water Project Analysis Office, Notices to State Water Contractors, 1988 – 2011.

1 Water year designation based on Sacramento Valley Water Year Hydrologic Classification, which is based on the sum of the unimpaired runoff in the water year as published in the DWR Bulletin 120 for the Sacramento River at Bed Bridge, Feather River inflow to Oroville, Yuba River at Smartville and American River inflow to Folsom reservoir (DWR, 2010).

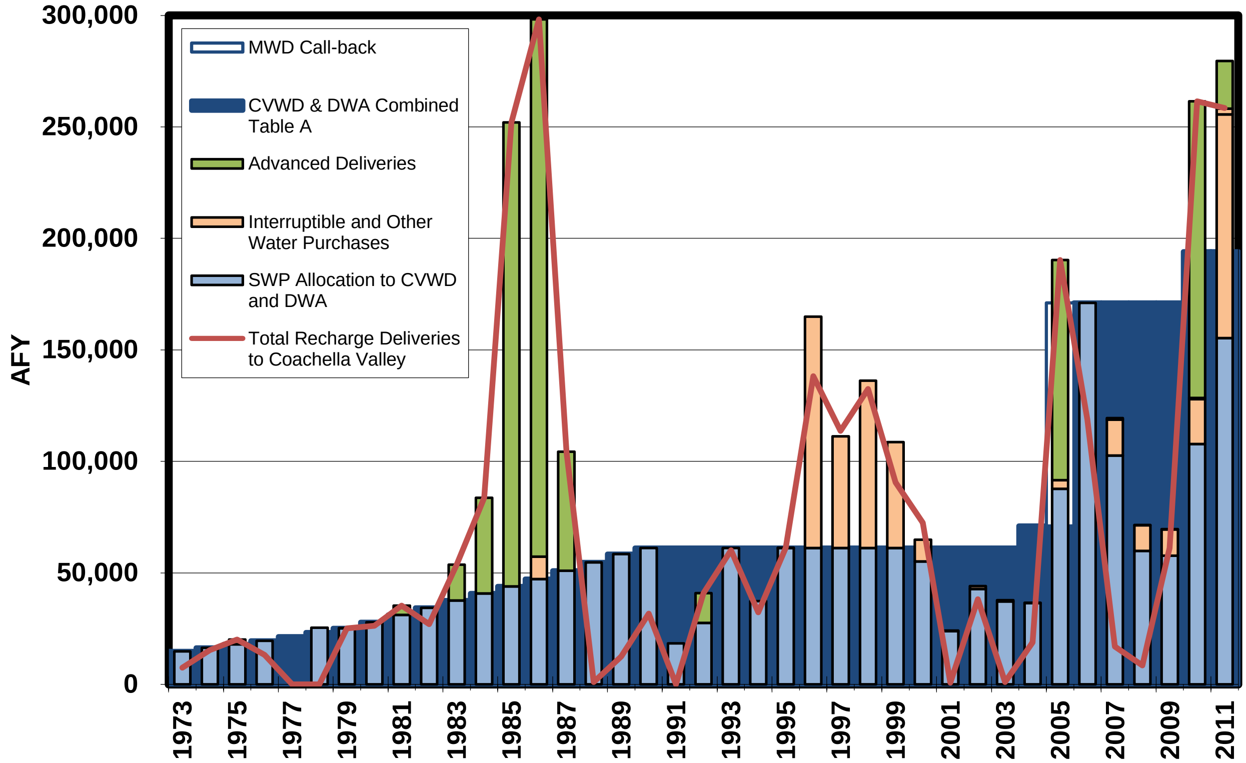


Figure 4-4
Historical SWP Exchange Deliveries to the Coachella Valley

4.3.4 SWP Delivery Reliability

DWR issues the SWP Delivery Reliability Report (DRR) every two years, with the 2009 final version currently available (DWR, 2010a),. This report accounts for impacts to water delivery reliability associated with climate change and recent federal litigation. Based on information from the final 2009 DRR, the average reliability of SWP Table A deliveries through 2029 is projected to be 60 percent of Table A Amounts after taking into consideration the effects of climate change. This allocation percentage is based on computer modeling of the state's watersheds, an expected range of Delta export controls to protect the Delta smelt, the current condition of the river and reservoir systems, and a climate change scenario. It should be noted that the published reliability of the SWP water has decreased over time. The 2003 DRR estimated a reliability of 75-76 percent in 2021; the 2005 DRR estimated a reliability of 77 percent in 2025, whereas the 2007 DRR had estimated reliability at 66-69 percent in 2027.

To account for additional uncertainties related with SWP reliability in the future, the 2010 WMP Update further reduces the reliability factor for the future conditions. The factors that could further reduce the SWP reliability considered in the 2010 WMP Update are:

- Uncertainty in modeling restrictions associated with biological opinions,
- Risk of levee failure in the Delta,
- Additional pumping restrictions resulting from biological opinions on new species or revisions to existing biological opinions,

- Impacts associated with litigations such as the California ESA lawsuit, and
- Climate change impacts

These factors are discussed in detail in **Section 4.7.2.** After taking the above factors into consideration, and in order to plan for higher contingency, the 2010 WMP Update assumes a long-term future average SWP reliability of 50 percent in the absence of successful completion of the Bay-Delta Conservation Plan (BDCP) and delta conveyance facilities.

CVWD's and DWA's SWP Table A Amounts are used to replenish both the Upper Whitewater River and the Mission Creek subbasins (CVWD-DWA, 2003). Water for recharge is allocated between the subbasins in proportion to pumping in the two subbasins. The estimated availability of SWP Table A Amounts for the Coachella Valley is presented in **Table 4-6**.

Table 4-6
SWP Availability for the Coachella Valley

SWP Components	Existing (2010) (AFY[1])	Future (2045) (AFY[1])
Table A Amount (Existing)	194,100	194,100
Assumed SWP Reliability [2]	60%	50%
Average SWP Delivery	116,500	97,100
Less Metropolitan Call-back [3]	(32,900)	(24,800)
Average Net SWP Supply [4]	83,600	72,300
Upper Whitewater Share		
Percent of Total Production[5]	93%	86%
Allocated to Upper Whitewater	77,800	62,200
Mission Creek Share		
Percent of Total Production[4]	7%	14%
Allocated to Mission Creek	5,800	10,100

Notes:
1. Values rounded to nearest 100 AFY.
2. Based on California DWR's 2009 SWP Reliability Report and adjusted based on the combined CVWD-DWA Table A Amounts and assumed future reliability amounts.
3. Average annual reduction assuming 100,000 AFY of Table A is called-back in four wet years during a 10 year period.
4. Net supply is calculated by deducting the Metropolitan callback from the Table A Amount with SWP Reliability.
5. Estimated percent of total production is the percent of production in each subbasin relative to the combined total production of the Upper Whitewater River and Mission Creek subbasins.

CVWD and DWA have made significant progress toward meeting the 2002 WMP goal of 140,000 AFY average SWP delivery for the Whitewater River Subbasin. However, increased demand, Delta environmental issues, recent court decisions, and other risks including climate change threaten to reduce SWP deliveries in the future. The potential reduction equates to reduced reliability of SWP supplies for all SWP contractors, including CVWD. The reduced reliability is factored into the 2010 WMP Update as reduced availability of SWP supplies to meet water demands, and a corresponding need to provide alternative supplies. The impacts of these issues on the Valley's SWP supplies are discussed below.

4.4 SURFACE WATER

Surface water supplies come from several local rivers and streams including the Whitewater River, Snow Creek, Falls Creek and Chino Creek, as well as a number of smaller creeks and washes. Some of this water is diverted for direct delivery to customers while the remainder becomes part of the groundwater supply through percolation of runoff. In 2009, surface water supplied less than one percent of the total water supply to the West Valley to meet urban and golf course demands and none to the East Valley. Because surface water supplies are affected by variations in annual precipitation, the annual supply is highly variable. Since 1936, the historical surface water deliveries have ranged from approximately 1,400 to 9,000 AFY, averaging about 5,800 AFY. DWA acquired the water rights of the Whitewater River Mutual Water Company in 2008 and reduced the amount of surface water diverted for direct use to about 3,400 AFY. The remaining surface water (2,400 AFY) will be recharged.

The majority of local surface water is derived from runoff from the San Bernardino and San Jacinto Mountains with lesser amounts from the Santa Rosa Mountains. This runoff either percolates in the streambeds or is captured in mountain-front debris basins where it recharges the groundwater basin. According to the estimates developed for the 2010 WMP Update, an average of approximately 44,000 AFY of surface water recharges the Whitewater River Subbasin. With the change in surface water use, the long-term average surface water available for recharge is estimated to be about 46,400 AFY.

4.5 RECYCLED WATER

Recycled water is a significant potential local resource that can be used to help reduce overdraft. Wastewater that has been highly treated and disinfected can be reused for landscape irrigation and other purposes; however, treated wastewater is not suitable for direct potable use. Recycled wastewater has historically been used for irrigation of golf courses and municipal landscaping in the Coachella Valley. In addition, fish farm effluent is available in localized areas of the East Valley and a portion is recycled. Based on 2009 data from CVWD and DWA, recycled water usage in the West Valley is approximately 11,700 AFY (7,500 AFY CVWD usage, 4,200 AFY DWA usage). Recycled water usage in the East Valley is approximately 700 AFY and is mainly for agricultural irrigation. In addition, about 10,000 AFY of wastewater was percolated to the groundwater basin. The 2002 WMP anticipated the reuse of 39,000 AFY of municipal wastewater by 2035 with the remaining flow being discharged to the CVSC. If this amount were extrapolated to 2045, reuse could reach about 42,000 AFY.

CVWD operates six water reclamation plants (WRPs), three of which (WRP-7, WRP-9 and WRP-10) generate recycled water for irrigation of golf courses and large landscaped areas. WRP-4 became operational in 1986 and serves communities from La Quinta to Mecca. WRP-4 effluent is not currently recycled; however, it will be recycled in the future when the demand for recycled water develops and tertiary treatment is constructed. The City of Palm Springs operates the Palm Springs Wastewater Treatment Plant (WWTP). DWA provides tertiary treatment to effluent from this plant and delivers recycled water to golf courses and parks in the Palm Springs area. There is also potential for obtaining recycled water from the reclamation plants operated by the City of Coachella and Valley Sanitary District (VSD), but water from these sources is not currently recycled. The existing and projected baseline amounts of recycled water (without additional indoor residential water conservation) available from these plants are presented in **Table 4-7.** Brief descriptions of Valley wastewater facilities are presented below.

4.5.1 WRP-4

CVWD's WRP-4 is a 9.9 million gallons per day (mgd**)** capacity treatment facility located in Thermal. WRP-4 provides secondary treatment consisting of pre-aeration ponds, aeration lagoons, polishing ponds, and disinfection. The treated effluent is discharged to the CVSC pursuant to a National Pollution Discharge Elimination System (NPDES) permit. The annual average flow to the facility is approximately 4.75 mgd (5,300 AFY). Future flows could reach 34,500 AFY by 2045 without additional conservation.

4.5.2 WRP-7

WRP-7 is located in north Indio. The plant is a 5.0 mgd secondary treatment facility with a current tertiary treatment capacity of 2.5 mgd. The tertiary treated wastewater is used for irrigation of golf courses in the Sun City area. The average annual flow is currently 2.11 mgd (2,400 AFY). The plant consists of aeration basins, circular clarifiers, and polishing ponds. Recycled water not used for irrigation is percolated at on-site and off-site ponds. A plant expansion is currently under design that will increase the plant capacity to 7.5 mgd. Growth is expected to increase WRP-7 flows to 9,200 AFY without additional conservation.

4.5.3 WRP-9

WRP-9 is located in Palm Desert. WRP-9 treats approximately 0.33 mgd (370 AFY) of wastewater from the residential development surrounding the Palm Desert Country Club. The WRP consists of the following treatment units: a grit chamber, aeration tanks, secondary clarifiers, chlorine contact chamber, aerobic digester, and two infiltration basins. One basin is lined for storage of treated wastewater. Raw wastewater in excess of the design capacity is pumped to WRP-10. Secondary effluent from WRP-9 is used to irrigate a portion of the Palm Desert Country Club golf course. No change in plant flow is expected in the future.

4.5.4 WRP-10

WRP-10 is located in Palm Desert. WRP-10 consists of an activated sludge treatment plant, a tertiary wastewater treatment plant, a lined holding basin, 6 storage basins and 21 infiltration basins.

The combined secondary wastewater treatment design capacity of the WRP is 18 mgd. WRP-10 treats an annual average daily flow of 10.8 mgd (12,100 AFY) from the activated sludge plant. Approximately 60 percent of this plant's effluent receives tertiary treatment for reuse and is delivered to customers through an existing recycled water distribution system. The remaining secondary effluent is piped to a holding basin and/or the six storage basins, and then to the 21 infiltration basins for final disposal.

Most secondary effluent receives tertiary treatment and is used for irrigation of local golf courses. Since 2009, CVWD blends tertiary effluent with Canal water provided by the Mid-

Table 4-7
Existing and Projected Total Wastewater Flows in the Coachella Valley

Wastewater Treatment Plant	Flow - AFY [1]								
	2005 [2]	2010	2015	2020	2025	2030	2035	2040	2045
Palm Springs WWTP	7,272	8,100	8,600	9,200	9,900	10,700	11,600	12,500	13,400
Coachella SD WWTP	2,412	3,500	4,600	5,800	7,000	8,100	9,400	10,600	11,800
VSD WWTP	6,172	7,000	7,800	8,400	8,900	9,500	10,100	10,700	11,300
CVWD WRP-10	12,290	13,100	14,000	15,000	15,900	16,500	16,900	17,300	17,400
CVWD WRP-4	5,055	6,200	8,100	11,800	16,800	20,600	25,200	29,900	34,500
CVWD WRP-7	2,411	3,300	3,900	5,400	5,900	6,800	7,600	8,400	9,200
CVWD WRP-9	335	300	300	300	300	300	300	300	300
Total	**35,947**	**41,500**	**47,300**	**55,900**	**64,700**	**72,500**	**81,100**	**89,700**	**97,900**

1 – Projected flows do not include the effects of future additional water conservation on indoor water use, which would reduce these amounts.

2 – Actual plant flows for the year 2005; all other years are estimated.

Source: Average Dry Weather Flows developed by MWH based on growth forecasts.

Valley Pipeline (MVP) for distribution to golf courses. CVWD plans to expand the non-potable water delivery system in the future, as discussed in **Section 6**. Growth is expected to increase WRP-10 flows to 17,400 AFY without additional conservation.

4.5.5 DWA Water Reclamation Plant

The City of Palm Springs provides wastewater collection and treatment service within its city limits. The City of Palm Springs operates the Palm Springs WWTP, which has a capacity of 10.9 mgd and produces secondary-treated effluent. DWA provides tertiary treatment to a portion of the effluent from this plant and delivers recycled water to golf courses and parks in the Palm Springs area. The City of Palm Springs disposes any remaining secondary-treated effluent that in percolation ponds located near the City's plant site. In 2009, about 4,200 AFY of plant effluent received tertiary treated and was reused. Flows are projected to reach 13,400 AFY without additional conservation.

4.5.6 Valley Sanitary District WWTP

The VSD owns and operates an 11 mgd capacity wastewater treatment facility that serves most of the City of Indio. The wastewater treatment system consists of preliminary, primary, and secondary treatment processes. Secondary treatment is provided by three process trains – activated sludge (7.5 mgd), oxidation ponds (2.5 mgd) and wetlands treatment (1 mgd). Effluent from the oxidation ponds and the wetlands is either routed to pasture irrigation or blended with activated sludge effluent, disinfected, dechlorinated and discharged to the CVSC. VSD plans to increase the capacity of the activated sludge process to 10 mgd through the addition of aeration basins and secondary clarifiers by 2011. This will increase the total plant capacity to 13.5 mgd (CRRWQCB, 2010c).

The VSD plant treated and discharged about 7,200 AFY of wastewater in 2011. Growth within the VSD service is projected to increase the flow to the plant to about 11,300 AFY by 2045 without additional conservation. The City of Indio's Water Resources Development Plan indicates that the City intends to use as much recycled water as is practical from VSD to meet future demands in its service area (Indio, 2008).

4.5.7 Coachella Sanitary District WWTP

The City of Coachella through its Coachella Sanitary District owns and operates a 4.5 mgd secondary treatment wastewater facility utilizing activated sludge and oxidation ditch processes. Treated wastewater is discharge to the CVSC (CRRWQCB, 2010b). The City is currently analyzing the cost-benefit of upgrading the wastewater treatment facility to tertiary treatment to determine its feasibility (Coachella, 2008). The City does not have infrastructure in place to recycle water. If the treatment system upgrade feasibility study produces a favorable result and tertiary treatment is added to the facility, potential uses include large landscape irrigation, groundwater recharge, water exchange, agricultural irrigation, industrial reuse, and habitat revitalization. Separate, non-potable water systems were required with approval of many of the larger recent developments. These non-potable water systems were constructed using "purple pipe" to facilitate connections to a future City-wide recycled water system without significant system modification costs (Coachella, 2008). Projected wastewater flows could reach 11,800 AFY by 2045 without additional conservation.

4.5.8 Aquaculture Water Reuse

CVWD has worked with a local aquaculture firm to develop water efficiency programs that include water treatment and reuse. Historically, the amount of fish farm effluent recycled in the East Valley was approximately 2,000 AFY. However, one of the largest fish farms in the East Valley recently terminated operations and is now using their ponds to grow algae that will be used for the production of biofuel. This shift in operations has significantly reduced groundwater pumping as well as essentially eliminated a source of reusable aquaculture effluent. Water users that have used this recycled water will need to convert to Canal water as a supply. Several areas have been approved for Canal water service pending design and construction of facilities. The 2010 WMP Update assumes that no aquaculture water is available for future reuse.

4.6 OTHER SUPPLIES

CVWD and DWA along with other Valley agencies have investigated other water transfer opportunities described below. Since these water transfers are highly uncertain, they are not accounted for as firm existing supply capacity available to CVWD.

Yuba River Accord Dry Year Water Purchase Program: In March 2008, CVWD and DWA entered into separate agreements with the DWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program. This program provides dry year supplies through a water purchase agreement between DWR and Yuba County Water Agency (YCWA) as part of the Lower Yuba River Accord (Yuba Accord) which settled long-standing operational and environmental issues over instream flow requirements for the lower Yuba River. Yuba Accord water transfers will include both surface water and groundwater substitution transfers for an estimated total of up to 140,000 AFY. The available water is allocated among participating SWP contractors based on their Table A Amounts. It is estimated that CVWD and DWA may be able to purchase up to 4 percent or 5,600 AFY, and 1.3 percent or 1,820 AFY, respectively for a total of 7,420 AFY. The amount of water available for purchase in a given year varies and will be based on DWR's determination of the Water Year Classification. These agreements provide for the exchange of these supplies with Metropolitan for Colorado River water in accordance with existing exchange agreements. CVWD and DWA obtained 1,836 AF in 2008 and 3,482 AF in 2009 from this program.

Rosedale-Rio Bravo Transfer: In 2008, CVWD executed an agreement with Rosedale-Rio Bravo Water Storage District (Rosedale) in Kern County for a one-time transfer of 10,000 AF of banked Kern River flood water that is exportable to CVWD. Per the Rosedale agreement, deliveries to CVWD began in 2008 and were to be completed by 2012 (CVWD, 2011). Similar transfers could be executed in future years based on water availability.

4.7 SUPPLY RISKS AND UNCERTAINTIES

The existing water supplies face risks and uncertainties that could affect long-term supply reliability. These risks and uncertainties include the extended drought in the southwestern United States and legal/regulatory decisions affecting vital contracts and water deliveries. In addition, climate change could impact both supplies and demands in the Valley. Climate change is discussed in **Section 5**.

4.7.1 Colorado River

Although CVWD's Colorado River supply has historically been fully reliable, the extended Colorado River drought and the recent invalidation of the QSA may impact the availability of this supply.

4.7.1.1 Extended Colorado River Drought

CVWD receives approximately 40 percent of its overall water supply from the Colorado River. The period from 2000 through 2007 was the driest eight-year period in the 100-year historical record of the Colorado River. This drought in the Colorado River Basin reduced Colorado River system storage, while demands for Colorado River water supplies continued to increase. From October 1, 1999 through September 30, 2007, storage in Colorado River reservoirs decreased from 55.8 million AF (approximately 94 percent of capacity) to 32.1 million AF (approximately 54 percent of capacity), and was as low as 29.7 million AF (approximately 52 percent of capacity) in 2004. In November 2010, Lake Powell and Lake Mead were at 62 percent and 38 percent of their storage capacities, respectively (Reclamation, 2010b). Although slightly above-normal snowpack conditions existed in the Colorado River basin in 2008, the years 2009 and 2010 saw a return of below normal runoff conditions. Consequently, the potential for continued drought conditions exists.

Extended droughts in the southwestern United States are believed to have occurred a number of times in the past 1,200 years. A study published in 2007 reconstructed Upper Colorado River flows at Lee Ferry (below Lake Powell) using tree-ring data for the period A.D. 762 to 2005 (NOAA/NCDC, 2006). This study indicated that the Colorado River basin may have experienced two droughts extending for 60 to 80 years during the Medieval period (A.D. 800 to 1200), including a drought in the mid-1100s where the average flow over a 25-year period decreased by 15 percent. One of these droughts is believed to have caused the decline of the Anasazi culture in the Southwest. Several droughts having durations of 20 to 30 years are also inferred from the tree-ring data. Although basin-wide inflows have exceeded water use over the past 100 years, the reconstructed hydrology suggests that the average flow at Lee Ferry might be 14.65 million AFY, which is significantly lower than the 16.5 million AFY allocated to Colorado River users.

CVWD will continue to monitor the supply conditions on the Colorado River, make appropriate adjustments to its operations, and actively participate in efforts to augment the water supplies of Colorado River.

4.7.1.2 Colorado River Interim Guidelines

Each year, the Secretary of the Interior is required to declare the Colorado River water supply availability conditions for the Lower Basin States in terms of normal, surplus, or shortage. Although operational criteria have been developed for normal and surplus, Reclamation did not have specific operational guidelines in place to address the operations of Lake Powell and Lake Mead during drought and low reservoir conditions. In 2007, Reclamation adopted specific interim guidelines for Lower Basin shortages and coordinated operations for Lake Powell and Lake Mead. These interim guidelines will remain in effect for determinations to be made through 2025 regarding water supply and reservoir operating decisions through 2026 and will provide guidance for development of the Annual Operating Plan (AOP) for Colorado River Reservoirs (Reclamation, 2007).

The purposes of the interim guidelines are to: 1) improve Reclamation's management of the Colorado River by considering trade-offs between the frequency and magnitude of reductions of water deliveries, and considering the effects on water storage in Lake Powell and Lake Mead. Reclamation will also consider the effects on water supply, power production, recreation, and other environmental resources; 2) provide mainstream United States users of Colorado River water, particularly those in the Lower Division states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions; and 3) provide additional mechanisms for the storage and delivery of water supplies in Lake Mead to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions.

As a result of the interim guidelines, recipients of Colorado River water, including CVWD, will receive deliveries with a higher degree of reliability. Information presented in the Final Environmental Impact Statement (EIS) for the Interim Guidelines indicates that California would only experience shortages if the total shortage in the Lower Basin exceeds 1.7 million AF. Due to California's Colorado River priority system, all delivery shortages would be borne by Metropolitan, which has a lower priority than CVWD (Reclamation, 2007). Consequently, no reduction in CVWD's Colorado River supplies is projected at this time.

4.7.1.3 QSA Litigation

In November 2003, IID filed a validation action to confirm the validity of the QSA and twelve of the thirty-four QSA related agreements. The case was coordinated for trial with other lawsuits challenging QSA environmental and regulatory approvals in the Sacramento County Superior Court.

On February 11, 2010, the trial court entered judgment declaring the QSA and eleven of the related agreements void and invalid based on a determination that the unconditional state obligation in the QSA-JPA Agreement to pay for excess environmental mitigation costs violated the appropriation requirement of California Constitution, article XVI, section 7, and that the other agreements would not have been entered into absent that state obligation. The court declined, for jurisdictional reasons, to validate the thirteenth agreement, the IID-CVWD Salton Sea Flooding Settlement Agreement.

CVWD and other parties appealed the judgment. On March 9, 2010, the California Court of Appeal, Third Appellate District, issued a temporary stay of the judgment pending further briefing and order of the court regarding appellants' request for a stay of the appeal. The appellate court reversed the Superior Court decision on December 7, 2011 and remanded the case back to the trial court for decision on the environmental challenges to QSA Program EIR. As of the January 2012 adoption date for this WMP Update, these cases remained pending.

Since California must still comply with its 4.4 million AFY allocation, it appears likely that some variation of the QSA will need to be developed if the QSA is ultimately overturned. Therefore, the 2010 WMP Update assumes that the current QSA or a functional equivalent will be in place in the future. If future changes to the QSA as a result of litigation significantly impact water supplies for CVWD, the WMP will be updated to reflect those changes.

4.7.2 SWP

As described earlier, DWR estimates the current average reliability of the SWP to be 60 percent of Table A Amounts. The 2010 WMP Update assumes future SWP Table A deliveries to the Coachella Valley to be 50 percent of Table A Amounts to account for the potential water reductions associated with the current and future risks affecting Delta water exports in the absence of programs to balance Delta environmental concerns and water supply needs. This 50 percent average reliability factor is considered reasonable for the 2010 WMP Update considering recent and pending water litigation, risks associated with levee failure in the Delta, as well as potential variability associated with climate change through 2045.

4.7.2.1 Delta Environmental Issues

All SWP supplies flow through the Sacramento-San Joaquin River Delta, the largest estuary system on the west coast of the United States. The Delta is the home of more than 750 native plant and animal species, several of which are listed threatened or endangered, and is the hub of water supply for the State. For decades, the Delta has been the focus of competing interests – economic, environmental, urban, and agricultural. Significant threats to the Delta are declining fish and wildlife habitat, native plant and animal species being threatened with extinction, degradation of Delta water quality and supply reliability and risk of levee failures.

Attention has focused on the decline in pelagic (open water) organisms in the Delta since the early 2000s. Pelagic organisms that have shown recent declines include Delta smelt, winter- and spring-run salmon, Central Valley steelhead, longfin smelt, striped bass, and threadfin shad, among others. Studies conducted over the last five years point toward several factors that affect the decline of these organisms, including toxic runoff, predatory and invasive non-native species (such as Asian clams), wastewater discharges and water diversions. During 2007, DWR ceased pumping and Reclamation significantly limited pumping from the Delta to minimize the take of Delta smelt. The decline in these organisms has resulted in several recent court rulings and administrative decisions reducing or having the potential to reduce Delta water diversions with a corresponding impact on SWP supplies.

A series of legal and regulatory rulings have affected water deliveries from the Delta in recent years. In 2005, environmental groups filed suit alleging DWR did not have proper legal authority to take endangered fish while operating the SWP. In 2007 and 2008, federal Judge Oliver Wanger overturned the 2004 biological opinions addressing the impacts of operation of the SWP and the CVP on the Delta smelt and Chinook salmon. In response to these rulings, in 2009 the U. S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) issued revised biological opinions regarding the Delta smelt, Chinook salmon, steelhead and green sturgeon. State and federal water contractors challenged these recent opinions and, in May 2010, Judge Wanger ruled these opinions did not use the best available scientific data and failed to evaluate the environmental impacts of the export restrictions on humans and the human environment.

In August 2010, the SWRCB adopted a report identifying new flow criteria for the Delta ecosystem that are necessary to protect public trust resources, which include navigation, commerce, fisheries, recreation, scenic, and ecological values (SWRCB, 2010a). Prepared in response to the Delta Reform Act (SB 1x7 2009), this report presents flow criteria based only on a technical assessment of flow and operational requirements that provide fishery protection under existing conditions. The report concluded that Delta outflow should be up to 75 percent of the "unimpaired" outflow from January to June to protect Delta habitat and fisheries with a significant reduction in the amount of water available for export. However, the report does not consider "the allocation of water resources, the application of the public trust to a particular water diversion or use, water supply impacts, or any balancing between potentially competing public trust resources (such as potential adverse effects of increased Delta outflow on the maintenance of cold-water resources for salmonids in upstream areas)" (SWRCB, 2010a).

4.7.2.2 Other Risk Factors

Other factors that could further adversely affect SWP delivery reliability are additional environmental restrictions to protect other Delta species, failure of Delta levees, and climate change. Failure of the network of Delta levees due to earthquakes, flooding or sea level rise could disrupt imported water deliveries and allow intrusion of saline water. Climate change could further reduce average reliability by changing the timing and patterns of snowpack and runoff. Warmer temperatures and decreasing snowpack cause more winter runoff and less spring/summer runoff (DWR, 2009b). DWR attempted to quantify the potential effects of climate change on SWP deliveries in its 2007 and 2009 delivery reliability reports.

4.7.2.3 Delta Planning Activities

A number of planning activities are underway to improve environmental conditions and water supply reliability in the Delta. These include the CALFED Bay-Delta Program, the CALFED Ecosystem Restoration Program Conservation Strategy, the Delta Risk Management Strategy (DRMS) to, the BDCP and the Delta Habitat Conservation and Conveyance Plan (DHCCP). Implementation of these programs may increase the reliability of SWP supplies in the future. The effects of these programs will be taken into account in future updates of the Plan.

The BDCP is being developed in compliance with the Federal Endangered Species Act (FESA) and the California Natural Communities Conservation Planning Act (NCCPA). When completed, the BDCP would provide the basis for the issuance of endangered species permits for the operation of the state and federal water projects. The plan would be implemented over the next 50 years. A public draft of the BDCP is expected to be released in 2011 with adoption of a final plan in 2012 (BDCP, 2010).

The Delta Habitat Conservation and Conveyance Program (DHCCP) was created in 2008 as a result of Governor Schwarzenegger's calls for studies to assess potential habitat restoration and water conveyance options in the Delta. The DHCCP is a partnership between DWR and Reclamation to evaluate the ecosystem restoration and water conveyance alternatives identified by the BDCP. DHCCP activities include an environmental review of the BDCP. The DHCCP will advance the preferred alternative for water conveyance facilities and habitat restoration.

DHCCP goals include:

- Analyzing BDCP proposed actions and alternatives to those actions through a formal EIR/EIS process.
- Analyzing options and considering areas of concern presented by the public during the EIR/EIS process.
- Developing engineering options for habitat restoration and water conveyance.

A draft EIR/EIS is expected to be released in 2011 with adoption of a final EIR/EIS and Record of Decision in 2012.

There currently are no published data or information regarding the effect that the BDCP and DHCCP will have on SWP delivery reliability. Consequently, it is assumed for planning purposes that, if successful, these programs will restore SWP average delivery reliability to the pre-Wanger decision levels of 77 percent of Table A Amounts. This assumption is consistent with planning assumptions being made by Metropolitan (Metropolitan, 2010a and 2010b). The 2010 WMP Update evaluates both low (50 percent) and high (77 percent) reliability in determining future water needs for the Valley.

4.7.2.4 2009 Comprehensive Water Package

In October 2009, the California Legislature and Governor Schwarzenegger crafted a comprehensive plan to ensure future water supply reliability and restore the Sacramento-San Joaquin Delta and other ecologically sensitive areas. The plan consists of four policy bills and an $11.14 billion bond issue. The package establishes a Delta Stewardship Council, sets ambitious water conservation policy, ensures better groundwater monitoring, and provides funds to the SWRCB for increased enforcement of illegal water diversions. With cost-sharing, the bond will fund drought relief, water supply reliability, Delta sustainability, statewide water system operational improvements, conservation and watershed protection, groundwater protection, water recycling, and water conservation (DWR, 2009a). The bond was withdrawn from the 2010 ballot and may be submitted to the electorate in 2012.

4.7.3 Recycled Water

Recycled wastewater has historically been used for irrigation of golf courses and urban landscaping in the Coachella Valley. The amount of wastewater available for recycling in the future primarily depends on growth in the Valley. However, the level of water conservation implemented in the future could reduce the amount of wastewater generated and available for reuse. Future waste discharge requirements will dictate the level of treatment that would be required at the Valley wastewater treatment plants. More stringent discharge requirements might result in higher treatment costs, which in turn might make recycling a more feasible option. Thus, future growth and water quality regulations will dictate the amount of recycled water available in the Valley.

4.8 NO PROJECT ALTERNATIVE – CONTINUATION OF 2002 WMP

To establish the context for the 2010 WMP Update, a No Project Alternative is present. The No Project Alternative describes what would happen if the 2002 WMP were not updated to account for changes in the existing and projected environment that have occurred since 2002. Evaluation of the No Project Alternative is also required by the California Environmental Quality Act (CEQA).

Figure 4-5 shows the water supply plan for the No Project Alternative through 2045 assuming average hydrologic conditions. For the No Project Alternative, water demands are based upon the current growth forecasts as presented in **Section 3**. Agricultural demands decrease while urban and golf course demands increase. Water conservation is assumed to be implemented at the levels defined in the 2002 WMP. Future SWP reliability is assumed to reduce from its current average of 60 percent to 50 percent of Table A Amounts as described earlier in this section. Use of Canal water and other supplies remain as identified in the 2002 WMP.

In the No Project Alternative, not all available Canal water is used because of the decrease in agricultural demand and because the 2002 WMP anticipated only a relatively small of amount of Canal water deliveries (32,000 AFY) to urban customers. Net groundwater pumping (pumping less imported water recharge) shows a significant increase to meet future urban demands. This is driven by 2002 WMP assumption that most domestic demand would be met primarily by groundwater pumping. Demand due to growth outside the basin results in either a water supply deficit or additional groundwater pumping that would exacerbate future overdraft. However, even if the available Canal water supply were fully utilized, net groundwater pumping would increase in the absence of additional supplies, potentially leading to increased overdraft.

Increased urban development would result in the generation of significantly more municipal wastewater. The 2002 WMP anticipated reuse of a limited amount of treated effluent from WRP-4 for agricultural purposes. All other municipal effluent would be discharged to the CVSC rather than being recycled.

Increased groundwater pumping for urban uses would result in increased overdraft in the long term. As shown on **Figure 4-6**, the No Project Alternative exhibits a positive change in storage (gain) from 2010 through 2025 and overdraft resumes thereafter. In the West Valley, reduced SWP availability, coupled with increased urban use of groundwater use, would result in increased overdraft.

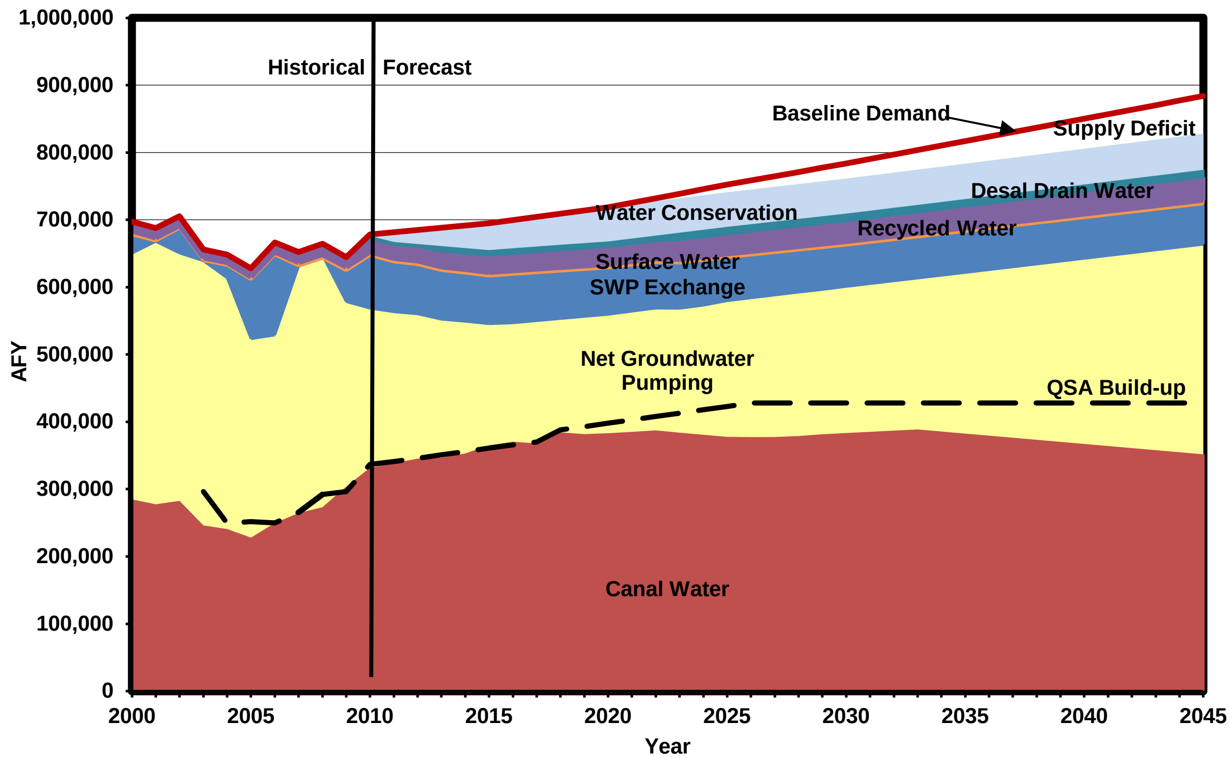


Figure 4-5
Water Supply Plan for No Project Scenario

Flows to the Salton Sea consist of agricultural drainage captured by the subsurface drain system, municipal wastewater discharges to the CVSC, fish farm effluent discharged to surface drains and the CVSC, and regulatory water (Canal water releases due scheduling issues). **Figure 4-7** presents estimated flows to the Salton Sea under the No Project Alternative. This chart shows that drainage water initially increases while the East Valley is gaining storage. However, as growth occurs and pumping increases, tile drainage decreases in response to declining groundwater levels. In addition, wastewater discharges increase as a result of growth. To provide sufficient tile drain flow to export salt from the groundwater basin, studies conducted by CVWD indicate that about 100,000 AFY of drain flow may be required. Since the tile drainage is projected to be about 42,000 AFY in 2045, an additional 60,000 AFY of net groundwater inflow would be required to provide this level of drain flow.

The issues discussed above point out the need to modify the 2002 WMP to adapt to changing conditions. This will require measures to decrease water demands, increase use of Canal water, recycled water and other local resources, acquire additional supplies, and manage the groundwater basin. Without these changes, the Valley's water management goal and objectives will not be achieved. Options to accomplish these changes are described in detail in **Section 6**.

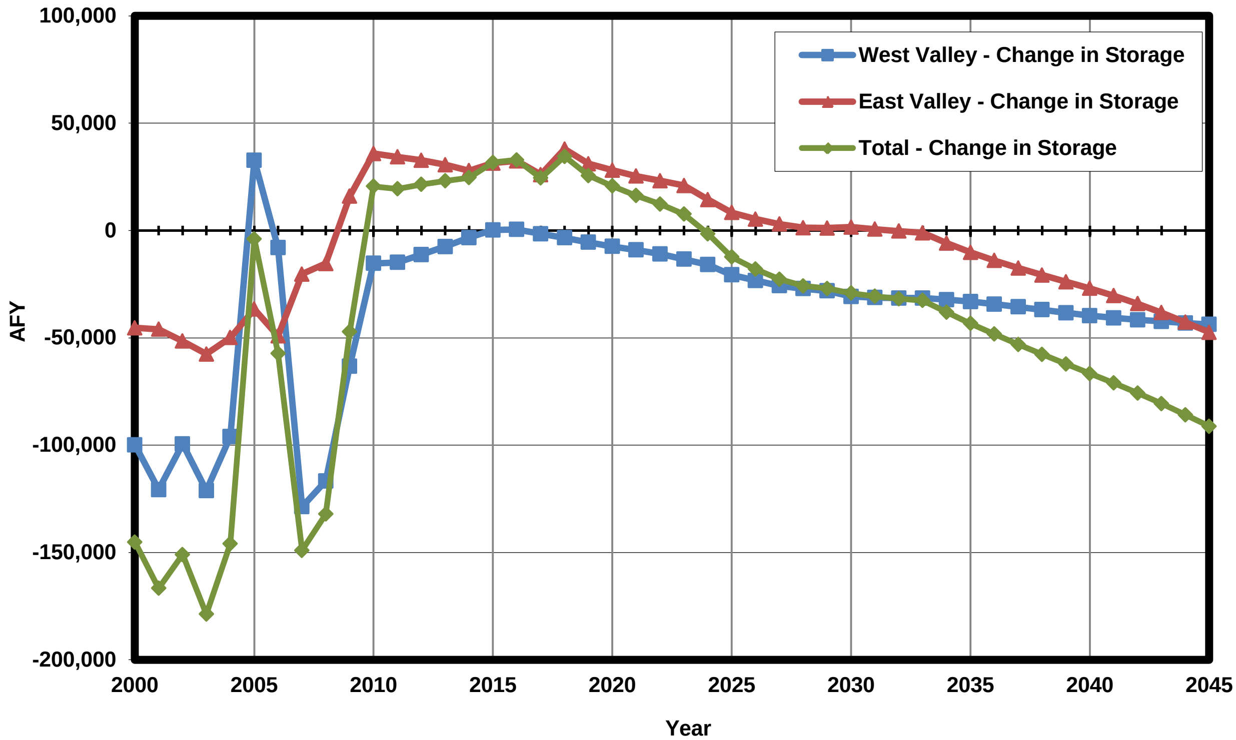


Figure 4-6
Estimated Annual Change in Storage – No Project Alternative

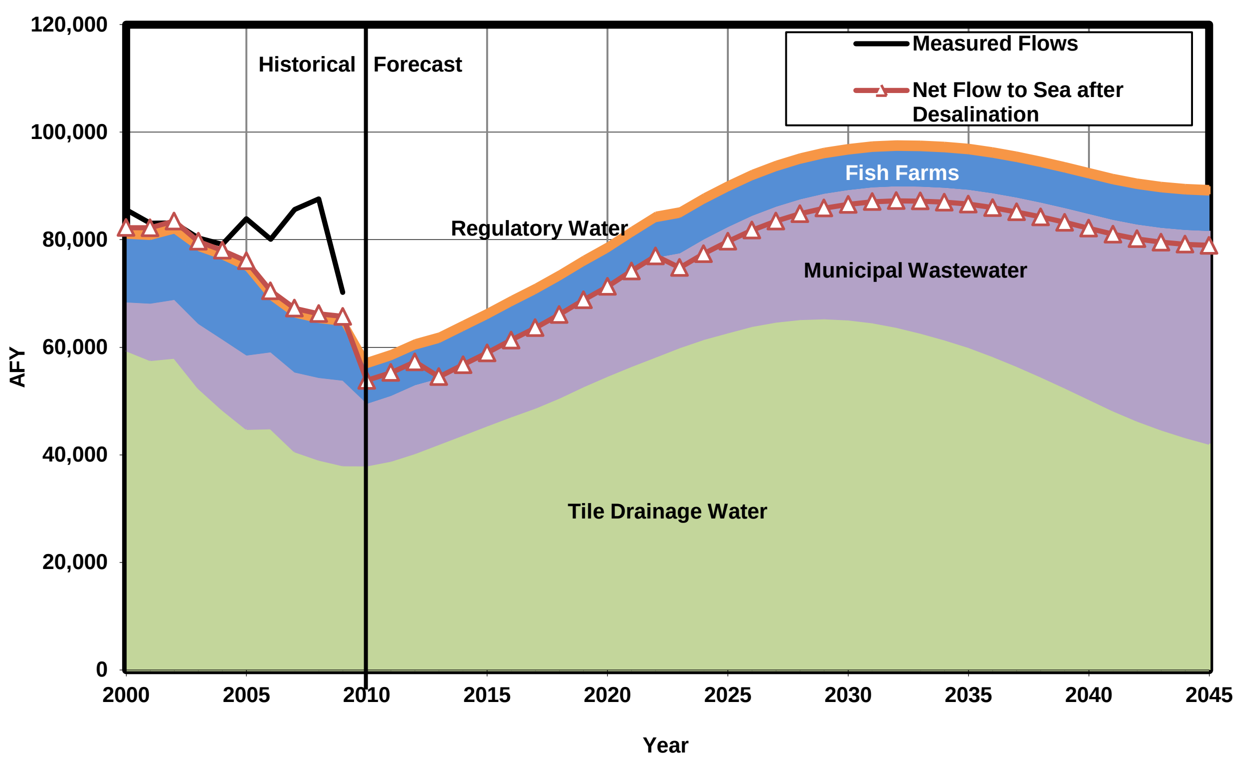


Figure 4-7
Estimated Annual Flow to Salton Sea – No Project Alternative

4.9 SUMMARY

As described in this section, the Coachella Valley has both imported water and local water sources in its current water supply portfolio. A comparison of the projected water demands (**Table 3-2**) with the currently available supplies is presented in **Table 4-8** and **Figure 4-8**. The figure shows that currently available supplies as planned in the 2002 WMP are not adequate to meet the current demand (2010) or the projected demands in 2045. The Colorado River supply increases significantly due to the QSA. Recycled water use and water conservation also increase due to planned water management activities. Extended drought, climate change, and the recent QSA litigation further increase the uncertainties associated with Colorado River water. Recent and pending water litigation surrounding the endangered species in the Delta, risks associated with levee failure in the Delta, as well as potential variability associated with climate change pose a threat to the reliability of SWP water. Based on this assessment, about 203,000 AFY of additional supply will be required by 2045. Alternative water sources including conservation are discussed in Section 6 and evaluated in Section 7 of this report.

The overdraft condition in the East Valley and West Valley groundwater aquifers presents a challenge to both the quantity and the quality of groundwater in the Valley. Future growth and water quality regulations will affect the amount of recycled water available in the Coachella Valley.

Table 4-8
Summary of Existing Water Supplies

	2010 (AFY)	2045 (AFY)
Local Runoff [1]	46,400	46,400
Surface Water – Direct Use[1]	3,400	3,400
Subsurface Inflow	11,000	11,000
Recycled Water[2]	24,400	41,900
Returns from Use[3]	233,700	203,100
Less Desired Tile Drainage and Other Outflows[4]	(113,400)	(113,400)
Colorado River Water[5]	337,000	428,000
SWP Exchange[6]	77,800	62,200
Total Supply	**620,300**	**682,600**
Demand	**678,600**	**885,400**
Surplus or (Shortage)	**(58,300)**	**(202,800)**

Notes:
1. Surface water based on information presented in Section 4.4.
2. Recycled water is water reused or percolated into the groundwater basin. Excludes discharges to CVSC.
3. Returns from use are based on estimated returns to the groundwater basin from surface water, groundwater, imported and recycled water uses.
4. Returns from use are reduced by the desired drain, phreatophyte and subsurface flow that would occur with a balanced basin (estimated to be 113,400 AFY, see Section 7).
5. Available Colorado River water is based on Table 4-3.
6. SWP Supply is based on Table 4-6.

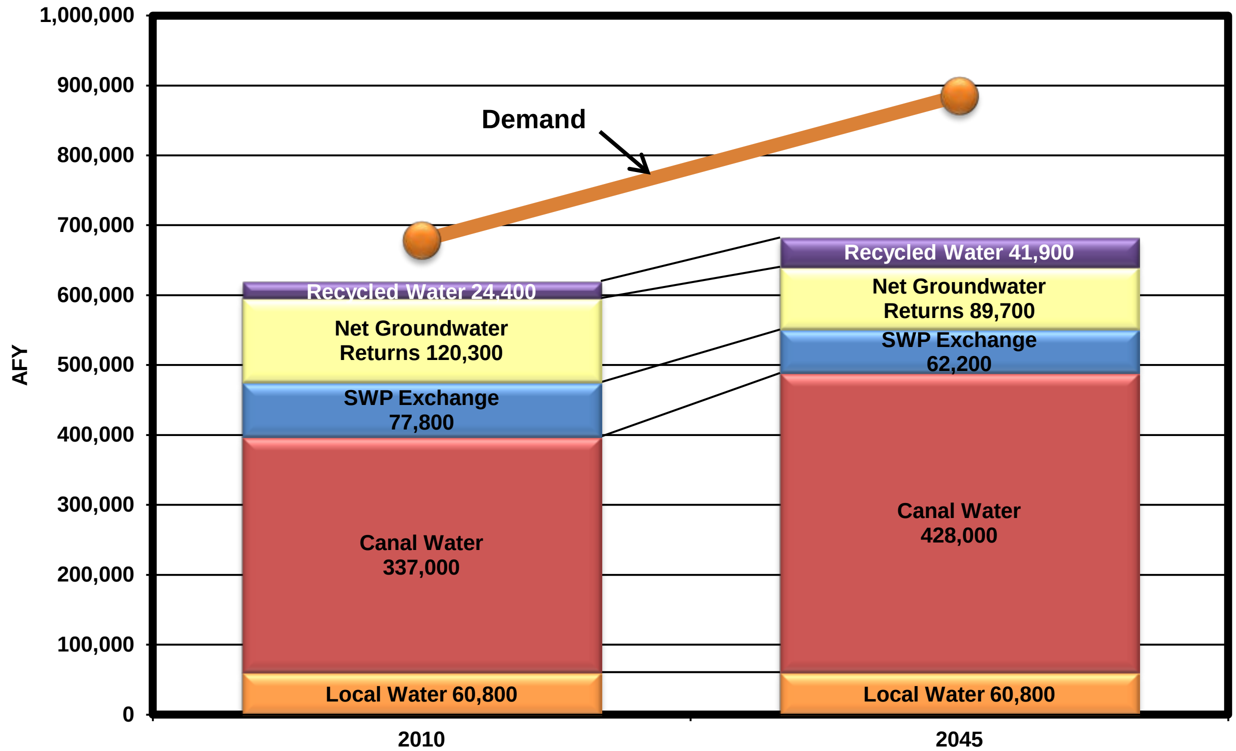


Figure 4-8
Supply and Demand Comparison under Existing Supply Conditions

Projected growth in the Valley, coupled with uncertain and less reliable future water supplies, is expected to create a supply deficit (gap) as shown in **Figure 4-8** unless new supply sources are developed. The uncertainties surrounding both imported and local water supplies within the Valley make it imperative that the 2010 WMP Update provide a plan to develop new supply sources for the Valley including a contingency factor to assure adequate supplies. A detailed discussion of the future supplies is provided in **Section 6** of this report.

Section 5

Section 5
Emerging Issues

This section describes emerging issues that may affect the 2010 WMP Update. Some issues that present potential challenges to water management planning in the Coachella Valley have been identified but have not been fully developed. Actions on higher priority issues needing further investigation are included in this Update. However, solutions will be addressed in subsequent planning efforts. A list of issues discussed in this section is presented below:

- Water Quality
  - Basin Plan
  - Salinity Management
  - Groundwater Quality
- Climate Change
- Invasive Species – Quagga Mussels
- State Water Conservation Guidelines
- Subsidence
- Salton Sea Restoration
- Seismic Response

5.1 WATER QUALITY

There are a number of historical, current and future water quality issues that warrant discussion in the 2010 WMP Update. The major issues described below are associated with the Water Quality Control Plan for the Colorado River Basin Region (Region 7, Basin Plan), salinity management in the Valley, and other groundwater quality issues. These issues and recommended future actions for these issues are described below.

5.1.1 Basin Plan

The Water Quality Control Plan for the Colorado River Basin Region (Region 7) (Basin Plan) was prepared and adopted by the Colorado River Basin Regional Water Quality Control Board (Regional Board) in 1993. The planning area includes the Coachella Valley. The Basin Plan was updated with subsequent amendments and was readopted by the Regional Board in June 2006. The Basin Plan was prepared in accordance with the California Porter-Cologne Water Quality Control Act (California Water Code §13000 *et seq.*), the Federal Clean Water Act, and other state and federal rules and regulations. The Plan provides guidelines for optimizing use of state waters within the Colorado River Basin Region by preserving and protecting the quality of these waters. The plan is reviewed periodically by the State Water Resources Control Board (SWRCB) and the U. S. Environmental Protection Agency (USEPA) and updated as necessary.

The various designated beneficial uses of water within Region 7 as described in the Basin Plan include municipal and domestic, agricultural, aquacultural and industrial supply; groundwater recharge; power generation; recreation; and preservation and enhancement of fish and wildlife habitat (CRRWQCB, 2006). The Basin Plan establishes water quality objectives to ensure the reasonable protection of these beneficial uses. The Basin Plan further describes the implementation programs, projects and actions necessary to achieve these water quality objectives. Policies and issues affecting the Basin Plan and activities related to monitoring and surveillance within the basin are also discussed. The Regional Board implements the Basin Plan by enforcing waste discharge requirements through permits.

5.1.1.1 Triennial Review and Potential Basin Plan Amendments

The Federal Clean Water Act (Section 303 (c)) requires states to hold public hearings for review of the water quality standards at least once every three years. At the end of the triennial public hearings, the Regional Board prepares a priority list of potential water quality problems with the Basin Plan. Plan amendments are then issued to address the identified problems. Amendments can also be prepared to address any urgent issues (not identified in the triennial review) or to reflect new legislation.

The most recent Triennial Review for the Region 7 Basin was in 2007. A Work Plan was completed in January 2008. There were 13 issues identified in the 2007 Triennial Review. Five of these issues were given “High” priority, while the rest had a “Medium” priority. Four out of these five high priority issues affect the Coachella Valley and are briefly discussed below:

Issue 3: Bacteriological Water Quality Objectives and Associated Monitoring Requirements

The proposed revisions to the Basin Plan are: 1) reduce the number of bacterial indicator organisms for surface water quality from three (fecal coliform, *E. coli*, and enterococci) to one bacteria indicator organism (*E. coli*); 2) clarify which indicator organisms apply to which surface waters of the Region, and 3) develop site-specific objectives. A Basin Plan Amendment was adopted in May 2010 (Regional Board Resolutions R7-2010-0027, R7-2010-0028).

Issue 4: Critical Flow Rates in the Coachella Valley Stormwater Channel (CVSC) and their Temporal Impact on Certain Beneficial Uses of the Channel

The Triennial Review identified that storm events in the Coachella Valley result in extremely high flows in the CVSC. These high flows pose a public health and safety hazard. These events also hamper some of the beneficial uses of the CVSC, such as recreation. A Basin Plan amendment addressing this situation is recommended.

Issue 5: Policy to Address Discharges of Agricultural Wastewater

The Triennial Review identified that discharges of agricultural return flows in the Coachella Valley fail to comply with the California Water Code Section 13269 because the existing waivers issued for these discharges have expired. These discharges might have potential and/or actual impacts on the waters of the Region. The Basin Plan amendment will address this water quality control policy issue.

Issue 6: Clarification of State Anti-degradation Policy – State Water Resources Control Board (SWRCB) Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California"

The Regional Board staff recommended that, in order to show consistency between the SWRCB anti-degradation policy and the federal anti-degradation policy, the Basin Plan should include a discussion on how the State Non-point Source Program implements the policy.

The specifics of the proposed changes to the Basin Plan are not available at this time. CVWD continues to actively participate in the development of these changes and will address issues arising from these changes in future Plan updates.

5.1.1.2 303(d) List and TMDLs

Section 303(d) of the federal Clean Water Act requires states, territories and authorized tribes to prepare a list of water bodies that do not or are not expected to attain water quality standards after application of required technology-based controls. The 303(d) list includes the size of the water body, the sampled pollutants affecting designated beneficial uses, the source of the pollutant, and the water body's priority status with regard to developing Total Maximum Daily Loads (TMDLs). To develop a means of correcting these conditions, the statute (Section 303 (c)(1) of the Clean Water Act and California Water Code Section 13240) allows for development of total maximum daily loads (TMDL) to set limits on discharged pollutants that will overcome impairment of water quality. The 303(d) lists are prepared as part of the Water Quality Assessment of the State's major waterbodies, and meet a requirement of section 303(d) of the Clean Water Act.

The Regional Board is currently updating the 303(d) list of impaired water bodies in Region 7. Proposed changes to the list that affect the Coachella Valley are presented below.

CVSC

The TMDLs specified for the CVSC under the 2006 303(d) list are shown in **Table 5-1.**

Salton Sea

Table 5-2 presents the TMDLs included in the 303(d) list adopted by the SWRCB Region 7.

Specific actions to address these TMDLs will be developed separately in the future and are not addressed in the 2010 WMP Update. These actions might include increased monitoring, development of new treatment technologies, and implementation of additional best management practices (BMPs).

5.1.2 Salinity Management

Salinity management is an important water quality issue in the Coachella Valley. Use of imported water for recharge, agricultural irrigation and municipal irrigation directly results in the addition of salt into the basin. Some areas in the Valley such as the Oasis and Salton City have

Table 5-1
TMDLs for the CVSC

TMDL Name	Source	TMDL Completion Date	Comments
Pathogens	Unknown	2014	Found along a 17-mile stretch from Dillon Rd. to Salton Sea.
Toxaphene	Unknown	2019	Used as an insecticide until 1982. Found in the CVSC along a two-mile stretch from Lincoln St. to Salton Sea.
Dichlorodiphenyltrichloroethane (DDT)	Unknown	2021	Used as a pesticide until early 1970s. Found in analysis of fish tissue samples collected between 1986 and 2000.
Dieldrin	Unknown	2021	Used as a pesticide until 1974. Found in analysis of fish tissue samples collected between 1986 and 2000.
Polychlorinated biphenyls (PCBs)	Unknown	2021	Used as coolants and lubricants in electrical equipment until 1977. Found in analysis of fish tissue samples collected between 1986 and 2000.

Source: CRRWQCB, 2011 - 303(d) TMDL list.

Table 5-2
TMDLs for the Salton Sea

TMDL Name	Source	TMDL Completion Date	Comments
Nutrients	Industrial point source, agricultural return flows, out-of-state flows	2006	Phosphorus is the primary concern.
Salinity	Agricultural return flows, out-of-state flows	2019	Need to address this issue by developing an engineering solution collectively with federal, local, and state cooperation.
Selenium	Agricultural return flows	2019	Naturally occurring element in soil. Gets leached out into the water in agricultural drains.
Arsenic	Unknown	2021	Naturally-occurring element in earth's crust. Observed in analysis of fish tissue sample collected between 1985 and 2000.
Chlorpyrifos	Unknown	2021	Used as a household and on-farm insecticide. Found in analysis of fish tissue samples collected between 1996 and 1997.
Dichlorodiphenyltrichloroethane (DDT)	Unknown	2021	Used as a pesticide until early 1970s. Found in analysis of fish tissue samples collected between 1980 and 2000.
Diazinon	Unknown	2021	Used as a pesticide. Found in analysis of fish tissue samples collected between 1996 and 1997.
Enterococcus	Unknown	2021	Genus of lactic acid bacteria. Exceedances observed in samples collected between 2002 and 2003.

Source: CRRWQCB, 2011 - 303(d) TMDL list.

naturally-occurring high salinity groundwater. If the activities in the basin are not managed properly, the salt could eventually migrate to the Lower aquifer and result in long-term water quality degradation in the groundwater basin.

5.1.2.1 Impacts of Colorado River Water Recharge

Colorado River water used for direct delivery and recharge in the Coachella Valley has higher TDS concentrations on average than most of the local groundwater. Based on historical and projected variations in Colorado River water quality, the TDS range for the SWP Exchange water recharged at the Whitewater River Recharge Facility is 530 to 750 mg/L, averaging 636 mg/L since 1973. SWP Exchange water is Colorado River water delivered via the Colorado River Aqueduct (see **Section 4.1.3**). The TDS range for the Colorado River water delivered via the Coachella Canal is 625 mg/L to 975 mg/L averaging 790 mg/L over the past 60 years. This water is used for recharge in the East Valley.

During the 1930s, TDS concentrations in groundwater throughout the Coachella Valley averaged less than 250 mg/L. In the 1970s, the groundwater typically contained 300 mg/L TDS in the Upper aquifer and 150 to 200 mg/L TDS in the Lower aquifer (WMP, 2002). More recent data show that the TDS in the Upper aquifer averages about 834 mg/L. In the Lower aquifer, TDS concentrations average 355 mg/L (CVWD, 2005).

CVWD and DWA have recharged SWP Exchange water at the Whitewater River Recharge Facility in the West Valley since 1973 and in the Mission Creek Subbasin since 2002. In 2009, recharge began at the Thomas E. Levy Groundwater Replenishment Facility Levy in the East Valley. One of the primary elements of both the 2002 WMP and this 2010 WMP Update is continued recharge of Colorado River water to eliminate overdraft in the Valley. After 37 years of operation, TDS levels in wells near the Whitewater River Recharge Facility have increased from a range of 150-300 mg/L to 350-600 mg/L, with the TDS varying from year with the amount of recharge. Wells located more than about 8 miles away from the Whitewater facility have shown little change in quality. Water quality changes near the Levy facility are inconclusive at the time this report was prepared. Some monitoring wells show increased TDS while others show little change or TDS improvement. Whether the cause of TDS increases is the result of recharge activities or adjacent agriculture is uncertain.

The District is investigating alternatives to reduce water quality impacts of Colorado River recharge. One of these alternatives is direct importation and recharge of lower TDS SWP water. The average TDS concentration (between 1973 and 2009) of the SWP water was 245 mg/L (Lake Silverwood at Devil Canyon). CVWD and DWA, along with other partner agencies, are evaluating the feasibility of importing SWP water to the Coachella Valley via a direct connection to the SWP. The SWP extension would terminate at the Whitewater and Mission Creek spreading facilities. The preliminary construction cost estimate for the aqueduct is between $800 million and $1.5 billion. This project could significantly increase the cost of providing water to Coachella Valley customers, and it would provide water only for recharge in the West Valley, as there are no plans to convey SWP water to the East Valley recharge sites due to the distance, cost, and lack of supply.

Another alternative is the treatment of Colorado River water before recharge. Reverse osmosis (RO) is a proven technology for desalinating water. However, one of the primary deterrents to this alternative is cost. According to preliminary estimates developed for CVWD, the cost of treating Canal water at the Levy facility would range from $538 per AF (TDS = 500 mg/L) to $685 per AF (TDS = 250 mg/L). Costs for treating SWP Exchange water (Metropolitan Colorado River Aqueduct at Whitewater) would range from $460 per AF (TDS = 500 mg/L) to $595 per AF (TDS = 250 mg/L). These treatment costs could increase to as much as $1,200 per AF when estimated costs for brine management and disposal are included. Urban water users in the Valley on average consume approximately one AF of water annually per connection. Based on this figure, treatment of Colorado River water before recharge could increase the annual water bill for an average urban customer by up to $450. For major pumpers such as golf courses, the annual impact would be as much as a three to nine fold increase over their current costs.

In summary, the use of Colorado River water for groundwater recharge increases salinity in the Valley groundwater basin. Increased salinity has been observed in wells near the Whitewater recharge facility. Potential alternatives being investigated to mitigate this condition have high costs. The scope and importance of this Valley-wide issue makes it an ideal candidate for discussion in a forum such as the Integrated Regional Water Management Plan (IRWMP).

5.1.2.2 Recycled Water Policy

Recycled municipal wastewater has historically been used for irrigation of golf courses, other municipal greenbelts and landscaped areas in the Coachella Valley. Based on file data from CVWD and DWA, recycled water usage in the West Valley is approximately 12,400 AFY (8,200 AFY CVWD usage, 4,200 AFY DWA usage). Recycled water usage in the East Valley is approximately 700 AFY and is mainly for agricultural irrigation, duck clubs and fish farms. As discussed in **Section 4.5**, the amount of municipal wastewater available for reuse is expected to increase 150 percent by 2045. This water represents a valuable resource that needs to be put to beneficial use to reduce groundwater overdraft.

The SWRCB adopted a Recycled Water Policy in February 2009 to regulate the quality and the quantity of recycled water used throughout the state. The goals of this policy are to:

- increase the use of recycled water by at least 1 million AFY over the 2002 levels by 2020 and by 2 million AFY by 2030,
- increase the use of stormwater by at least 500,000 AFY over 2007 levels by 2020 and by 1 million AFY by 2030,
- increase urban and industrial water conservation by 20 percent over the 2007 levels by 2020, and
- substitute potable water with recycled water to the maximum possible extent by 2030.

This policy provides guidelines for appropriate criteria to be used by regulating agencies (Regional and State Water Boards) for issuing permits for recycled water projects. The State will address the conservation and storm water use goals of this policy (listed above) under separate policies.

According to the policy, substitution of recycled water, which is sufficiently treated and which does not have any adverse health or environmental impacts, for potable water, groundwater, or surface water is considered to have beneficial effects.

- The SWRCB has also established a mandate to increase the beneficial use of recycled water within California by 200,000 AFY by 2020 and by an additional 300,000 AFY by 2030.
- Agencies producing recycled water and not putting it to beneficial use shall make this water available to other water purveyors for reuse on reasonable terms and conditions.
- Pursuant to the California Water Code Section 13550 *et seq*., the SWRCB considers it a waste and unreasonable use of water by water agencies if recycled water of adequate quality is available and not put to beneficial use.

These mandates are contingent upon sufficient funding available for the construction of recycled water projects. Development and use of additional recycled water within the Coachella Valley will contribute toward meeting these goals and mandates.

The policy defined the roles of the SWRCB, the Regional Boards, the California Department of Public Health (CDPH), DWR and California Public Utilities Commission (CPUC) in connection with recycled water projects. The policy also requires the preparation of salt/nutrient management plans as discussed below.

5.1.2.3 Salt/Nutrient Management Plans

Some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed the water quality objectives established by the applicable Basin Plan. At this time, not all Basin Plans incorporate measures for achieving compliance with the water quality objectives for salts and nutrients (SWRCB, 2009). Over and above recycled water, there are a number of other sources adding salt/nutrients to groundwater such as waste discharge and irrigation using surface water. Consequently, the SWRCB recognized that regulation of recycled water alone will not address these conditions.

The SWRCB Recycled Water Use Policy described previously requires every region in the state to develop a salt/nutrient management plan by 2014. The salt/nutrient management plans are intended for management of all sources contributing salt/nutrients on a basin-wide or watershed-wide basis to ensure that water quality objectives are achieved. The content and length of the plans will vary based on factors such as size and complexity of the basin, source water quality, hydrogeology, stormwater recharge, aquifer water quality and other factors. As specified in the policy, the plans will include:

- Basin/subbasin-wide water quality monitoring plan with an appropriate network of monitoring locations
- Annual monitoring of emerging constituents (e.g., personal care products or pharmaceuticals, endocrine disruptors)
- Water recycling and stormwater recharge/use goals and objectives

- Salt and nutrient source identification, basin/subbasin assimilative capacity and loading estimates
- Transport of salts and nutrients
- Implementation measures to manage salt and nutrient loading in the basin on a sustainable basis
- Anti-degradation analysis

The local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled salt/nutrient management plans. The plans are to be developed using collaborative processes open to all stakeholders and will include compliance with CEQA and participation by Regional Board staff. The plans are to address and implement provisions for all sources of salt and/or nutrients to groundwater basins, including recycled water irrigation projects and groundwater recharge reuse projects.

5.1.2.4 Anti-degradation vs. Maximum Benefit

SWRCB's Resolution No. 68-16, also referred to as the Anti-degradation Policy, is incorporated into all Basin Plans. The policy applies to high quality waters (surface water as well as groundwater) and requires that the high quality be maintained to the maximum extent possible. The policy allows for degradation if the change is consistent with maximum benefit to the people of the state, such a change does not adversely affect the beneficial uses, and does not result in water quality lower than the acceptable standards.

The policy also considers the use of recycled water for landscape irrigation in accordance with this policy as a beneficial use. Regardless of the source, irrigation activities over time result in degradation of groundwater quality. The SWRCB intends to address this impact by requiring development of salt/nutrient management plans described earlier.

Historically, the Regional Board has recognized the importance of groundwater recharge using Colorado River water to control overdraft and in spite of the higher TDS of this supply. Consequently, the Board has not taken a formal position on recharge with Colorado River water but has encouraged water conservation and recycling (Regional Board, 2006). It will continue to be important that CVWD, DWA and the other valley water agencies and tribes work together to with the Regional Board to develop policies and implementation plans that balance overdraft elimination with water quality protection.

5.1.2.5 Emerging Constituents/Chemicals of Emerging Concerns

There are provisions in the SWRCB Recycled Water Policy to regulate emerging contaminants (ECs). The policy acknowledges the incomplete and evolving knowledge of ECs and provides for research and development of analytical methods to determine potential environmental and public health impacts of ECs. The impact this regulation would have on water management planning efforts in the Coachella Valley is not known at this time. CVWD and other water purveyors in the Valley will continue to monitor the development of this regulation and will take appropriate action in the future to address issues arising from it.

5.1.2.6 Brine Discharge/Management

The Basin Plan prohibits the discharge of brine to facilities that ultimately discharge in areas where such wastes can percolate to groundwater usable for domestic and municipal purposes.

CVWD currently employs offsite hauling and disposal of brine produced by arsenic treatment at three East Valley wells. Because offsite hauling is a costly method of brine disposal, CVWD is evaluating alternative methods. The 2010 WMP Update is considering desalination of Canal water for municipal water supply (approximately 90,000 AFY) and drain water from the CVSC (up to 85,000 AFY) for urban and agricultural use in the Valley as water supply options. Desalination of additional Colorado River water used for groundwater recharge (up to 100,000 AFY in the West Valley and 80,000 AFY in the East Valley) has been suggested by some stakeholders. Treatment at these levels would result in production of large volumes of brine (up to 55 mgd of brine assuming an 85 percent recovery rate), which would need to be disposed in a cost-effective manner and in compliance with the Basin Plan requirements. Some of the options for brine disposal, along with the associated issues to be considered, are:

- Brine evaporation ponds – These are shallow, lined ponds that allow water to evaporate leaving the salt behind. The salt is then hauled away by trucks. The principal environmental concern associated with brine evaporation ponds is that pond leakage could result in groundwater contamination. Also, land acquisition costs should be considered since substantial amounts of land would be required.
- Re-concentration – This involves use of mechanical evaporators to heat the brine solution to boiling temperature. Water evaporates, leaving highly concentrated brine solution for final disposal.
- Deep Well Injection – This technology involves injecting the brine into wells that vary in depth from a few hundred feet to several thousand feet, depending on the geology of the selected site. This method is considered to be one of the most cost effective methods of brine disposal.
- Brine Pipeline – This involves construction of a dedicated pipeline to transfer the brine to the Salton Sea. The primary environmental consideration is the feasibility of using the brine for salt marsh habitat creation around the Salton Sea.
- A combination of the above options can also be used to achieve zero liquid discharge (ZLD).

Based on the above, brine discharge and management will be a major issue in the Coachella Valley in the future. A detailed study should be conducted to evaluate brine disposal alternatives and to select the most cost-effective and environmentally feasible alternative.

5.1.2.7 Agricultural Drainage Discharge Regulation

The California Water Code authorizes State and Regional Boards to conditionally waive waste discharge requirements (WDRs) if this is in the best interest of the public. Historically, the waivers required that the discharges not cause violations of water quality objectives but did not require any water quality monitoring.

Discharges from agricultural lands are irrigation return flow, flows from tile drains, and storm water runoff. These discharges can affect water quality by transporting pollutants such as pesticides, sediment, nutrients, salts (including selenium and boron), pathogens, and heavy metals from fields to surface waters.

As described earlier, the existing waivers issued to CVWD for these discharges have expired. Pursuant to Water Code Section 13269, the Regional Board must develop water quality control policy to address potential and/or actual impacts of these discharges on the waters of the Region. The Colorado River Basin Regional Board has adopted conditional prohibitions as a TMDL implementation plan is incorporated into the Basin Plan (CRRWQCB, 2010). The impacts of any new regulation/policy adopted in the future on this Plan Update are not clear at this time. Appropriate action to resolve this issue will be developed in subsequent updates once the specifics of this regulation become available.

5.1.3 Groundwater Quality

Groundwater quality in the Coachella Valley varies with depth, proximity to faults, presence of surface contaminants, proximity to recharge basins, and other hydrogeologic or cultural features.

Current and emerging groundwater quality issues considered in the 2010 WMP Update consist of salinity, arsenic, perchlorate, chromium-6, uranium, nitrate, carcinogens and endocrine disrupting compounds. With the exception of salinity which is discussed above under "Impacts of Colorado River Water Recharge", these water quality issues are discussed below.

5.1.3.1 Arsenic

Arsenic is a naturally occurring element found in the earth's crust. It is found to have carcinogenic and non-carcinogenic effects on health if ingested at high levels over a long period of time. Before 2001, the primary (health-based) drinking water standard for arsenic was 50 micrograms per liter (μg/L). Under the 1996 Amendments to the Safe Drinking Water Act, the U.S. Environmental Protection Agency (USEPA) was required to publish a revised standard for arsenic by January 2001. USEPA published a final Maximum Contaminant Limit (MCL) for arsenic of 10 μg/L on October 31, 2001. The new standard became enforceable on January 22, 2006. California adopted the federal MCL effective November 28, 2008.

Arsenic concentrations as high as 162 μg/L have been observed in some East Valley water supply wells (CVWD 2005 water quality data). In response to new federal regulations, CVWD commenced studies in 2004 to evaluate and design facilities to meet the revised arsenic standard at several of its municipal wells. Three groundwater treatment facilities were constructed using an ion-exchange process with a brine minimization and treatment process that produces a small volume of non-RCRA hazardous solid waste and a non-hazardous liquid waste. These facilities became operational in 2005 and 2006 and continue to operate. If needed, they can be expanded to treat additional wells in the future. The waste brine produced by the treatment process is hauled by trucks to Lakeland Processing Company located in Santa Fe Springs for final disposal.

Several mobile home and RV parks in the East Valley that use private wells have arsenic levels exceeding the drinking water regulations. Several Tribal wells providing domestic water also have arsenic levels that exceed the MCL. In Coachella and the unincorporated East Valley communities of Mecca, Oasis and Thermal, Riverside County environmental health officials have identified wells at 19 mobile home and RV parks that recently tested positive for high levels of arsenic ranging from 12 to 91 µg/L (Desert Sun, 2010). These parks are served by private wells and are located some distance from CVWD's potable water system. About half of the parks have installed treatment filters to reduce the arsenic levels. CVWD and other stakeholders have applied for funding to develop a regional solution for the arsenic issue.

5.1.3.2 Perchlorate

Perchlorate (ClO4-) is a contaminant from the solid salts of ammonium, potassium or sodium perchlorate and is used as an oxidizer for the ignition of solid fuel propellant for rockets and fireworks. Perchlorate salts are also found in roadside flares, airbag inflators and are used in the manufacture of matches. Perchlorate is known to occur in sodium nitrate fertilizers imported from Chile. Perchlorate is found in rainwater and can occur naturally in groundwater in arid and semi-arid areas through long-term atmospheric deposition (USGS, 2006). Perchlorate is highly soluble in water. Perchlorate inhibits the uptake of iodine in the thyroid gland. The state MCL for perchlorate is 6 µg/L.

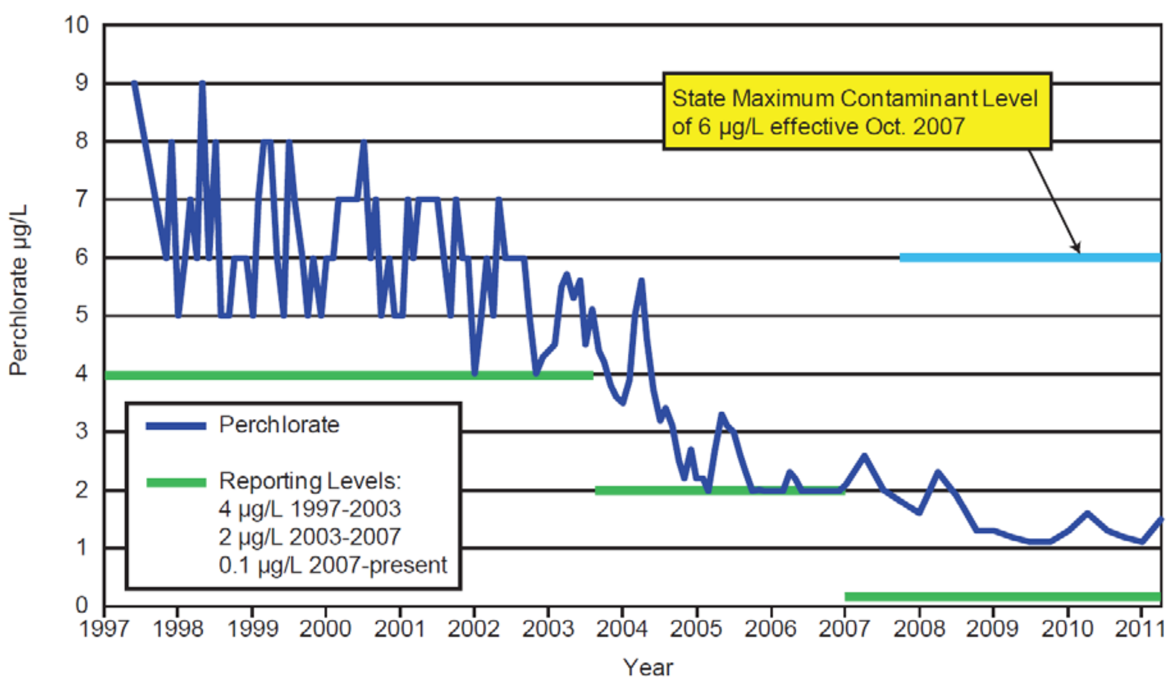
Perchlorate was initially detected in Colorado River water in early 1997 by Metropolitan at a concentration of 9 µg/L. The source of perchlorate in Colorado River water was determined to be the Kerr-McGee Chemical Company (now Tronox, LLC) and the former PEPCON (now American Pacific Corporation) perchlorate manufacturing facilities in Henderson, Nevada. Waste disposal practices allowed perchlorate to permeate the groundwater that flows into Las Vegas Wash upstream of Lake Mead.

Perchlorate seep capture and treatment was initiated in 1999 in Nevada at three different locations. This has resulted in significant reduction in perchlorate concentration in the Lower Colorado River. As shown on **Figure 5-1**, perchlorate concentrations in Colorado River water have steadily declined since the initiation of treatment and have reached levels below the state reporting level of 2 µg/L. Current concentrations in Colorado River water delivered to the Coachella Valley in the CRA since 2008 have been consistently below 2 µg/L, well below the method reporting detection limit of 4 µg/L and the California drinking water MCL (Metropolitan, 2011). Perchlorate concentrations in the Coachella Canal have been below the method reporting detection limit of 4 µg/L (CVWD, 2010c).

In 2006, after nearly 10 years of study, California set an MCL of 6 µg/L in drinking water. No federal MCL has been established; however, in February 2011, EPA announced it would develop an MCL over the next two years. In January 2011, the California Office of Environmental Health Hazard Assessment (OEHHA) released for public comment a new draft public health goal (PHG) of 1 µg/L for perchlorate in drinking water. The PHG is not an enforceable regulatory standard but rather is the level of a chemical contaminant in drinking water that does not pose a significant risk to health. OEHHA's press release says that the proposed revision to the PHG is based on new research that indicates infants are more susceptible to the health effects of perchlorate. The State also released for comment its supporting documentation for the new proposed PHG (OEHHA, 2011).

Low levels of perchlorate have been detected in some wells in the Coachella Valley. The source of this perchlorate has not been identified but may be from one or a combination of sources that include Colorado River water used in the past for irrigation and recharge, natural atmospheric deposition and imported fertilizer. Although perchlorate contamination in Colorado River water is no longer a major concern, CVWD monitors the water quality of Canal water annually. Its groundwater wells have been monitored twice between 2000 and 2009 with no detectable perchlorate. Future monitoring of CVWD wells will be performed in accordance with CDPH monitoring requirements or waivers. DWA detected low levels of perchlorate (below the MCL) in some wells since 2001. Perchlorate has been detected in two private water company wells in the East Valley (CDPH, 2011).

Figure 5-1
Perchlorate Concentrations at Lake Havasu



Source: Metropolitan Water District of Southern California Annual Report 2011

5.1.3.3 Chromium-6

Chromium-6 (or hexavalent chromium) is currently regulated in California under the 50 µg/L MCL for total chromium. California's MCL for total chromium was established in 1977 under what was then a "National Interim Drinking Water Standard" for chromium. The total chromium MCL was established to address exposures to chromium-6, which is considered to be the more toxic form of chromium (CDPH, 2012).

Since adoption of the 2002 WMP and PEIR, OEHHA released a draft PHG for public comment of 0.06 µg/L for chromium-6 in August 2009. In December 2010, OEHHA released a revised draft PHG of chromium-6 of 0.02 µg/L for public comment. The public comment period closed on February 15, 2011 and the PHG was finalized in July 2011. At the time of the WMP Update adoption, CDPH was developing a proposed MCL for chromium-6.

Currently there are no wells in the Coachella Valley that exceed the 50 µg/L total chromium MCL. However, based on monitoring performed in the early 2000s, there are over 100 wells in the Valley that have detectable levels of chromium-6. In January 2011, the USEPA recommended enhanced monitoring for chromium-6 by public water systems to: better inform their consumers about the levels of chromium-6 in their drinking water, evaluate the degree to which other forms of chromium are transformed into chromium-6 in their drinking water and assess the degree to which existing treatment is affecting the levels of chromium-6. Coachella Valley water purveyors should continue monitoring the chromium-6 PHG and MCL process and take appropriate action in order to comply with the chromium-6 regulation.

5.1.3.4 Uranium

There are two possible sources for uranium found in Coachella Valley groundwater. The first is naturally occurring uranium in the geologic formations of the basin, and the second is imported Colorado River water. While there has not been enough investigation done to determine the exact source, the level of uranium found in local groundwater is consistent with levels that can occur from erosion of sediments containing naturally occurring uranium. Uranium found in local sediments is a result of erosion of granitic rocks occurring in the southern California Desert portion of the eastern Peninsular Ranges. The uranium content for samples collected within this batholith are as high as 13 parts per million (Churchill, 1991).

One of the country's largest uranium deposits was found in Moab, Utah, located along the Colorado River, in 1952. A uranium reduction mill operated at this site until 1984. Waste slurry from the uranium reduction process was stored in unlined ponds near the river. These ponds were capped after the mill was shut down. It is believed that waste was leaching from the ponds and contaminating groundwater below the site with radioactive material (USDOE, 2009). Monitoring associated with the evaluation and remediation of this site continues to show no consistent, distinguishable increase in uranium levels in the mainstream of the river downstream of the mill.

The site is currently under the control of the U.S. Department of Energy (DOE). The DOE is undertaking a project to move 10.8 million tons of radioactive tailings by rail to a lined pit in Crescent Junction, Utah, about 30 miles from the Colorado River. The removal is expected to take approximately 20 years.

Uranium levels are common in the groundwater produced by CVWD sources throughout the Valley with an average level of about 5 pCi/L (CVWD, 2010c). Uranium levels exceeding 20 pCi/L can be found in some areas of the Mission Creek subbasin (GSi/water, 2009). There is no evidence linking the uranium found in the Valley groundwater to Colorado River water. CVWD conducts annual testing of the Colorado River water in the Canal for uranium. Results of this monitoring compares well with historical Colorado River monitoring performed by

Metropolitan, which shows uranium concentrations in Colorado River water typically vary from 3 to 4 pCi/L. CVWD's most recent reading of 3.5 pCi/L (May 2010 is well below the California MCL of 20 pCi/L and less than the average uranium levels historically found in groundwater produced by CVWD sources.

CVWD and other Valley agencies (MSWD, DWA, City of Indio, City of Coachella) will continue to monitor for radioactive materials in the Colorado River water used for recharge.

5.1.3.5 Nitrate

Nitrate is a nitrogen compound that is a nutrient and can also have public health implications in drinking water, especially for babies. The primary drinking water standard for nitrate is 10 mg/L as nitrogen (45 mg/L as nitrate). Higher concentrations of nitrate (as high as 40 mg/L as N in Cove Communities based on CVWD's 2008-09 Annual Review and Water Quality Report) exist in some of the shallower portions of the Coachella Valley groundwater basin. Sources of nitrate include nitrogen-based fertilizers used for agriculture, golf courses and landscaping; septic tank discharges; wastewater disposal through percolation; natural sources like mesquite hummocks; and alluvial fan formations. Generally, nitrates are found in the unsaturated and shallow aquifer zones above 300 to 400 feet, and have not been observed in the deeper aquifer zones below 500 feet. Activities in the basin that could cause nitrate to leach into higher quality groundwater include recharge, pumping, and overdraft reduction.

Nitrate does not adsorb to aquifer sediments and readily migrates in groundwater. Steps that can be taken to reduce the risk of nitrate migration include:

- Locating recharge activities away from areas known or expected to have higher nitrate contamination in shallow aquifer zones.

- Avoid pumping in areas known to have nitrate concentrations that can be leached downward by pumping into lower aquifer zones

- Monitor areas of high nitrate concentration to ensure that they do not become oversaturated as overdraft reduction occurs.

- In areas where shallow pumping can prevent nitrate concentrations from leaching into the deeper aquifer, consider implementing ion exchange treatment or similar approach to remove the nitrate from the pumped groundwater.

5.1.3.6 Carcinogens

The USEPA is considering a new strategy to tighten restrictions on four waterborne compounds that can cause cancer. The four compounds to be addressed as a group are tetrachloroethylene (PCE), an organic compound used in dry cleaning; trichloroethylene (TCE), an organic compound used as an industrial solvent; acrylamide, a compound used in manufacturing; and epichlorohydrin, an organic compound used in plastic manufacturing. Under the new strategy being explored by USEPA, the agency would address chemical contaminants as a group for more expeditious and cost-effective enforcement. This strategy would also foster development of new water-treatment technologies, and partnerships with states to better monitor public water systems. CVWD should continue to monitor for the above constituents and track the development of the new USEPA strategy. Any action that would be required to address the issue of carcinogens in the Coachella Valley, as the new strategy evolves, might be developed in future updates of this Plan Update.

5.1.3.7 Endocrine Disrupting Compounds

There is growing interest by regulatory agencies in possible effects of endocrine disrupting compounds (EDCs) in drinking water and groundwater. EDCs are a class of chemicals that interfere with the natural action of hormones in the body, and are thought to interfere with the reproductive systems of both wildlife and humans. EDCs encompass a wide range of contaminants that include some pesticides and a number of chemicals that may be used in residential, commercial and industrial applications. Some pharmaceuticals and personal care products such as antibiotics, prescription drugs, shampoos and cleansers have also been implicated as potential EDCs.

To date, the documented levels of these compounds in drinking water are generally low, at the low end of the parts per trillion range. Most drinking water standards are set in the mg/L or µg/L range, which are 1,000 to 10,000 times higher than the levels at which EDCs are typically detected in water supplies. What is not presently known is the importance of detection at such low levels, since these compounds may have the potential for impact at low concentrations. Sex abnormalities in aquatic organisms in relation to wastewater discharge and other possible influences in the Potomac River and other rivers are consistent with hormonal imbalances in which EDCs may play a role (USFWS, 2003). The mode of exposure of these populations is quite different and more intense than human exposure by drinking water, making extrapolation questionable. The issue of importance to drinking water is not presently resolved.

Several water treatment technologies can remove EDCs, including nanofiltration and reverse osmosis. Coachella Valley water purveyors should continue to monitor this issue along with the associated regulations and take appropriate action in the future.

5.2 CLIMATE CHANGE

Climate change has the potential to affect Coachella Valley’s two major sources of imported water: the Colorado River and the SWP. Potential effects of global warming could also increase water demand within the Coachella Valley.

5.2.1 Colorado River Basin

Precise estimates of future impacts of climate change on runoff throughout the Colorado River basin are not currently available (Reclamation, 2007). These impacts may include decrease in annual flow and increased variability, including more frequent and more severe droughts (see **Section 4.6.1.1**). Furthermore, even without precise knowledge of the effects, increasing temperatures alone would likely increase losses due to evaporation and sublimation, resulting in reduced runoff.

Increased air temperature will result in earlier snow melt runoff and a greater proportion of runoff due to rainfall. Because reservoir storage in the Colorado River basin is so large in comparison to annual basin runoff (roughly four times average runoff), a change in the timing of annual runoff would not be expected to significantly affect basin yield (DWR, 2006).

Potential changes in the amount of precipitation received by the Colorado River basin could affect basin yield. Warmer temperatures could also be expected to increase water demands and increase evaporation from reservoirs and canals. While changes in any particular location will likely be small, the aggregate change for the basin could be significant because so much land is involved. No reliable quantitative estimates of potential changes in precipitation (or increased demand) are available (Reclamation, 2007).

Climate changes impacts were evaluated in the Environmental Impact Study (EIS) on the "Colorado River Interim Guidelines for East Basin Shortages and Coordinated Operations for Lakes Powell and Mead," (Reclamation, 2007). The guidelines extend only through 2026, providing the opportunity to gain valuable operating experience through the management of Lake Powell and Lake Mead, particularly for low flow reservoir conditions, and to improve the bases for making additional future operational decisions during the interim period and thereafter.

The shortage sharing guidelines are crafted to include operational elements that would respond if potential impacts of climate change and increased hydrologic variability occur. The guidelines include coordinated operational elements that allow for adjustment of Lake Powell releases to respond to low average storage conditions in Lake Powell or Lake Mead. In addition, the guidelines enhance conservation opportunities in lower basin and retention of water in Lake Mead.

While impacts from climate change cannot be quantified at this time, the interim guidelines should provide additional protection against impacts of shortage sharing at least through 2026. Coachella Valley water supplies are protected from impacts of climate change and corresponding shortages by 1) California's first priority for Colorado River water supplies in the lower Colorado River basin, and 2) Coachella's high priority for Colorado River supplies among California users of Colorado River water.

5.2.2 State Water Project

To assess impacts of climate change on the SWP, DWR evaluated four scenarios generated from two different Global Climate Models (GCMs), a Geophysical Fluid Dynamic Lab (GFDL) model and a Parallel Climate Model (PCM). All four scenarios predict a warming trend for California. The likelihood of any one of these scenarios occurring over another has not been assessed (DWR, 2006). DWR conducted an updated analysis using six different global climate models in 2009. The analysis shows a 7 percent to 10 percent reduction in Delta exports by mid century and up to 25 percent reduction by the end of the century. Reservoir carryover storage is projected to decrease by 15 percent to 19 percent by mid century and up to 38 percent by the end of the century.

The models also projected a change in the timing of runoff from the Sierra Nevada and the southern end of the Cascades. More runoff will occur in the winter and less in the spring and summer, making it more difficult for the SWP to capture water and deliver it to contractors.

The 2006 study performed by DWR predicted significant declines in SWP deliveries. **Table 5-3** presents potential impacts on SWP water deliveries.

Table 5-3
Impacts of Five Climate Change Scenarios on State Water Project Table A and Article 21 Average Deliveries (for 2020)

Scenario	Table A			Article 21		
	Average	Difference		Average	Difference	
	TAFY*	TAFY	%	TAFY	TAFY	%
BASE	3,186	0	0	99	0	0
GFDL A2	2,879	-307	-9.6	106	7	7.1
PCM A2	2,964	-222	-7.0	103	4	4.0
GFDL B1	2,861	-325	-10.2	101	2	2.0
PCM B1	3,224	+38	+1.2	88	-11	11.1

TAFY = Thousand acre-feet per year
GFDL = National Oceanic and Atmospheric Administration Geophysical Fluid Dynamics Laboratory CM2.1 model
PCM = Parallel Climate Model
Source: Progress on Incorporating Climate Change into Management of California's Water Resources, DWR, July 2006

DWR assessed the impacts of climate change on SWP Table A and Article 21 deliveries in 2007 and 2009. The assessment included the impact of court rulings to protect the endangered Delta smelt. A review of the effects of climate change, as presented in DWR's 2009 SWP Reliability Report (DWR, 2010a), indicates that climate change could decrease average SWP deliveries by as much as 5 percent by 2029 based on interpolation of the 2006 climate change report.

The average SWP reliability factor of 50 percent of Table A Amount used in the 2010 WMP Update is believed to account for potential climate change impacts on supply through 2045.

5.2.3 Coachella Valley Supplies and Demands

Projected potential changes in temperature or evapotranspiration for the Coachella Valley due to climate change are not currently available. However, based on larger scale studies, it can be inferred that increased temperatures in the Coachella Valley would increase water demands for crop and landscape irrigation, municipal water use, and evaporative losses from canals and open reservoirs. It has been suggested that increased summer temperatures could draw increased monsoonal flow resulting in more frequent summer thunderstorms. However, no formal studies have been conducted.

5.2.4 Conclusion

The current projections regarding global warming and climate change increase the uncertainty regarding Coachella Valley water supplies. Consequently, to account for such uncertainty, the 2010 WMP Update has adopted a more flexible approach by assigning book-end targets (ranges) for each of the major project categories. The book-ends represent reasonable minimum and maximum amounts for potential project development. In addition, inclusion of a water supply contingency over and above the supplies required to meet projected demands provides an additional buffer in the event that water supplies do not produce the expected amounts. Implementing the elements of the 2010 WMP Update is expected to be a good means of dealing with this additional uncertainty. Water conservation and development of alternative supplies such as recycled water and desalinated drain water increase the reliability of supplies to the Coachella Valley.

5.3 INVASIVE SPECIES – QUAGGA MUSSELS

The non-native mollusk, *Dreissena bugensis*, also known as Quagga mussel, has been found in the Colorado River system. A Quagga mussel invasion could significantly affect the Coachella Valley’s water quality, aquatic ecosystems, and water delivery systems.

Figure 5-2
Quagga Mussels in a Pipe

Quagga mussels were first discovered in Lake Mead in January 2007. They infested the CRA by way of Lake Havasu, and now exist in many lakes in the San Diego area. They have been found at Imperial Dam, but have not been detected in the Coachella Canal.

Quagga mussels cause the greatest economic damage when infesting the pipes, pumps or other components of water supply systems. Impacts can include loss of intake head, obstruction of valves, blockage of rotating screens, cavitation-mediated wear on pump bowls and impellers, putrefactive decay of mussel flesh and the related methane gas production, and increased electro-corrosion of steel and cast iron pipelines resulting from bacterial growth around the mussels’ attachments.

Ecological impacts of Quagga mussels include:

- Remove food and nutrients from the water column efficiently, leaving less or nothing for native aquatic species.
- Potential of collapsing existing food webs.

Economic impacts include:

- Clog pipelines and pumps, ruin boat motors and damage aquatic recreational equipment.
- Routine maintenance of water resource infrastructure is necessary and perpetual.
- Maintenance costs are enormous, particularly for industrial raw water users like power stations and water supply agencies.

Methods for controlling the infestation of Quagga mussels include:

- Turbulence – physical pigging of pipes and intake structures
- Chlorination – high doses of chlorine kill the mussels
- Desiccation – drying and manual cleaning of the infested components
- Heat – exposure to elevated water temperatures kills the mussels. High temperature is obtained by passing the water through a heat exchanger.

CVWD has been proactively working to prevent the infestation and spread of Quagga mussels in the Coachella Canal and the irrigation system. Since July 2008, the District has been chlorinating Canal water just downstream of the turnout from the All American Canal. In addition, turbulence is generated by keeping the Canal gate partially closed. The District also performs monthly testing of Canal water samples for Quagga mussel DNA, and routinely performs visual inspection of sample coupons and infrastructure.

The cost of this chlorine treatment is funded through a mitigation charge of $5 per AF paid by Canal water users. The District also chlorinates at the Mid-Valley Pipeline pumping station.

5.4 STATE WATER CONSERVATION GUIDELINES

The proposed California 20x2020 Program (Program) is a statewide municipal water conservation program. In February 2008, Governor Arnold Schwarzenegger established a statewide goal of 20 percent reduction in per capita municipal use of potable water by the year 2020. Urban domestic users in California consume 8.7 million AFY of potable water; under the Program, Californians would save enough water (approximately 1.74 million AFY) to serve more than two million families each year (SWRCB, 2010b).

Several state and federal agencies (Program Team) have teamed up to assist with the development and implementation of the Program. The state agencies involved in the Program are:

- DWR
- SWRCB

- California Energy Commission (CEC)
- CDPH
- CPUC
- California Urban Water Conservation Council (CUWCC)

In addition to the above mentioned state agencies, Reclamation is also a part of the Program Team.

The Program supports other statewide water planning efforts such as Delta Vision and the California Water Plan Update (Bulletin 160). The common goals are identifying and implementing strategies for sustainably managing the valuable water resources of California to support both its environmental and economic functions.

The Governor also invited legislation to incorporate the goal of the Program into statute. Senate Bill x7-7 (SBx7-7) supporting the Program was passed in the state Senate and Assembly in late 2009. This bill requires a statewide reduction in per capita urban water usage by 20 percent by December 31, 2020. The bill also requires that the state achieves incremental progress towards the goal by reducing the per capita usage by 10 percent by December 31, 2015. The bill requires each urban water supplier to develop interim and final urban water use targets consistent with the requirements of the bill. Urban water suppliers are required to comply with the requirements established by the bill on or before July 1, 2016 in order to be eligible for state water grants or loans.

DWR is working on developing a methodology to calculate the baseline water use and compliance water use targets. According to the current DWR schedule, this methodology will be made available by December 2010. CVWD is closely monitoring the work being performed by DWR under the purview of SB 7. CVWD will incorporate the requirements of the bill in their subsequent planning efforts (e.g., 2010 Urban Water Management Plan). Additional information on compliance with the requirements of SBx7-7 is presented in **Section 6**.

5.5 SUBSIDENCE

Declining groundwater levels can contribute to or induce land subsidence in aquifer systems that contain a significant fraction of unconsolidated fine-grained sediments (silts and clays). Land subsidence can disrupt surface drainage; cause earth fissures; and damage wells, buildings, roads, and utility infrastructure.

Pumping of groundwater has resulted in water level declines as large as 50 feet through the late 1940s. In 1949, the importation of Colorado River water to the East Valley caused a reduction in groundwater pumping and a recovery of water levels during the 1950s through the 1970s.

Since the late 1970s, however, the demand for water in the East Valley has exceeded the deliveries of the imported surface water. Pumping has increased and water levels have again declined. By 2005, water levels in many wells in the East Valley had declined 50 to 100 ft and some wells were at their lowest recorded water levels. Results of previous studies by the U. S.

Geological Survey (USGS) indicate that land subsidence may have been as much as about 0.5 ft (150 mm) in the eastern parts of the Valley between 1930 and 1996.

In 1996, the USGS, in cooperation with CVWD, established a geodetic network of monuments to monitor vertical changes in land surface in the East Valley. In 2007, USGS published the results of the monitoring program (USGS, 2007). The objectives of this study were to detect and quantify land subsidence that has occurred in the Coachella Valley from 1996 through 2005. The study is the fourth in a series of Coachella Valley land subsidence studies completed by the USGS in cooperation with CVWD. The location and magnitude of vertical land-surface changes during 1996-2005 were determined with measurements spanning the area from Palm Desert on the north to the Salton Sea on the south.

At least four areas in the Coachella Valley experienced land surface elevation changes, indicating that land subsidence occurred in three of the areas (Palm Desert, Indian Wells, and La Quinta) and both subsidence and uplift apparently occurred in one of the areas (Indio-Coachella) between February 26, 2003 and September 25, 2005. Other local areas in the Coachella Valley also may have deformed, but the size of these areas and the amount of deformation generally are small compared with the Palm Desert, Indian Wells and La Quinta areas.

Eight of the fourteen measurement sites for which subsidence rates could be compared show subsidence rates increased by as much as a factor of 10 between 2000 and 2005, compared with subsidence rates prior to 2000. The data showed drops in surface elevation of less than an inch at three Global Positioning Satellite (GPS) benchmarks and about a one-foot drop at three other benchmarks. At one benchmark near the intersection of 54th Avenue and Jackson Street in Coachella, a one-foot drop occurred between 2000 and 2005. The data indicate that subsidence rates in the Palm Desert, Indian Wells and La Quinta areas have significantly increased since 2000.

These studies to date have not confirmed the relationship between land subsidence and declining water levels. The USGS Scientific Investigation Report 2007-5251 states, "Although the localized character of the subsidence signals is typical of the type of subsidence characteristically caused by localized ground-water pumping, the subsidence may also be related to tectonic activity in the valley." This report also concludes additional monitoring is needed to permit meaningful interpretations of the aquifer-system response to water level changes. CVWD's Board of Directors approved additional funding to continue these cooperative subsidence studies with the USGS. Future studies include additional monitoring designed to evaluate the potential relationship between declining water levels and land subsidence. Potential land subsidence caused by declining water levels was addressed by mitigation measures described in the 2002 Coachella Valley Water Management Plan Programmatic Environmental Impact Report (CVWMP PEIR).

5.6 SALTON SEA RESTORATION

The Salton Sea is a saline terminal lake located at the east end of the Coachella Valley. It is California's largest lake and is a main stop on the Pacific Flyway for migratory birds. Over 400 bird species have been documented there. The Sea is about 35 miles long and 9-15 miles wide with approximately 360 square miles of water surface and 105 miles of shoreline. The surface of the Sea currently lies approximately 232 feet below mean sea level (MSL). One of the major functions of the Salton Sea is to serve as a sump for agricultural wastewater from the Imperial and Coachella valleys. Executive Order of Withdrawal (Public Water Reserve No. 114, California No. 26), signed by President Coolidge in 1928, designated lands within the Salton Basin below elevation 220 feet below MSL as storage for wastes and seepage from irrigated lands in the Imperial Valley. Approximately 90 percent of the freshwater inflow to the Sea is agricultural drain water from Imperial Valley, Coachella Valley and Mexicali Valley (Salton Sea Authority website, 2010). Because the Sea has no outlet, salts concentrate in it by evaporation and concentrated nutrients increase eutrophic conditions. Salt concentrations in the Sea are currently about 51,000 mg/L or about 45 percent higher than ocean water, with salinity increasing at approximately 1 percent per year (DWR, The Resource Agency, Department of Fish and Game, 2009).

The Salton Sea Reclamation Act of 1998 (Public Law 105-372) directed the Secretary of the Interior, through Reclamation, to study options for managing the salinity and elevation of the Sea to preserve fish and wildlife health and to enhance opportunities for recreation use and economic development while continuing the Sea's use as a reservoir for irrigation drainage.

In January 2003, a status report was released by the Secretary of the Interior about the Salton Sea Restoration Project. In September of that year, state legislation was passed in which the State of California accepted responsibilities for ecosystem restoration at the Sea. The legislation directed DWR to prepare an ecosystem restoration study and programmatic environmental document. The study, conducted in consultation with a legislatively mandated advisory committee and with the Authority, included a proposed funding plan for implementing the preferred alternative (Reclamation, 2008).

In June 2006, the Salton Sea Authority (SSA) published a study entitled "Salton Sea Authority Plan for Multi-Purpose Project". As part of this study, the SSA developed a combined, multi-purpose revitalization/restoration project. The preferred project design resulting from this study included components such as in-sea barrier and circulation channels, water treatment facilities, habitat enhancement features, Colorado River water storage reservoir, park, open space and wildlife areas (SSA, 2006).

In May 2007, the State published the "Salton Sea Ecosystem Restoration Program Preferred Alternative Report and Funding Plan". The Plan and the accompanying PEIR/EIS considered eight restoration alternatives along with a no project alternative. The preferred alternative includes Saline Habitat Complex in the northern and southern sea bed, a Marine Sea that extends around the northern shoreline from San Felipe Creek to Bombay Beach in a "horseshoe" shape, Air Quality Management facilities to reduce particulate emissions from the exposed playa, Brine Sink for discharge of salts, Sedimentation/Distribution facilities, and Early Start Habitat to provide habitat prior to construction of the habitat components (California Resources Agency, 2007).

Salton Sea Restoration Project - SB 187 was approved by Governor Arnold Schwarzenegger on September 27, 2008 (Chapter 374, Statutes of 2008). SB 187 limits expenditures of funds from Proposition 84, upon appropriation by the Legislature, to those activities to be completed in the first five years (Period I) identified in the Resources Agency's report entitled "Salton Sea Ecosystem Restoration Program Preferred Alternative Report and Funding Plan." Activities identified for completion in Period I include a demonstration project, early start habitat, and additional biological, inflow, sediment, water and air quality investigations.

The 2010 WMP Update projects that in order to meet the 2045 demand conditions in the Valley, up to 112,000 AFY of drain flow to the Salton Sea will be captured and desalinated for urban use (see **Section 6.4.1.3**). This might result in a significant reduction of projected flow to the Salton Sea from the Coachella Valley compared to the figures in the 2002 CVMWP PEIR. The impacts associated with this reduced flow to the Salton Sea will be discussed in the 2010 WMP Update Subsequent PEIR.

5.7 SEISMIC RESPONSE

The USGS performed a study in 2008, which projected that the probability of a magnitude 6.7 or higher earthquake occurring in California over the next 30 years is greater than 99 percent. The probability of this earthquake occurring in Northern California is 93 percent and for the southern half of the state is 97 percent. When such an earthquake occurs, it is expected that, along with the loss of life and serious injuries, there will be major damage to infrastructure across the state.

California has hundreds of faults splaying from the San Andreas fault, which is the main locus of the slip. According to the USGS study, the highest probability of a major earthquake in the next 30 years is along the southern San Andreas fault (USGS Fact Sheet 2008-3027). Due to the close proximity to the southern San Andreas fault, infrastructure serving the Coachella Valley (especially the Coachella Canal) is considered as highly vulnerable. In the event of such a calamity, water and other utility services in the Coachella Valley is likely to be compromised.

CVWD has prepared an Emergency Response Plan in compliance with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, and in accordance with the latest USEPA Office of Water – Planning Guidelines published in July 2003. The Plan is routinely updated to assure compliance. CVWD has recommended emergency preparedness measures for such events, which can be found on the District website at: http://www.cvwd.org/news/emergency.php.

Other agencies in the Valley have similar disaster/emergency preparedness plans. Information for these agencies can be found at:

- DWA: http://www.dwa.org/index.php?option=com_content&view=article&id=46&Itemid =105.
- MSWD: https://mswd.org/preparedness.aspx.
- City of Coachella: http://www.coachella.org/index.aspx?nid=28.
- City of Indio: http://www.indio.org/index.aspx?page=519

5.8 SUMMARY

As discussed above, there are several current and emerging issues that might impact water management planning in the Coachella Valley. Some of these issues will be addressed as part of the 2010 WMP Update while others will be addressed in other subsequent planning efforts. **Table 5-4** presents a summary of the issues along with proposed actions to resolve these issues.

Table 5-4
Summary of Emerging Issues

Issue	Impact to Coachella Valley Water Management Planning	Proposed Action
Basin Plan Amendment/Triennial Reviews	New policies/guidelines specifying water quality requirements might impact projects identified in 2010 WMP Update	Coachella Valley water agencies to keep tracking proposed changes to the Basin Plan and actively participate in development of new policies
TMDLs	May limit discharges into the CVSC and Salton Sea	Might include actions such as additional monitoring, increased treatment, and implementation of additional BMPs in the Valley
Salinity Management	Might require treatment of Colorado River water before recharging or recharging with better quality imported water	CVWD to work with other water purveyors in the Valley to develop a plan for addressing this issue. IRWMP might be an ideal forum for addressing this issue
Recycled Water Use Policy	Requires increased use of recycled water in the Valley and development of Salt/Nutrient Management Plans	Implement Valley-wide recycled water projects identified in the 2010 WMP Update and prepare Salt/Nutrient Management Plan in compliance with Recycled Water Use Policy
Brine Discharge Management	Disposing of large quantities of brine and its associated cost could limit the extent of desalination projects proposed in 2010 WMP Update	Detailed study investigating alternatives for brine disposal is recommended in this Update
Agricultural discharge waivers	Not clear at this time	Continue to monitor the development of this regulation and take appropriate action when necessary
Arsenic	Degrades water quality in the basin	Arsenic treatment before distribution
Perchlorate	No significant impact	Continue monitoring for perchlorate in the Colorado River water and groundwater
Chromium-6	Once the MCL for chromium-6 is established, treatment at wells with high chromium-6 might be required	Coachella Valley water agencies to keep monitoring the chromium-6 PHG and MCL process
Uranium	No significant impact; localized impact in some wells.	Continue monitoring for uranium in Colorado River water and groundwater
Nitrate	Impacts groundwater quality	Locate recharge activities away from areas with high nitrate concentration and treat pumped groundwater high in nitrate
Carcinogens	Not clear at this time	Continue to monitor the development of this regulation and take appropriate action when necessary

Table 5 4 (continued)
Summary of Emerging Issues

Issue	Impact to Coachella Valley Water Management Planning	Proposed Action
Endocrine Disrupting Compounds	Impairs drinking water	Continue to monitor the development of this regulation and take appropriate action when necessary
Climate Change	Affects the reliability and availability of imported water in the Valley	2010 WMP Update provides for water supply contingency and flexibility by implementing a "book-end" approach to address uncertainties associated with climate change
Quagga Mussels	Physical, ecological, and environmental impacts to waterbodies and water infrastructure	CVWD to continue implementing chlorination, turbulence in the Coachella Canal and the irrigation system
Urban Water Conservation	Compliance with Senate Bill SB x7-7 required	Implement the proposed conservation measures in the 2010 WMP Update
Subsidence	Might limit the quantity of pumping in the Coachella Valley	Continue Valley-wide subsidence studies
Salton Sea Restoration	Might limit the quantity of drain flows available for treatment and reuse	The 2010 WMP Update provides for existing drain flows into the Salton Sea to remain at the current level
Seismic Response	Major earthquake along the southern San Andreas fault might cause major damage to water infrastructure in the Valley	Coachella Valley water agencies have Emergency Preparedness/Response Plans to address this issue

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Section 6

Section 6
Management Plan Elements

The water management plan elements included in the 2002 WMP were water conservation, development of additional water sources, source substitution and groundwater recharge. These elements were combined into a preferred plan to meet current and future demands while eliminating groundwater overdraft in the Valley. Since the 2002 WMP was adopted, changed planning conditions require modification of the elements included in the 2002 WMP. In addition to the elements considered in the 2002 WMP, the 2010 WMP Update considers and evaluates additional management options as well as potential water quality improvements.

This section discusses the need for changes to the 2002 WMP and presents the water management elements that are considered in the 2010 WMP Update. Evaluation of these elements is presented in Section 7.

6.1 NEED FOR FLEXIBILITY

The preceding sections of this report describe the need for changes to the Coachella Valley's water management strategy. Expectations for population growth have increased significantly, and result in a corresponding increase in the projected urban development of agricultural and vacant land in the Valley. Areas that were previously expected to have little growth are now expected to develop within the next 35 years. At the same time, the reliability of imported water supply from the SWP has declined due to a combination of extended drought, climate change, legal and environmental restrictions and risk of levee failure in the Sacramento-San Joaquin Delta (Delta). Increasing demands coupled with reduced imported water supply reliability have increased the potential for future supply deficits that must be addressed in the 2010 WMP Update. In addition, a number of other emerging issues may affect water management in the future including more stringent water quality regulations, the need for salt and nutrient management plans, land subsidence, infrastructure needs, control of invasive species, integrated regional water management planning, Salton Sea Restoration plans and climate change. To address these uncertainties, the 2010 WMP Update incorporates a more flexible and adaptive approach to water resources management. Such an approach will allow the Valley's water agencies to adjust the implementation strategy when future changes occur.

Sections 3, 4 and 5 of the 2010 WMP Update have identified some of the uncertainties that affect water resources planning and management in the Coachella Valley. However, it is not possible to quantify all of the uncertainties affecting the Valley's water resources. Consequently, the 2010 WMP Update has adopted a more flexible approach by assigning book-end targets (ranges) for each of the major project elements. The book-ends represent reasonable minimum and maximum amounts of supplies provided by the projects included in the Plan elements. This allows Valley water managers to plan more pragmatically in the near term and adjust those plans in the future as more information becomes available and the level of uncertainty is reduced.

The 2002 WMP identified specific objectives and projects for water conservation, new sources, groundwater recharge and source substitution. The goal of the 2002 WMP is to assure adequate quantities of safe, high-quality water at the lowest cost to Coachella Valley water users. This would be accomplished by meeting the following objectives:

1. Elimination of groundwater overdraft and its adverse impacts, including:
    - Groundwater storage reductions,
    - Declining groundwater levels,
    - Land subsidence and
    - Water quality degradation.
2. Maximizing conjunctive use opportunities,
3. Minimizing adverse economic impacts to Coachella Valley water users,
4. Minimizing adverse environmental impacts.

The 2010 WMP Update has refined these goals and objectives to better match the current needs of the Valley. The basic goal of the WMP remains the same but has been modified to reflect a more holistic approach: "to reliably meet current and future water demands in a cost-effective and sustainable manner." However, the underlying objectives have been refined based on the water resources uncertainties facing the Valley. The programs and projects identified in the 2010 WMP Update are based on the following objectives:

1. **Meet current and future water demands with a 10 percent supply buffer.** As discussed previously, the water resources environment in California faces significant uncertainties due to growth, legal and environmental restrictions of water exports from the Delta, legal uncertainty associated with the Quantification Settlement Agreement, and climate change. Because of this uncertainty, the 2010 WMP Update includes a water supply planning buffer of 10 percent of projected demand. This buffer will provide Valley water managers with a contingency in the event that growth is greater than expected or that water supplies are lower than expected.

2. **Eliminate long-term groundwater overdraft.** Groundwater overdraft reduction was the primary driving force behind the 2002 WMP. Overdraft reduction continues to be an important objective of the 2010 WMP Update because of the importance placed of sustainability. Water supplies must be sufficient to reduce the current overdraft and manage future overdraft such that future generations will have adequate dependable water supplies. However, the water managers recognize that the large amounts of water stored in the groundwater basin provide a valuable resource for meeting water demands during periods of imported water shortage. Consequently, overdraft should be managed in a way that allows this storage to be used when needed to avoid shortages.

3. **Manage and protect water quality.** The quality of the groundwater is generally very high. However, localized water quality issues such as arsenic exist that currently require treatment to make water suitable for potable use. Concerns have been expressed about recharging the basin with Colorado River water which has a higher salinity than the existing groundwater. The need to manage water quality is addressed in the 2010 WMP

Update, including the cost of treatment which could significantly increase the cost of water.

4. **Comply with state and federal laws and regulations.** A number of local, state, and federal laws, regulations, permits and agreements affect water management in the Coachella Valley including: drinking water regulations, waste discharge requirements, well construction standards, CalGreen Building Code, and state and federal water contracts to name a few. CVWD and the participants in this plan will make their best efforts to comply with applicable laws, regulations and agreements and will plan for future changes to those requirements.
5. **Manage future costs.** The cost for development and management of the Coachella Valley water resources is expected to increase in the future in response to resource scarcity, increasing regulatory requirements, and growth. While there are few if any "cheap" water supply solutions remaining, the 2010 WMP Update seeks to meet future water needs in the most cost-effective manner.
6. **Minimize adverse environmental impacts.** The California Environmental Quality Act (CEQA) requires the evaluation and mitigation of adverse environmental impacts. The WMP minimizes and mitigates adverse environmental impacts to the extent practical.

6.2 WATER MANAGEMENT ELEMENTS

Water management elements that are included in the 2010 WMP Update consist of:

- Water conservation measures
- Acquisition of additional water supplies,
- Conjunctive use programs to maximize supply reliability,
- Source substitution programs
- Groundwater recharge programs
- Water quality protection measures
- Other management activities

These elements are discussed in detail in the following sections.

6.3 WATER CONSERVATION

Water conservation is a major component of water management. As a desert community heavily reliant upon imported water supplies, the Coachella Valley must use its water resources as efficiently as possible. It is essential that the region continue to invest in water conservation. This is also a requirement of the California Water Code and recent legislation such as 20x2020 (SB 7x7) in order to maintain eligibility for State funding opportunities through compliance of AB 1420 demand management measures (DMMs). This section describes urban, agricultural and golf course conservation activities, and describes potential water conservation implementation strategies.

The primary focus of water conservation is on urban/residential use, agricultural irrigation and golf course irrigation, since these are the principal water uses. Other water use groups represent a relatively small portion of the total demand and will be handled on a case-by-case basis.

Consistent with Plan objectives, the 2010 WMP Update achieves a level of water use reduction consistent with applicable State law without causing dramatic lifestyle changes on the part of those conserving. In the future, as total demand increases and the landscape ordinance is applied to new growth, the volume of water conserved will increase, representing the equivalent of a substantial source of supply.

6.3.1 Urban Conservation

Urban water use is expected to grow significantly in the future as development occurs. CVWD, DWA, IWA and the City of Coachella are implementing a number of on-going water conservation programs for both large landscape customers and residential customers. Water efficient plumbing is being installed in all new homes consistent with existing building code. Most water purveyors and several cities have implemented landscape audit programs and rebates for replacements of lawns with water-efficient landscaping.

Example of Desert Landscaping

6.3.1.1 California Law and Policies

California law establishes a number of policies regarding water conservation. It mandates several water conservation techniques, which have been already implemented in the Valley. For example, California plumbing codes have required the installation of ultralow-flush toilets (1.6 gallons/flush) and low-flow showerheads (2.5 gpm maximum) on all new construction since 1992. The Federal Energy Policy Act of 1992 (PL 102-486) mandated these same standards nationwide on all plumbing fixtures manufactured since January 1994.

Water Conservation in Landscaping Act: The Water Conservation in Landscaping Act (California Government Code, Sections 65591-65600) required each city and county to adopt a water efficiency ordinance for landscaping or enforce the Department of Water Resources' model ordinance by January 1, 1993. Amendments to this law in 2006 required DWR to update the model landscape ordnance and local agencies to adopt an updated ordinance that meets or exceeds the new model ordinance. In 2003, CVWD adopted an updated model landscape ordinance (CVWD Ordinance No. 1302) that required a 25 percent reduction in outdoor water use over that required by the State's model ordinance. The CVWD ordinance was further tightened in 2007 requiring an additional 17 percent reduction in outdoor use by new development (CVWD Ordinance No. 1302.1, 2007). Recently, the Coachella Valley cities, water districts, Riverside County and CVAG developed a single model landscape ordinance that each city and water district could adopt to promote maximum landscape water use efficiency

(CVWD Ordinance No. 1302.1 (Revised by CVWD Ordinance No. 1374, 2009). The 2009 ordinance provides uniform landscaping standards throughout the Valley. The ordinance is based on the 2007 CVWD ordinance and is one of the most stringent in the State. It is one of the few ordinances in the State to establish turf limitations for new golf courses.

California Urban Water Conservation Council MOU: In addition to state law requirements, water agencies and public interest groups formed the California Urban Water Conservation Council (CUWCC) and developed the Memorandum of Understanding Regarding Urban Water Conservation (MOU), dated September 1991 (as amended June 9, 2010 – CUWCC, 2010). The MOU asks that participating water agencies commit to make a "good faith effort" to: (1) develop comprehensive conservation Best Management Practices (BMPs) programs using sound economic criteria and (2) consider water conservation on an equal basis with other water management options.

The MOU identified 14 BMPs for urban water conservation that are generally recognized as producing more efficient water usage and are considered technically and economically feasible. The list of BMPs has been updated several times since the MOU was first developed. In December 2008, the MOU was amended and the BMPs were revised. This revision reorganized the CUWCC's 14 BMPs into five categories. Two categories, Utility Operations and Education, are referred to as "Foundational BMPs," because they are considered to be essential water conservation activities by any utility and are adopted for implementation by all signatories to the Urban MOU as ongoing practices with no time limits. The remaining BMPs are "Programmatic BMPs" and are organized into Residential; Commercial, Industrial, and Institutional (CII); and Landscape categories.

The MOU now allows a more flexible approach to implementing the Programmatic measures. Signatories may implement the specific measures described for each BMP, implement a set of additional measures which achieves equal or greater water savings (Flex Track Menu) or may choose a "gpcd" compliance option which requires an 18 percent water use reduction in per capita water use by 2018 compared to 1997-2006 baseline usage.

California 2008 Water Conservation Plan: In February 2008, Governor Schwarzenegger proposed a goal of reducing statewide urban water usage by 20 percent by the year 2020 and directed state agencies to develop plans to implement this goal. In April 2009, a draft plan was released for public review. The final 20x2020 Water Conservation Plan was released in February 2010 (SWRCB, 2010b).

SBx7-7: As part of the 2009 comprehensive water package, the California Legislature adopted SBx7-7 (Steinberg) which mandates California urban water agencies to achieve a 10 percent reduction in urban per capita water demand statewide by 2015 and a 20 percent reduction by 2020. Water use reductions are compared on a per capita basis to a 10-year baseline period. Water agencies may select their target either individually or on a regional basis.

Table 6-1 presents the new BMPs along with their old designation.

Table 6-1
Urban Water Conservation Best Management Practices

Type	Category	Best Management Practice
Foundational BMPs	Utility Operations	Conservation Coordinator (BMP 12)
		Water Waste Prevention (BMP 13)
		Wholesale Agency Assistance Programs (BMP 10)
		Water Loss Control (BMP 3)
		Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections (BMP 4)
		Retail Conservation Pricing - water and wastewater rates ((BMP 11)
	Education	Public Information Programs (BMP 7)
		School Education Programs (BMP 8)
Programmatic BMPs	Residential	Residential assistance program (BMP 1 & 2)
		Landscape water survey (BMP 1)
		High-efficiency clothes washers (BMP 6)
		WaterSense Specification (WSS) toilets (BMP 14)
		WaterSense Specifications for residential development
	Commercial, Industrial, and Institutional	Conservation Programs for Commercial, Industrial, and Institutional (CII) Accounts (BMP 9)
	Landscape	Large Landscape Conservation Programs and Incentives (BMP 5)

SBx7-7 will require Coachella Valley urban water users to increase conservation over and above the goal established in the 2002 WMP.

6.3.1.2 Water Conservation Targets

Several alternative targets for achieving increased conservation in the Valley are considered in the 2010 WMP Update. Valley water purveyors could continue to implement their existing conservation measures such as the Landscape Ordinance, tiered water rates and landscape rebates as appropriate. Alternatively, the water purveyors could implement more aggressive conservation measures to achieve greater levels of conservation. Areas like Las Vegas, Phoenix, Tucson and the San Bernardino High Desert communities have average water uses ranging from 120-180 gpcd, less than half of the average Coachella Valley water use. This level of conservation would be achieved through aggressive measures such as water use restrictions and enforcement programs that may include turf reductions, penalties for wasteful water use, and possibly even punitive water rates.

For the 2010 WMP Update, several levels of conservation are considered:

<u>**Level 1:**</u> **Continuation of the goals established in the 2002 WMP**. The 2002 WMP required a ten percent reduction in urban water use. Based on review of available water

usage data, urban water users have met this goal. However, with the adoption of SBx7-7, this level is no longer adequate as a higher reduction is now required by law.

<u>**Level 2:**</u> **Meet State-mandated 20 percent per capita use reduction by 2020 relative to the DWR 10-yr baseline water usage.** Existing customers are reducing their water use in response to conservation measures already adopted by local water agencies. New development uses less water due to stringent plumbing and landscaping requirements. Consequently, it is expected that per capita use will gradually decline more than the 20 percent level mandated in the 20 by 2020 program. The demand projections in the 2010 Plan Update include these savings.

<u>**Level 3:**</u> **Implementation of Current Conservation Measures.** This option involves the continued implementation of the conservation measures already adopted by local water agencies for existing and new customers plus additional measures to reduce the use of existing customers. This option is expected to reduce per capita use by nearly 40 percent and achieve an additional 8 percent reduction in urban water use in 2045 compared to the baseline demand projection. This would reduce urban water demand by an additional 43,000 AFY over Level 2 by 2045. However, the potential for higher savings due to implementation of the landscape ordinance and water budget-based rates could raise this amount to as much as 100,000 AFY depending on the type of development.

<u>**Level 4:**</u> **Achieve Colorado River Region's per capita use target.** This conservation level would achieve a per capita use consistent with the water conservation target assigned to the Colorado River Region under the Final 20x2020 Plan (SWRCB, 2010b), about 211 gpcd. This would require a 41 percent reduction in water demand or 219,000 AFY in 2045 compared to the Level 2 projection.

<u>**Level 5:**</u> **Reduce per capita use comparable to Tucson.** The highest level might be to implement a program to reduce usage comparable to that of Phoenix or Tucson (about 177 gpcd). This approach might require per capita water usage reductions by as much as 50 percent demand reduction or 266,000 AFY by 2045 compared to the Level 2 projection used in the 2010 WMP Update.

A challenge associated with these latter two approaches is the potential adverse impact of such significant usage reductions on the Coachella Valley economy. In addition, the cost to achieve higher conservation targets increases as the target increases. The Water Conservation Alliance of Southern Arizona (Water CASA) completed the *Evaluation and Cost Benefit Analysis of Municipal Water Conservation Programs* (ECoBA) in 2006. The ECoBA study evaluated the cost and water savings associated with implementing a variety of water conservation measures including water audits, device giveaways, washing machine rebates, landscape conversion rebates, toilet rebates, toilet distribution, water rates and other measures. The study found that the cost per AF of conservation ranges from $101 to $3,276/AF with a median cost of $876/AF among all measures. Consequently, urban conservation measures must be carefully evaluated so the most cost effective measures are implemented first before moving to more costly measures.

Although the Valley could likely meet the requirements of SBx7-7 without implementing additional conservation measures, water savings in excess of SBx7-7 requirements are likely given the significant emphasis placed on reduced water use by existing and future customers in the 2010 WMP Update. Based on the potential range of domestic water conservation actions identified herein, additional urban water conservation savings could potentially range from 43,000 AFY to 266,000 AFY by 2045. Extreme changes in lifestyle would be required to reduce water use to an amount comparable to Tucson (50 percent reduction) or the Colorado River Region's target in the 20x2020 Plan (41 percent reduction).

Methods available for achieving the Level 3 option include the following:

- Continued implementation of the 2009 Valley-wide Landscape Ordinance (Ordinance 1302.1 Revised by Ordinance 1374)
- Installation of automated or "smart" water meters
- Extension of the landscape ordinance to include all landscaping regardless of size (current limit is 5,000 square-feet or larger for homeowner furnished landscaping)
- Implementation of water budget-based tiered water rates or other conservation based rates by other water agencies
- Further decreases in the water allocations for landscape irrigation consistent with good irrigation practices and desert landscaping
- Landscape retrofit rebates – i.e., economic incentives for replacing high water use landscaping, also known as "cash for grass"
- Restrictions on the total amount of turf allowed
- Mandated use of smart irrigation controllers by all customers
- Audits of new development to assure continued compliance with the Landscape Ordinance
- Plumbing retrofits for existing properties including mandatory retrofit (ultra low flush toilets, showerhead replacement, etc.) prior to sale of property
- Conservation rebates for high-efficiency clothes washers
  Compliance with California Green Building Code Standards (California Code of Regulations Title 24, Part 11, 2009)
- Water distribution system audits and loss reduction programs

6.3.2 Agricultural Conservation

Agriculture is an essential part of the Coachella Valley economy generating more than $500 million per year in production. Agriculture typically uses an average of 6.2 AFY per cropped acre, including allowances for multiple cropping, and accounts for more than 40 percent of Valley water use.

6.3.2.1 Agricultural Conservation Activities (2002 through 2009)

Since the 2002 WMP was prepared, CVWD has implemented in a variety of agricultural water conservation efforts:

- Extra-ordinary Conservation

- Water 2025

Extra-ordinary Conservation Measures

With the signing of the QSA, the U. S. Bureau of Reclamation (Reclamation) adopted the Inadvertent Overrun and Payback Policy (IOPP). This policy defined procedures that account for contractor diversions of Colorado River water in excess of their respective allocation and the requirements for paying back those excess diversions. The QSA specified that CVWD, Imperial Irrigation District (IID) and Metropolitan Water District of Southern California (Metropolitan) had overrun their allocations in 2001 and 2002 by a combined total of 313,200 AF of which the CVWD share was 73,200 AF. The QSA required this water to be paid back within eight years (2004 through 2011).

The District's response to the IOPP requirements included the implementation of the CVWD Extra-ordinary Conservation program. This program consisted of District funded and grower participation in a number of agricultural conservation programs. Grower participation was entirely voluntary. Through the Extra-ordinary Conservation Program, the District was able to completely payback the IOPP overrun (73,200 AF) by 2009, two years early. Conservation program measures included:

Drip irrigation of grapes reduces water use

- Scientific Irrigation Scheduling
- Salinity Management
- Salinity Field Mapping
- Conversion to Micro-Irrigation
- Distribution Uniformity Evaluations
- Grower Training and Meetings
- Engineering Evaluations

Water 2025

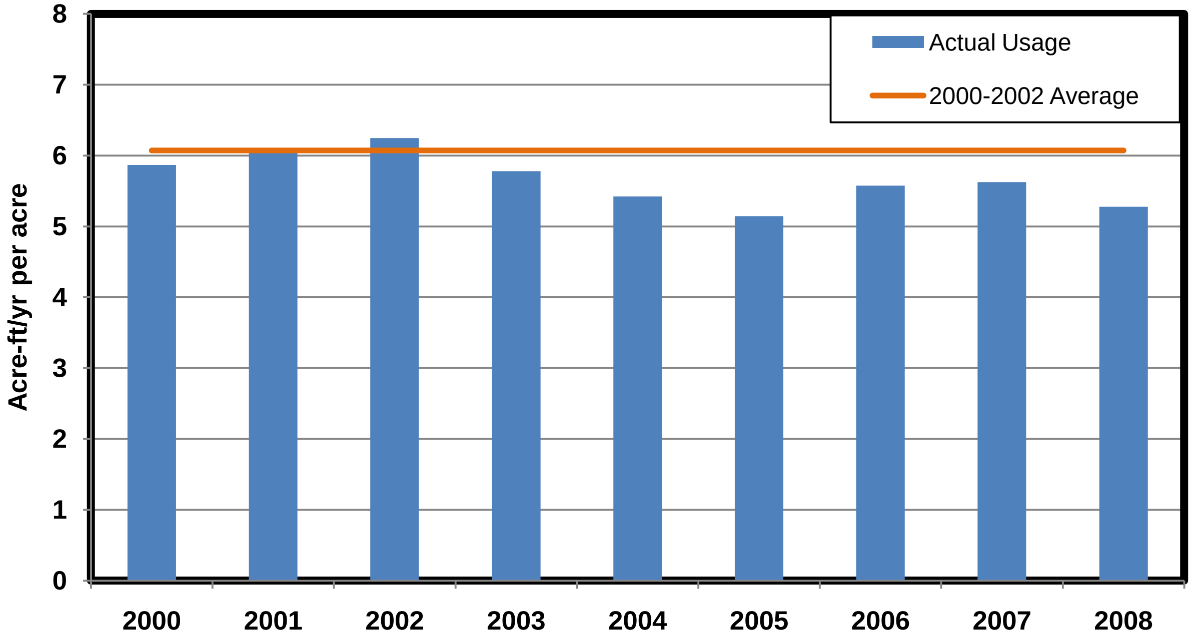
Water 2025 was a cooperative study effort funded by Reclamation, CVWD, and participating growers and suppliers within the Coachella Valley. The objectives of the study were to provide unequivocal quantification of reductions in applied water resulting from specific farm practices and to develop a market mechanism for saved water (DOI/CVWD, Water 2025, October 2007). The Water 2025 study identified the following conservation measures as cost-effective:

- Conversion to drip from furrow or sprinkler,
- Scientific irrigation scheduling,
- Scientific salinity management, and
- Overhaul/maintenance of irrigation systems.

Water Conservation Achievements

Agricultural water use in any given year is a function of weather conditions, cropping patterns and water conservations efforts. The annual average crop water use per acre is calculated by dividing total agricultural water deliveries (Canal, groundwater and other sources) by the number of acres irrigated in that year. For comparison purposes, a baseline was established using the 2000-2002 average water use to represent pre-Plan conditions. As shown on **Figure 6-1**, this comparison indicates that agricultural water conservation performance has varied from 2003 through 2008, averaging about 9.9 percent.

Figure 6-1
Historical Agricultural Water Usage



In response to the IOPP, Coachella Valley farmers implemented extraordinary water conservation measures that reduced agricultural water usage by as much as 15 percent on an AF/acre basis in 2005. However, since the payback obligations were met, agricultural conservation has declined. It should be noted that some of the apparent decline may be due to ET variations, inaccuracy of reported groundwater production, estimates of irrigated acreage outside ID-1 and variations in cropping patterns.

6.3.2.2 SBx7-7 Considerations

SBx7-7 requires all water suppliers to increase the water use efficiency and it requires the implementation of specified efficient water management practices for agricultural water supplies by July 31, 2012. The law also requires the preparation of agricultural water management plans paralleling the UWMP requirements. However, the bill specifically excludes agricultural water suppliers that are a party to the QSA from implementing specified conservation requirements for the duration of the QSA. The conserved water created as part of the QSA projects is to be credited against the obligations of the agricultural supplier as specified in the bill. CVWD is exempt from the requirement to develop an agricultural water management plan due to being a party to the QSA.

6.3.2.3 Agricultural Program for 2010 WMP Update

For agricultural conservation, it has been demonstrated that District-provided programs with voluntary grower participation are effective in increasing water use efficiency through both the 2025 and the Extra-ordinary Conservation Measures programs. However, the levels of conservation that will be required from the agricultural community to eliminate overdraft are significant and additional incentives or regulations are likely to be needed. For the 2010 WMP Update, a building block approach is used. Initially, education, training and audits would be implemented. If these programs fail to provide sufficient conservation, additional District-provided programs with voluntary grower participation would be implemented. If the additional programs still do not produce sufficient conservation, then the next step is taken and so on until the desired level of conservation is achieved. The following provides the building blocks for agricultural conservation.

Grower Education and Training: This would consist of grower meetings and grower training programs funded by the District. In order to encourage grower participation, the District would implement confidential grower audits.

District-Provided Services: This would include District-funded conservation programs provided as a service to growers within the District. Programs would include scientific irrigation scheduling, scientific salinity management, moisture monitoring and farm distributions uniformity evaluations. From 2004 through 2009, 73,400 AF of documented extraordinary conservation occurred using these programs for a total program cost of $2,954,000 (about $40/AF). Additional expenditures of $200,000 in 2009-10 resulted in savings of 3,400 AFY ($59/AF).

Irrigation Upgrade/Retrofit: This would add full funding, partial funding or financial support to growers that wish to convert from flood and sprinkler to micro-sprinkler and drip systems. In a fully funded program, the District would provide reasonable reimbursement to a grower that upgrades his irrigation system or retrofits an aging drip system. A partially funded program would cost-share the expenses and a program that offers financial support would provide low or no-interest loans for the upgrades or retrofits.

Economic Incentives: This would involve adoption of one or more pricing approaches to encourage conservation, if needed. This might be accomplished by establishing an irrigation water allocation based on evapotranspiration and a crop-specific coefficient. Water use in excess of the base allocation would be charged at a higher rate.

Regulatory Programs: These types of programs would be considered as a last resort, and would include regulations that support and provide for agricultural conservation. Programs could include the following:

- Grower-prepared on-farm water management plans defining the methods of applying water and the water conservation measures utilized, and

- All new permanent crops would use drip and/or micro-spray irrigation systems. All current crops must be converted within a 5 year period.

Each of these "building blocks" represents increased investment and potential for agricultural water use reductions. Evaluation of grower practices and crop requirements indicates that a savings of up to 14 percent of current water use can be achieved through incremental implementation of these measures. Assuming no change in cropping patterns and average ET conditions, agricultural water use is expected to decrease from 6.2 AFY per acre to about 5.33 AFY per acre. As agricultural land is removed from production in response to urban development, it is expected that the amount of water saved through agricultural conservation will decrease from almost 39,500 AFY in 2020 to 23,000 AFY in 2045. In general, CVWD program experience indicates the cost of agricultural conservation is in the range of $30 to $60/AF of water conserved, making it a very cost-effective method for extending the water supply.

Continued investment in agricultural conservation programs is needed to meet the higher levels discussed in this report.

6.3.3 Golf Course Conservation

The CVWD Landscape Ordinance established maximum allowable turf area and associated water demands for new golf courses by limiting turf to 4 acres per hole plus 10 acres for associated practice areas (driving ranges and putting greens). Other landscaping must use low water-using plant materials. Based on a typical 18-hole course encompassing about 125 acres of landscaped area, the expected water use would be about 700 AFY, which is an additional 22 percent reduction compared with the 2002 WMP goal for new courses.

New golf courses incorporate desert landscaping to reduce water use

CVWD continues to work with new and existing golf courses to reduce water demands through programs such as irrigation system audits, soil moisture monitoring, plan checking, inspecting new golf courses for plan check compliance, and monitoring maximum water allowance compliance.

Existing golf courses could achieve enhanced water savings by the following methods:

- Scientific irrigation scheduling
- Water audits - each course is audited every five years
- Monitoring of maximum water allowance compliance

As described earlier, the water demand for future golf courses is expected to be 22 percent less than the amount used in the 2002 WMP for new courses. This reduction can be achieved by the following methods:

- Full implementation of turf limitations specified in the Landscape Ordinance
- Plan checking for all new golf courses
- Inspection of all new courses after construction
- Water audits every five years

Implementation of conservation measures could reduce golf course demands by 11,600 AFY by 2045. The cost per AF of water saved to implement golf course conservation is expected to be comparable to that of agriculture ($30 to $60/AF), making golf course conservation a cost-effective source of water.

6.3.4 Potential Savings from Water Conservation Programs

Based upon the water conservation measures described above, the ranges of potential savings used in this plan are shown in **Table 6-2**. Total water savings would range from 60,000 to 145,000 AFY by 2045. Urban conservation in excess of 100,000 AFY is considered if cost-effective compared to other water supply options.

Table 6-2
Range of Water Conservation Savings – 2045

Type of Conservation	Low Range (AFY)	High Range (AFY)
Urban [1]	43,000	100,000
Agriculture [2]	11,000	23,000
Golf Courses	6,000	22,000
Total	60,000	145,000

Notes:
1. Low range for domestic conservation represents the amount of additional water saved as a result of currently adopted conservation programs.
2. Agricultural savings declines over time as agricultural land is developed for urban uses.

6.4 ADDITIONAL WATER SOURCES

CVWD and DWA should continue their efforts to obtain additional water supplies to meet projected water demands and help eliminate overdraft. Sources of additional water include Colorado River water, SWP water, recycled water, exchanges, entitlements and transfers, dry year purchases, water development projects, other groundwater supplies, and desalination.

6.4.1 Colorado River Water

In addition to the supplies made available to CVWD under the QSA (Section 4), the potential may exist to develop some additional Colorado River water supplies in the future. It is expected that these additional supplies would be the result of improved water use efficiency either in the scheduling of water deliveries to reduce wastage, improvements in irrigation efficiency and infrastructure improvements. The water transfers under the QSA and the Interim Surplus Guidelines are based on these approaches.

Intentionally Created Surplus Program: The potential may exist to develop additional supply under the Intentionally Created Surplus (ICS) program. The ICS program was created by the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead in December 2007 (Reclamation, 2007). This program allows a water user to create additional supplies through:

1. Extra-ordinary conservation where a user implements conservation measures such as land fallowing, canal lining or desalination that result in increased storage at Lake Mead;
2. Tributary conservation where a user fallows pre-1929 rights on a Colorado River tributary;
3. System efficiency where a user funds a project that reduces water losses on the Colorado River system; and
4. Imported ICS where a user conveys non-Colorado River water to the River for credit.

Coachella Canal

CVWD is currently not participating in the ICS program. Although options for CVWD to develop additional supplies under the ICS program have not been identified at this time, they would most likely occur within the first and third categories.

Reduced Canal Losses: The potential may also exist to deliver additional Colorado River water by further reducing canal and distribution system conveyance losses. Current conveyance losses are estimated to be approximately 31,000 AFY.

CVWD could potentially obtain additional water by reducing its allocated losses in the All-American Canal and the first reach of the Coachella Canal. If these losses could be reduced cost-effectively, potentially as much as 10,000 AFY of additional supply may be available to CVWD. For comparison purposes, the cost of the Coachella Canal Lining Project (CCLP) was $71 million. Based on a water savings of 26,000 AFY, the cost of water saved by the CCLP was $194/AF of saved water.

Fallowing/Irrigation Systems Improvements by Others: Other potential projects to generate additional Colorado River water might include retrofit of irrigation systems to improve efficiency and land fallowing in other districts. System efficiency and retrofit projects include conversion from flood irrigation to sprinkler or drip technology or similar on-farm improvements financed by CVWD in return for the saved water. This approach was the basis for the original IID-Metropolitan transfer agreement and the IID-San Diego County Water Authority (SDCWA) and IID-CVWD transfers under the QSA. The potential amount of water saved would be a function of the existing distribution system, crop types, irrigation methods and current disposition of return or tail water flows as well as the cost of system efficiency improvements.

Metropolitan has implemented targeted fallowing activities with Palo Verde Irrigation District (PVID) to provide Colorado River water since 1992. The current agreement (authorized in 2004) has a 35-year term and provides a minimum of 26,000 AFY up to 118,000 AFY of water for Metropolitan. Under this agreement Metropolitan pays an up-front cost per acre to participating land-owners plus an annual cost per acre of land fallowed in a given year. The cost of water under this program is currently about $192/AF. Although the Metropolitan-PVID program has obligated much of the available water, CVWD executed a one-time water transfer with PVID in 2003 for 32,000 AF to offset expected delivery reductions prior to execution of the QSA. Additional supplies might be developed on a temporary basis through similar targeted land fallowing activities with PVID or other agencies. The amount of water available from a fallowing program would be a function of many factors including the landowner willingness, cost, political acceptability, environmental impacts and third party impacts.

Yuma Desalter Saved Water: In 2009, the Seven Colorado River Basin States issued the Study of Long-term Augmentation Options for the Water Supply of the Colorado River (CRWC, 2008). Among the options consider are ocean water desalination and operation of the Yuma Desalter. Ocean water desalination is discussed in **Section 6.4.8**. The Yuma Desalter was constructed by Reclamation in 1992 to treat saline agricultural return flows from the Wellton-Mohawk Irrigation and Drainage District. The treated water was intended for inclusion in water deliveries to Mexico thereby preserving a like amount of water in Lake Mead. The plant has been maintained since construction but only operated twice since then. The facility could potentially produce up to 78,000 AFY of water to augment Colorado River supplies. A one-year pilot program is planned for 2010-2011 that will produce up to 29,000 AF of ICS water for Metropolitan, SNWA and Central Arizona Water Conservation District. The cost of operations was estimated to be $322-556/AF in 2007. If the pilot program is successful, water from the desalter could be available to CVWD.

Based on the foregoing, there may be somewhat limited future opportunities to obtain additional Colorado River supplies beyond that provided by the QSA. Of these options, reduction in Canal conveyance losses is considered for additional evaluation. However, CVWD will continue to monitor potential opportunities for obtain additional Colorado River supplies when available.

6.4.2 SWP Exchange Water

As discussed in Section 4, the SWP faces many challenges including the on-going drought, risk of Delta levee failure, legal and regulatory restrictions on exports due to environmental degradation, water quality degradation and climate change. In the absence of definitive measures to resolve these challenges, SWP reliability is likely to continue declining. The current average SWP reliability is 60 percent of the Table A Amounts consistent with DWR's 2009 SWP Delivery Reliability Report. for planning purposes, the 2010 WMP Update assumes two cases for future SWP reliability. As a worst case, the future average SWP reliability will decline to 50 percent of the Table A Amounts without Delta conveyance and habitat improvements. Under these conditions, the Valley's SWP supply would be about 72,200 AFY in the future, of which about 61,400 AFY would be available to recharge the Whitewater River Subbasin (see **Table 4-5** for derivation**)**. In order to increase the amount of Whitewater recharge to levels comparable to those of the 2002 WMP (103,000 AFY on average), additional SWP Exchange water, improved SWP reliability or other supplies will be required.

As a best case, if the BDCP and DHCCP in conjunction with the water bond issue are successfully implemented, SWP reliability would be restored to the level that existed before the Wanger decision. This reliability level is assumed to be 77 percent of Table A Amounts based on the 2005 SWP Delivery Reliability Report and is consistent with Metropolitan's planning (Metropolitan, 2010b). Delta conveyance improvements are expected to begin operations by 2023 with full operations by 2026. Under this assumption and based on its existing Table A Amounts and Metropolitan call-backs, CVWD and DWA could potentially increase their average annual SWP deliveries by about 39,000 AFY (from 72,200 AFY to 111,200 AFY). Of this incremental amount, up to 85 percent (32,600 AFY) would be allocated for use in the Whitewater River Subbasin with the balance used for recharge in the Mission Creek Subbasin, as discussed in **Section 4**.

The cost of the BDCP and DHCCP are currently being developed; however, preliminary estimates suggest a capital cost for conveyance facilities in the range of $7 to $12 billion (BDCP 2010). Water costs could be roughly $400-500/AF in addition to existing SWP conveyance costs for a total cost of about $600-700/AF. Increased SWP reliability is considered under the discussion of alternative water supply scenarios in **Section 7**.

6.4.3 Future Imported Water Acquisitions

Water transfers involve the temporary or permanent sale or lease of a water right or contractual water supply between willing parties. Water can be made available for transfer from other parties through a variety of mechanisms:

- Transferring surface water from storage that would have otherwise carried over to the following years
- Pumping groundwater instead of surface water delivery and transferring the surface water
- Transferring previously stored groundwater either by direct pumping or exchange for surface water
- Reducing consumptive use through crop idling/shifting or implementing water use efficiency measures
- Reducing return flows or conveyance losses

The water made available from these mechanisms would then be delivered through existing facilities such as the SWP.

The ability to successfully execute a water transfer depends upon a number of factors including:

- Water rights (pre- vs. post-1914 rights) and place of use requirements
- Regulatory approval (SWRCB, DWR, Reclamation)
- Ability to convey the transferred water

- Delta carriage water[1] and conveyance losses
- Environmental impacts (CEQA/NEPA compliance)
- Third-party impacts
- Supply reliability
- Cost

Potential sources of water transfers include the Sacramento Valley and the San Joaquin Valley. DWR and Reclamation typically limit water transfers involving crop idling to no more than 20 percent of the total agricultural land in a county to minimize economic impacts. CVWD and DWA acquisitions are described below.

Future Acquisitions: CVWD, DWA, and the City of Indio (IWA) are considering the acquisition of additional imported water supply to augment existing supplies. However, specific plans for these acquisitions have not yet been identified. For the 2010 WMP Update, it is assumed that up to 50,000 AFY of additional water supplies could be acquired through either long-term leases or entitlement purchase from willing parties. Potential sources might include the Delta Wetlands Project which would store surplus water at two Delta islands for later delivery, Sacramento Valley irrigation water transfers or purchase of additional Table A water from other SWP contractors.

The cost of long-term leases is likely to be in the range of $400 to $600/AF plus the cost of SWP conveyance (pumping), for a total cost of $550 to $750/acre-ft. The up-front cost of Table A purchase is currently about $5,300/AFY of Table A Amount (Mojave Water Agency's purchase of 14,000 AFY of SWP from Dudley Ridge Water District) plus SWP capital and operating costs. The total cost for a SWP Table A acquisition including amortization of the up-front purchase cost is expected to be in the range of $1,100 to $1,400/AF assuming an average SWP reliability of 50 percent. These costs are likely to increase in the future in response to increasing demand for water transfers.

As opportunities arise, CVWD and DWA should make water purchases from programs such as Governor's Drought Water Bank. Additional purchases from the SWP and from others with water rights, mainly in the Central Valley of California, will be evaluated as they become available to determine whether they meet CVWD's and DWA's needs.

6.4.4 Other Water Exchanges and Transfers

Other potential water transfers and exchanges could include development of a new source of water elsewhere in the region or State that could be used in lieu of an existing supply. The existing supply would then be transferred to the Coachella Valley and delivered via the SWP, Metropolitan's Colorado River Aqueduct or the Coachella Canal. As an example, CVWD and DWA could pay the capital and operations cost to develop and install a drain water treatment facility in Central California that allowed a local water district that currently uses SWP or CVP

1 Delta carriage water is the extra water needed to carry a unit of water through the Delta to the SWP or CVP pumping plants while maintaining Delta water quality. Carriage losses range from 0 to 25 percent depending on hydrologic conditions.

water to reuse the drain water instead for irrigation. The local district's SWP or CVP water would be delivered to CVWD and DWA via the SWP aqueduct. Contractually, the local district's water would continue to be used locally while the reclaimed drain water would be transferred to CVWD and DWA. Conveyance would likely be on an "as-available" capacity basis, meaning that the water could be transferred only when sufficient SWP aqueduct capacity is available. This operational limitation might require some type of storage agreement in addition to development and exchange agreements.

Another option would be to pay for the installation of water conservation devices (such as drip irrigation, tailwater pumpback systems or urban conservation) or recycled water delivery systems at a local water district in central or northern California in exchange for their transferring the saved water to CVWD and DWA.

At this point, no specific transfer projects have been identified that follow this model and none are included in the 2010 Plan Update.

6.4.5 Recycled Wastewater

Recycled water is a significant potential local resource that could be used to help reduce overdraft. Wastewater that has been highly treated and disinfected can be reused for landscape irrigation and other purposes; treated wastewater is not suitable for potable use. Recycled wastewater has historically been used for irrigation of golf courses and urban landscaping in the Coachella Valley.

6.4.5.1 Potential Supply

Urban growth is expected to increase the amount of wastewater generated and will make additional water available for reuse, primarily in the East Valley. As discussed in **Section 4**, with water conservation measures, East Valley wastewater will total about 67,000 AFY by 2045.

Pumping station delivers recycled water to golf courses in Palm Desert

In addition, growth is expected to occur in areas that are not currently served by wastewater treatment facilities. It is expected that the wastewater agency serving these areas will extend their wastewater collection systems as development occurs. For the areas within the cities of Coachella and Indio and their respective spheres of influence that are northeast of the San Andreas fault, it is expected that one or more satellite treatment facilities will be constructed to treat wastewater generated in these areas. This wastewater should be reused for outdoor use within those developments to reduce the need for additional imported water supplies. Based on order of magnitude estimates of water demands and wastewater flows, recycled water could meet as much as 12,000 AFY of non-potable demand in this area by 2045.

6.4.5.2 Potential Approaches for Reuse

The approach to reuse implementation will depend on the location of the wastewater discharges in the Valley.

West Valley: In the West Valley, all treated municipal wastewater is either reused for irrigation uses or percolated for disposal. No treated wastewater is discharged to surface waters. When reused, the recycled water offsets groundwater pumping by golf courses and other large landscape irrigators. Wastewater that is not recycled is disposed to percolation-evaporation ponds where most of the percolated water enters the groundwater basin. This typically occurs during the winter months when irrigation demands are low. Consequently, from a groundwater balance point of view, there is little difference between recycling the water for irrigation and disposal by percolation. However, from a water quality point of view, treated wastewater contains nutrients like nitrogen that can adversely affect groundwater quality. When the water is recycled for irrigation uses, much of the nutrients are taken up by the plants and turf reducing the need for fertilizer. Thus, reuse provides a water quality benefit.

One issue in the West Valley is that the demand for non-potable water typically exceeds the available supply, especially in the summer months. Irrigators using recycled water currently must supplement that supply with local groundwater to meet their peak summer demands. This limits the amount of overdraft reduction that is possible to the available recycled water supply. CVWD has implemented the Mid-Valley Pipeline (MVP) project to convey Canal water to WRP-10 where it is blended with recycled water for delivery to large urban irrigators. Eventually, the delivery system will be expanded to serve additional golf courses and significantly reduce their groundwater use. The MVP is discussed in more detail in **Section 6.3.1.3**. CVWD also supplements the recycled supply from WRP-7 with Coachella Canal water. However, other treatment facilities do not have access to supplemental water. For the West Valley, a planning target of recycling 90 percent of the available treated wastewater has been established. Where feasible, recycled water would be supplemented with available imported water sources to reduce pumping by large landscape irrigators.

East Valley: In the East Valley, little reuse of wastewater is occurring. With the exception of a small amount of wastewater used for pasture irrigation at the VSD plant, essentially all wastewater produced from the three East Valley plants (City of Coachella, VSD, and CVWD WPR 4) is discharged into the CVSC, pursuant to permits issued by the Colorado River Regional Water Quality Control Board (Regional Board). As growth occurs in the East Valley, significantly more wastewater will be generated and require treatment. This represents a significant resource that could be used to offset groundwater pumping.

The 2002 WMP focused on reuse from the WRP-4 facility. In that plan, up to 8,000 AFY of tertiary treated effluent was proposed to be delivered for agricultural use. Since CVWD does not control the VSD and City of Coachella treatment facilities, a decision was made at that time not to establish reuse targets for these facilities. However, given the East Valley growth projections and the changing water resources picture, this 2010 WMP Update identifies planning targets for all wastewater treatment facilities in the East Valley. The cities of Indio and Coachella are evaluating the feasibility of recycling water from the Valley Sanitary District and Coachella facilities, respectively (IWA, 2008 and Coachella, 2008).

Two options have been identified to define the range of possible reuse options for the East Valley. Option 1 would involve recycling all wastewater generated by future growth in the East Valley. However, any existing wastewater discharges to the CVSC would continue to maintain flows that support riparian and marsh habitat in the CVSC and at the mouth of the Salton Sea. Option 1 is expected to generate about 37,000 AFY of additional water supply by 2045. Option 2 would involve a “zero discharge” approach where all treated wastewater is reused. This option would eliminate all municipal wastewater discharges to the CVSC but would provide additional water supply benefits. Option 2 could generate about 53,000 AFY of additional water supply in the East Valley; however, there may be an adverse impact on habitat in the CVSC and at the mouth of the Salton Sea. A benefit of Option 2 is that treatment requirements for non-potable water reuse are likely to be less stringent than future regulatory requirements for surface water discharges. Uses for recycled water are discussed in **Section 6.5.1.**

Cost of Recycled Water: The cost of water recycling consists of treatment and distribution components. Tertiary treatment is currently provided at each West Valley reclamation facility; consequently the only treatment costs that might be incurred are related to the future expansion of these facilities. In the East Valley, the wastewater treatment facilities provide secondary-level treatment with disinfection prior to discharge to the CVSC. Additional tertiary treatment will be required to make the recycled water suitable for unrestricted non-potable water uses such as golf course, landscape or agricultural irrigation. The typical cost of adding tertiary treatment is in the range of $250 to $400/AF. Distribution costs vary with the size and distance from the reclamation facility and can range from about $200/AF systems serving large nearby users to more than $1,000/AF for systems serving smaller more scattered users. By comparison, the cost of wastewater treatment for continued discharge will depend on future discharge requirements and the level of treatment needed to meet those requirements. If wastewater discharge requirements become too stringent, the cost of treatment for compliance could exceed the cost of reuse.

6.4.6 Other Local Groundwater

Development in the areas northeast of the San Andreas fault outside the Whitewater River Subbasin could potentially use local groundwater to meet a portion of the new demand. The Fargo Canyon Subarea is located east of the San Andreas fault within the Desert Hot Springs Subbasin. Groundwater is generally of poor quality (TDS >1,000 mg/L) and the native yield is limited. DWR estimated the average mountain runoff to the entire Desert Hot Springs Subbasin to be 2,900 AFY (DWR, 1964). Since the Fargo Canyon subarea represents less than one-third of the subbasin, the natural inflow is likely less than 1,000 AFY.

Since there is currently no significant development in this area, basin return flows are currently minimal. With development, the potential return flows from landscape irrigation might be on the order of 13 percent of total applied water (assuming anticipated demand levels with conservation) or 7,000–11,000 AFY at build-out. Thus, local groundwater might produce 8,000–12,000 AFY assuming capture of all native and return waters. Due to the elevated TDS of groundwater in this subbasin, some level of desalination may be required to make the groundwater suitable for irrigation. Additional investigation of water quality would be required.

6.4.7 Desalinated Drain Water

CVWD plans to use treated agricultural drainage water for irrigation purposes. The 2002 WMP recommended that a drain water desalination facility commence operation between 2010 and 2015 with a 4,000 AFY facility. The facility would be expanded to 11,000 AFY capacity by 2025. Product water would be delivered to the Canal distribution system for non-potable use.

Drain water desalination pilot facility

A brackish groundwater treatment pilot study and feasibility study was completed in 2008 (Malcolm-Pirnie, 2008a and 2008b). A variety of treatment technologies, brine management approaches and source water supply combinations were compared and assessed over a range of treatment capacities. The treatment alternatives compared reverse osmosis (RO) with dew evaporation, and RO was the chosen technology. Source water supply options consist of the collection of agricultural drainage water at select outfall locations and the installation of a well field to extract groundwater in the upper part of the aquifer influencing the agricultural runoff water.

The 2008 study recommended a combined source water strategy involving wells and direct connection to the open drain outfalls. Such a combined approach will provide additional flexibility and reliability to this new water supply. The study also developed a detailed evaluation of performance and cost of the two technologies, and RO was the recommended treatment technology to meet the current water quality goals and provide additional flexibility in the level of water quality produced should the facility’s objectives change in the future. After a similar evaluation of brine management strategies, the recommended approach was to convey the RO concentrate via pipeline to constructed wetlands located at the north shore of the Salton Sea. This approach takes advantage of the water quality characteristics of the RO concentrate to generate and sustain a new saline wetlands habitat. This study concluded that agricultural drainage water can effectively be treated for reuse as non-potable water and potentially as new potable water. The estimated cost of drain water desalination including brine disposal to managed wetlands ranges from $480 to $740/AF depending on the facility capacity and source configuration. Brine disposal by way of zero liquid discharge approaches could increase the cost of drain water desalination to as much as $1,200/AF (CVWD, 2010f).

The amount of drain water that would be treated and recycled depends on supply availability (the amount of drain flow occurring), the overall supply mix (the amount of additional water needed), and the cost of treatment and brine disposal. For this evaluation, a maximum of 100,000 AFY is considered.

Treated drain water could be delivered to the Canal water distribution system and used as a non-potable supply for agricultural, golf course and landscape irrigation and potentially for potable water supply. Since the desalinated drain water is local water, it could be used anywhere within the CVWD service area. This could provide opportunities to deliver the water to users outside the Colorado River service area (ID-1) including the West Valley through a Colorado River water exchange. Such an exchange would involve delivering the treated water to existing Colorado River users in exchange for using an equal amount of Colorado River water elsewhere in the District. This exchange could allow desalinated drain water to be used for recharge at Whitewater or other locations via exchange for Colorado River water. The quality of desalinated drain water exchanged for Colorado River water would be the same as the existing SWP Exchange water.

6.4.8 Desalinated Ocean Water

Coastal communities in southern California are conducting feasibility studies and developing plans to desalinate ocean water as a water supply source. A 50 mgd capacity ocean water desalination in Carlsbad, California has received final approval and is expected to be operational in late 2012, providing water for San Diego County (Poseidon, 2010). This source offers the potential for essentially unlimited water supply. However, desalinating ocean water has relatively high costs due to the energy required to operate reverse osmosis facilities and potential environmental impacts associated with seawater intakes supplying the plant and disposal of brine.

Since the Coachella Valley is located a significant distance from the ocean, desalinated ocean water would need to be exchanged with an imported water source (SWP or Colorado River water) for delivery to the Valley. The amount of water that could be developed through ocean water desalination and exchange is likely to be limited by economics the physical capacity to deliver desalinated ocean water into the coastal water delivery systems and water quality. Conveyance limitations may require that participation in multiple desalination projects be undertaken. Because the quality of desalinated seawater would be better than the exchanged water, a flow adjustment for quality might be required. For the 2010 WMP Update, it is assumed that up to 100,000 AFY of desalinated seawater could be developed and exchanged for Colorado River water. The cost of desalinated seawater is in the range of $1,000 to as much as $2,000/AF of water produced including treatment, conveyance and exchange costs.

6.4.9 Stormwater Capture

Stormwater capture has been identified as a potential method to augment local water supplies in the Coachella Valley. The following presents background information on the stormwater characteristics of the Valley and the potential to capture additional flows.

The Coachella Valley drainage area is approximately 65 percent mountainous and 35 percent typical desert valley with alluvial fan topography buffering the valley floor from the steep mountain slopes. The mean annual precipitation ranges from 44 inches in the San Bernardino Mountains to less than 3 inches at the Salton Sea. Three types of storms produce precipitation in the drainage area: general winter storms, general summer storms and local thunderstorms. Longer duration, lower intensity rainfall events tend to have higher recharge rates, but runoff and flash flooding can result from all three types of storms. Otherwise, there is little or no flow in most of the streams in the drainage area.

The 70-mile-long Whitewater River/Coachella Valley Stormwater Channel and its tributaries have been channelized and improved to safely convey flood flows. Improvements typically consist of debris basins and concrete channels to capture debris and convey flash flood flows to the main channel. Debris basins also have the added benefit of capturing and infiltrating small storm flows, thus enhancing recharge of stormwater. The East Valley and especially the Oasis area on the west side of the Salton Sea lack flood control improvements. As future development occurs in the East Valley and flood control funding becomes available, debris basins and channels will be constructed. Debris basins detain flood flows and enhance stormwater capture (CVWD, 2009). Significant amounts of local runoff are currently captured at the Whitewater River Recharge Facility and in the debris basins and unlined channels of the West Valley. Additional stormwater will be captured when the 1000 Palms Flood Control Project is completed and when flood control is constructed in the Oasis area. However, limited data exist to estimate the amount of additional stormwater that could be captured by new facilities in the Coachella Valley.

CVWD maintains rain and flow gauges and also participates in flow measurement with the USGS, which maintains 16 stream gauging stations in the Valley. Analysis of historical flow data at the Whitewater River station near Indio indicates that average flows are about 3.5 cfs; however, measurable flow only occurs about 2.3 percent of the time or about 8 days per year. When flow is occurring, the average flow rate is 142 cfs with peak flow exceeding 5,000 cfs. The amount of storm water that could be recovered is a function of diversion and storage capacity. For example, if a 10 AF storage facility were constructed, an average of about 50 AFY of additional flow could be captured. A 100 AF facility would capture about 250 AFY on average. A 10,000 AF facility might be required to capture all flow and would yield about 2,600 AFY. Consequently, large-scale stormwater capture is not expected to yield sufficient water to be worth the investment as a single purpose project. However, small-scale stormwater retention systems located in areas of suitable geology to allow percolation could capture small intensity storms as well as street runoff. The potential yield of these smaller systems is not known at this time. Consequently, stormwater capture should be considered in conjunction with projects that construct stormwater and flood control facilities.

6.4.10 Conjunctive Use

Conjunctive use is the coordinated and planned operation of surface and groundwater resources to maximize the overall availability and reliability of regional water supplies. The Coachella Valley has practiced conjunctive use activities since the early 1970s when it began recharging imported SWP Exchange water at the Whitewater River Recharge Facility to replenish the groundwater basin. In the mid-1980s, CVWD, DWA and Metropolitan commenced an advanced delivery operation at Whitewater where Metropolitan stores surplus water for future exchange with CVWD and DWA. This program has allowed the Valley to benefit from higher groundwater levels while water is stored and allowed Metropolitan to essentially discontinue Exchange water deliveries during dry periods, drawing upon its stored water. CVWD and DWA also purchase and store available surplus water for groundwater storage.

With the increased variability of SWP deliveries and uncertainty regarding the QSA, increased emphasis will be placed on conjunctive use. Since the Valley has a large groundwater basin, it can provide groundwater storage opportunities for other water agencies in the State. As part of the QSA, CVWD and IID have signed an agreement that allows IID to store surplus Colorado River water in the Coachella Valley. Under the agreement, CVWD would store water for IID subject to availability of storage space, delivery and recharge capacity and the prior storage rights of CVWD, DWA and Metropolitan. Stored water would incur a 5 percent recharge loss and a 5 percent annual storage loss. IID may also request CVWD to investigate and construct additional locations for direct or in-lieu recharge facilities. CVWD would return stored water to IID by reducing its consumptive use of Colorado River water. This could be accomplished by temporarily reducing or eliminating groundwater recharge. If reduced recharge were not sufficient to produce the required delivery reduction, CVWD or its customers could pump groundwater and reduce Colorado River water deliveries to source substitution projects. This program would benefit Coachella Valley by providing higher levels of groundwater storage while IID water is stored in the Valley.

The 2002 WMP did not identify specific conjunctive use projects, but instead recommended that flexibility be provided for conjunctive use. For the 2010 WMP Update, it is recommended that recharge facilities have sufficient capacity to allow capture of surplus water deliveries during future wet periods. This could be accomplished by providing additional recharge basins or by changing the operations of existing facilities to recharge water on a more continuous basis. The ability to recharge additional water may be limited by water delivery system capacity and the need to meet existing customers' demands.

In addition to providing sufficient recharge capacity, additional pumping capacity may be required to maximize the potential for conjunctive use. Under the Advanced Delivery and Exchange Agreements, the mechanism for returning stored water to entities outside the basin is through a reduction in SWP deliveries. If stored water is to be returned through reductions in Canal water deliveries, then deliveries for recharge would need to be reduced during the payback period. If recharge reductions are insufficient, then reductions in direct deliveries would need to be offset through increased groundwater pumping.

6.5 SOURCE SUBSTITUTION

Source substitution is the delivery of an alternate source of water to users that currently pump groundwater. The substitution of an alternate water source reduces groundwater extraction and allows the groundwater to remain in storage, thus reducing overdraft. Source substitution projects include:

- Conversion of existing and future golf courses in the West Valley from groundwater to recycled water
- Conversion of existing and future golf courses in the East Valley from groundwater to Colorado River water
- Conversion of existing and future golf courses in the West Valley from groundwater to Colorado River water via the Mid-Valley Pipeline
- Conversion of agricultural irrigation from groundwater to Colorado River water, primarily in the Oasis area
- Conversion of urban use from groundwater to treated Colorado River water in the East Valley

- Conversion of outdoor urban use to non-potable water including Colorado River water or recycled water in the East Valley

The following discussion of source substitution projects is presented by water source and by location within the Valley.

6.5.1 Recycled Water Uses

Recycled water is a significant potential local resource that could be used to help reduce overdraft. Wastewater that has been highly treated and disinfected can be reused for landscape irrigation and other purposes; treated wastewater is not suitable for potable use. Recycled wastewater has historically been used for irrigation of golf courses and urban landscaping in the Coachella Valley. Future recycled water uses could also include indirect potable reuse (IPR), which is the planned use of highly treated wastewater to directly augment water supplies via direct or indirect groundwater recharge, or blending with other potable sources.

6.5.1.1 Non-potable Uses

The principal non-potable uses for recycled water in the Coachella Valley are:

- Agricultural irrigation
- Golf course irrigation
- Urban landscape irrigation

Each of these recycled water uses could be implemented through: 1) direct blending with Coachella Canal water and delivery through the existing Canal water distribution system or the MVP system, 2) construction of an isolated distribution system that delivers recycled water only, 3) expansion of existing dedicated recycled water systems to serve new customers, and 4) a combination of these options. Each approach has advantages and disadvantages.

The first option has a significant potential cost advantage in that the distribution system is in place; little additional capital expenditures would be needed to deliver recycled water to a wide range of non-potable water users. Recycled water (even blended with Canal water) may not be acceptable to certain agricultural users; however, the California Department of Public Health (DPH) regulations allow the use of tertiary treated municipal effluent to irrigate "food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop" (CCR Title 22, 2010). However, the introduction of recycled water into the Canal system could pose significant permitting issues for the future potable use of Canal water. This may require isolating portions of the system that receive recycled water from those that would ultimately deliver water to urban water treatment facilities.

The second option would avoid the issues created by serving a blend of recycled and Canal water by operating a dedicated recycled delivery system. However, this option is most feasible where the suitable users are located relatively near the recycled water source. It is also difficult to balance demand and supply with this type of system because irrigation needs fluctuate seasonally.

The third option is partially in place. Existing dedicated recycled water systems have been constructed near each of the West Valley wastewater treatment facilities. Expansion of these systems makes sense when the users can be served recycled water from a cost-effective extension.

The fourth option may be the most viable approach in the East Valley where agriculture is expected to transition to urban land uses. Here, the existing Canal water distribution system can serve Colorado River water to most users. This also allows the system to convey water to future potable water treatment facilities. New non-potable water systems could be designed to use both Canal and recycled water where appropriate. Portions of the Canal distribution system located near the recycled water sources that can be isolated could be used to deliver a blend of water to non-potable customers.

6.5.1.2 Indirect Potable Reuse

An additional recycled water use in the East Valley is indirect potable reuse (IPR). IPR is the planned use of highly treated wastewater to directly augment water supplies. IPR is likely to become an important element of water resources development in southern California due to the limitations on imported water supplies. Orange County Water District and West Basin Municipal Water District have been pioneers in the development of IPR for injection at the coastal seawater intrusion barriers. Several other agencies in southern California including Metropolitan, Los Angeles County Sanitation Districts, Water Replenishment District of Southern California, Upper San Gabriel Valley Municipal Water District, Eastern Municipal Water District and the City of San Diego are investigating IPR for either groundwater replenishment through surface spreading and/or injection prior to extraction or blending with surface water supplies prior to diversion for potable use.

In all cases, multiple barriers are provided to protect the safety of the water supply. Most commonly, membrane treatment processes (microfiltration/nanofiltration and reverse osmosis) followed by ultraviolet light and hydrogen peroxide addition are being used or investigated to meet the stringent public health requirements established by the State of California DPH and the Regional Boards. In addition, strict source control programs prevent the introduction of harmful pollutants to the wastewater supply coupled with comprehensive monitoring and blending with natural and imported water supplies. The cost for IPR is high due to the extensive treatment requirements with capital costs in the range of $4.50 to $6.50 per gallon of plant capacity. Including conveyance and operations/maintenance costs, recent IPR projects have unit costs in the range of $900-$1,200/AF.

In the Coachella Valley, IPR could be practiced through treatment and groundwater recharge via spreading or injection or through treatment and blending with Coachella Canal water. However, it is likely that simple blending with Coachella Canal water may not provide sufficient retention time to satisfy the regulatory agencies without construction of a large surface reservoir. IPR is an emerging approach that may be considered in future WMP updates, but are not included in the 2010 Plan Update.

6.5.2 Groundwater to Canal Water Conversion

Canal water is a significant water supply source for the Coachella Valley. One of the underlying principles in the development of the 2010 WMP Update is to fully use the available Canal water supply. This is achieved by conversion of agricultural users and golf courses from groundwater to Canal water, development of dual piping for urban users and treatment of Canal water for urban use and groundwater recharge. Recharge activities are discussed in **Section 6.6**.

6.5.2.1 Agricultural Conversion from Groundwater

Agriculture accounted for approximately 314,000 AFY (69 percent) of the water use in the Coachella Valley in 2009. Of the total agricultural use, about 66,000 AFY of demand is estimated to be supplied from groundwater pumping.[2]

The 2002 WMP focused on conversion of agricultural groundwater use to Canal water use and proposed two principal measures:

- expansion of the distribution system to areas within ID-1 not served by the current distribution system, and
- conversion of groundwater users who have Canal water available for use but choose to irrigate with groundwater

Expansion of the Canal Water Distribution System: CVWD is currently working with two farming groups (Gold Coast Growers and Ocean Mist, et al.) to extend the Canal water delivery system to serve agricultural operations that are not currently served with Canal water. One extension will deliver water outside the ID-1 to serve agriculture that pumps groundwater from the Lower Whitewater River Subbasin. The other extension will serve a group of farmers located south of Mecca in a portion of the ID-1 service area that did not originally receive Canal water. Implementation of these two extensions will increase Canal water use by about 5,300 AFY.

A third location of potential expansion of the Canal water delivery system is the Oasis area. This area is included in the ID-1 service area but did not receive Canal water because the soils were not suitable for farming based on the irrigation technology of the time. Currently, much of this area is irrigated with groundwater using drip irrigation.

In 1996, CVWD completed a study investigating the feasibility of expanding the distribution system to serve farmers on the Oasis slopes (Summers, 1996). Desalinated drain water and recycled water would be served to the areas outside ID-1 via an exchange to avoid then existent limitations preventing delivery of Canal water outside ID-1. The 2002 WMP recommended construction of this system with additional facilities to serve farmers located outside ID-1 with the system being operational in the mid-2020s. However, farmers considered the system too costly. Recently, there has been renewed interest in expanding the irrigation system in the Oasis

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[2] Reported pumping in 2009 was 25,748 AFY. About 40,000 AFY of additional pumping is estimated based on historical power records.

area. Since the QSA now allows Canal water to be used outside ID-1 to reduce groundwater overdraft in ID-1, the need for delivering non-Canal water via exchange has been eliminated. If completed, this system is expected to deliver about 27,000 AFY of Canal water to offset groundwater pumping. As development occurs in the Oasis area, the system could be converted to serve non-potable water for landscape irrigation.

A 1958 agreement between CVWD and Reclamation allows the extension of the Canal water distribution system to serve tribal lands if requested by the tribes. The cost of the extension is to be paid by the federal government. The Torres-Martinez tribe has expressed interest in obtaining Canal water service. Since much of the land is not currently farmed, this represents a new use of Canal water. The potential amount of Canal water that could be used has not been quantified.

Increased Use by Existing Canal Water Customers: A review of reported groundwater extraction from the Engineer's Report on Water Supply and Replenishment Assessment for the Lower Whitewater River Subbasin Area of Benefit (CVWD, 2010b) shows agriculture pumped at least 25,748 AFY in 2009. It is believed that significantly more agricultural pumping (up to 40,000 AFY) may be unreported, based on historical power records. Eight of the largest farming operations that pump 1,000 AFY or more represent 92 percent of the reported agricultural pumping. Most of these operations are within the ID-1 service area. Of these, about 65 percent of their water use is from groundwater and 35 percent is Canal water.

If these operations could increase their Canal water use to 90 percent of their demand, then 20,700 AFY of additional Canal water could be utilized, with a corresponding reduction in groundwater overdraft. Since many of these agricultural operations have Canal water connections, it is expected that little additional cost would be incurred to increase their usage. The District should determine what obstacles exist that prevent these pumpers from using additional Canal water and encourage them to reduce their groundwater pumping.

Summary of Agriculture Conversion Potential. For the 2010 WMP Update, agricultural use of groundwater is assumed to decrease from about 66,000 AFY in 2009 to about 7,000 AFY by 2045, a decrease of 59,000 AFY or 89 percent.

6.5.2.2 Golf Course Conversion

There are currently about 80 golf courses in the West Valley and 35 golf courses in the East Valley (Palm Springs Life, 2010). Additional golf courses are expected to be constructed as development occurs, primarily in the East Valley. In 2010, CVWD developed a new non-potable water use agreement that requires golf courses with access to Canal or recycled water to meet at least 80 percent of their irrigation demand from that source (CVWD, 2010e). For the 2010 WMP Update, a target is established of 90 percent use of Canal water by 2015.

East Valley Golf Course Conversion: The use of Canal water by golf courses has increased from 6,500 AFY in 1999 to 14,900 AFY in 2009 in the East Valley. There are 19 existing golf course operations in the East Valley that have Canal water connections. The total water usage (Canal water and groundwater) for these courses was 26,100 AFY in 2009. Existing Canal water use constituted approximately 57 percent of their total annual water use. Based on the 90 percent non-potable usage target, there is a potential for an additional 8,800 AFY of Canal water usage at these golf courses. Since these customers have Canal water connections, there is little additional cost associated with increasing their non-potable water use.

In addition to golf courses that currently have Canal water connections, there are nine golf course operations that rely solely on groundwater. In 2009, these courses used about 8,300 AFY of groundwater. All of these courses are located within or adjacent to ID-1; however, not all have access to Canal water. The Canal water distribution system is nearby the Eagle Falls, Indian Palms, La Quinta Country Club, La Quinta Resort and Rancho Casablanca courses. However, the system would need to be extended about one mile to serve The Quarry and several miles to serve Bermuda Dunes and Palm Royale. The district plans to serve the latter two courses from the MVP. These courses could reduce their groundwater pumping by up to 7,800 AFY when connected to non-potable water.

CVWD currently requires new golf courses with access to Canal water to meet at least 80 percent of their demand with that source. With an estimated additional demand of 34,000 AFY, new courses should use at least 27,000 AFY of Canal water. Based on this assessment, non-potable water use by golf courses could reduce groundwater pumping by 44,000 AFY by 2045 as shown in **Table 6-3**.

Table 6-3
East Valley Golf Course Conversion Potential

User	Demand (AFY)	Current Non-potable Use [1] (AFY)	Future Non-potable Use [2] (AFY)	Pumping Reduction (AFY)
Existing Courses with Canal Water Connections	26,100	14,900	23,900	8,800
Existing Courses without Canal Water	9,200	0	8,300	8,300
New Courses	34,000	0	27,000	27,000
Totals	**69,300**	**14,900**	**59,200**	**44,100**

1 Current non-potable use is Canal water.
2 Future non-potable use includes both Canal water and recycled water.

West Valley Golf Course Conversion: In the West Valley, the MVP will provide 37,000 AFY of Canal water and 15,000 AFY of WRP-10 recycled water to golf courses in lieu of groundwater pumping. The MVP project is discussed further in **Section 6.5.3.** Additional golf course conversion in the West Valley could be accomplished using recycled water from the DWA Water Reclamation Plant and WRP-7. Canal water, amounting to 2,300 AFY, will also be provided to Mountain Vista, Shadow Hills and Classic Club in the West Valley by 2045. Conversion of all feasible golf courses in the West Valley to use at least 80 percent non-potable water would reduce groundwater pumping by 56,800 AFY by 2045 as shown in **Table 6-4**. These figures are applied in the 2010 Plan Update.

6.5.2.3 Potable Urban Use in the East Valley

As growth occurs in the East Valley and farms are converted to urban land uses, agricultural demand for Canal water will decrease. To avoid increased urban groundwater pumping, there will be a need to begin treating Canal water for urban use. The 2002 WMP anticipated this need and proposed that treatment be provided beginning in the late 2020s and about 32,000 AFY be treated by 2035. Increased domestic water demand coupled with reduced agricultural demand is expected to increase this amount.

Table 6-4
West Valley Golf Course Conversion Potential

User	Demand (AFY)	Current Non-potable Use [1] (AFY)	Future Non-potable Use [2] (AFY)	Pumping Reduction (AFY)
Palm Springs Area Courses	16,500	4,300	13,200	8,900
Mid-Valley Courses	50,700	6,600	45,600	39,000
North Indio Area Courses	4,800	4,300	4,300	0
New Courses	11,200	0	8,900	8,900
Totals	**83,200**	**15,200**	**72,000**	**56,800**

1 Current non-potable use is principally recycled water with limited Canal water use.
2 Future non-potable use includes both recycled water and Canal water.

Several possible approaches exist for defining the range of treated Canal water required in the future. By 2045, urban water demand in the East Valley is projected to be about 190,000 AFY with conservation. Because water treatment infrastructure is relatively costly, one approach would be to treat only the amount of potable demand created by new growth. Since about 25 percent of domestic water is used for potable purposes, about 48,000 AFY of treatment would be required to meet new indoor potable demands in the East Valley. A somewhat larger program might involve treating all indoor demands in the East Valley. Based upon a 2045 urban demand of about 265,000 AFY (with conservation), about 62,000 AFY of treated Canal water could be used to meet the indoor water demands. A third approach would be to treat all urban water demand not met by groundwater and non-potable Canal water deliveries. This might require 75,000 to 90,000 AFY of treated water depending on the amount of non-potable water delivered for irrigation. Using these approaches, treated Canal water capacities might range from 48,000 to 90,000 AFY compared to the 32,000 AFY identified in the 2002 WMP. This represents a significant increase in the amount of Canal water that would be treated for urban use compared to the 2002 WMP. Treatment strategies are discussed further in **Section 6.7.1**.

6.5.2.4 Non-potable Urban Water Systems in the East Valley

One approach for reducing future groundwater use and overdraft while increasing Canal water use is the installation of dual source water systems, which refers to the operation of separate but parallel potable and non-potable systems to serve urban development.

An urban non-potable distribution system may be achieved by the following methods:

- Developer installation of on-site non-potable irrigation system (treatment if needed, storage, pumping and piping) which connects to Canal water distribution system or recycled water systems as available and feasible.
- Rehabilitation and extension of the existing Canal delivery system, as needed
- Separate potable water system that meets indoor and other uses requiring a potable supply.

A separate non-potable system could reduce the amount of groundwater that would have to be treated for arsenic removal, minimize the number of new wells required to serve growth and could be designed to meet fire protection needs, thus reducing the size of the potable water system. In addition, delivery of non-potable water for urban use would reduce the amount of Canal water treatment need for potable use. The non-potable system would need to be distinguishable from the potable water system to prevent cross-contamination and backflow issues. In California, non-potable systems are installed using "purple pipe" in compliance with the California Health and Safety Code §116815, to clearly indicate that the water is not for drinking purposes.

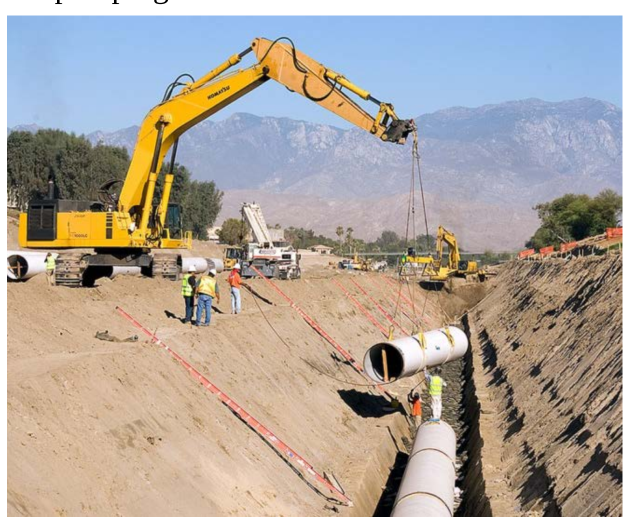
For this 2010 WMP Update, it is estimated that distribution systems could be installed for at least two-thirds to as much as 80 percent of the new development in the East Valley by 2045. This estimate is based on the following:

- Growth will create about 190,000 AFY of new demand in the East Valley with conservation. Of this amount, about 75 percent or 143,000 AFY is expected to be outdoor demand.
- Larger developments must mitigate for their incremental demand on the basin.
- Large developments are more likely to have the financial capability to distribute the costs of infrastructure among more housing units, thereby lowering the individual unit's cost.

Based on these premises, about 95,000 to 115,000 AFY of non-potable use with Canal water and desalinated drain water could potentially be implemented by 2045. Additional investigations should be conducted into the feasibility of delivering non-potable water on this scale over the next five years.

6.5.3 Mid-Valley Pipeline

The MVP is a pipeline distribution system to deliver Colorado River water to the Mid-Valley area for use with CVWD's recycled water for golf courses and open space irrigation. This source substitution project will reduce groundwater pumping for these uses. Construction of the first phase of the MVP from the Coachella Canal in Indio to WRP-10 (6.6 miles in length) was completed in 2009. Implementation of later phases will expand the MVP to be able to serve approximately 50 golf courses in the Rancho Mirage-Palm Desert-Indian Wells area that currently use groundwater as their primary source of supply with a mixture of Colorado River water and recycled water.



Construction of the Mid-Valley Pipeline

The 2010 WMP Update assumes that the MVP will serve about 37,000 AFY of imported water and 15,000 AFY of WRP-10 recycled water on average by 2045. The

MVP will meet approximately 72 percent of the West Valley golf course demand by 2045.

Since the MVP has not been fully implemented, the amount of water it can currently deliver is limited by the demands of existing non-potable customers. There are eight golf courses and five other users in the West Valley currently connected to the WRP-10 recycled water system, which can receive both recycled water and canal water via the MVP. If all of these courses use at least 90 percent of their irrigation needs with non-potable water, then about 2,700 acre-ft/ of groundwater pumping could be eliminated.

There are four golf courses adjacent to the MVP that can be connected to the system by undertaking minimal construction, thus making them ideal candidates to receive Canal water through the MVP. In fact, construction of Phase 1 of the MVP included outlets along the pipeline to serve these courses. However, pipeline connections to deliver Canal water from the MVP to each course have yet to be constructed. When all of these courses are connected, about 4,500 AFY of additional pumping could be eliminated. At least ten additional courses could be connected to the MVP downstream of WRP-10 with relatively simple pipeline connections, reducing pumping by about 11,200 AFY. In total, about 18,400 AFY of golf course pumping could be eliminated.

In addition to delivering water for non-potable uses, another possible use for the MVP is conveyance of Canal water to urban water treatment facilities. Although this use was not contemplated when the MVP concept was developed, it is possible that one or more small-scale water treatment facilities could be constructed to offset urban groundwater pumping. The locations and economic feasibility of this approach has not been evaluated. However, since the MVP has a capacity of 92 cfs at the Coachella Canal diversion, conveyance of Canal water to water treatment facilities would reduce the capacity available to serve golf courses. Thus the cost to treat and deliver potable water would need to be compared with the cost to expand the MVP distribution system to serve additional golf courses.

CVWD should implement the near-term extensions to the MVP and prepare a master plan to lay out the remainder of the MVP system. In addition to non-potable uses, the feasibility of using a portion of the capacity to treat water for urban water uses will be evaluated.

6.5.4 Source Substitution Scenarios

Potential source substitution options are arrayed by size as summarized in **Table 6-5**. For this table, the amount of source substitution is determined by comparing the change in groundwater production after deducting the effects of planned water conservation. The amounts of source substitution included in the 2002 WMP are also shown for comparison.

6.6 GROUNDWATER RECHARGE

Groundwater recharge is an important component of basin management. Groundwater recharge can be accomplished by surface spreading or by injection. The feasibility of each method is a function of geologic conditions, land availability, cost and other factors. With surface spreading, water is placed in shallow ponds where it is allowed to percolate into the underlying aquifers. Surface spreading requires large areas of open land for construction of ponds and the absence of significant confining clay layers that would prevent the water from reaching the aquifers. With injection, water is put directly into the aquifers through a well. Frequently, injection wells are also used to extract the stored water. Injection wells have a relatively small footprint compared to recharge basins and the cost is only slightly higher than the cost of a new production well; however, injected water needs to be treated prior to injection to ensure that it meets drinking water regulations and to prevent well clogging.

Table 6-5
Range of Source Substitution Options

Scenario	Agriculture (AFY)	Golf Courses (AFY)	Urban-Treated (AFY)	Urban-Untreated (AFY)	Total (AFY)
2002 WMP	51,000	59,000	32,000	0	142,000
Minimum	5,300	108,200	48,000	95,000	256,500
Moderate	33,000	120,000	62,000	105,000	320,000
Maximum	38,000	142,600	90,000	115,000	385,600

Since 1973, CVWD and DWA have recharged the West Valley basin at the Whitewater River Spreading Facility with over two million AF of SWP Exchange water. As a part of the 2002 WMP, CVWD investigated recharge in the East Valley using Colorado River water and finished construction at the Thomas E. Levy Groundwater Replenishment Facility (Levy facility) and is planning the construction of another major recharge facility at Martinez Canyon. Additional surface recharge sites in the Mid-Valley area will be considered on the basis of geologic suitability and availability of sufficient vacant land.

6.6.1 West Valley Recharge Facility

The Whitewater River Recharge Facility has a recharge capacity of in excess of 300,000 AFY. The 2002 WMP established a future average annual recharge goal at this facility of about 100,000 AFY. Consequently, no additional recharge capacity expansion is required. The available capacity is valuable for conjunctive use operations by CVWD and DWA as well as Metropolitan or other interested parties.

Whitewater River Spreading Facility located north of Palm Springs

As described in **Section 6.4.2**, to reach the 100,000 AFY goal for the Whitewater facility, CVWD and DWA would need to acquire additional SWP Table A Amounts or other imported water sources. As discussed in **Section 4**, the SWP Exchange supply can currently provide about 77,700 AFY for the Whitewater facility. However, the 2010 WMP Update assumes the reliability of the SWP will decline to about 50 percent of the Table A Amounts without improvements in the Delta. Consequently, under future conditions, it is possible that recharge at Whitewater could be limited to the available future supply of about 61,400 AFY unless it is augmented with other supplies. If Delta habitat and conveyance improvements can be successfully implemented, this supply could increase to 93,000 AFY.

6.6.2 East Valley Recharge Facilities

CVWD has operated a pilot recharge facility at Dike 4 near Avenue 62 since 1997. Construction of the full-scale Levy facility was completed in mid-2009. This facility is located on the west side of the Valley in La Quinta and has an estimated average recharge capacity of 40,000 AFY. Currently, the capacity is limited by hydraulic and water delivery constraints within the Canal water distribution system to a long-term average of about 32,000 AFY. Consequently, construction of an additional pipeline and pumping station from Lake Cahuilla may be required in the future.

Thomas E. Levy Groundwater Replenishment Facility located in La Quinta

The Martinez Canyon recharge facility is a pilot project underway since 2005. Upon completion of a full-scale facility, this project (according to the 2010 WMP Update) is expected to recharge 20,000 to 40,000 AFY on average. The Martinez Canyon facility is projected to start initial operation in 2016 and is expected to reach full capacity by 2018.

CVWD is also evaluating alternative recharge locations that might allow recharge in the vicinity of areas of significant groundwater pumping. A settlement agreement between the City of Indio and CVWD specifies a process for proposing and evaluating additional recharge facilities in the vicinity of Indio (CVWD-Indio, 2009). CVWD and the City of Indio are investigating the potential of a recharge site within the City of Indio which would benefit the Indio area.

IWA conducted a preliminary investigation (performed by Petra Geotechnical) that identified Posse Park (Avenue 42 and Golf Center Parkway adjacent to the Coachella Canal) as a potential location for recharge of both the upper and lower Coachella Valley aquifer by either spreading or injection wells. IWA recently drilled two exploratory wells at this location and plans to conduct further studies to validate the use of Posse Park to replenish the aquifer. The amount of potential recharge at this location has not been determined. The 2010 WMP Update assumes for planning purposes that an Indio facility could recharge 10,000 AFY.

As discussed previously, surface recharge facilities are only effective in areas where the geology is suitable. In the Coachella Valley, significant portions of the East Valley are underlain by relatively thick clay and silt which impedes the vertical percolation of water into the deep aquifers from which most groundwater is produced. Consequently, most surface recharge facilities are located on the fringes of the East Valley where these clay and silt layers are not present. As an alternative, the groundwater basin can also be recharged by injection through either dedicated recharge wells or aquifer storage and recovery (ASR) wells which can be used for both recharge and groundwater production. Injection has the benefit of placing replenishment water at the same location where pumping has occurred. However, injection requires a high quality, turbidity-free source of water. In most areas where injection is practiced, a treated water source that meets federal and state surface water treatment rules is used.

Injection was considered in the 2002 WMP as a potential means of recharge. However, injection was deferred from consideration at that time due to the cost. In the future, injection may become more viable as a recharge approach when treated Colorado River water becomes more widely available. However, impacts of injection on local water quality may affect feasibility.

6.6.3 Recharge Scenarios

Three alternative recharge scenarios are considered for possible implementation in the 2010 WMP Update: minimum, intermediate and maximum.

A minimum scenario would involve continued operation of the existing Whitewater, Levy and Martinez recharge facilities based on capacity and existing supply limitations. Recharge at Whitewater is assumed to be limited by future SWP supply availability (about 61,400 AFY) without Delta habitat and conveyance improvements. In the East Valley, the Levy facility would operate at 40,000 AFY and the Martinez demonstration project operate at 3,000 AFY. This would provide about 101,000 AFY of recharge on average.

An intermediate scenario is considered that is similar to that proposed in the 2002 WMP. This option would increase recharge at Whitewater to 100,000 AFY through the use of supplemental water from either the QSA or agricultural drain desalination, construct the Martinez facility to an average capacity of 40,000 AFY as indicated in the 2002 WMP, and add recharge at a potential site in Indio. This would increase the total recharge capacity to 190,000 AFY on average. Recharge at the Levy and Martinez facilities could be adjusted if needed to manage water levels and drain flows.

The maximum scenario would maximize recharge by significantly increasing recharge at each of the three East Valley facilities. This scenario could be coupled with a minimum source substitution option but would require a significant increase in groundwater pumping capability. Based on modeling results, it is unclear whether this maximum option is technically feasible due to mounding at the recharge sites, a condition that occurs when recharging at a faster rate than the rate at which water can be flow downward and outward through the soil into the basin (transmissivity rate). This is a hydrogeologic constraint, and the only possible solution would be to recharge at lower rates, but at more recharge sites. Since the number of sites where recharge is viable in the East Valley is limited, a different approach to recharge such as the use of injection wells might be required. Should injection wells prove cost-effective in the Valley, this recommendation should be revisited. **Table 6-6** presents the range of recharge options considered.

6.7 WATER QUALITY IMPROVEMENTS

Water quality has been identified as a significant issue. **Section 5** identifies several water quality issues including salinity and metals such as arsenic.

Table 6-6
Range of Groundwater Recharge Scenarios

Scenario [1]	Whitewater (AFY)	Levy (Dike 4) (AFY)	Martinez (AFY)	Indio [4] (AFY)	Total (AFY)
2002 WMP [2]	103,000	40,000	40,000	0	183,000
Minimum [3]	61,000	40,000	3,000	0	104,000
Moderate	100,000	40,000	40,000	10,000	190,000

Notes:
1. Maximum recharge was dropped due to technical feasibility concerns.
2. The 2002 WMP envisioned 140,000 AFY of SWP Exchange water, of which 37,000 AFY would be used to supply the MVP.
3. Whitewater recharge is limited by the amount of available supply.
4. Indio recharge is tentatively set at 10,000 AFY until studies indicate the actual capacity that could be implemented.

6.7.1 Urban Water Treatment

The use of Colorado River Water (Canal water) for potable uses will require treatment to meet drinking water regulations. In anticipation of constructing potable water treatment facilities, CVWD completed a pilot treatability study for Canal water in 2008 (Malcolm-Pirnie, 2008c). This study investigated three alternative treatment approaches for meeting the Surface Water Treatment Rule and reverse osmosis to improve the salinity of Colorado River water delivered for urban use. The study recommended that blending of treated Colorado River water with local groundwater be carefully evaluated to minimize the potential for customer complaints.

The size of individual water treatment plants is a function of economies of scale with larger facilities being more cost-effective than small facilities. However, larger treatment plants require higher capacity transmission pipelines to deliver the water to the distribution system. Since the current potable water systems are designed around a highly distributed groundwater source, the cost of treated water transmission may be more costly for larger treatment facilities. Consequently, an investigation of the economic tradeoffs between large-scale centralized facilities and small scale facilities should be conducted.

6.7.2 Recharge Water Quality Improvement

The Colorado River water delivered to the Coachella Valley contains more than one ton of salt in every acre-foot of water delivered (600 to 700 ppm). If outflows to the Salton Sea are not sufficient, this salt accumulates in the groundwater basin. The Native American tribes and other interested parties have expressed concern about the long-term effect that increased recharge with Colorado River water might have on Valley groundwater quality. Although this concern was addressed in the 2002 WMP and a Statement of Overriding Considerations was adopted for the PEIR, this concern remains. Two options have been identified for reducing the salt load of the water used for recharge: desalination and importation of SWP water.

6.7.2.1 Colorado River Desalination

Desalination of Colorado River water has been mentioned as an approach for reducing the salt load in the recharged water. As discussed above, CVWD conducted pilot testing of alternative treatment processes which concluded that reverse osmosis was the only viable approach for removing salt from the Colorado River water. If desalination were determined to be the best approach for water quality improvement, three or more separate treatment facilities might be required, one at each recharge location. Significant issues impacting a decision to implement desalination prior to recharge include the cost of treatment, methods and costs of brine disposal, and how the costs of treatment would be recovered. Preliminary costs to desalinate Colorado River water are in the range of $500 to $650/AF depending on the desired treated water salinity (Malcolm-Pirnie, 2008c). In addition, between 10 and 20 percent of the treated water would be lost as brine. Brine disposal methods involving zero liquid discharge might reduce these losses but could increase the cost to more than $1,000/AF. Initial investigations indicate that if the cost of recharge water desalination were borne by the groundwater producers, the replenishment assessment charge might triple in the West Valley and increase more than seven times its current level in the East Valley. It is believed this level of cost increase would have a devastating effect on the local economy.

6.7.2.2 SWP Importation

Direct importation of SWP water to the Coachella Valley has been considered since 1963. Direct delivery of SWP offers the potential for improved water quality compared to the current SWP Exchange with Metropolitan. However, previous investigations concluded that the cost of constructing a conveyance facility was too great. In 2007, CVWD and DWA in association with Metropolitan, San Gorgonio Pass Water Agency and Mojave Water Agency commenced an investigation of alternative routes for a Coachella Valley extension of the California Aqueduct. This study initially considered four alternative alignment corridors: 1) North Pass alignment from Devil Canyon Afterbay in San Bernardino roughly paralleling Interstate 10 to the Whitewater River area, 2) South Pass alignment from Lake Perris roughly paralleling CA-60 to Beaumont and then following the I-10 corridor, 3) San Jacinto Tunnel alignment from Lake Perris paralleling Metropolitan's San Jacinto Tunnel and then following the I-10 corridor, and 4) a Lucerne Valley alignment through the high desert from Hesperia through Yucca Valley and into the Coachella Valley. More detailed studies focused on a Modified North Pass alignment that included joint use of a portion Metropolitan's Inland Feeder system and the Lucerne Valley alignment.

These studies are expected to be completed in 2010. The participating agencies will then decide whether to proceed with detailed environmental studies for CEQA and NEPA compliance. Construction of a SWP extension could cost in the range of $1.0 to 1.5 billion dollars and have an average cost of $450-600/AF of water delivered. This option would be capable of reducing the salinity of water recharged at the Whitewater and Mission Creek recharge facilities from about 700 mg/L to about 350 mg/L. However, it would have no effect on the salinity of Canal water recharged in the East Valley.

Both of these approaches involve significant capital and operating costs. If the cost of recharge water desalination or SWP importation were borne solely by groundwater producers through the replenishment assessment charges, these producers might expect a significant increase in their costs which could affect their ability to operate. Assessment of this impact is beyond the scope of the 2010 WMP Update. Therefore, these options are not considered in the 2010 WMP Update. Consequently, methods for improving recharge water quality might be considered as part of the future Integrated Regional Water Management Plan (IRWMP) or similar approach involving broad stakeholder involvement.

6.7.3 Groundwater Quality and Treatment

A wide variety of water quality constituents can affect groundwater use. Among the more important for the Coachella Valley are:

- Salinity
- Nitrate
- Fluoride
- Arsenic
- Chromium VI
- Perchlorate
- MTBE
- VOCs
- DBCP

Several of these constituents are discussed in **Section 5.1.3** and are considered to be emerging issues because they do not violate water quality standards. In addition to salinity, the water quality constituents of primary concern for the 2010 WMP Update are arsenic, fluoride and dibromochloropropane (DBCP). Other constituents will continue to be monitored for possible action in the future.

The quality of Coachella Valley groundwater is high and most of the groundwater delivered to urban customers receives only disinfection. Currently, the only groundwater treatment being undertaken is for arsenic removal in the East Valley. Naturally-occurring arsenic is found in the eastern Coachella Valley groundwater from Mecca to Oasis and appears to be associated with local faults and geothermal activity. CVWD identified six of its domestic water wells that showed arsenic levels above the revised federal maximum contaminant limit (MCL) (0.01 mg/L). In early 2006, CVWD completed construction of three groundwater treatment facilities that use an ion-exchange process with a brine minimization and treatment process to remove arsenic. If needed, they can be expanded to treat additional wells in the future.

A number of mobile home and recreational vehicle (RV) parks in the East Valley that utilize private wells have arsenic levels that exceed the drinking water regulations. In addition, several tribal wells have arsenic levels exceeding the MCL. These parks are served by private wells and are located some distance from CVWD’s potable water system. CVWD is working with Riverside County and the Torres-Martinez tribe and has applied for federal grants to fund a portion of the cost to extend the potable water system to these communities. CVWD is also evaluating the feasibility of treating Colorado River water instead of constructing additional groundwater treatment facilities.

Fluoride is a naturally occurring element that is found in concentrations exceeding drinking water regulations (2 mg/L) in portions of the Coachella Valley. Most commonly, elevated fluoride concentrations are found near faults and geothermally active areas such as near the San

Andreas fault and in the Oasis area. CVWD typically avoids drilling wells in these areas. However, private drinking water wells drilled in susceptible areas may have high fluoride concentrations. Fluoride can be removed from water by using reverse osmosis or activated alumina filtration.

Between 1955 and 1977, DBCP was injected into the soil to control nematodes, parasitic thread-like worms that damage the roots of crops and other plants. DBCP was used in portions of the Coachella Valley, most notably in an area north of Interstate 10 and west of Indio. Detectable concentrations of DBCP that do not exceed drinking water regulations (less than 0.2 µg/L) have occasionally been found in the groundwater of this area. CVWD water quality specialists are concerned that groundwater recharge activities in this area could raise water levels and allow the migration of DBCP to potable water wells. Consequently, the 2010 WMP Update has avoided locating recharge facilities in this area.

6.8 OTHER MANAGEMENT ACTIVITIES

In addition to the five principal management elements described in this Section, additional management considerations are discussed in this section. These include source water protection programs, drainage control, flood control, data monitoring and management, and stakeholder involvement.

6.8.1 Source Water Protection

Well management programs are required to ensure that existing and future wells do not impact the usability of the groundwater resource. Specific programs applicable to the Coachella Valley are: well construction/destruction/abandonment policies, artesian well management and well capping. Each program is described below.

6.8.1.1 Construction/Destruction/Abandonment Policies

Improperly constructed wells can result in poor yield and contaminated groundwater by establishing a pathway for pollutants to enter a well, allow communication between aquifers of varying quality, or the unauthorized disposal of waste into the well. Inactive or improperly abandoned wells present a physical danger and can allow groundwater pollution.

Well construction, destruction and abandonment policies should be developed in cooperation with Riverside County. These policies should include the following principles:

- All wells drilled in the Coachella Valley must be in compliance with the California Water Code §13700 through §13806.
- All well drilling contractors must be in possession of an active C-57 Contractor’s license.
- Permits for the drilling, deepening, modification, or repair of any well must be obtained and be in accordance with Riverside County Ordinance 682.3. These permits should conform to well construction standards that are specified in DWR Bulletins 74-81 and 74-90.

- All wells within the Coachella Valley, whether active, inactive, abandoned or improperly destroyed, should be identified by conducting a well canvass. All identified wells should be included in the groundwater GIS.
- The status of all wells should be evaluated to identify which wells should be destroyed and which wells can be capped or retained as monitoring wells. If no future use is anticipated, wells must be properly destroyed according to the destruction procedures are also specified in the DWR Bulletins 74-81 and 74-90. If future use is anticipated, wells can be capped and maintained as outlined in Riverside County Ordinance 682.3 (Riverside County, 1999).
- Coordination between Riverside County and the District should take place to ensure that property owners, who are responsible for proper well destruction and capping of wells, follow the destruction procedures and guidelines.

6.8.1.2 Artesian Well Management Program

The State of California defines an artesian well as "… any artificial hole made in the ground through which water naturally flows from subterranean sources to the surface of the ground for any length of time." (Water Code, Section 300) Historically, artesian groundwater conditions existed in much of the East Valley. In the vicinity of Lincoln Street and Avenue 72, about 30 ft of artesian pressure occurred in 1939 (Huberty, 1948). DWR estimated flows from 21 artesian wells and three springs to be about 2,400 AFY in the summer of 1961 (DWR, 1964). Artesian flows occurred in decreasing amounts until the early 1990s (CVWD, 2010g).

Artesian Well in the East Valley

As water management actions in the Valley restore water levels, groundwater levels in the deep aquifers will once again become higher than the ground elevation, resulting in artesian conditions. Recently, evidence of a return to artesian flowing conditions has been observed near Mecca.

Although artesian flowing conditions can reduce the amount of pumping energy required to extract groundwater, most wells are not properly equipped to deal with artesian pressure. This can result in loss of water from improperly controlled wells. Water from flowing wells could also cause property damage if not routed to drainage channels. Such nuisance water flows could cause issues with vectors. Under State Law, allowing an artesian well to flow uncontrolled without putting the water to beneficial use is considered a waste. Any artesian well which is not capped or equipped with a mechanical appliance which will effectively arrest and prevent the flow of any water from the well is a public nuisance, a misdemeanor under California law.

To avoid unnecessary waste of water and the potential for property damage, CVWD will develop a program to educate and work with well owners to properly control artesian wells. The California Groundwater Association has prepared standards of practice for management of artesian wells which should be provided to affected well owners.

6.8.1.3 Well Capping Program

As discussed in **Section 6.8.1.1**, unused and improperly abandoned wells can provide a pathway for groundwater contamination. Rather than destroying the wells, a capping program could allow the well's continued use for groundwater monitoring.

CVWD will implement a cooperative program to identify and cap wells that are no longer being used for groundwater production.

6.8.2 Drainage Control

Throughout geologic time, the Colorado River would flood, carving new channels on its way to the Gulf of California. Historic evidence and geologic studies have shown that the Colorado River periodically changed course near its delta and flowed into the Salton Sink, the basin currently occupied by the Salton Sea. Freshwater lakes formed in the Salton Sink until the river again changed course. These lakes deposited significant layers of fine-grained sediments which underlie much of the East Valley from Indio south. Much of these soils contained large amounts of salt, left by the evaporating lakes.

The arrival of Coachella Canal water brought a significant increase in agricultural activities. Land previously considered too salty for agriculture could now be irrigated if the fine-grained soils could be leached of salt and the shallow water levels could be maintained below the rooting depth. This was accomplished by the construction of subsurface agricultural tile drains buried at depths between 5 and 10 ft below ground which collect the shallow saline groundwater and convey it to the Salton Sea. The first farm drainage systems were installed in February 1950. From the early 1950s through the 1970s, CVWD constructed more than 187 miles of open channel and pipe drains and farmers constructed nearly 2,300 miles of shallower tile drains. Today, about 37,400 acres of land have tile drains. Most of the drains empty into the CVSC; however, 25 smaller open channel drains at the southern end of the Coachella Valley discharge directly to the Salton Sea. These drains are the principal mechanism for exporting salt from the groundwater basin.

Since most of the original drainage system was constructed more than 50 years ago, it is approaching the end of its useful life. Significant maintenance and replacement will be required. The anticipated transition of land use from agriculture to urban will not eliminate this need because the underlying fine-grained sediments continue to impede the percolation of irrigation water. As development occurs in locations susceptible to shallow perched groundwater, the existing drainage system will need to be replaced and new drains constructed to control the shallow groundwater. The cost to construct and maintain these replacement drainage systems will need to be considered as development occurs. Funding sources will be needed to replace, expand, enhance and maintain the system for urban development in the future. CVWD is evaluating alternative methods for funding the drainage system and will undertake a study of the improvements needed to continue system operation in the future.

6.8.3 Flood Control

As discussed in Section 6.4.9, portions of the Coachella Valley including the Thousand Palms area in the West Valley and much of the East Valley especially the Oasis area on the west side of the Salton Sea lack flood control improvements. While flood control is not the subject of the 2010 WMP Update, flood control will be an important consideration facing CVWD. As the designated flood control agency for much of the Valley, CVWD, in conjunction with the cities, Riverside County and the development community, will need to develop and implement plans to improve flood protection in vulnerable areas. Integration of future flood control projects with water management activities offer the potential for maximizing regional benefits to the Valley.

6.8.4 Monitoring and Data Management

The primary objective of the monitoring and data management program is to evaluate the effectiveness of the water management programs and projects identified in the WMP and modify actions and plans based on factual data, also referred to as adaptive management. Although a significant amount of data is currently collected, opportunities exist for improvements in data collection, sharing and evaluation. This section summarizes the existing program, data gaps and actions that will be implemented to enhance the existing program and eliminate data gaps. New elements to be added to the monitoring and data management program are identified. Details of the current and proposed monitoring are presented in **Appendix C.**

6.8.4.1 Existing Monitoring Program

The hydrologic system of the Coachella Valley has been extensively monitored by a number of agencies for many years. This section provides a general overview of the types of data currently being collected and action items that will be implemented to improve the existing program.

Existing monitoring activities include:

- Weather data – precipitation, temperature and evapotranspiration
- Hydrologic data – streamflow
- Well logs – drillers logs of wells
- Groundwater production – pumping records for each well
- Water levels – groundwater elevations in wells
- Water quality – surface water and groundwater quality data
- Subsidence – ground surface elevation changes

CVWD and DWA each prepare annual engineer’s reports on water supply and replenishment assessment for the groundwater basins within their respective service areas that subject to a groundwater replenishment assessment charge. These reports describe the groundwater basins, water supply conditions, groundwater production, replenishment program and the annual replenishment assessment charged for production within each basin. Annual reports are currently prepared for the Mission Creek, Upper Whitewater River and Lower Whitewater River subbasins. No reports are prepared for the Desert Hot Springs or Garnet Hill subbasins as production from these basins is not currently subject to a replenishment assessment.

The following new action items will be performed with regard to existing monitoring and reporting activities:

- Summaries of annual precipitation and ETo should be presented in the annual engineer's reports on water supply and replenishment assessment.
- Work with DWR to improve the quality and consistency of data obtaining from existing CIMIS[3] stations.
- Work with the U. S. Geological Survey (USGS) to restore/improve the gauging station on the CVSC at Lincoln Street to provide continuous flow recording.
- Enter data from all well completion reports into a centralized GIS database that allows visualization of the well construction data to improve the usability of the well completion reports for future investigations.
- Conduct an updated survey of production wells in the East Valley to determine the owner/operator, location, operational status and production reporting for each well.
- Use power records and pump tests to develop more accurate estimates of pumping by unmetered wells.
- Install meters on wells where necessary to obtain accurate production data.
- Each water agency will apply to DWR and be designated as the groundwater level monitoring and reporting entity for the Valley within their respective service areas. Each agency will work with DWR through the CVRWMG to determine reporting requirements for the groundwater elevation data to DWR.
- Present additional water level information in the annual engineer's reports for each groundwater basin in response to the public reporting requirements of SBx7-6 reflecting the areal distribution of wells in the basin.
- Compare measured groundwater levels with groundwater model results to document progress toward meeting the WMP objectives.

6.8.4.2 Data Gaps

Specific data gaps identified in this 2010 WMP Update are:

- Surface water flow data to estimate potential yield from stormwater capture projects.
- Insufficient data documenting water requirements for habitat, water quality and compliance with water quality regulations.
- Lack of a centralized groundwater database that allows all water agencies to share data.

[3] CIMIS – California Irrigation Management Information System.

- Uniform reporting of urban water use by user class to track water conservation efforts.
- Groundwater production data for wells in the East Valley, especially agricultural wells.
- Non-uniform water quality monitoring data for several constituents of concern, especially perchlorate.
- Existing groundwater models lack water quality predictive capabilities.

Evaluation of data gaps will be performed on an on-going basis to identify areas where data being collected in the Valley are insufficient. The monitoring program will be updated to ensure provision of data needed to manage water resources and evaluate the effectiveness of WMP activities.

6.8.4.3 New Monitoring and Data Evaluation Elements

To eliminate the data gaps identified above, several new programs/projects will be implemented:

- Develop water resources database to facilitate data sharing between agencies and tribes.
- Construct additional monitoring wells in conjunction with new recharge facilities.
- Develop a water quality assessment documenting on-going monitoring activities in the basin.
- Conduct a joint investigation of the distribution of perchlorate in water supply wells in the Valley.
- Update and recalibrate Coachella Valley groundwater model based on current data and conduct a peer review of updated model.
- Develop a new planning interface and database that can be linked with land use plans and agricultural activities to better distribute pumping and return flows to the model.
- Develop and calibrate a water quality model capable of simulating the changes in salinity and possibly other conservative water quality parameters in conjunction with the salt/nutrient management plan.
- Develop a coordinated approach among the water purveyors and CVAG for calculating urban per capita water usage including methodologies for determining service area population.

6.8.5 Stakeholder Involvement

The implementation of a water management plan such as this requires the cooperation of many entities. The Groundwater Management Planning Act (Section 10750 et seq. of the California Water Code, commonly referred to as Assembly Bill 3030) encourages the formation of a technical advisory committee of interested parties within the plan area to help guide the development and implementation of the plan and provide a forum for resolution of controversial issues. Although the Coachella Valley WMP was not prepared under this statutory authority, CVWD sought stakeholder input during the development of the 2002 WMP and the 2010 WMP Update.

When the 2002 WMP was prepared, CVWD met with a broad cross-section of Coachella Valley stakeholders to provide information about the importance of water management in the Valley and to seek their input. After the 2002 WMP was adopted, CVWD developed a WMP Implementation Program. Preparation of the Implementation Program was guided by the Stakeholder Task Force, which was involved in all aspects of the Program development (see Section 2).

CVWD established an advisory committee in conjunction with implementation of the replenishment assessment program in the Lower Whitewater River Subbasin. This committee consists of representatives of the water agencies and pumpers that extract groundwater from this area. The committee meets periodically to discuss progress in implementing the WMP and the financing of groundwater replenishment programs using the Replenishment Assessment Charge (RAC).

CVWD and the Valley's Native American tribes have met several times over the past three years to discuss the issues to be addressed in 2010 WMP Update. Additional meetings have been held between CVWD and individual tribes to discuss specific water issues affecting the tribes.

Implementation of the 2010 WMP Update will require on-going coordination among the water agencies, tribes, cities, Riverside County and affected stakeholders. In addition, the IRWMP process has opened additional forums for dialogue on water management issues in the Valley.

6.9 SUMMARY

The water management needs of the Coachella Valley are evolving in response to a variety of uncertainties. Reduced imported water reliability, urban growth, reduction in agricultural demand, water quality and climate change are just of few of these factors. The Valley will likely face additional management issues in the future. Section 6 has presented the water management elements that have been considered in the development of the 2010 WMP Update. These elements include water conservation, additional water supplies, source substitution, groundwater recharge, water quality protection and other water management activities. Many of these elements can be implemented to varying degrees in response to future needs. The 2010 WMP Update seeks to provide the water agencies of the Coachella Valley with additional flexibility to adapt the plan to the future needs.

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Section 7

Section 7
Plan Evaluation

This section presents an evaluation of the water management elements that are considered as part of the 2010 WMP Update as presented in **Section 6**. These elements consist of water conservation, additional water sources, source substitution, groundwater recharge and water quality improvements. Next, this section discusses the important factors that are considered in developing a balanced plan – basin management considerations and costs – and how these factors are used to revise the recommendations of the 2002 WMP. Finally, the section describes the approach for the development of the elements that are included in the 2010 WMP Update.

7.1 EVALUATION APPROACH

The 2010 WMP Update evaluates the need for changes in direction and strategies to meet changing conditions. Consequently, the 2010 WMP Update revisits decisions made in the 2002 WMP to the extent that changed conditions necessitate a change in strategy. The evaluation of future plan elements considers the goals of the Plan and criteria needed to measure the effectiveness of the updated Plan.

7.1.1 Evaluation Factors

To evaluate the effectiveness of water management elements, evaluation factors have been developed. Each factor is described along with how the factor is considered in the evaluation process.

7.1.1.1 Potential Supply

The initial consideration of a management action or project within an element is the amount of water it can produce in the case of conservation and water supply elements, or the amount of overdraft reduction that can be accomplished in the case of source substitution and recharge elements. The amount of water is expressed in terms of average supplies or deliveries considering the range of hydrology or the potential magnitude of the potential element.

7.1.1.2 Water Quality

Water quality is an important factor for maintaining the long-term salt-balance and use of the basin. In the case of water sources, water quality is identified principally in terms of total dissolved solids (TDS) expressed in milligrams per liter (mg/L) or other critical water quality components.

7.1.1.3 Cost

A major consideration in updating the plan is minimizing the future cost to Valley water customers to the extent practicable. Costs are expressed in dollars per acre-foot ($/AF). Where program costs have not been well defined a range of potential costs are identified.

7.1.1.4 Reliability

The reliability of water source is important for determining its availability during a range of wet and dry cycles. A supply is considered to have high reliability if it can provide water on a more-or-less continuous basis; that is, average supply is greater than 90 percent of the maximum supply. In the case of source substitution and groundwater recharge, reliability is judged on the basis of the option's ability to reduce overdraft on a continuous basis over the planning period.

7.1.1.5 Technical Feasibility

Many factors can affect the technical feasibility of a management element. For example, an element that is well defined and/or uses a proven technology would be rated higher than one that is very conceptual. Where possible, technical issues are identified that may affect feasibility.

7.1.1.6 Environmental Impacts

Many water management elements can have impacts on the environment. Ideally, a management element that has no environmental impacts or whose impacts can be fully mitigated would be rated much higher than one that has significant adverse impacts that cannot be mitigated.

7.1.1.7 Permitting

Many management elements require some level of permit approval by regulatory agencies prior to construction. The level of difficulty to obtain permit approval or the number of permits required for the option being evaluated is considered in this evaluation factor.

7.1.1.8 Public Acceptance

Management elements that are acceptable to the public have a much higher chance of being successfully implemented than are those which are opposed by the public. In some cases, the level of public acceptance is not well known.

7.2 WATER SUPPLY EVALUATION

Prudent water supply planning dictates the need to include a supply buffer due to the uncertainties associated with water demand projections and the risks in developing and implementing new water supplies. The 2010 WMP Update differs from the 2002 WMP in that a 10 percent supply buffer is applied to the projected water demands while eliminating overdraft. This buffer compensates for uncertainties such as demands higher than forecast or supplies that cannot be implemented or do not deliver as much water as planned.

Future water demand for the Valley is presented in **Section 3** along with possible ranges of growth. Water demands could range from 793,600 AFY to 971,500 AFY with a planning value of 885,400 AFY. Consequently, the WMP seeks to identify sufficient water supplies and conservation to provide 974,000 AFY by 2045 (supply with 10% buffer as discussed earlier). With this supply buffer, the Valley would be better able to adapt to higher water demands that anticipated or further supply reductions.

From a water supply planning point of view, conservation activities are viewed on par with water supply measures. Water conservation efforts, mandated through state law, plumbing codes and landscaping ordinances and voluntary efforts help meet future demands in the same way that additional supplies meet those demands.

7.2.1 Water Supply Scenarios

Water supply planning scenarios are identified that describe a range of possible future outcomes for the 2010 WMP Update. The scenarios are based on existing local water supplies and differing levels of imported water supply availability. For each scenario, the amount of additional water supply required is estimated by subtracting the existing supply from the water demand including the 10 percent buffer.

Local Water Supplies: The existing local water supplies in the Valley consist of surface water diversions, local mountain-front runoff that recharges the groundwater basin, recycled water and return flows from use that replenish the basin, minus any groundwater consumed by native vegetation, drain flows discharged to the Salton Sea and subsurface outflow from the basin. The local supply available in 2045 is estimated to be about 148,300 AFY as shown in **Table 7-1** without implementation of the 2010 WMP Update. This value is based on information presented in Section 4 and is further reduced by 44,100 AFY to account for expected future return flow reductions due to anticipated conservation efforts.

Table 7-1
Summary of Local Supplies

Source	Amount in 2045 (AFY)
Natural Inflow[1]	57,400
Surface Water (direct use)[2]	3,400
West Valley Recycled Water	41,900
Returns from Use	203,100
Less:	
Effect of Future Conservation on Return Flows	(44,100)
Drain flows to Salton Sea	(104,200)
Phreatophyte Evapotranspiration [1]	(8,100)
Subsurface Outflow to Salton Sea	(1,100)
Total	**148,300**

Notes:
1 Natural inflow consists of stream runoff (46,400 AFY) and subsurface inflow from adjacent groundwater basins (11,000 AFY).
2 Direct use of surface water is expected to be 3,400 AFY in the future (see Section 4..
3 Phreatophytes are native vegetation located near the Salton Sea that utilize groundwater.

Coachella Canal Supply – Colorado River: Two scenarios are considered for the Coachella Canal supply – with and without the QSA. Under a “with QSA” scenario, no changes are made to the delivery schedule prescribed in the QSA and CVWD would receive 459,000 AFY of supply by 2027 less 31,000 AFY of conveyance losses. Reclamation has stated that it views the

QSA and the federal Water Delivery Agreement as binding and it intends to honor and implement the provisions of these agreements (Reclamation, 2010).

If the QSA were invalidated, CVWD management believes that revisions to the existing agreements involving the State of California and the other QSA parties would be developed to address the Court's concerns or that a water transfer arrangement similar to the QSA would be developed to ensure California's compliance with its 4.4 million AFY Colorado River allocation. Although considered to be a remote possibility, the 2010 WMP Update addresses the actions that might need to be taken if CVWD's Coachella Canal usage were reduced to 300,000 AFY as a worst case scenario. It is assumed that the Coachella Canal supply would be not less than about 300,000 AFY based on long-term historical usage. CVWD management believes such a low level is unlikely.

SWP Supply: Two options are considered regarding the existing available SWP supply – existing reliability (50 percent, assumed, see Section 4) and improved reliability (77 percent) resulting from construction of a Delta conveyance facility as described in **Section 4.** Under future conditions without Delta conveyance improvements, about 62,200 AFY of the existing SWP supply would be available for use in the Whitewater River Subbasin.

If SWP reliability were restored to 77 percent through the BDCP, it is estimated that about 95,600 AFY of SWP water would be available to the Whitewater River Subbasin on average[1] as shown in **Table 7-2**. Based on DWR's current implementation schedules, it is assumed that any additional water provided by the Delta conveyance facility would begin in 2023 and be fully available by 2026. CVWD and DWA are required to financially participate in the final Delta facility through their respective SWP contracts.

For the two principal imported water sources, Colorado River and SWP supplies, future availability is summarized in **Table 7-3** based on whether a long-term solution to the problems of the Delta is implemented and whether the QSA is upheld by the courts. Using these possible outcomes, four supply planning scenarios emerge, each with an associated amount of average water availability.

Table 7-4 shows the amount of additional supply required to meet the projected needs including the 10 percent buffer. This table indicates that between 302,100 and 463,500 AFY of additional supplies may be required to meet projected demand with the 10 percent buffer of 974,000 AFY depending on the final outcome of the QSA litigation and the Delta water conveyance programs.

Since CVWD and DWA would pay for and receive any increased yield resulting from the BDCP and Delta conveyance facilities, Scenario 1 is considered the most likely to occur. The other scenarios indicate how much additional water might be required. Under Scenario 4, the worst case might be that the Valley needs to develop almost 161,000 AFY of additional conservation

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[1] This expected average amount of SWP water is based on a pro-rata increase in both the total amount of water delivered and reflects the estimated amount of water that Metropolitan could recall under the terms of the 2003 Water Transfer Agreement. Should Metropolitan not exercise its call-back option, the estimated amount of SWP water available to the Whitewater River Subbasin could be 128,600 AFY.

and supplies beyond that required for Scenario 1 to meet demands, provide a supply buffer, and eliminate overdraft.

Table 7-2
SWP Availability for the Coachella Valley under Delta Fix

SWP Components	Existing (AFY[1])	2045 without BDCP (AFY[1])	2045 with BDCP (AFY[1])
Table A Amount (Existing)	194,100	194,100	194,100
Assumed SWP Reliability [2]	60%	50%	77%
Average SWP Delivery	116,500	97,100	149,500
Less Metropolitan Call-back [3]	(32,900)	(24,800)	(38,300)
Average Net SWP Supply [4]	83,600	72,300	111,200
Upper Whitewater Share			
Percent of Total Production [5]	93%	86%	86%
Allocated to Upper Whitewater with Call-back	77,800	62,200	95,600
Mission Creek Share			
Percent of Total Production [5]	7%	14%	14%
Allocated to Mission Creek with Call-back	5,800	10,100	15,600

Notes:
1. Values rounded to nearest 100 AFY.
2. Based on California DWR's 2009 SWP Reliability Report and adjusted based on the combined CVWD-DWA Table A Amounts and assumed reliability amounts.
3. Average callback assuming 100,000 AFY call-back occurs in the 4 wet years during any 10 year period.
4. Net supply is calculated by deducting the Metropolitan callback from the Table A Amount with SWP Reliability.
5. Percent of total production is the percent of production in each subbasin to the combined total production. Values for 2045 are based on estimated production developed for the Mission Creek-Garnet Hill WMP (in production).

Table 7-3
Water Supply Planning Scenarios – 2045

Scenario	QSA Validated	Delta Conveyance	Local Supply (AFY)	Colorado River Supply (AFY)	SWP Supply (AFY)	Available Supply (AFY)
1	Yes	Yes	148,300	428,000	95,600	671,900
2	Yes	No	148,300	428,000	62,200	638,500
3	No	Yes	148,300	300,000	95,600	543,900
4	No	No	148,300	300,000	62,200	510,500

Table 7-4
Water Supply Needs – 2045

Scenario	QSA Validated	Delta Conveyance	Demand (AFY)	Demand with 10% Buffer (AFY)	Available Supply (AFY)	Additional Supply Required (AFY)
1	Yes	Yes	885,400	974,000	671,900	302,100
2	Yes	No	885,400	974,000	638,500	335,500
3	No	Yes	885,400	974,000	543,900	430,100
4	No	No	885,400	974,000	510,500	463,500

7.2.2 Evaluation

The evaluation of supply and conservation elements centers on a comparison of the relative rankings of each element with respect to the evaluation factors presented in **Section 7.1.1**. **Table 7-5** presents a summary comparison of the water conservation and supply elements considered in the 2010 WMP Update. A discussion of each factor is presented in the following sections.

7.2.2.1 Potential Supply

The potential supply associated with each water conservation and management element is based on the information presented in **Section 6**. Of the elements evaluated, urban water conservation, desalinated drain water, and desalinated ocean water offer the highest potential supplies. The next highest ranked elements include recycled water and water transfers via lease or purchase. Agricultural and golf course conservation, Canal water loss recovery and Fargo Canyon groundwater offer moderate supply increases. No additional yield is attributed to West Valley recycled water because all available water would be recovered either through expansion of non-potable delivery systems or groundwater percolation. The potential amount of water that could be captured from stormwater recovery is not known and requires additional evaluation.

7.2.2.2 Water Quality

The source water quality of each water supply element is considered based primarily upon its salinity. As shown in **Table 7-5**, the highest quality water sources are local recycled water and stormwater. Transferred water obtained through exchange with Metropolitan has a total dissolved solids (TDS) concentration averaging about 650 mg/L, while Coachella Canal water averages about 750 mg/L. Desalinated drain water quality could be customized depending on its use ranging from 250 – 750 mg/L. Desalinated ocean water has a high quality at its source (~250 mg/L); however, since there is no mechanism for direct conveyance to the Valley, an exchange for Colorado River water would result in TDS of 650-750 mg/L depending on the delivery location (Whitewater or Coachella Canal). Based on limited available information, Fargo Canyon groundwater is believed to have a TDS in excess of 1,000 mg/L which could reduce its potential use without treatment.

As shown in **Table 7-5**, the highest quality water sources are local recycled water and stormwater. Transferred water obtained through exchange with Metropolitan has a TDS averaging about 650 mg/L while Coachella Canal water averages about 750 mg/L. Not shown on the table is the quality of SWP water delivered directly to the Valley. If an SWP extension

Table 7-5
Comparison of Alternative Water Supply Elements

Supply Element	Potential Supply (AFY)		Salinity/Water Quality	Source Cost	Technical Feasibility	Reliability	Environmental	Permitting	Public Acceptance
	2020	2045							
Agricultural Conservation	40,000	23,000	Not applicable	$40-60/AF	Proven technology	High	No significant impacts	None	High
Golf Course Conservation	12,000	12,000	Not applicable	$40-60/AF	Proven technology	High	No significant impacts	None	High
Urban Conservation	33,000	43,000	Not applicable	$200-400/AF	Proven technology	High	No significant impacts	None	High
Additional Urban Conservation	44,000	57,000	Not applicable	$400-800/AF	May require significant re-landscaping	Depends on Participation	No significant impacts	None	Potentially Low
Canal Water Loss Recovery	10,000	10,000	750 mg/L TDS	$200-400/AF	Cause of losses is unknown	High if losses can be reduced	Unknown site-specific impacts	Moderate	High
West Valley Recycled Water	0	0	450 mg/L TDS	$50-400/AF for tertiary treatment only; additional cost for distribution	Essentially all water is being recovered	High but little additional yield	Potential site-specific and water quality impacts	Moderate	High
East Valley Recycled Water-existing flows	16,000	16,000	450 mg/L TDS	$400/AF for tertiary treatment only; additional cost for distribution	Additional treatment and conveyance infrastructure required	High	Reduction in existing CVSC flow	Significant	Moderate
East Valley Recycled Water-growth	6,000	32,000	450 mg/L TDS	$400/AF for tertiary treatment only; additional cost for distribution	Additional treatment and conveyance infrastructure required	High	No significant impacts	Significant	Moderate
Fargo Canyon Area Recycled Water	0	11,000	500-1,000 mg/L TDS	$400/AF for tertiary treatment only; additional cost for distribution	No existing facilities	High	Unknown site-specific and water quality impacts	Significant	Moderate
Fargo Canyon Groundwater	0	9,000	>1,000 mg/L TDS	$150-200/AF; additional cost for distribution	Yield undetermined	Unknown	Unknown	Moderate	High
Stormwater Capture	Unknown	Unknown	300-500 mg/L TDS	Unknown	Diversion, storage and recharge facilities required	Poor – highly variable flow	Unknown site-specific impacts	Unknown	Moderate
Water Transfers – Lease/Purchase	50,000	50,000	650 mg/L TDS	$700-1,400/AF	No significant issues	Depends on the transfer terms	Delta and/or area of origin impacts	DWR Approval	Moderate
SWP Existing Table A with Delta Conveyance	0	33,000	650 mg/L TDS	$400-500/AF	Significant issues with Delta conveyance	50 percent improvement	Impacts mitigated by BDCP	Significant permitting by others	Unknown
Water Transfers – Lease/Purchase with Delta Conveyance	0	25,000	650 mg/L TDS	$1,100-1,900/AF	Significant issues with Delta conveyance	50 percent improvement	Delta and/or area of origin impacts	DWR Approval	Moderate
Desalinated Drain Water	5,000	90,000	250-750 mg/L TDS	$500-1,200/AF	Brine disposal issues	High	Brine disposal; energy use	Significant	Low - Moderate
Desalinated Ocean Water	0	100,000	250-750 mg/L TDS	$1,000-1,500/AF	Exchange agreements	High	Seawater intakes, brine disposal, energy use	Significant	Low - Moderate due to high cost

Cost excludes treatment for potable use and delivery to individual uses

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were constructed to the Valley, the TDS of SWP water would average about 350 mg/L. If desalinated ocean water were exchanged for SWP water delivered directly to the Valley, a comparable quality might be achieved.

7.2.2.3 Costs

The 2010 WMP Update considered the potential sources of additional water supply and ranked those supplies based on anticipated cost and yield. The results of the cost ranking are shown on **Figure 7-1**. Costs of new supplies range from about $40/AF to nearly $1,800/AF.

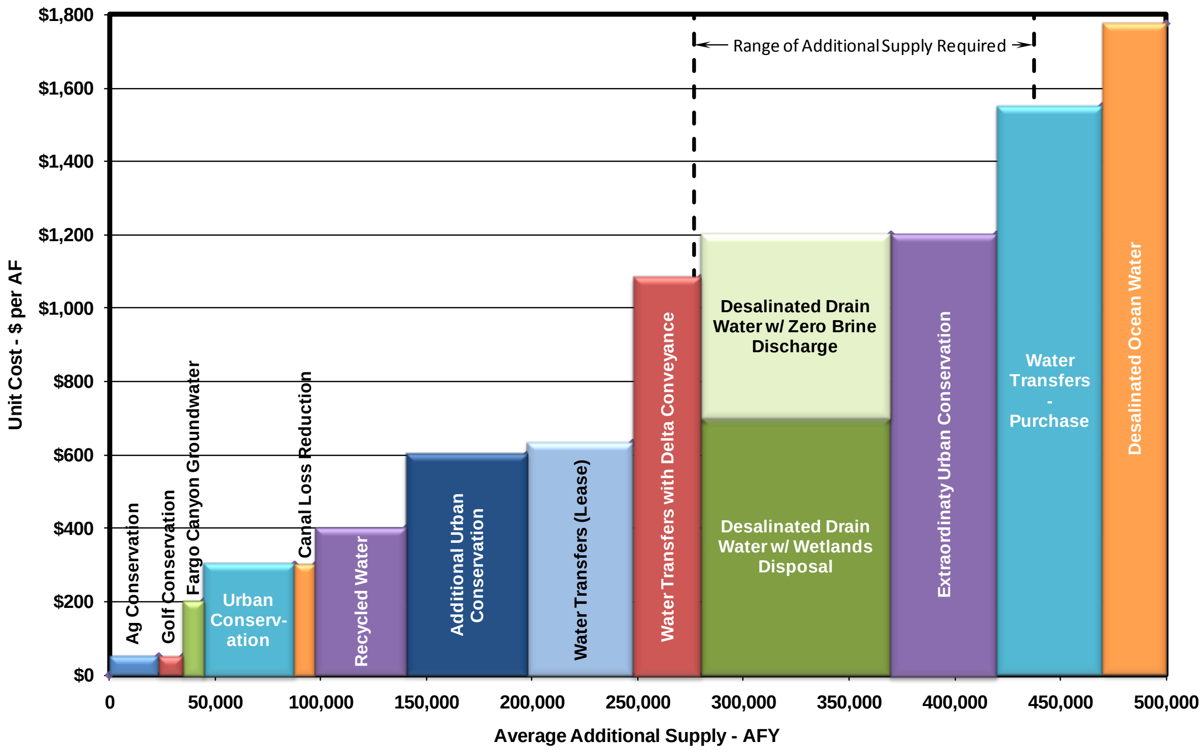


Figure 7-1
Cost Rank of Water Sources

As indicated in this figure, the most cost-effective supply augmentation approaches involve water conservation. Additional Canal water loss recovery may potentially be cost-effective, but requires a feasibility study to verify the amount of savings and evaluate the feasibility of recovering the water. Development of recycled water for non-potable uses may also be cost-effective; however, the cost of a separate non-potable distribution system can add significant costs depending on the distance from the source to the user. Additional urban water conservation totaling up to about 100,000 AFY and water transfers acquired through long-term lease are the next most cost-effective options. Leased transfers with the additional yield created by a Delta conveyance facility would be similar in cost to desalinated drain water costs, which are significantly affected by the brine disposal approach. If acceptable to the regulatory agencies, wetlands disposal of brine (and ultimately to the Salton Sea) is more cost-effective than zero liquid discharge approaches which could increase the cost of desalinated drain water by about 70 percent. Under Supply Scenario 1 with Delta conveyance and the QSA, no additional supplies are needed.

Under the less favorable supply scenarios, additional higher cost water would be required to meet demands and provide the desired supply buffer. These higher cost waters include the purchase of additional Table A and extreme urban conservation. Desalination of ocean water would not likely be required given the current demand projections and supply options. It should be noted that for the purpose of determining cost of the 2010 WMP Update implementation, Delta Fix costs are accounted to establish the higher end of the costs.

Because the feasibility of some water supply strategies have not yet been evaluated, additional supplies may be needed to meet the supply targets may be required. For example, the yield and feasibility of developing Fargo Canyon groundwater and Canal water loss reduction require additional study. Should these potential supplies prove infeasible, then additional, more costly supply options must be considered. While additional urban water conservation may be more cost-effective than desalination of drain water, it is uncertain how much additional conservation can be implemented without dramatic life-style and economic changes in the Valley. If the desired level of conservation cannot be achieved, additional high cost supplies might be required. Alternatively, growth restrictions might be needed to reduce future demands.

Similarly, the feasibility of certain options is affected by actions outside the control of Valley water agencies. If the BDCP and Delta conveyance are not successful in increasing the average SWP reliability, options for enhancing the yield from water transfers may not be as viable.

7.2.2.4 Reliability

Supply reliability is evaluated based on the anticipated long-term variability of each supply option. Water recycling and drain water desalination are highly dependable and reliable local sources of water. Water conservation measures can also be reasonably reliable but depend upon the level of participation and the commitment of the customers. Imported supplies that originate from other parts of California are affected by hydrologic variability and regulatory restrictions on exports from the Delta. Some supply options such as Fargo Canyon groundwater and Canal loss recovery require additional study to evaluate their reliability.

7.2.2.5 Technical Feasibility

Many of the water supply options under consideration utilize proven technologies. While recycled water and desalinated drain water require significant treatment infrastructure, the technologies that would be used have been implemented in the Valley and elsewhere in California. Options involving Delta exports may have technical issues if a politically and publically acceptable solution to the Delta conveyance and habitat restoration issues cannot be found. High levels of water conservation can be implemented but may require significant customer investment in re-landscaping.

7.2.2.6 Environmental Impact

Some of the supply options could have potentially significant environmental impacts while others would have no or less than significant impacts. While water conservation measures generally have little environmental impact, higher levels of conservation would reduce the return flow to the groundwater basin, potentially decreasing the groundwater supply. Use of recycled water resulting from growth would have little environmental impact but use of water currently being discharged could reduce flows in the CVSC, affecting riparian vegetation. Water supply options involving desalination are energy intensive, may require additional generation capacity and could generate greenhouse gas emissions. Brine disposal from desalination processes is expected to be an important environmental consideration. Options involving northern California water exports may create additional Delta or area of origin impacts. Significant adverse impacts require mitigation to the extent feasible.

7.2.2.7 Permitting

The level of permitting and regulatory approval varies with the type of supply. Water conservation measures require essentially no regulatory approvals. In comparison, recycled water and desalinated drain water will require regulatory approvals for treatment processes, use of water and disposal of any wastes, especially brine. Because water exports from the Delta are undergoing extreme regulatory oversight, the regulatory feasibility of exporting additional water may be more difficult. However, the transfer of water that has already been moved through the Delta would involve less significant regulatory oversight. Ocean water desalination has been identified as a significant future source for southern California; however, permitting and regulatory approvals for new facilities have proven difficult, costly and time-consuming. Other permit requirements will be site-specific and may include easements, discharge permits, sensitive species take permits, wetland mitigation requirements, air quality permits, dust control permits, and the like.

7.2.2.8 Public Acceptance

Public acceptance is evaluated based on input received from meetings with members of the public and the Native American tribes during the preparation of the 2010 WMP Update. In general, water conservation measures are viewed favorably by the public; however, opposition potentially could arise if the public perceives that high levels of conservation are too onerous. Use of recycled water has also been viewed favorably by the public. Desalination of drain water is also expected to be viewed favorably.

7.2.3 Preferred Supply Mix

Based on this evaluation, the water supply strategy for the 2010 WMP Update seeks to achieve a balanced portfolio of existing and new supplies while retaining the flexibility to adapt to changing supply conditions. However, if water supply conditions are such that both the QSA is overturned and no Delta Fix can be implemented, then a combination of extreme conservation, desalinated ocean water and growth restrictions may be necessary. **Figure 7-2** presents possible water supply mixes that meet the demands under the four planning scenarios.

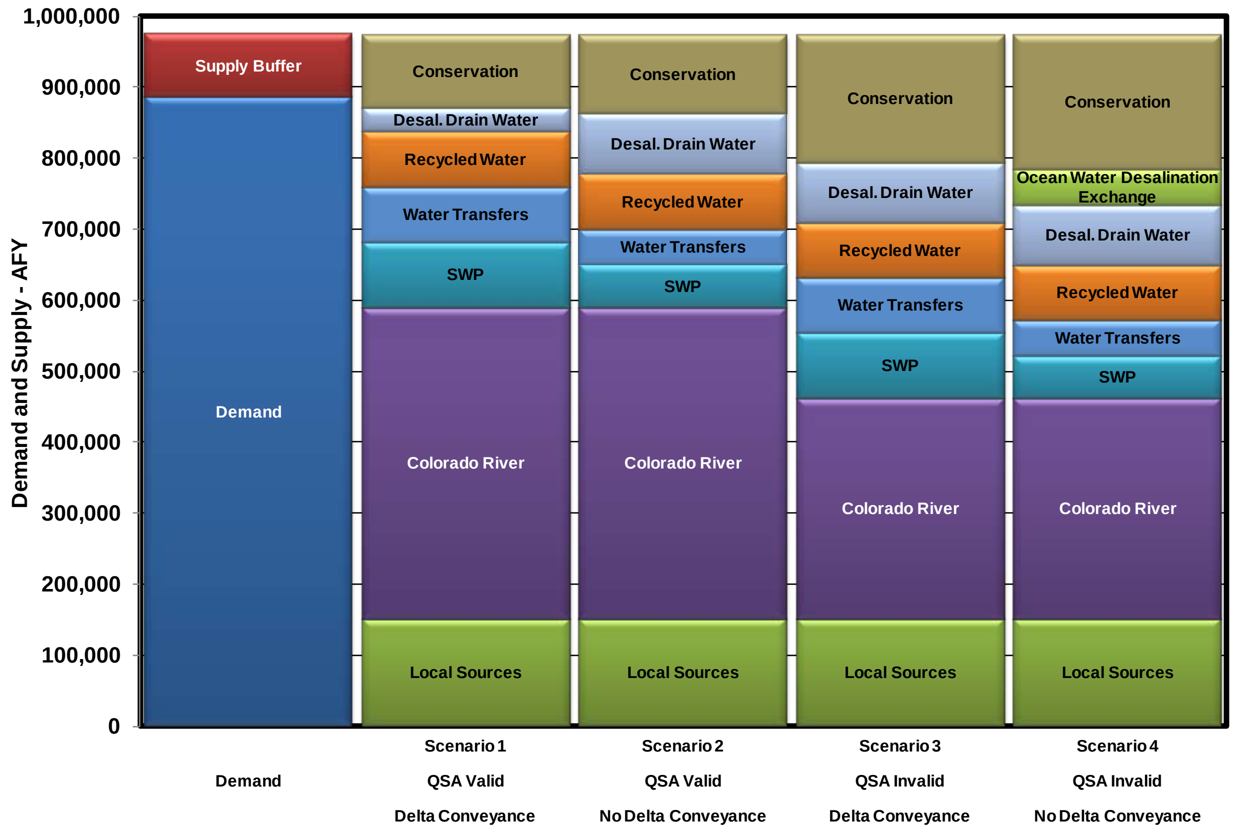


Figure 7-2
Comparison of Potential Supply Mixes by Scenario (2045)

Based on the efforts being made to achieve a solution to the Delta environmental issues, it is expected that Scenario 1 is the most likely to occur in the future. However, WMP project planning will proceed based on the possibility that Scenario 2 occurs, until it has been demonstrated that the BDCP will proceed and produce the anticipated results. Therefore, the 2010 WMP Update is based on Scenario 2 which assumes that the QSA is valid but that no improvements in Delta conveyance occur, resulting in an SWP reliability of 50 percent. The anticipated water supply mix under Scenario 2 is presented in **Figure 7-3**. With this mix, conservation continues to be implemented, Canal water is fully utilized, SWP supplies are reduced consistent with the conservative Delta planning assumptions, recycled water is developed in the East Valley as growth occurs, additional water transfers are acquired and desalinated drain water is developed. If SWP supplies and water transfers resulting from the BDCP and improved Delta conveyance facilities could be increased (Scenario 1), the amount of desalinated drain water required would be reduced.

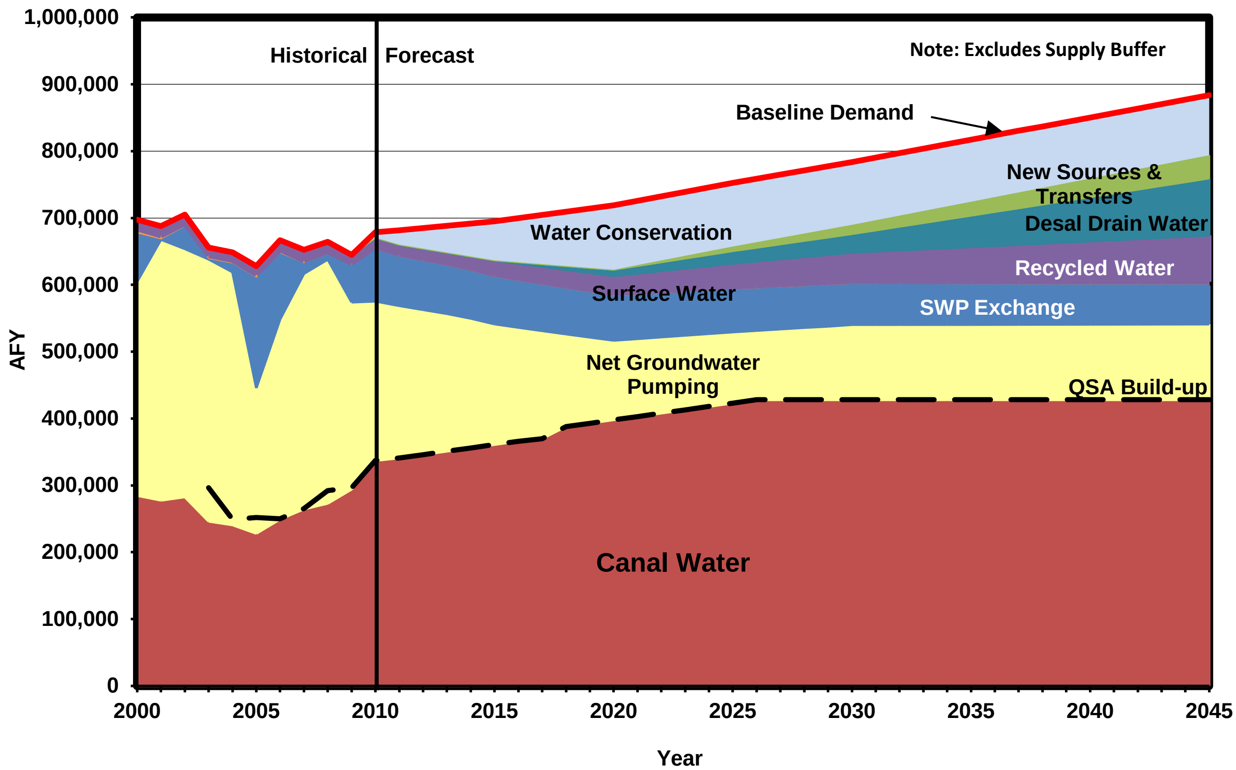


Figure 7-3
Water Supply Mix for 2010 WMP Update

7.3 EVALUATION OF SOURCE SUBSTITUTION AND RECHARGE ELEMENTS

The approach to water delivery and use affects the performance of the WMP relative to overdraft reduction and other important factors. **Section 6** described available source substitution and recharge elements. This section evaluates the potential performance of these elements. **Table 7-6** presents a summary of the source substitution and recharge elements and a comparison of their relative costs, merits and issues.

7.3.1 Overdraft Reduction

Source substitution and recharge elements are evaluated based on their ability to offset current or future groundwater pumping. Among the source substitution options, those involving urban potable and non-potable use of Canal water offer the greatest reductions in current and future groundwater pumping. Because agricultural use is expected to decline over time while urban demands increase, initial focus on conversion of agricultural groundwater pumping to Canal water use offers near-term benefits. As urban growth occurs, Canal water delivery facilities can be converted to urban use. Most of the other source substitution options offer moderate pumping offsets. Many of the potential projects are constrained by the available demand for the particular use.

Groundwater recharge programs reduce overdraft by placing water directly into the groundwater basin. The largest recharge program is operated at the Whitewater River Recharge Facility. Although up to 300,000 AFY of water has been recharged at this location, the amount of recharge is limited only by the available water supply. The Thomas E. Levy Groundwater Replenishment Facility (Levy facility) is expected to recharge 40,000 AFY when complete. Martinez Canyon and Indio facilities are shown with capacities of 20,000-40,000 AFY and 10,000 AFY, respectively. As project planning proceeds, the capacity of these facilities will be refined. Recharge with injection and indirect potable reuse (IPR) need additional investigation to determine their potential recharge contributions.

7.3.2 Unit Cost

The unit water delivery cost consists of the capital costs amortized over 25 yrs and annual operating/maintenance costs need to treat (if needed) and deliver water for the intended use. The total annual cost is divided by the average delivery to provide a cost per AF. In the case of existing facilities, previous capital costs are excluded. In general, the least costly source substitution options are those that deliver relatively larger amounts of untreated water to nearby customers. Recycled water system costs tend to be higher due to more extensive delivery systems to smaller customers. Similarly, delivery of Canal water for non-potable urban irrigation uses has a relatively high cost due to the added infrastructure to convey water to individual homes. Treatment for potable uses generally adds to the cost of water.

In general, the cost of groundwater recharge is lower than for source substitution because the higher water deliveries and larger infrastructure provide economies of scale. Recharge at Whitewater is the least costly recharge option followed by the Levy facility in La Quinta, because these are existing facilities. New recharge facilities in Indio or at Martinez Canyon and construction of additional conveyance capacity at Levy have similar unit costs, which are comparable to the lower cost source substitution projects. Injection of Canal water is expected to be relatively costly due to the need for potable water treatment prior to injection. IPR of municipal wastewater for groundwater recharge is expected to have high costs due to the advanced treatment required to obtain California Department of Public Health and Regional Board approvals.

7.3.3 Water Quality Issues

Water quality issues for source substitution and recharge programs are related to the water source. Because Colorado River water has relatively high salinity, there may be salt tolerance issues when irrigating salt-sensitive plants. This is expected to be a relatively minor issue since Colorado River water has been used for irrigation in the Valley for many years. Concerns have also been expressed about the ongoing use of untreated Colorado River water for groundwater recharge, as discussed in Section 5. Coachella Valley recycled water generally has moderate salinity levels and should not cause problems when used for irrigation. When delivered for potable uses, Colorado River water requires filtration and disinfection as a minimum and may require some level of desalination for customer acceptance. As discussed previously, IPR may have significant water quality issues and requires extensive treatment when used to supplement potable supplies.

Table 7-6
Comparison of Water Delivery and Use Options

Delivery Option	Potential Overdraft Reduction - AFY		Treatment/ Delivery Cost	Water Quality Concerns	Technical Feasibility	Reliability	Environmental	Permitting	Public Acceptance
	2020	2045							
Source Substitution									
Canal Water - Increased agricultural use	41,000	6,000	$40-60/AF	No significant issues	No technical issues	Use declines as urban growth occurs	No significant impacts	None	Good
Canal Water - Golf course irrigation	29,000	32,000	$500/AF	Salinity - salt tolerance of some plants	No technical issues	High but may be susceptible to delivery interruptions	No significant impacts	None	Good
Canal Water - Urban Non-potable for new development	16,000	90,000	$500/AF	Salinity - salt tolerance of some plants	Requires separate "purple pipe" system	High but may be susceptible to delivery interruptions	No significant impacts if built during development	Comply with RW distribution requirements	Good
Canal Water - New Urban Potable	30,000	90,000	$300-700/AF	Can be treated to desired quality	No technical issues	High but may be susceptible to delivery interruptions	Brine disposal; siting	DPH approval required	Good
Canal Water - Oasis Area	0	23,000 - 28,000	$100-150/AF	Salinity	Extensive infrastructure	High but may be susceptible to delivery interruptions	Construction impacts	Minimal permitting	Good
East Valley Recycled Water - Existing Canal Delivery System	16,000-24,000	32,000-48,000	$150-400/AF	May limit ability to treat Canal water for urban potable use	Requires separate "purple pipe" system	High – recycled water flow is relatively continuous	No significant impacts if built during development	Regional Board permit required	Moderate
East Valley Recycled Water - Separate Delivery System	16,000-24,000	32,000-48,000	$200-700/AF	No significant issues	Requires separate "purple pipe" system	High – recycled water flow is relatively continuous	No significant impacts if built during development	Regional Board permit required	Moderate
Mid-Valley Pipeline - Canal and RW	32,000	45,000	$150-200/AF	Salinity - salt tolerance of some plants	Requires separate "purple pipe" system	High – dual sources improves reliability	Construction impacts in developed urban area	Regional Board permit may be required	Good
West Valley Recycled Water - System Expansions	10,000 [2]	16,000 [2]	$150-200/AF	No significant issues	Requires separate "purple pipe" system	High – recycled water flow is relatively continuous	No net effect on overdraft	Regional Board permit amendment required	Good
Groundwater Recharge									
SWP Exchange - Whitewater	67,000	60,000-100,000	$20/AF	Colorado River supply salinity	Existing facility	Depends on Metropolitan's operations	Existing program	Existing program	Good; tribal concern about salinity
Desalinated Drain Water – Whitewater	0-20,000	0-30,000	$150/AF including CRA delivery	Same as existing Colorado River supply if exchanged	Requires transfer and exchange for Colorado River water with Metropolitan	Depends on Metropolitan's operations	Brine disposal; reduced flow to Salton Sea; CRA pumping	Minimal permitting	Good
Canal Water – LEVY – Existing	32,500	32,500	$55/AF O&M Cost only	Canal water supply salinity	Existing facility	High but may be susceptible to delivery interruptions	Existing program	Existing program	Good; tribal concern about salinity
Canal Water – LEVY – Expansion	7,500	7,500	$150/AF	Canal water supply salinity	Requires additional pumping station and pipeline	High but may be susceptible to delivery interruptions	Expansion of existing program; construction impacts	Minimal permitting	Good; tribal concern about salinity
Canal Water - Indio	10,000	10,000	$120/AF	Canal water supply salinity	Depends on site location; may require demonstration facility	High but may be susceptible to delivery interruptions	Changes in water levels; construction impacts	Minimal permitting	Good

Delivery Option	Potential Overdraft Reduction - AFY		Treatment/ Delivery Cost	Water Quality Concerns	Technical Feasibility	Reliability	Environmental	Permitting	Public Acceptance
	2020	2045							
Canal Water – Martinez	4,000	20,000-40,000	$140/AF	Canal water supply salinity	Existing demonstration facility	High but may be susceptible to delivery interruptions	Changes in water levels; construction impacts	Minimal permitting	Good; tribal concern about salinity
Canal Water – Other Surface Recharge Sites	TBD	TBD	$100-200/AF	Canal water supply salinity	Depends on suitable hydrogeologic conditions	High but may be susceptible to delivery interruptions	Changes in water levels; construction impacts	Minimal permitting	Good; tribal concern about salinity
Canal Water – Injection	TBD [3]	TBD [3]	$400-800/AF including potable treatment	Canal water supply salinity; requires potable water treatment	Proven technology; requires potable water treatment	High but may be susceptible to delivery interruptions	Changes in water levels; construction impacts	May require DPH [4] approval	Good
Recycled Water - Indirect Potable Reuse	TBD [3]	TBD [3]	$900-1,200/AF	High quality water; can be treated to desired quality	Extensive treatment requirements including reverse osmosis	Potentially High – recycled water flow is relatively continuous	Siting; energy use; brine disposal	Extensive Permitting - DPH and Regional Board approval required [4]	May have significant issues

1 Costs shown exclude previous (sunk) capital costs
2 Option offsets pumping but does not reduce overdraft since unused recycled water is percolated.
3 TBD – To be determined. This is a future option that requires additional investigation to evaluate feasibility.
4 DPH - California Department of Public Health

7.3.4 Technical Feasibility

Essentially all approaches are similar with regard to technical feasibility with the exception of IPR. The source substitution and groundwater recharge programs are mature technologies that can be readily implemented. While potable water treatment is a proven technology, local water agencies may wish to implement demonstration level programs initially to gain local operating experience. Technical feasibility of groundwater recharge at the Whitewater, Levy and Martinez Canyon has been demonstrated. Although a potential recharge site has been identified in Indio, it may require operation of a demonstration-scale project to verify technical feasibility. Development of other surface recharge sites will depend on the location and the presence of suitable hydrogeologic conditions. Groundwater recharge by injection is a proven technology elsewhere in the southwestern United States. Demonstration-level testing may be required before any significant investment is made in multi-purpose injection-extraction wells.

7.3.5 Reliability

Most of the delivery options are considered to have high reliability in terms of their ability to reduce overdraft. One reliability concern that has been expressed regarding source substitution programs in general is the potential for “demand hardening.” This means that when groundwater users are converted to imported or recycled water supplies, they may have reduced ability to withstand a supply interruption or water shortage. To mitigate for this concern, it will be important that these users continue to maintain their groundwater wells to provide a back-up in the event of a water shortage or other emergency. Delivery of SWP and desalinated drain water to Whitewater may also have reduced reliability because the exchanges and deliveries from the Colorado River Aqueduct (CRA) are at Metropolitan’s operational discretion. Canal water use for groundwater recharge generally has high reliability; however, reductions would occur if supplies are reduced by drought or voluntarily payback of water storage via conjunctive use programs.

7.3.6 Environmental Impacts

The most commonly anticipated environmental impacts of source substitution and recharge projects relate to site-specific construction impacts. However, most of these impacts can be mitigated to a level of less-than-significant. Installation of “purple pipe” non-potable water systems would have slightly more construction impacts that could be minimized by installation in conjunction with other utilities when new development occurs. Desalinated drain water and IPR are expected to have brine disposal and energy usage impacts. Exchange and delivery of desalinated drain water for recharge at Whitewater would have additional energy impacts resulting from increased pumping along Metropolitan’s CRA. New recharge programs at Indio and Martinez Canyon are expected to increase groundwater levels both locally and regionally, which may be beneficial. However, tribal concerns about salinity and other water quality issues with Canal water recharge may continue to be an issue.

7.3.7 Permitting

Many of the non-potable source substitution programs have few or no local, state or federal permit requirements. Projects involving non-potable water delivery to individual homes and recycled water projects are expected to require permits from health and water quality regulators. Recycled water use permits from the Regional Board are required for all recycled water projects. Waste discharge requirements would likely be required for any project that involves brine disposal. IPR would also have extensive permitting requirements from DPH and the Regional Board.

7.3.8 Public Acceptance

Most source substitution and recharge programs are expected to have high public acceptance. Public input has tended to favor source substitution over recharge approaches primarily due to water quality concerns. It is expected that public opposition to IPR could be significant without a concerted public education program.

7.3.9 Preferred Delivery Approach

Based on the evaluation of the water delivery and use elements, groundwater recharge programs appear to be the least costly approach for overdraft reduction. As discussed in Section 6, surface spreading in the East Valley is limited to areas where the hydrogeologic conditions allow the recharge water to reach the groundwater table. In the absence of additional demonstrated recharge sites, groundwater recharge may be limited to Whitewater, Levy, Martinez Canyon and possibly Indio. This effectively limits groundwater recharge programs to about 170,000 AFY. This amount could increase if additional suitable sites are identified or if injection becomes viable with the availability of treated Canal water. IPR is an emerging technology whose progress should be monitored closely for potential future application in the Coachella Valley if needed.

The remainder of any groundwater pumping reduction would be accomplished through source substitution. The initial focus should be on projects with the lowest unit costs and the highest pumping reductions. This would include completion of the Mid-Valley Pipeline (MVP) distribution system, and connection of additional agricultural and golf course uses to Canal water. Expansion of existing non-potable delivery systems in the West Valley should also continue. As growth occurs and agricultural use declines, it will be important to develop both potable and non-potable Canal water delivery systems for urban uses. To avoid lost opportunities, water agency policies may need to require installation of non-potable water systems by new development.

7.4 EVALUATION OF PLAN PERFORMANCE

Evaluation of potential strategies for the 2010 WMP Update has considered a number of factors. The management approach must be flexible so that it can be adapted for changing conditions for both local development and water demands as well as the statewide water supply situation. A number of alternative water supply strategies have been considered including water conservation, maximizing use of local resources such as recycled water and additional imported supplies. However, new water supplies will be increasingly more costly in the future. There are two primary approaches for reducing groundwater overdraft: source substitution and groundwater recharge. To provide adequate flexibility, both approaches are required. Finally, water quality concerns must be addressed in developing the Update. Based on the evaluation of source and delivery elements, a preferred supply mix and approach for use of those supplies have been identified.

To finalize the preferred approach for the 2010 WMP Update, basin management performance must be evaluated. This is accomplished through the evaluation of groundwater balances and the use of the Coachella Valley groundwater model. The intent of the evaluation is determine whether the water supply and delivery strategies can manage overdraft without creating significant new issues.

There are a number of issues considered in selecting the appropriate approach for water management in the Coachella Valley. These considerations include change in groundwater storage, groundwater balance, changes in drain flows, salt balance and water quality, groundwater levels, liquefaction and subsidence risks, capture and desalination of drain water, and effects on Salton Sea inflows. The preferred approach seeks to achieve a reasonable balance among these considerations while retaining sufficient flexibility to meet unanticipated conditions including changing water demands and supply availability.

7.4.1 Change in Groundwater Storage

Change in groundwater storage is the annual amount of groundwater that is stored or removed from the groundwater basin. The continued reduction in groundwater storage to the point that adverse impacts occur is referred to as overdraft. These adverse impacts can include water quality degradation and land subsidence as well as increased pumping costs. Over the past ten years, a total of 1,000,000 AF has been removed from basin storage. This storage depletion can lead to a variety of adverse impacts, including increased pumping energy/cost, water quality degradation and land subsidence.

A key objective of the 2002 WMP was to reduce groundwater overdraft and its associated adverse impacts. Under that Plan, overdraft would be eliminated by about 2030. The 2010 WMP Update retains this objective.

Elimination of overdraft not only involves halting the decline in groundwater levels, but also restoring the balance of inflows and outflows to provide long-term supply sustainability and adequate salt export. Since the only mechanism for salt export from the groundwater basin is through the tile drain system, adequate drain flows must exist to export the salt that is contained in the imported water supply and added through use.

Evaluations of alternate management strategies indicate that groundwater overdraft can be controlled through a variety of recharge and source substitution strategies. The approach taken in the 2010 WMP Update involves adjusting the basin inflows and outflows through a combination of conservation, recharge and source substitution strategies to achieve a positive annual change in groundwater storage, as shown on **Figure 7-4**. This results in a gradual increase in basin storage and restoration of groundwater levels, especially in the East Valley. Over time, as storage volumes are restored, the positive change in storage in the East Valley gradually declines to control excessive drain flows and minimize water level increases. In the West Valley, change in storage is maintained at a slightly positive level. This preserves operational storage for buffering SWP supply variations and Metropolitan's periodic needs to store water under the Advanced Delivery Agreement.

One challenge in attaining this increase in storage is the variability of SWP Exchange supplies. During periods when SWP deliveries are reduced, groundwater is removed from storage. When SWP deliveries are relatively high, groundwater storage is gained, as occurred in 2005. The groundwater basin balance and groundwater modeling is performed under long-term average hydrologic conditions. As the WMP is implemented, it is important to recognize these variations when evaluating plan performance.

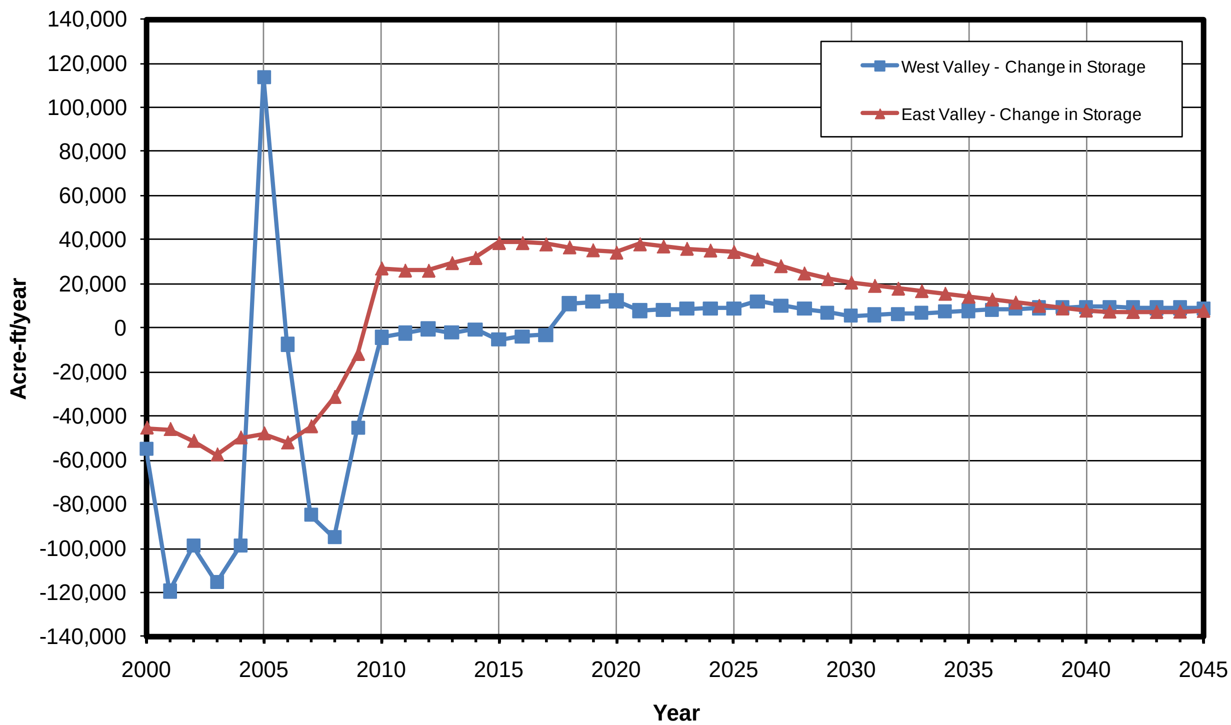


Figure 7-4
Projected Change in Storage

7.4.1.1 Drain Flows

Throughout much of the East Valley, agricultural tile drains were installed to drain shallow groundwater perched on fine-grained, high-salinity, ancient lakebed soils. Most of the drains empty into the CVSC; however, 25 smaller open channel drains at the southern end of the Coachella Valley discharge directly to the Salton Sea. Adequate drain flows are needed to export salt from the basin and to maintain habitat in the CVSC, drains and Salton Sea.

The quantity of flow in the drains, and therefore in the CVSC, depends upon water levels in the underlying aquifers and the quantities of applied irrigation water. Historically, the highest drain flows occurred from the 1960s to the early 1980s when groundwater levels were at their highest. Groundwater levels in some areas of the confined Lower aquifer were above ground surface or at least above those in the Upper aquifer, creating an upward hydraulic gradient. This upward gradient tended to flush the more saline water in the Upper and Semi-perched aquifers into the drain system.

Since that time, both water levels and drain flows have declined. However, as overdraft has increased, deep groundwater levels have declined and a downward vertical gradient has been created. This has allowed more irrigation return flow to recharge the groundwater basin rather than flow to the drains. Because the quality of the return flows is generally poor (~2,000 mg/L TDS), an increasing amount of poor quality water recharges the basin when drain flows are low, leading to water quality degradation. While this degradation may initially occur in the shallower aquifers, it may eventually contribute to degradation in the Lower aquifer. In the absence of higher groundwater levels and drain flows, this recharge of poor quality water will continue.

Increased drain flows are beneficial through the export of salt from the groundwater basin; however, changes in drain flows may potentially have adverse effects on biological resources of the Valley. Some resource agencies view any change in drain flows (increase or decrease) from current conditions as detrimental relative to their effect on endangered species such as desert pupfish. In addition, increased drain flows could be viewed as wasting water because additional water must be put into the basin through recharge activities to offset the amount of water lost to the drains. Although a portion of the higher drain flows could be recovered and reused through treatment, this would require added cost and energy consumption.

Groundwater modeling results indicate that drain flows in 2045 can range from a low of about 66,000 AFY for continued implementation of the 2002 WMP strategies with the revised water demands to a high of about 119,000 AFY with restoration of historical groundwater levels. Consequently, drain flows are sensitive to the management approach. It appears that somewhat lower drain flows can be maintained by reducing recharge near the Oasis area and increasing recharge in the Indio area where there is more pumping. This would allow better use of the basin storage capacity. However, the amount of recharge feasible in the Indio area has not been demonstrated by field testing.

Figure 7-5 shows the projected flows to the drain system with implementation of the 2010 WMP Update. This chart indicates that flows will decline until about 2015 and then increase as water levels in the East Valley recover as a result of management activities. The net amount of flow reaching the Salton Sea is a function of total drain flows (water flowing from subsurface drains), wastewater discharges to the CVSC less any flow recovered through drain water desalination and recycled water use. **Figure 7-5** also shows the potential flow to the Sea in the event that desalination of drain water is maximized and all recycled water generated by new growth is used to meet future demands. The actual flow to the Sea could be higher than shown if alternate sources of water are implemented (such as water transfers) that could offset a portion of the drain water desalination. Consequently, the net flows to the Sea represent a minimum level with implementation of the 2010 WMP Update. Under assumptions of improved Delta exports flows to the Salton Sea would be about 64,000 AFY in 2045, comparable to 2009 conditions.

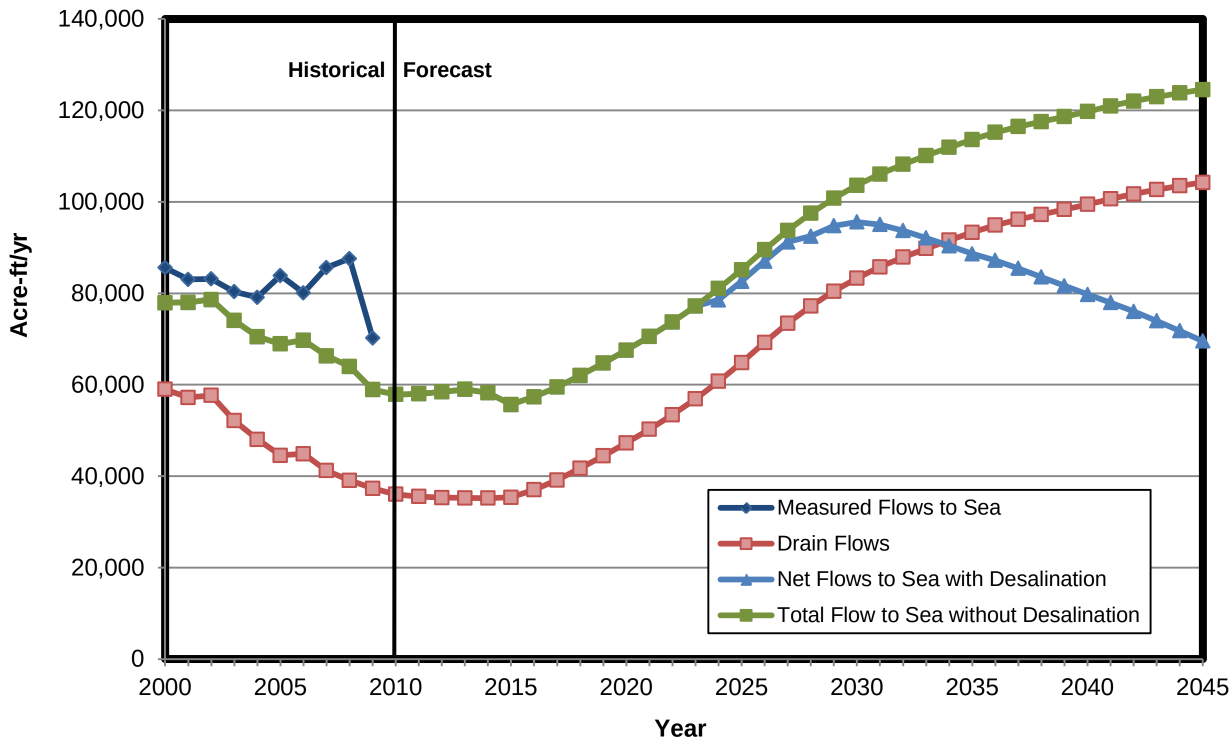


Figure 7-5
Historical and Projected Drain Flows

7.4.1.2 Salt Balance

The salt balance of a basin is the mass balance of salt entering and leaving the basin, typically measured in tons per year. Salt is added to the groundwater basin through natural recharge, wastewater percolation, application of fertilizers, imported water use (irrigation or recharge), and intrusion from the Salton Sea. Salt is removed from the basin principally through the agricultural drains, wastewater discharge to the CVSC and subsurface outflow to the Salton Sea. If sufficient salt is not removed from the basin, groundwater quality will gradually deteriorate. Primary source of salt in the Coachella Valley is imported water, which has a salt content of about 1 ton/AF (1 ton/AF = 735 mg/L). Under current average conditions, imported water brings about 350,000 tons of salt into the basin each year. Under the 2002 WMP, imported water and desalinated water deliveries would increase significantly, resulting in about 230,000 tons/yr of additional salt being brought to the basin.

Mechanisms for improving basin salt balance are reduced imported water salt load (new higher quality sources or desalination), increased salt export (increased drain flows or desalination), or managing salt additions (fertilizers, etc. – a minor component). To balance the current salt influx to the basin from imported water through drain flows having a typical salinity of about 2,000 mg/L, the drain flows would need to be about 130,000 AFY. Under future conditions, about 186,000 AFY of drain flows could potentially be required. If the salt concentration of drain water could be increased, the volume required for salt export would decrease. This could be accomplished through increased water conservation, which reduces return flows and increases the salt content of the return water. However, any benefit derived from higher return water salinity may be offset by reduced agricultural production caused by higher soil salinity. Desalination of drain flows could also assist in concentrating the salt discharges from the basin provided there is a suitable method for brine disposal.

Salt balance calculations have been performed for the Whitewater River Subbasin. The results of these calculations, shown on **Figure 7-6**, indicate that the net salt addition in the West Valley area gradually increases from about 100,000 tons/yr to about 150,000 tons per year. This salt originates from SWP Exchange water delivered for recharge and from Canal water delivered to the MVP. The value remains relatively stable because the only outlet for salt in the West Valley is through subsurface outflow to the East Valley.

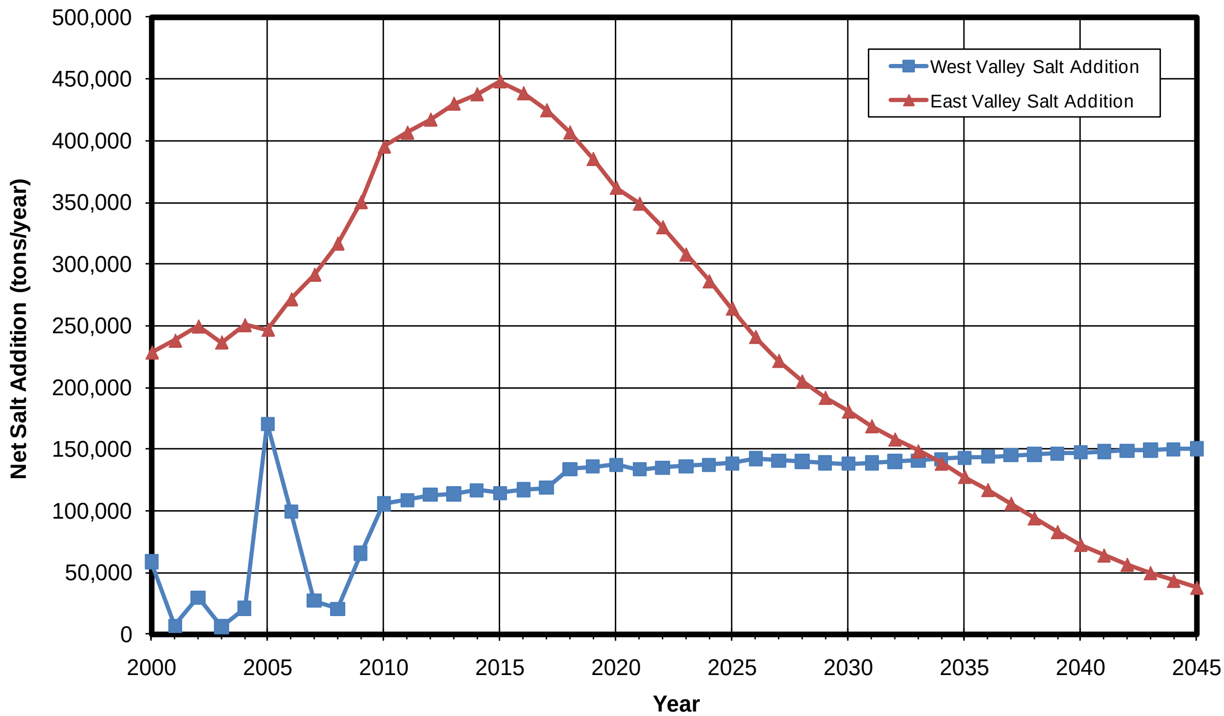


Figure 7-6
Salt Balance

Salt additions to the East Valley show a significant increase between 2005 and 2015 as Canal water utilization increases for groundwater recharge and source substitution. However, after 2015, drain flows begin to increase in response to increased storage and groundwater levels as shown previously on **Figure 7-5**.

7.4.1.3 Shallow Groundwater

High groundwater levels in shallow perched or semi-perched aquifers can lead to waterlogging of soils. In turn, this can lead to septic system failures, structural flooding (seepage into subterranean parking, etc.), utilities damage (flooded vaults, sewer infiltration, etc.) and saturated root zones resulting in adverse effects on agricultural production and landscaping. In some portions of the United States, shallow groundwater surfaces in low lying depressions creating lakes that flood seasonally when groundwater levels are high, conditions which do not exist in the Coachella Valley.

Currently, extensive agricultural irrigation in the East Valley contributes a significant amount of return flow to the semi-perched aquifer maintaining the shallow groundwater levels. As development occurs, agriculture will be replaced by urban land uses. Water conservation activities are expected to reduce the amount of return flow to the groundwater basin by about 30 percent. This could potentially lower water levels in the semi-perched aquifer and partially reduce the risk of property damage from shallow groundwater. Basin recharge activities coupled with source substitution would reduce groundwater overdraft, creating an upward vertical gradient that could increase semi-perched aquifer water levels. If the amount of overdraft reduction is greater that the reduction in return flows, then increased water levels could occur in the semi-perched aquifer. Torres-Martinez tribal representatives have expressed concern about the potential negative impacts that increased water levels might have on the operation of their septic disposal systems.

Continued use of the drainage system is expected to be necessary to maintain water levels and to export salt resulting from irrigation. If semi-perched water levels cannot be adequately controlled by the drain system to minimize impacts on septic systems, then connection to CVWD's regional wastewater collection system may be required.

Groundwater modeling results for the 2002 WMP indicated that significant areas of shallow groundwater would exist in the East Valley as water management activities are implemented. Most of the affected areas are near existing surface channels like the CVSC or are areas that do not currently have subsurface drains. **Figure 7-7a** shows the areas affected by shallow groundwater. While water conservation could reduce the amount of return flows, modeling for the 2010 WMP Update indicates that shallow groundwater will still exist in central portion of the East Valley primarily along the CVSC. Given the geology of the Valley, shallow groundwater conditions cannot be avoided as long as irrigation (both agricultural and urban/golf) is occurring. As stated above, it will be important that the regional drainage system be maintained and enhanced as development occurs in the Valley.

7.4.1.4 Liquefaction

Liquefaction is a physical process by which sediments below the water table temporarily lose strength and behave as a liquid rather than a solid. In the liquefied condition, soil may deform enough to cause damage to buildings and other structures. Seismic shaking is the most common cause of liquefaction. During an earthquake, the granular structure of the saturated soil particles is compressed increasing the pore water pressure between particles. If the pressure becomes high enough, the soil loses its strength and the particles can move freely causing a loss of bearing strength. This can cause buildings to sink into the ground or tilt, empty buried tanks to rise to the ground surface, slope failures, nearly level ground to shift laterally tens of feet (lateral spreading), surface subsidence, ground cracking and sand blows. Excess water pressure is vented upward through fissures and soil cracks, and a water-soil slurry bubbles onto the ground surface. Site-specific geotechnical studies are the only practical and reliable way of determining the specific liquefaction potential of a site; however, a determination of general risk potential can be provided based on soil type and depth of groundwater.

Liquefaction occurs in well-sorted (similar sized) sands and silts in areas with high groundwater levels. Liquefaction has been most abundant in areas where groundwater occurs within 30 feet of the ground surface; few instances of liquefaction have occurred in areas with groundwater deeper than 60 feet (EERI, 1999). Dense soils, including well-compacted fills, have low susceptibility to liquefaction (EERI, 1999). Liquefaction hazards are noted for the area from Indio southeast to the Salton Sea (Riverside County Integrated Plan, 2003). DWR indicated a liquefaction hazard exists for the majority of the East Valley floor because of perched groundwater and presence of appropriate soils. However, there is no surface indication of any liquefaction occurring in the past (DWR, 1964).

In the 2002 WMP PEIR, the existing risk for liquefaction was recognized in areas having semi-perched groundwater. The PEIR stated that the Proposed Project will not change the potential for liquefaction in most of the East Valley because the subsurface agricultural drains maintain groundwater in the Semi-perched aquifer. In the vicinity of recharge basins, water levels were projected to remain greater than 30 ft below ground surface. Detailed site-specific geotechnical analyses would be required prior to construction of major water resources facilities.

Figure 7-7a shows the areas where shallow groundwater is less than 60 feet below ground surface (green line). This area of liquefaction risk is consistent with mapping presented in the Safety Element (Chapter 6) of the 2003 Riverside County General Plan. Future development in the East Valley will need to address the current risk of seismically-induced liquefaction through proper foundation design and construction techniques. Current groundwater modeling indicates that much of the land underlain by the Semi-perched aquifer could have shallow groundwater ranging from the ground surface in areas without drains to 50 ft below ground. Since the existing drain system is generally at a depth of 10 ft, much of the area has a depth to water in the range of 0 to 10 ft. In these areas, it will be important that detailed geotechnical investigations be conducted prior to foundation design to minimize the risks of differential settlement due to liquefaction. Such steps may include over-excavation and re-compaction and the use of geotextiles to reinforce the soil.

7.4.1.5 Subsidence

Land subsidence is the lowering of the ground surface due to groundwater withdrawal or seismic activity. Seismic-induced movements may cause subsidence on the depressed side of a fault, or relatively small-scale subsidence can also occur when dry soils are saturated with water due to seismic activity.

Groundwater withdrawal is the most likely mechanism or cause for land subsidence in the Coachella Valley. Groundwater withdrawal reduces the groundwater pressure and the support that it provides causing the fine-grained aquifer sediments to compact from the weight of the overlying sediments. The amount of compaction depends upon the thickness and hydrogeologic characteristics of the aquifer, as well as the rate and amount of decrease in the water level. Fine-grained sediments (silts and clays), such as those composing the aquitard that separates the Upper and Lower aquifers, are more susceptible to compaction and subsidence than coarse-grained sediments (sands) when groundwater is removed from them. However, the low permeability and high specific storage of fine-grained sediments cause compaction to occur slowly, over a period of several years, rather than as an instantaneous response to water level decline. Therefore, a short-term impact might be difficult to detect and subsidence may occur years after the water level had declined. However, once the compaction occurs, compaction of fine-grained sediments is permanent, due to a permanent rearrangement of soil particles. This results in a permanent loss of groundwater storage capacity and causes permanent land subsidence.

Uneven depression of the land surface is the major indication of vertical compaction due to surface subsidence. Land subsidence due to vertical compaction usually is not uniform, possibly due to differences in the underlying sediments. The resulting damage can include:

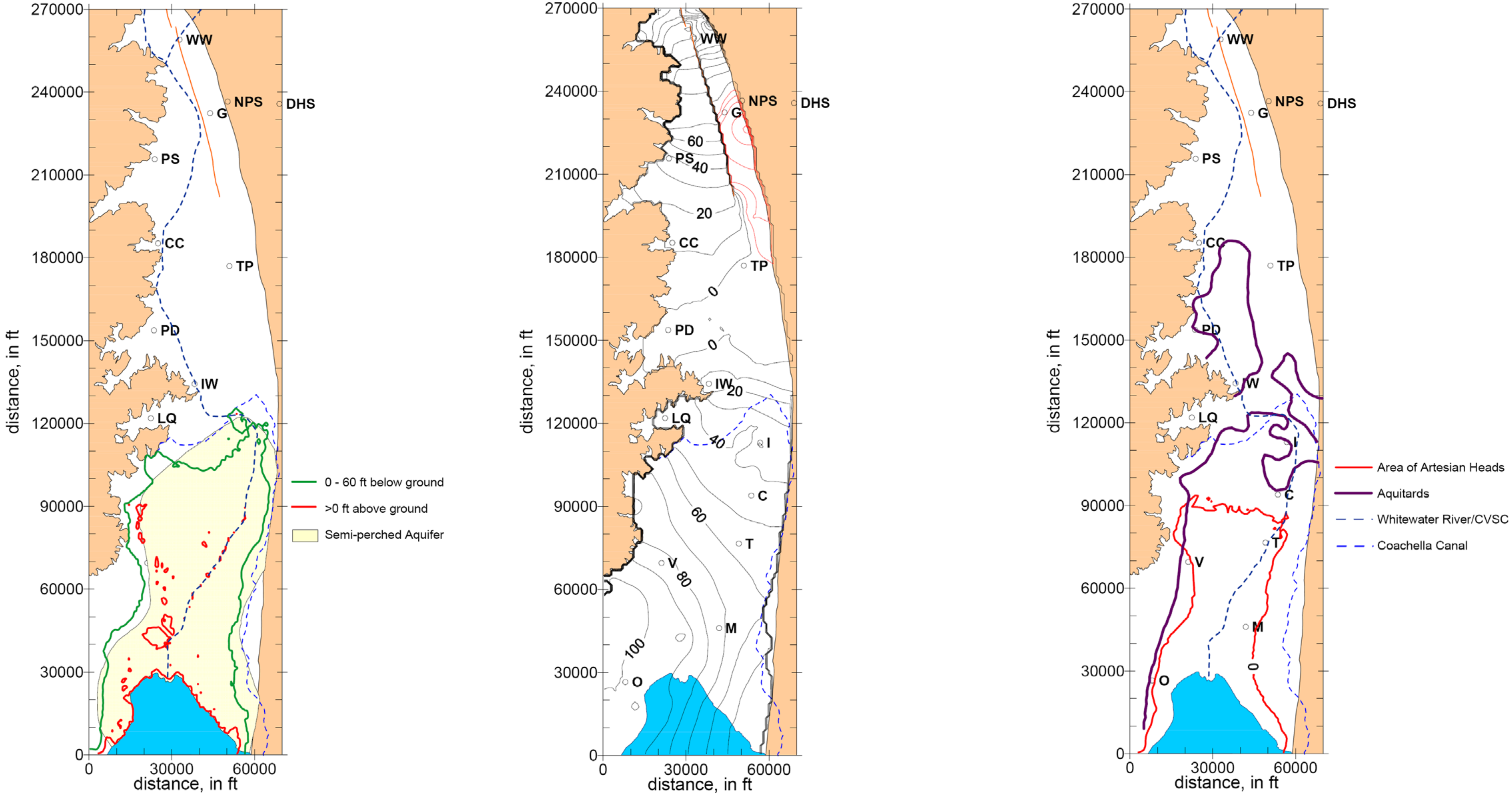
- Visible cracks, fissures, or surface depressions
- Damage to structures, such as canals, utilities, roads, and buildings
- Damage and loss in effectiveness of the subsurface agricultural drainage system
- Disruption of surface drainage and irrigation systems
- Loss of vertical elevation

In addition to vertical compaction, regional and local horizontal movements can occur due to large amounts of localized groundwater extraction or due to changes in aquifer thickness. Changes in aquifer thickness occur at the basin margins or where the depth to bedrock is shallow and non-uniform. The horizontal movements can ultimately result in inelastic failures at the ground surface that appear as surface fissures. Surface fissures can damage structures, interrupt irrigation of agriculture, capture runoff, and can become direct conduits for poor quality water to enter the aquifer. Historically, surface fissures developed in the La Quinta area in the later 1940s, possibly as a result of land subsidence or seismic action.

In 1996, the USGS, in cooperation with CVWD, established a geodetic network of monuments to monitor vertical changes in land surface in the East Coachella Valley. In 2007, USGS published the results of the latest monitoring program (USGS, 2007). The 2007 report identified at least four areas in the Coachella Valley that had experienced land surface elevation changes, indicating that land subsidence occurred in three of the areas (Palm Desert, Indian Wells and La Quinta) and both subsidence and uplift apparently occurred in one of the areas (Indio-Coachella) between February 26, 2003 and September 25, 2005. Other local areas in the Coachella Valley also may have deformed, but the size of these areas and the amount of deformation generally are small compared with the Palm Desert, Indian Wells and La Quinta areas. All the areas where subsidence was detected – Palm Desert, Indian Wells and La Quinta – coincide with or are near areas where groundwater pumping generally caused groundwater levels to decline.

To minimize the future potential effects of land subsidence, it will be important to maintain groundwater levels at or higher than the level of the compressible clays. A more detailed assessment of the location of the compressible clay layers is required to determine the ideal groundwater level. However, for much of the East Valley, this means that water levels should not be allowed to drop below the 2005 levels and levels should be increased to maintain a safety factor. For those areas where inelastic subsidence has occurred, increased water levels will not restore ground elevations to pre-subsidence conditions. Groundwater modeling indicates that

Figure 7-7
Groundwater Levels



A – Areas of Shallow Groundwater **B - Changes in Deep Groundwater Levels 2005-2045** **C – Areas of Artesian Conditions**

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water levels for all of the evaluated options will result in increased water levels and consequently should reduce the risk of subsidence.

7.4.1.6 Artesian Groundwater Levels

Historically, artesian groundwater conditions have existed in much of the East Valley. Huberty, et al. (1948) presented a map showing the approximate extent of artesian flow reaching the grounds surface in 1939. In the vicinity of Lincoln Street and Avenue 72, about 30 ft of artesian pressure was noted in 1939. From the mid-1970s through 1994, more than 50 wells in the East Valley exhibited artesian pressure with wells as far north as Coachella and extending to the Oasis area. Pressures as high as 60 ft above ground surface were observed near the Salton Sea in the late 1980s. As overdraft conditions are reduced, groundwater levels in the deep aquifers are expected to return to conditions similar to those of 1970s and 1980s. This finding was indicated in the Program EIR for the 2002 WMP.

Although flowing artesian conditions can reduce the amount of pumping energy required to extract groundwater, most wells are not properly equipped to deal with the available pressure. This can result in loss of water from improperly controlled wells. Water from flowing wells could also cause property damage if not routed to drainage channels. Such nuisance water flows could cause issues with vectors. It should be noted that State law specifies that any artesian well which is not capped or equipped with a mechanical appliance that effectively arrests and prevents the flow of any water from the well is a public nuisance and the landowner allowing such waste is guilty of a misdemeanor (California Water Code §305-307).

Another potential issue with high artesian heads is the potential for leakage from the deeper aquifers into the shallow aquifers through wells that are perforated in both zones. Like flow from improperly controlled artesian wells, flow into the Upper or Semi-perched aquifers could result in loss of high quality water from the basin.

Recent observations indicate that artesian conditions have returned to portions of the East Valley. This occurrence appears to be the result of changed pumping patterns including a significant pumping reduction by aquaculture operations south of Mecca. Groundwater model simulations that excluded this pumping reduction indicated that artesian levels in the East Valley could be as much as 60 ft above ground surface near the Salton Sea by 2045. **Figure 7-7c** shows the areas in the East Valley that modeling shows could experience artesian conditions by 2045. Artesian pressures above ground surface begin to appear between 2015 and 2020 with the affected area expanding over time. It should be noted that these high pressures may not be observed in the field as vertical leakage into the Semi-perched aquifer and then into the drains may partially reduce this effect. However, historical data shows that high artesian pressures are possible in some areas of the basin.

7.4.1.7 Achieving Balance between Water Level Increases and Impacts

Although an important WMP objective is to manage basin overdraft, the challenge is to achieve an appropriate balance between the resulting higher groundwater levels and the risks and benefits associated with those levels while meeting fundamental needs of regional water supply and storage. Since a number of these factors conflict with each other, it may not be possible to establish a specific set of criteria that will meet all constraints.

Table 7-7 summarizes the general relationships between depth to groundwater and basin impacts.

Table 7-7
Relationship between Groundwater Depth and Basin Impacts

Factor	Decreasing Depth to GW	Increasing Depth to GW
Waterlogging/Septic Failures	Increased Risk	Decreased Risk
Artesian Water Losses	Increased Risk	Decreased Risk
Land Subsidence	Decreased Risk	Increased Risk
Liquefaction	Increased Risk	Decreased Risk
Drain Flows	Increased Flow	Decreased Flow
Salt Balance/Water Quality	Positive/Improved	Adverse/Degraded
Energy Consumption (pumping)	Reduced energy	Increased Energy
Water Supply (and Storage)	Decreased Risk	Increased Risk

Although an important WMP objective is to manage basin overdraft, the challenge is to achieve an appropriate balance between the resulting higher groundwater levels and the risks and benefits associated with those levels while meeting fundamental needs of regional water supply and storage. Since a number of these factors conflict with each other, it may not be possible to establish a specific set of criteria that will meet all constraints.

For example, maintaining a beneficial or neutral salt balance in the basin will require that drain flows be increased from their current levels. Since the quality of the drain flow is dictated by the source water quality and the water application practices, water conservation and source substitution activities will affect the quality of return flows and drain quality. For agriculture, the return percentage with no conservation is estimated to be about 38 percent of the applied water. If Canal water having a TDS of 750 mg/L is used for agricultural irrigation, the TDS of the return water will be 1,970 mg/L. A conservation level of 14 percent will reduce the return water to about 28 percent of the applied water but will increase the TDS of the returns to 2,680 mg/L. As discussed previously, salt export is more efficient (i.e., requires less water) when the concentration is higher.

Some of the factors cannot be reasonably balanced so as to eliminate future risks. For example, the basic geology of the Coachella Valley is such that shallow groundwater and the risk of seismically induced liquefaction cannot be avoided. Consequently, future development must take appropriate precautions to minimize these risks.

The approach for developing the 2010 WMP Update is to reduce overdraft in the basin by achieving a positive change in storage and raising water levels. When this is achieved, the risk of subsidence is reduced or eliminated. The strategies evaluated for the 2010 WMP Update achieve a reasonable balance between the benefits of overdraft reduction, water level increases and impacts resulting from those increases. As the WMP is implemented, it is important that monitoring results be evaluated on a regular basis to ensure that unanticipated adverse impacts are not occurring. If monitoring shows potential adverse conditions, then appropriate action can be taken to adjust plan implementation.

7.4.2 Development of Preferred Approach

The preferred approach for the 2010 WMP Update recognizes the increased uncertainty associated with growth and the water resources of the Coachella Valley. The 2010 WMP Update builds upon the concepts originally identified in the 2002 WMP but adds flexibility in the form of ranges for implementation rather than specific targets.

7.5 SUMMARY

Implementation flexibility is critical to respond to uncertain future growth as well as water supply conditions. A range of water conservation and water supply elements are evaluated to identify the most cost-effective sources. These conservation and supply elements must be sufficient to meet not only the projected water demands but provide a level of contingency in the event that individual water conservation and supply projects cannot be implemented as currently envisioned or growth is higher than anticipated.

A building block approach is used to implement water conservation and supply development. This approach requires an ongoing evaluation of the effectiveness of each element in reducing demands or generating new supplies. If the identified objectives are not met, then additional measures can be implemented to achieve those objectives. For example, the amount of future water conservation, water transfers and drain water desalination can be adjusted in response to the outcome of long-term solutions in the Delta.

Once water conservation and supplies are defined, the next step is the development of water management strategies to reduce and ultimately eliminate groundwater overdraft. The two primary measures for doing this are source substitution and groundwater recharge. Again, a flexible approach is taken where targets for both source substitution and recharge are established. However, these targets are flexible to allow adjustments in response to changes in development patterns affecting sources substitution and basin groundwater levels. Source substitution programs initially focus on supplying imported and recycled water to existing groundwater users. As growth occurs, these systems can be used to meet the needs of future development without increasing groundwater use. Recharge projects provide flexibility by allowing variable amounts of recharge in the future to either restore storage losses during dry periods and to prevent excessively groundwater levels.

By implementing this flexible approach, the 2010 WMP Update becomes a working planning tool that can adapt to changing conditions in the Coachella Valley. Details of the recommended approach are presented in **Section 8.**

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Section 8

Section 8
Implementation Plan

The Coachella Valley Water Management Plan (WMP) is a dynamic document. The WMP must be periodically updated to reflect changing conditions in development and water demand, water supply availability, and other internal and external factors affecting the water resources of the Valley. As discussed in the previous sections, the 2010 WMP Update has been prepared to reflect the changes in expected development within the Valley based on conversion of agricultural land to urban land uses and the reductions in water supply reliability estimates that have taken place as a result of environmental and legal restrictions in the California Delta. Additional factors such as climate change, changing water quality requirements and the potential for other emerging issues have also been considered. This section presents the proposed implementation plan for water supply development and control of groundwater overdraft.

8.1 PLAN COMPONENTS

The goal of the Coachella Valley WMP is to reliably meet current and future water demands in a cost-effective and sustainable manner. This will be accomplished by achieving the following objectives:

- Meet current and future water demands with a 10 percent supply buffer
- Eliminate long-term groundwater overdraft
- Manage and protect water quality
- Comply with state and federal laws and regulations
- Manage future costs
- Minimize adverse environmental impacts

As described in **Section 6**, the principal components of the WMP include water conservation and water supply development to meet water demands coupled with groundwater recharge and source substitution to reduce groundwater overdraft. Water quality improvements incorporated into the plan will ensure that the water delivered for urban use meets State and Federal drinking water requirements.

Key underlying themes of this update are balance and flexibility. Consequently, the approach with the 2010 WMP Update is to maximize flexibility in implementing plan elements while minimizing costs. In addition, the recommended Implementation Plan avoids excessive reliance on any one supply source while meeting projected water demands with a 10 percent supply buffer. In 2011, the supply buffer should ideally be about 68,000 AFY. The supply buffer should gradually increase with demand to about 89,000 AFY by 2045. The supply buffer serves as a contingency in the event that demands are higher than expected or supplies cannot be implemented at the levels expected. This supply buffer is achieved by establishing increased planning targets for urban water conservation, desalinated drain water, recycled water and water transfers and taking the actions to implement these higher targets if and when needed. Currently, due to groundwater overdraft and full use of existing developed supplies, there is no supply buffer. Development of the additional supplies to provide buffer may also provide the opportunity to reduce overdraft earlier and store water in the basin for future use. Development of this buffer should be accomplished in the next ten years such that plans are in place no later than 2020.

8.1.1 Continuation and Expansion of Existing Projects

The 2002 WMP included a number of recommended programs and features to reduce groundwater overdraft. These programs are effective, but with the reduced supply reliability described in this Update, they are not enough. They must be expanded to provide the balance and flexibility needed to reduce the groundwater overdraft reliably. The following describes the expansion of these existing programs.

8.1.1.1 Water Conservation

Water conservation continues to be a cornerstone of the WMP. Specific recommendations for water conservation are presented by user category. In addition to water conservation included in the baseline water demand projections, the 2010 WMP Update includes a minimum water conservation target of 117,300 AFY by 2045.

Agricultural Conservation: An agricultural conservation program will be implemented that achieves up to a 14 percent reduction in consumptive use by 2020. The savings would be achieved utilizing a staged approach. Initially, low cost, voluntary programs would be initiated followed by increasingly more expensive and mandatory programs as required. The following building blocks have been identified for implementation as needed:

- Grower Education and Training – Grower meetings and training programs combined with confidential grower audits funded by the District.
- District-provided Services–Scientific irrigation scheduling, scientific salinity management, moisture monitoring and farm distributions uniformity evaluations funded by the District.
- Irrigation System Upgrade/Retrofit – Partial or full funding and/or financial support of growers that convert from flood/sprinkler to micro-sprinkler/drip systems.
- Economic Incentives – As needed to achieve the 14 percent goal, this “building block” will involve adoption of one or more incentive pricing approaches to encourage conservation. Examples include tiered pricing, water budget pricing, or seasonal pricing.
- Regulatory Programs – This could include regulation that support and provide for agriculture conservation. Examples include farm management plans, mandatory drip/micro-spray systems for new permanent crops and conversion of existing crops over time.

These program features will be incrementally expanded until the target reduction is achieved. In order to achieve the maximum return on investment from conservation activities, emphasis will be placed on agricultural operations with the lowest irrigation efficiency.

Initially, the agricultural conservation program will save about 39,500 AFY of water by 2020, decreasing to 23,300 AFY by 2045 as agricultural land transitions to urban uses. CVWD will develop methods for tracking the effectiveness of agricultural water conservation. These methods will include determining average water use per acre of farmed land and average irrigation efficiency. The methods will reflect variations in annual/seasonal evapotranspiration and cropping patterns. Progress toward meeting agricultural conservation goals will be evaluated and reported annually.

Urban Conservation: The urban water conservation program will be expanded and enhanced to meet the State's requirement of a 20 percent reduction in per capita use by 2020 (20 by 2020). This will be accomplished by:

- continued public education and outreach programs promoting water conservation,
- improved landscape irrigation scheduling and efficiency,
- implementation of irrigation system retrofit rebates,
- implementation of appropriate water rate structures that provide the economic incentives needed to encourage efficient water use,
- coordinated regional water conservation programs involving Valley water purveyors, cities and Riverside County,
- Continued implementation of the 2009 Valley-wide Landscape Ordinance (Ordinance 1302-2)
- Installation of automated or "smart" water meters
- Extension of the landscape ordinance to include all landscaping regardless of size (current limit is 5,000 square-feet or larger for homeowner furnished landscaping) further decreases in the water allocations for landscape irrigation consistent with good irrigation practices and desert landscaping,
- Implementation of water budget-based tiered water rates or other conservation based rates by other water agencies
- Further decreases in the water allocations for landscape irrigation consistent with good irrigation practices and desert landscaping
- Landscape retrofit rebates – i.e., economic incentives for replacing high water use landscaping, also known as "cash for grass"
- Restrictions on the total amount of turf allowed
- Mandated use of smart irrigation controllers by all customers
- Audits of new development to assure continued compliance with the Landscape Ordinance
- Plumbing retrofits for existing properties including mandatory retrofit (ultra low flush toilets, showerhead replacement, etc.) prior to sale of property
- Conservation rebates for high-efficiency clothes washers
  Compliance with California Green Building Code Standards (California Code of Regulations Title 24, Part 11, 2009)
- Water distribution system audits and loss reduction programs

Once 20 percent conservation is achieved, continued implementation of these conservation measures will result in even greater savings per capita as new growth occurs. Projections indicate that continued implementation of these measures in conjunction with the State's 2010 CALGREEN Building Code requirements will result in per capita water use reduction of nearly 40 percent compared to the baseline per capita use defined in SB 7x7. This could potentially result in additional water savings of 55,000 AFY by 2045 if growth occurs as projected. To provide a portion of the water supply buffer, this target is increased to 73,500 AFY by 2045.

Valley water agencies will adopt DWR's method pursuant to SB 7x7 to track the effectiveness of urban water conservation. Progress toward achieving the urban water conservation goals will be reported in urban water management plans prepared on five year intervals. If progress shows that additional conservation is being achieved, then the water supply needs will be reassessed,

Golf Course Conservation: Golf course conservation continues to be an important component of water management in the Valley. Valley water agencies will do the following:

- Implement a water conservation program to achieve a ten percent reduction in water use by existing golf courses (built prior to 2007) by 2020. This would be accomplished through golf course irrigation system audits and soil moisture monitoring services.
- Encourage existing golf courses to reduce water use by reducing their acreage of turf.
- Implement the 2009 CVWD/CVAG Landscape Ordinance objectives for all new golf courses (built in 2007 and later). Conduct landscaping and irrigation system plan checks to verify compliance.
- Develop and implement methods to evaluate the effectiveness of golf course water conservation such as measuring water use per irrigated acre.

These measures are expected to achieve a savings of 11,600 AFY by 2045. Progress toward meeting golf course conservation goals will be evaluated and reported annually. Additional golf course conservation could contribute to the supply buffer; however, no specific target is included in the 2010 WMP Update.

8.1.1.2 Supply Development

As described in **Section 6**, the strategy for water supply development consists of a balanced portfolio which retains flexibility to adapt to future changes in supply reliability. Sufficient water supplies will be planned to provide a 10 percent buffer on an average basis to meet unanticipated reductions in existing supplies or difficulties in developing new supplies. The planning targets are described below. The additional supplies needed to provide the buffer would be implemented when required based on an on-going analysis of projected demands and supplies.

Acquisition of Additional Imported Supplies: Additional water supplies will be required to eliminate groundwater overdraft and meet the future demands of the Valley. Given the uncertainty in the California water supply picture, the average amount of additional imported supply required is in the range of 50,000 to 80,000 AFY. The lower value assumes successful implementation of the BDCP and Delta conveyance facilities while the upper value is based on reduced future SWP reliability (50 percent). _Of this amount, up to 35,000 AFY would be required to meet future demands in the Indio and Coachella portions of planning area east of the San Andreas fault. Should development in this area occur at a lesser level, less additional water will be required. The amount of additional transfers required do not include additional water needs for the Mission Creek-Garnet Hill water management area which is the subject of a separate water management plan.

Additional supplies will be obtained through the following actions:

- Acquire additional imported water supplies through long-term lease or purchase where cost-effective.
- Continue to purchase SWP Turnback Pool, SWP Article 21 (Interruptible) and supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program as available.
- Work with Metropolitan to define the frequency and magnitude for SWP Table A call-back under the 2003 Water Transfer Agreement.
- Continue to play an active role with U. S. Bureau of Reclamation (Reclamation), California Department of Water Resources (DWR), the State Water Contractors and other agencies in developing the Bay-Delta Conservation Plan and Delta Habitat Conservation and Conveyance Program.

Increased Recycled Water Use: As urban growth occurs, the following activities will be implemented:

- In the West Valley, implement a joint agency goal to increase recycling of all generated wastewater for non-potable irrigation from 60 percent to at least 90 percent by 2020 where feasible.
- In the East Valley, maximize the use of recycled water generated by future growth for urban irrigation as development occurs and customers become available by constructing tertiary treatment and distribution facilities at the CVWD WRP-4, City of Coachella and Valley Sanitary District facilities.
- Evaluate the feasibility of delivering recycled water in the existing Canal water distribution system while avoiding potential conflicts with future urban water treatment and use of Canal water.
- Determine the minimum amount of recycled and other water flow that must be maintained in the CVSC to support riparian and wetland habitat.
- Fully utilize all wastewater generated by development east of the San Andreas fault for irrigation uses to meet demands in that area and reduce the need for additional imported water supplies.

Based on these recommendations, up to 30,000 AFY of recycled water would be utilized in the West Valley, up to 33,000 AFY of recycled water would be utilized in the East Valley and up to 10,800 AFY of recycled water would be utilized in the area east of the San Andreas fault for direct non-potable uses by 2045, for a total of 73,000 AFY.

Develop Desalinated Drain Water: CVWD will implement programs and projects to validate its water rights application for the Whitewater River. Measures will include:

- Develop a program to recover, treat and distribute desalinated drain water and shallow groundwater for non-potable and potable uses in the East Valley.
- Construct a demonstration facility to gain operational experience in drain water desalination and brine disposal.

The amount of water recovered through drain water desalination will range from 55,000 to 85,000 AFY. The lower end of the range is based on the successful implementation of the BDCP and Delta conveyance facilities. The high end of the range is close to the maximum amount of drain water expected to be generated in the Valley. The program will be phased so that it can be expanded in response to future water supply conditions and needs of the Valley.

Conjunctive Water Management: Conjunctive water management is the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region to meet various management objectives. CVWD and DWA have engaged in conjunctive water management since imported water became available to the Valley. Initially, groundwater replenishment with local surface water was implemented to minimize water losses and offset groundwater pumping. Delivery of Coachella Canal water allowed CVWD to reduce groundwater pumping and provide in-lieu replenishment to the basin. Once SWP Exchange water became available, this supply provided groundwater replenishment. Later, implementation of the Advanced Delivery program with Metropolitan allowed the pre-deliver of SWP Exchange water and enhanced supply reliability for both Metropolitan and the Coachella Valley. Implementation of additional groundwater recharge and in-lieu facilities such as the Mid-Valley Pipeline Project further enhance conjunctive management of the Valley's water resources. CVWD and DWA will continue to identify partnership opportunities that enhance water management in the Coachella Valley.

8.1.1.3 Groundwater Recharge Programs

The 2002 WMP had a planning target of 103,000 AFY of SWP water at the Whitewater recharge facilities and 80,000 AFY of Canal water recharge at East Valley recharge facilities by 2035. Groundwater recharge will continue to be a significant component of water management in the Coachella Valley. Existing and proposed recharge activities identified in the 2002 WMP will continue with some modifications as identified below.

Whitewater River Recharge

- Continue operation of the Whitewater facilities to recharge SWP Exchange water, at least 100,000 AFY over a long-term (20-yr) average.
- Transfer and exchange any unused desalinated drain water and SWP water from the QSA for Colorado River Aqueduct (CRA) water delivered to Whitewater for recharge (see **Section 6.6.1**).
- Utilize additional acquired water transfers to supplement the existing SWP exchange water.

Thomas E. Levy Groundwater Replenishment Facility

- Continue operation of the Levy facility and recharge 40,000 AFY on a long-term basis as system conveyance capacity allows.
- Monitor groundwater levels in shallow and deep aquifers for signs of rising shallow groundwater. Develop operating criteria to minimize chances for shallow groundwater mounding.
- If the existing conveyance system is not capable of sustaining 40,000 AFY of deliveries for recharge at the Levy facility, construct a second pumping station and pipeline from Lake Cahuilla to provide a supplemental supply.

Martinez Canyon Recharge

- Conduct siting and environmental studies, land acquisition and design for the full-scale Martinez facility with a design capacity of up to 40,000 AFY.
- Complete construction of the Martinez facilities in phases such that the facility can be initially operated at 20,000 AFY with potential future expansion to as much as 40,000 AFY based on groundwater overdraft conditions and implementation of East Valley source substitution projects.
- Coordinate pipeline and pumping station construction with expansion of the Canal distribution system in the Oasis area.

8.1.1.4 Source Substitution Programs

Like groundwater recharge, source substitution continues to be an important element for reducing groundwater overdraft. Due to the expected changes in water use patterns in the Valley as a result of continued development, source substitution will receive increased emphasis in the future. Based on this need, the following actions are recommended.

The 2002 WMP had a goal of using 31,000 AFY of Canal water for urban use. The target for the 2010 WMP Update for urban water treatment is between 58,000 and 90,000 AFY by 2045. The amount to be implemented will depend on the amount of urban development, the amount of dual piping (see **Section 8.1.2.1**) and the availability of Colorado River water supplies. Treatment of Colorado River water may offset the need to treat additional groundwater for arsenic removal (see **Section 6.7.3**).

Mid-Valley Pipeline (see Section 6.5.3)

- Prepare a MVP system master plan to lay out the future pipeline systems.
- Implement near-term project expansions to connect golf courses along the MVP alignment and extensions of the existing non-potable distribution system.
- Complete the construction of the remaining phases of the Mid-Valley Pipeline system by 2020 to provide up to 37,000 AFY of Canal water and 15,000 AFY of WRP-10 recycled water on average to West Valley golf courses.

Conversion of Agricultural and Golf Course Uses to Canal Water

- Work with existing East Valley golf courses to increase Canal water use to 90 percent of demand.
- Work with large agricultural groundwater pumpers to provide access to Canal water and encourage them to reduce their groundwater pumping.
- Revise and update the Oasis distribution system feasibility study considering possible future conversion to urban use. If cost-effective, design and construct the Oasis distribution system to deliver up to 27,000 AFY of Canal and desalinated drain water by 2020.

Treatment of Colorado River Water for Urban Use

- CVWD, the City of Coachella and Indio Water Authority (IWA) will develop coordinated plans to treat Canal water for urban use in the East Valley.
- Conduct a feasibility study to determine the economic tradeoffs between large-scale centralized treatment facilities and small scale satellite treatment facilities including potential delivery from the MVP system.
- Evaluate opportunities for regional water treatment projects between CVWD, the City of Coachella and IWA to capture economies of scale.
- Determine the amount of Canal water desalination needed to minimize taste, odor and corrosion.

8.1.2 New Projects and Programs

In addition to those programs identified in the 2002 WMP which will be continued or expanded, the following new projects and programs will be implemented and are discussed in the following subsections:

- Canal water use for urban irrigation
- Groundwater recharge in Indio area
- Investigation of groundwater storage opportunities with IID
- Additional groundwater treatment for arsenic
- Development of salt/nutrient management plan
- Desalination brine disposal
- Canal water loss reduction
- Drainage control
- Stormwater capture feasibility
- Development of local groundwater supplies for non-potable use

8.1.2.1 Canal Water Use for Urban Irrigation

As development occurs in the East Valley, CVWD and the other Valley water purveyors will require installation of dual piping systems for new development for distribution of non-potable water (Canal or recycled water) for landscape irrigation (also see **Section 6.5.2**).

This program will offset the reduced Canal water use by agriculture as land use transitions to urban development. It will also reduce groundwater pumping for urban use. At least two-thirds to as much as 80 percent of the landscape demand of new development will be connected to non-potable water delivery systems. This will result in the utilization of at least 92,000 AFY of non-potable water by 2045. This program is essential to insure continued full use of the Valley's Colorado River water supplies as agricultural land use declines.

8.1.2.2 Groundwater Recharge in Indio Area

The City of Indio is evaluating the feasibility of constructing a groundwater recharge project within its service area. This project would be used to offset partially the impacts of Indio's pumping. Pursuant to the Indio-CVWD settlement agreement (2009), CVWD will work with the City of Indio to evaluate the feasibility of developing a groundwater recharge project that reduces groundwater overdraft in the Indio area.

For the 2010 WMP Update, it is assumed that an Indio area recharge project could offset pumping by 10,000 AFY. The actual amount will depend on the feasibility study results.

8.1.2.3 Investigation of Groundwater Storage Opportunities with IID

As part of the QSA, CVWD and IID signed an agreement that allows IID to store surplus Colorado River water in the Coachella Valley. Under the agreement, CVWD will store water for IID, subject to available storage space, delivery and recharge capacity and the prior storage rights of CVWD, DWA and Metropolitan. Stored water would incur a 5 percent recharge loss and a 5 percent per year storage loss. IID may also request CVWD to investigate and construct additional locations for direct or in-lieu recharge facilities. CVWD is currently working with IID to identify options for increasing the capacity of currently planned facilities or to construct additional facilities to store water on behalf of IID. Facilities to recover the stored water for use by CVWD Canal water users will also be included if reductions in recharge deliveries are insufficient to replace water foregone when IID calls for its stored water, thus requiring CVWD to replace the foregone water with CVWD Colorado River deliveries.

8.1.2.4 Additional Groundwater Treatment for Arsenic

Elevated arsenic concentrations in groundwater have been a problem for some time in the East Valley (see **Section 6.7.3**). In response to elevated arsenic levels in private wells, CVWD is pursuing federal grants to fund a portion of the cost to extend the potable water system to serve these communities. CVWD is also assisting these communities in connecting to the potable water system to the extent feasible. CVWD is evaluating delivery of treated Coachella Canal water to urban water users. To the extent Canal water is used for urban indoor use, additional arsenic removal will not be needed for those areas. However, as required to meet future demands and provide adequate redundancy, CVWD may need to expand its existing arsenic treatment facilities or construct new facilities to treat water from additional wells.

8.1.2.5 Development of Salt/Nutrient Management Plan

The State Water Resources Control Board (SWRCB) Recycled Water Policy (adopted February 11, 2009) requires every region in the state to develop a salt/nutrient management plan by 2014 (see **Section 5.1.2.3**). The salt/nutrient management plans are intended for management of all sources contributing salt/nutrients on a basin-wide basis to ensure that water quality objectives are achieved. This plan will assess the salt contributions of imported water including that used for recharge. The Coachella Valley Regional Water Management Group (CVRWMG), of which CVWD is a member, will take the lead in developing a salt/nutrient management plan that meets the SWRCB requirements and allows cost-effective recycling of municipal wastewater in the Valley.

8.1.2.6 Brine Disposal

As discussed in **Sections 6.4.8** and **8.1.1.2**, desalination of drain water from the CVSC for use in the East Valley is proposed in this Update. Desalination of Canal water may be required for potable water delivery. Treatment at these levels would result in production of large volumes of brine, which would need to be disposed in a cost-effective and environmentally sound manner and in compliance with state and federal regulations. In addition, groundwater treatment for arsenic and nitrate removal requires a salt brine to regenerate the treatment resins, a potential use for the brine. Consequently, a brine disposal system is required to safely convey salts to an acceptable point of disposal. Concepts for brine disposal will be evaluated in conjunction with the salt/nutrient management plan described above.

8.1.2.7 Canal Water Loss Reduction

As indicated in **Section 6.4.1**, allocated losses and unaccounted water in the All-American Canal, the Coachella Canal and the distribution system may be as high as 31,000 AFY. To increase the amount of water delivered to the Coachella Valley, CVWD will:

- Conduct a study to determine the amount of water lost to leakage in the first 49 miles of the Coachella Canal and evaluate the feasibility of corrective actions to capture the lost water. This may require the installation of additional flow metering locations along the Canal. If feasible, implement the recommendations of this study.
- Work with IID to develop a transparent system for allocating losses along the All-American Canal.

8.1.2.8 Drainage Control

As described in **Section 6.8.2**, it will be important for both basin management (shallow groundwater level control and salt export) as well as the prevention of adverse impacts of shallow groundwater that CVWD's existing agricultural drainage system be maintained in some form, or replaced as urban development occurs. Funding is needed to replace, expand, enhance and maintain the system for urban development in the future. CVWD is evaluating alternative methods for funding the drainage system and will undertake a study of the improvements needed to continue system operation in the future.

8.1.2.9 Stormwater Capture

In **Section 6.4.10**, stormwater capture was identified as a viable method for increasing the amount of local water utilized for either groundwater recharge or direct use. The amount of additional stormwater that could be captured and used has not been documented. Based on this, the following measures will be undertaken:

- Conduct a feasibility study to investigate the potential for additional stormwater capture in the East Valley.
- If cost effective, implement stormwater capture projects in conjunction with flood control facilities as development occurs in the East Valley.

Proposals to capture stormwater will only be considered to offset groundwater pumping or provide replenishment if they can clearly demonstrate that the water captured is “new water” that otherwise would have been lost to the Salton Sea or evapotranspiration.

8.1.2.10 Development of Local Groundwater Supplies for Non-Potable Use

Growth in the areas northeast of the San Andreas fault will create additional demands for both potable and non-potable water. An investigation of groundwater development in Fargo Canyon Subarea of the Desert Hot Springs Subbasin should be conducted to determine the available supply and suitability for use in meeting non-potable demands of development east of the San Andreas fault. CVWD will propose that a study be performed jointly with the cities of Coachella and Indio. Preliminary estimates prepared for the 2010 WMP Update indicate that up to 10,000 AFY of local groundwater supply, including returns from use, might be developed, depending upon the ultimate level of development in this area.

8.1.3 Environmental Enhancement and Mitigation Projects

In the 2002 WMP PEIR, CVWD committed to construct several habitat replacement projects as mitigation for impacts of the WMP identified in the 2002 PEIR. The 2008 CVMSHCP incorporated these mitigation measures and added additional mitigation requirements for maintenance of the CVSC and drain system and for operation of the Whitewater River Spreading Facility. The habitat replacement and mitigation commitments included in the CVMSHCP are as follows:

- **Pupfish habitat** - 25 acres of managed replacement habitat to replace the habitat that is periodically altered by maintenance activities in drains and flood control channels that contain pupfish habitat. CVWD will also develop a study to evaluate the potential effect of routine drain maintenance on pupfish occupying the drains and to determine the efficacy of modifying maintenance practices to avoid or minimize potential Take.

- **Rail habitat –** 66 acres of permanent managed marsh habitat for listed California black rail and Yuma clapper rail in the CVSC and Delta Conservation Area to replace habitat that is periodically altered by flood control and drain maintenance activities.
- **Sonoran cottonwood-willow riparian forest habitat –** 44 acres of permanent riparian habitat to replace habitat that is periodically altered by flood control maintenance activities. The habitat will contribute to the conservation of this natural community and the riparian birds covered by the Plan.
- **Mesquite hummock habitat –** In conjunction with its WRP-7 recharge facility, CVWD will remove tamarisk from the site and, if a study undertaken by the Coachella Valley Conservation Commission demonstrates the feasibility of mesquite restoration, CVWD will restore and enhance mesquite and Coachella Valley round-tailed ground squirrel habitat on land it owns in the East Indio Hills Conservation Area to offset impacts to this species from CVWD's O&M activities in the CVSC and Delta Conservation Area.
- **Coachella Valley Fringe-toed Lizard (CVFTL) habitat –** CVWD will conserve the approximately 1,200 acres it owns in the CVFTL Habitat Conservation Plan (HCP) Whitewater Floodplain Preserve (part of the Whitewater Floodplain Conservation Area) in perpetuity as part of the CVMSHCP Reserve System. CVWD will deposit sand removed from the groundwater recharge basins during maintenance operations in the fluvial (water borne) and aeolian (wind-blown) sand transport area on available Reserve Lands in a manner that downwind habitat would receive appreciable inputs of aeolian sand from the deposits.

The habitat to be created in the East Valley is to be supplied with low selenium water, preferably from one of the drains or from the Coachella Canal. Based on the US Fish and Wildlife Service (USFWS) Permit (issued October 1, 2008), the pupfish study proposal and the plans for habitat development are to be submitted by October 1, 2010. The habitat will be established within three years of approval by the Wildlife Agencies of the plans to establish the habitat.

Over the past five years, the Torres-Martinez Tribe has constructed and operated an 85-acre freshwater-salt water habitat complex near the mouth of the CVSC. The complex consists of seven wetland treatment cells that polish (remove nutrients and pollutants from) drain water from the CVSC. The polished water is then blended with Salton Sea water and flows to four habitat ponds. This project has provided significant information regarding the development of engineered habitat near the Salton Sea and offers the potential for additional habitat creation as the Salton Sea recedes. CVWD will identify potential partnership opportunities with the Torres-Martinez Tribe to maximize the regional benefits of habitat enhancement projects.

8.1.4 Potential Future WMP Elements

Several programs and projects have been identified for possible inclusion in future updates to the WMP pending the results of feasibility studies.

8.1.4.1 SWP Extension

In 2007, CVWD and DWA in association with Metropolitan, San Gorgonio Pass Water Agency and Mojave Water Agency commenced an investigation of alternative routes for a Coachella

Valley extension of the California Aqueduct (see **Section 5.1.2.1**, **Section 6.4.2**). When this investigation is completed, CVWD and DWA will share the results with other Coachella Valley water suppliers and stakeholders, to make a determination of whether the costs to import SWP directly to the Valley are justified.

8.1.4.2 Desalination of Recharge Water

Under current average conditions, imported water brings about 350,000 tons of salt into the basin each year. Over time, this will lead to a gradual degradation of water quality in the basin. Desalination of Colorado River water is one approach for reducing the salt load in the recharged water. Significant issues include the necessity and level of treatment, benefits of treatment, cost of treatment, methods and costs of brine disposal and how the costs of treatment would be recovered from basin water users. An evaluation of the potential effects of Colorado River recharge will be conducted in conjunction with the salt/nutrient management plan (**Section 8.1.2.5**). Methods for improving recharge water quality will be considered as part of the IRWMP or a similar approach involving broad stakeholder involvement.

8.1.4.3 Nitrate Remediation/Treatment

High concentrations of nitrate exist in portions of the Coachella Valley groundwater basin. Generally, nitrate occurs in the unsaturated and shallow aquifers and has not been observed in the deeper aquifers. Restoration of groundwater levels as a result of the WMP could mobilize the nitrate in the unsaturated and shallow aquifers, increasing nitrate concentrations in pumped groundwater.

CVWD will continue to monitor and report nitrate concentrations in the groundwater. CVWD will consider evaluating the feasibility of installing nitrate treatment on selected high nitrate wells as a means of removing a potential future source of groundwater contamination. Inclusion of nitrate treatment as a WMP element will be re-evaluated in the next Plan update.

8.1.4.4 Seawater Desalination

Coastal communities in southern California are conducting studies and developing plans for desalinating ocean water as a water supply source. Because of the Coachella Valley's significant distance from the ocean, desalinated seawater would have to be acquired via exchange agreements. Due to the high cost of this supply, consideration of seawater desalination and exchange is being deferred to future WMP updates, should the need arise.

8.2 OTHER PROGRAMS

Other programs related to water management in the Coachella Valley consist of monitoring and data management activities, well management programs and stakeholder input.

8.2.1 Monitoring and Data Management

The need for monitoring and data management is described in **Section 6.8.4**. The following new programs/projects should be implemented to improve monitoring and data management in the Valley:

- Comply with the groundwater level monitoring requirements of the California Statewide Groundwater Elevation Monitoring (CASGEM) program established by SB X7-6.
- Develop a water resources database to facilitate data sharing between participating agencies and tribes.
- Construct additional monitoring wells in conjunction with new recharge facilities.
- Develop a water quality assessment documenting on-going monitoring activities in the basin.
- Conduct a joint investigation of the distribution of perchlorate in water supply wells in the Valley.
- Update and recalibrate Coachella Valley groundwater model based on current data and conduct a peer review of updated model.
- Develop a new planning interface and database that can be linked with land use plans and agricultural activities to better distribute pumping and return flows to the model.
- Develop and calibrate a water quality model capable of simulating the changes in salinity and possibly other conservative water quality parameters in conjunction with the salt/nutrient management plan.
- Develop a coordinated approach among the water purveyors and CVAG for calculating urban per capita water usage including methodologies for determining service area population.

8.2.2 Well Management Programs

Well management programs that should be implemented by Coachella Valley agencies include (see **Section 6.8.1** for details):

- Construction/destruction/abandonment policies - Well construction, destruction and abandonment policies should be developed and implemented in cooperation with Riverside County.
- Artesian well management program - As water management actions in the Valley restore water levels, groundwater levels in the deep aquifers will once again become higher than the ground elevation, resulting in artesian conditions. CVWD will develop a program to educate and work with well owners to properly control artesian wells.
- Well capping program - CVWD will implement a cooperative program to identify and cap wells that are no longer being used for groundwater production.

8.2.3 Stakeholder and Tribal Input

Stakeholder input and concurrence is vital to the implementation of water management programs in the Valley. CVWD and other Valley water agencies have significantly increased their public outreach through water conservation programs, implementation of water management projects, development of the 2010 WMP Update and development of the Coachella Valley Integrated Regional Water Management Plan. It is equally important that tribal concerns regarding water management be discussed and addressed to the extent feasible. It is recommended that CVWD, DWA, water agencies and the Coachella Valley tribes continue their on-going dialogue on water management in the Valley.

8.3 IMPLEMENTATION PLAN

The implementation strategy is a function of water needs and the feasibility of specific programs. CVWD, in conjunction with the tribes and the other valley water districts as appropriate, will implement new plan elements based on the schedule in **Table 8-1**.

Table 8-1
Implementation Plan

Plan Element	Responsible Entity(ies)	Completion Year
Water Conservation Program		
• Adopt and implement 2009 CVWD/CVAG Landscape Ordinance or equivalent	CVWD, water purveyors, cities, Riverside County	Ongoing
• Establish urban water conservation baseline	CVWD, other urban water purveyors	Completed
• Achieve minimum 10 percent reduction in existing golf course use	CVWD, DWA	2015
• Achieve 14 percent reduction in agricultural water use	CVWD	2020
• Achieve 20 percent reduction in urban use	CVWD, other urban water purveyors	2020
Water Supply Development Program		
• Complete siting studies, environmental impact evaluation and design for CVSC drain water capture and treatment facilities	CVWD	2013
• File for water rights application for change of point of use for wastewater effluent discharges to allow water recycling	CVWD, VSD, Coachella	2015
• Complete construction of initial CVSC drain water capture and treatment facilities	CVWD	2015
• Conduct a feasibility study to investigate the potential for additional stormwater capture in the East Valley	CVWD	2015
• Conduct a study to determine the amount of water lost to leakage or otherwise unaccounted in the first 49 miles of the Coachella Canal and evaluate the feasibility of corrective actions to capture the lost water	CVWD	2015
• Conduct a joint investigation with Indio and Coachella of groundwater development potential in Fargo Canyon Subarea of the Desert Hot Springs Subbasin to determine the available supply and suitability for use in meeting non-potable demands of development east of the San Andreas fault	CVWD, IWA, Coachella	2020
Source Substitution Program		
• Prepare a master plan for Mid-Valley Pipeline completion	CVWD	2011
• Connect four golf course users along the MVP alignment to MVP	CVWD	2011
• Work with existing East Valley golf courses having Canal water access to increase their use to 90 percent of demand	CVWD	2012
• Investigate regional opportunities for Colorado River water treatment facilities	CVWD, IWA, Coachella	2012
• Develop policy requiring the installation of non-potable water systems for new development	CVWD	2012
• Work with large agricultural groundwater pumpers to determine what obstacles exist that prevent them from using additional Canal water and encourage them to reduce their groundwater pumping	CVWD	2012

Table 8-1
Implementation Plan (continued)

Plan Element	Responsible Entity(ies)	Completion Year
• Construct north and east extensions to the MVP system	CVWD	2013
• Complete siting studies, environmental impact evaluation and design for Colorado River water treatment facilities	CVWD	2013
• Complete construction of initial Colorado River water treatment facilities and connect to distribution system	CVWD	2015
• Complete Oasis study update	CVWD	2015
• Prepare a non-potable water distribution master plan	CVWD	2015
• Complete construction of MVP backbone system	CVWD	2020
Groundwater Recharge Program		
• Operate and monitor the Levy replenishment facility with a 40,000 AFY goal	CVWD	2010
• Investigate groundwater storage opportunities with IID	CVWD	2010
• Transfer the unused portion of the 35,000 AFY of SWP water available under the QSA to the Whitewater Recharge Facility	CVWD	2011
• Work with the City of Indio to evaluate the feasibility of developing a groundwater recharge project that reduce groundwater overdraft. If feasible, work with Indio to construct the facility.	CVWD, IWA	2011
• Design and construct an additional pumping station and pipeline from Lake Cahuilla to the Levy facility if the existing pumping station and pipeline cannot provide sufficient water to meet the annual goal	CVWD	2015
• Conduct siting studies, environmental impact evaluation and design for Martinez Canyon Replenishment Facility	CVWD	2018
Monitoring and Data Management		
• Continue to monitor the extent of land subsidence	CVWD, USGS	2010
• Provide additional information in the annual engineers' reports: o Annual precipitation and stream flows o Additional groundwater level data and hydrographs o In-lieu recharge water deliveries from imported and recycled water that offset pumping o Imported water deliveries for direct use	CVWD, DWA	2011
• Obtain DWR designation as groundwater level monitoring and reporting entity for the Coachella Valley within their respective service areas	CVWD, DWA, water purveyors	2011
• Prepare a comprehensive groundwater monitoring plan	CVWD, DWA, water purveyors, wastewater agencies, tribes	2012
• Enhance the CVSC gauging station at Lincoln Street to provide continuous flow recording	CVWD, USGS	2012
• Develop centralized groundwater database	CVWD, DWA, water agencies, tribes	2012

Table 8-1
Implementation Plan (continued)

Plan Element	Responsible Entity(ies)	Completion Year
Other Programs		
• Continue to operate a groundwater advisory committee regarding groundwater management issues in the East Valley	CVWD, water agencies, pumpers, tribes	2010
• Develop a program to educate and work with well owners to properly control artesian wells	CVWD	2011
• Update and recalibrate the CVWD groundwater model based on the most current information	CVWD	2012
• Develop a water planning interface to the groundwater model	CVWD	2012
• Prepare a plan to maintain and enhance the existing drainage system to allow its future use for urban purposes	CVWD	2012
• Develop well construction, destruction and abandonment policies	CVWD, DWA, water agencies, tribes, Riverside County	2012
• Add groundwater quality simulation capabilities to the model that will allow simulation of salinity (TDS) and nitrogen in the groundwater	CVWD	2013
• Prepare a salt/nutrient management plan for the Valley to meet SWRCB Recycled Water Policy requirements	CVWD, DWA, water purveyors, wastewater agencies, tribes, agricultural and golf communities, and Regional Board	2014
• Extend urban water and sewer service to trailer/RV park communities with deficient infrastructure and poor water quality	CVWD	2015
• Investigate the feasibility of installing nitrate treatment on selected high nitrate wells to avoid redistribution of nitrates.	CVWD	2015
• Undertake a cooperative program to identify and cap wells that are no longer being used for groundwater production	CVWD, DWA	2015
Environmental Enhancement and Mitigation Projects		
• Develop plans for the creation of: • 25 acres of managed pupfish replacement habitat • 66 acres of managed rail replacement habitat • 44 acres of Sonoran cottonwood-willow riparian forest habitat	CVWD	2010
• Remove tamarisk, restore and enhance mesquite and Coachella Valley round-tailed ground squirrel habitat on land CVWD owns in the East Indio Hills Conservation Area	CVWD	Not Specified
• Conserve approximately 1,200 acres of land owned in the CVFTL HCP Whitewater Floodplain Preserve in perpetuity as part of the CVMSHCP Reserve System	CVWD	2010

8.4 IMPLEMENTATION COSTS

The continued implementation of the Coachella Valley WMP will require significant capital and operating investments to achieve the goals defined in this plan. **Table 8-2** presents the estimate of new capital and operating and maintenance (O&M) costs associated with Plan implementation and water production in the Valley. These costs include both the capital and O&M costs of water acquisitions, new water facilities for treatment, source substitution and recharge as well as the on-going costs of water supply and groundwater production in the Valley. The table assumes that the Valley will invest in its share of costs for Delta conveyance. These costs could vary depending on the timing and availability of alternative water sources and the effectiveness of water conservation measures.

Table 8-2
Implementation Costs by Plan Component
2011-2045

Component	Total Capital Cost $millions	Total O&M Cost $millions	Total Cost $millions	Average Annual Cost $millions
Water Conservation	$ 1	$ 230	$ 231	$ 6.6
Recycled Water	161	153	314	9.0
Colorado River Water		409	409	11.7
SWP Water		1,907	1,907	54.5
Delta Conveyance		472	472	13.5
Desalinated Drain Water	462	277	739	21.1
Groundwater Pumping and Treatment	135	1,950	2,085	59.6
Water Transfers	0	282	282	8.1
Other New Water		262	262	7.5
Source Substitution	1,142	782,	1,924	55.0
Recharge	48	181	229	6.5
Total	**$1,949**	**$6,907**	**$8,856**	**$253.0**
Annual Average	$56	$197	$253	

Significant capital investments will be required in the near-term to complete the construction of the MVP, construct urban water treatment facilities and develop a non-potable water delivery system for urban use in the East Valley. The current economic conditions of the Valley may affect the ability to develop the necessary funds to put this plan into operation. These conditions may also affect the rate at which urban development occurs.

In 2010, Valley water agencies expended approximately $414 million on all water and wastewater management activities. This total cost includes approximately $106 million on activities identified in this Water Management Plan associated with eliminating overdraft. During the next five years (2011-2015), it is estimated that Valley water agencies will expend an additional $5.4 million on activities to eliminate overdraft, assuming growth remains slow.

As growth occurs, additional projects to control overdraft will be needed. Capital costs associated with these projects will be paid by future growth, as well as most of the operation and maintenance costs. Ultimately, costs associated with growth to eliminate and control overdraft could approach an additional $100 million per year in capital project and annual operations and maintenance costs.

In developing the 2010 WMP Update, CVWD relies on the latest population projections developed by Riverside County. CVWD does not develop population growth projections for use in water management planning. The 2006 Riverside County projections could not have taken into account the current recession, which has slowed growth and will continue to have negative effects on growth in the near term. Over the long term, growth will continue, however population projections will need to be adjusted in terms of the timing of growth. These realities necessitate adjustment of Plan implementation to meet actual near term needs and continued updates of the Water Management Plan in the future to reflect revised population projections.

Near Term Projects to Meet Water Management Needs

Even with the current recession and lack of growth, continuation of existing projects and a few new projects are needed to reduce overdraft and its adverse effects. Ongoing projects that will be continued include:

- Whitewater Recharge with SWP Exchange Water and SWP purchases
- Implementation of the QSA
- Levy recharge at current levels of 32,000 AFY
- Martinez Recharge at Pilot Level of 3,000 AFY
- Water conservation programs at current levels, including implementation of the Landscape Ordinance
- Recycling in the West Valley
- Increased use of Canal water by golf courses with Canal water connections
- Conversion of East Valley agriculture to Canal water as opportunities arise
- Groundwater level/quality monitoring
- Subsidence monitoring

Assuming that growth remains relative low, during the next five years CVWD will focus on three new or expanded activities to reduce overdraft:

- Increased use of the Mid-Valley Pipeline project to reduce overdraft in the West Valley by connecting golf courses and reducing groundwater pumping by those courses.
- Implementation of additional water conservation measures, including the Landscape Ordinance, to meet the State's requirement of 20% conservation by 2020.
- Preparation of a salt/nutrient management plan for the Valley by 2014 to meet SWRCB Recycled Water Policy requirements

Long Term Projects to Meet Water Management Needs

Projects to eliminate and control overdraft that are likely to be needed as future growth occurs are described in the 2010 WMP Update. These projects include:

- Additional water conservation.
- Desalinated drain water.
- Additional water transfers.
- Additional recycled water.
- Canal water treatment for urban indoor use.
- Canal water treatment for urban outdoor irrigation.
- Recharge in the Indio area.

As growth ramps up, the projects will be implemented based on cost effectiveness and need.

8.5 FINANCING

In order to implement the recommendation of the 2010 WMP Update, a financial plan is required to allocate program costs to those who benefit from those programs. This cost allocation is beyond the scope of this Update and will require discussions between CVWD, DWA, the Valley water agencies, Native American tribes, the development community, user groups and the public.

A variety of financing mechanisms are available to provide funding for the WMP. These include:

- Water rates – water purveyor charges to water customers for the purchase of water for urban or agricultural use
- Replenishment assessments – charges for replenishment water to groundwater pumpers based on their annual production
- Developer fees – charges applied to new development on a per-connection basis to cover the capital cost of supply acquisition and water/wastewater system construction
- Assessment districts – charges applied to property tax bills to recover the capital cost of utility construction for new development
- Property taxes – charges applies to property tax bills of land owners to recover bonded indebtedness such as the SWP capital costs and other authorized bonds
- Grants – state or federal money provided for specific water management programs, usually awarded on a competitive basis
- Bonds – voter-authorized (general obligation) or water agency-authorized (revenue) funding for capital facilities

The specific financing mechanisms that will be applied to each WMP element will be determined by the CVWD Board and the governing bodies of participating agencies. A combination of funding sources will likely be used to best meet the needs of the Valley water users.

8.6 SUMMARY

The goal of the Coachella Valley WMP is to reliably meet current and future water demands in a cost-effective and sustainable manner. Implementation of the 2002 WMP has resulted in many successes toward achieving this goal. However, the 2002 WMP recognized the importance of on-going review and update to ensure the plan meets the ever-changing needs of the Coachella Valley. The 2010 WMP Update endeavors to achieve this goal and presents a number of changes in water management strategy for the Valley that adapt the WMP for these changing conditions. Additional changes in direction and scope will occur in the future as the plan continually adapts to the needs of the Valley.

Appendix A

Appendix A
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Appendix B

Appendix B
Acronyms, Abbreviations, and Glossary

B.1 ABBREVIATIONS

2002-CVWMP	2002 Coachella Valley Water Management Plan
AB	(California) Assembly Bill
acre-ft/yr	acre-feet per year (1 acre-foot equals 325,851 gallons.)
ADT	Average Daily Trips
AF	acre feet
AFY	acre feet per year
AOP	Annual Operating Plan for Colorado River reservoirs (USBR)
ASR	Aquifer Storage and Recovery
BDCP	Bay Delta Conservation Plan
BIA	(U.S.) Bureau of Indian Affairs
BLM	(U.S.) Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
CALFED	CALFED Bay Delta Program
Canal	Coachella Canal
CCLP	Coachella Canal Lining Project
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDPH	California Department of Public Health
CEC	California Energy Commission
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CII	Commercial-Industrial-Institutional
CIMIS	California Irrigation Management Information System
CPUC	California Public Utilities Commission
CRA	Colorado River Aqueduct
CRRWQCB	Colorado River Region Water Quality Control Board
CRW	Colorado River water
CUWCC	California Urban Water Conservation Council
CVAG	Coachella Valley Association of Governments
CVCC	Coachella Valley Conservation Commission
CVMSHCP	Coachella Valley Multiple Species Conservation Plan
CVP	Central Valley Project
CVRWMG	Coachella Valley Regional Water Management Group
CVSC	Coachella Valley Stormwater Channel
CVWD	Coachella Valley Water District

CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
DHCCP	Delta Habitat Conservation and Conveyance Program
DOE	(United States) Department of Energy
DOF	(California) Department of Finance
DOI	(United States) Department of the Interior
DPH	(California) Department of Public Health
DRMS	Delta Risk Management Service
DRR	(California) State Water Project Delivery Reliability Report
DWA	Desert Water Agency
DWR	(California) Department of Water Resources
EC	Emerging contaminants
EDCs	Endocrine disrupting compounds
EERI	Earthquake Engineering Research Institute
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	(U.S.) Environmental Protection Agency
ESA	Endangered Species Act
ET	Evapotranspiration
ETo	Reference Evapotranspiration
fps	feet per second
ft	Foot (feet)
GAMA	(SWRCB's) Groundwater Ambient Monitoring and Assessment Program
GFDL	Geophysical Fluid Dynamic Lab
GPA	General Plan Amendment
GPS	Global Positioning Satellite
GCMs	Global Climate Models
gpd	gallons per day
gpcd	gallons per capita per day
gpm	gallons per minute
HCP	Habitat Conservation Plan
HOA	Homeowners Association
IBWC	International Boundary and Water Commission
ICS	Intentionally Created Surplus
ID-1	Improvement District No. 1
IID	Imperial Irrigation District
IOPP	Inadvertent Overrun and Payback Policy
IPR	Indirect Potable Reuse
IRWMP	Integrated Regional Water Management Plan
ISG	Interim Surplus Guidelines

ITA	Indian Trust Assets
IWA	Indio Water Authority
KAF	thousand acre-feet
kWh	kilowatt-hour
kWh/yr	kilowatt-hours per year
LCR	Lower Colorado River
LROC	Long range operating criteria
M&I	Municipal and Industrial
MBAS	Methylene Blue Active Substances
MCL	Maximum Contaminant Level
Metropolitan	Metropolitan Water District of Southern California
mgd	million gallons per day
mg/L	milligrams per liter
ml	milliliters
MOU	Memorandum of Understanding
mph	miles per hour
MPN	Most probable number
MSHCP	Multi-Species Habitat Conservation Plan or Program
msl	Mean Sea Level
MSWD	Mission Springs Water District
MTBE	Methyl Tertiary butyl Ether
MVP	Mid-Valley Pipeline
MWD	Metropolitan Water District of Southern California
NCCPA	(California) Natural Communities Conservation Planning Ac
NCDC	National Climatic Data Center
NF	Nanofiltration
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
OSHA	Occupational Safety and Health Administration
O_3	Ozone
PCB	Polychlorinated biphenyl
PCE	Perchloroethylene
PCM	Parallel Climate Model
PEIR	Program Environmental Impact Report
PEIS	Programmatic Environmental Impact Statement
PHG	Public health goal
ppb	Parts per billion
ppm	Parts per million

PPR	Present Perfected Rights
PVID	Palo Verde Irrigation District
QSA	Quantification Settlement Agreement
RAC	Replenishment Assessment Charge
RCCDR	Riverside County Center for Demographic Research
RCIP	Riverside County Integrated Plan
RCP-06	Riverside County Projections 2006
Reclamation	(United States) Bureau of Reclamation
RO	Reverse Osmosis
ROW	right-of-way
RWQCB	California Regional Water Quality Control Board
SANDAG	San Diego Association of Governments
SB	(California) Senate Bill
SCAG	Southern California Association of Governments
SDCWA	San Diego County Water Authority
Se	selenium
SOI	Sphere of Influence
sq ft	square foot or square feet
sq mi	square mile(s)
SSA	Salton Sea Authority
SSAB	Salton Sea Air Basin
SWP	(California) State Water Project
SWRCB	(California) State Water Resources Control Board
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TEL	Thomas E. Levy Groundwater Replenishment Facility
THM	Trihalomethane
TMDL	Total maximum daily load
UBC	Uniform Building Code
ULFT	Ultra-Low-Flush Toilet
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
VSD	Valley Sanitary District

Water CASA	Water Conservation Alliance of Southern Arizona
WDR	Waste Discharge Requirements
WMP	Water Management Plan
WRCOG	Western Riverside County of Governments
WRP	Water Reclamation Plant
WWTP	Wastewater Treatment Plant
YCWA	Yuba County Water Agency
µg/L	Micrograms per liter

B.2 GLOSSARY

acre-foot – The volume of water that would cover one acre to a depth of one foot; equivalent to 43,560 cubic feet or 325,829 gallons.

adjudication – Court-ordered restrictions imposed through a process in which the water rights are allotted to individual groundwater pumpers.

alkaline – Describes soils or water with a pH higher than 7.0; generally contain high concentrations of dissolved ions.

allocation, allotment – Refers to a distribution of water through which means specific persons or legal entities are assigned individual rights to consume pro rate shares of a specific quantity of water under legal entitlements. For example, a specific quantity of Colorado River water is distributed for use within each Lower Division States through an apportionment. The water available for consumptive use in that state is further distributed among water users in that state through an allocation. An allocation does not establish an entitlement; the entitlement is normally established by a written contract with the Untied States.

alluvial fan – A roughly triangle-shaped deposit of unconsolidated sediments deposited by a stream at a point where there is a sharp decrease in stream gradient (e.g. a mountain front).

alluvium (alluvial deposits) – Unconsolidated sedimentary deposits of clay, silt, sand, and/or gravel deposited by rivers or streams.

annular space – the space between the well casing and the borehole walls.

anticline – Arch-shaped fold in rocks, with the oldest rocks in the center of the arch.

apportionment – Refers to the distribution of water available to each Lower Division state in normal, surplus, or shortage years, as set forth, respectively, in Articles II (B)(1), II (B)(2) and II (B)(3) or the Decree in Arizona v. California.

aquaculture – The propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or for use as bait.

aqueduct – A pipe or channel designed to transport water from a remote source, usually by gravity.

aquifer – A permeable geologic unit that will yield a usable quantity of water to a well or spring.

aquitard – Geologic formations or strata with relatively low permeability that retards the flow of water and yields negligible quantities to wells.

arroyo – Flat gully found along valley floor with steep walls and a sandy base formed during times of above average rainfall; stream beds are typically dry.

bajada – Extensive, gently sloping plain at the base of a mountain front formed by coalescing alluvial fans.

basement rocks –Older rocks overlain by relatively undeformed sedimentary cover; typically metamorphic or plutonic (crystalline) rocks with relatively low permeabilities.

biological opinion – Document stating the U.S. Fish and Wildlife Service and the National Marine Fisheries Service opinion as the whether a federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction of adverse modification of critical habitat.

candidate species – Plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the USFWS.

Colorado River Basin – The drainage basin of the Colorado River in the US.
cone of depression – The drawdown of the water table that happens when a well is pumped.
confined aquifer – A completely saturated aquifer whose upper and lower boundaries are impervious geologic units. Water is held under pressure and the water level in wells stands above the top of the aquifer.
confining unit – See aquitard.
conglomerate – Coarse-grained sedimentary rock composed of (gravel-sized) sediments that are greater than 2 millimeters in diameter.
conjunctive use – The coordinated storage and use of surface and groundwater supplies to improve water supply reliability.
consumptive use – The total water diversions from the Colorado River, less return flows to the river.
critical condition of overdraft – As defined by DWR, water management practices that would probably result in significant adverse overdraft-related environmental, social, or economic effects.
crystalline rock – Refers to igneous or metamorphic rocks; excludes rocks of sedimentary origin.

delta – A roughly triangularly shaped deposit of unconsolidated sediments deposited by a stream or river at the point that the river enters the ocean or other large water body where there is a sharp decrease in stream gradient (roughly the underwater equivalent of an alluvial fan).
desalination – The process of removing salt from water. Typical processes used include distillation, electrodialysis ion exchange and reverse osmosis.
dike – An elongate structure constructed to contain the flow of water especially during times of flooding.
discharge area – The zone in which groundwater leaves the ground, either as a spring or into a water body.
duck clubs – Privately owned, artificial ponds filled during the waterfowl migration season to attract game birds and create hunting opportunities.

endangered species – A species or subspecies whose survival is in danger of extinction throughout all or a significant portion of its range.
entitlement – Refers to an authorization to beneficially consume Colorado River water pursuant to (1) a decreed right, (2) a contract with the United States through the Secretary of the Interior, or (3) a Secretarial reservation of water. Also an authorization to beneficially use water from the California State Water Project through a contract with the State of California.
environmental impact report (EIR) – A California state environmental decision-making report prepared pursuant to the California Environmental Quality Act (CEQA).
environmental impact statement (EIS) – A federal environmental decision-making report prepared pursuant to the National Environmental Policy Act (NEPA).
evaporation – The process of liquid water becoming water vapor, including vaporization from water and land surfaces, but not from plant surfaces.
evapotranspiration – A combination of evaporation from open bodies of water, evaporation from soil surfaces, and transpiration from the soil by plants.

fault – An approximately planar break in a rock body caused by tectonic forces defined by movement of blocks of the earth's crust on either side.

fault block – A rock mass bound on at least two sides by faults, which may be uplifted or down-dropped (depressed) in relation to adjacent blocks.

fault scarp – Caused when a fault displaces the ground surface vertically causing one side of the fault to stand higher relative to the other.

fault zone – A region as much as 50 kilometers or more in width bounded by major faults; internally may consist of additional minor faults.

flow – Volume of water passing a given point per unit of time expressed in cfs.

granite – A light-colored, coarse-grained, silica-rich igneous rock consisting primarily of quartz, feldspar and mica; most commonly associated with continental crust.

groundwater – Water contained within void spaces beneath the earth's surface.

groundwater recharge – Replenishment of groundwater supplies via infiltration of surface water.

habitat – (1) A specific set of physical conditions that surrounds a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space. (2) The natural home or dwelling place of an organism.

hydrogeology – Science dealing with the occurrence and flow of groundwater.

hydrology – Science dealing with natural runoff and its effect on streamflow.

igneous– One of the three main groups of rock types (in addition to metamorphic and sedimentary) describing rocks that crystallized from magma.

infiltration – The downward migration of water into soil and underlying aquifers.

intensity – A number based on a scale (e.g. Mercalli scale) related to the damage caused to structures by an earthquake.

lacustrine – Associated with a lake. Lacustrine deposits are generally fine-grained silts and clays formed by sediments settling out of a lake.

landslide – A rapid downhill movement of sediment, soils, or rocks.

Law of the River – As applied to the Colorado River, a combination of federal and state statutes, interstate compacts, court decisions and decrees, federal contracts, an international treaty with Mexico, and formally determined operating criteria.

liquefaction – The temporary transformation of soil or sediments to a fluid state caused by the intense shaking experienced in an earthquake.

Lower Basin – The part of the Colorado River watershed below Lee Ferry, Arizona; covers parts of Arizona, California, Nevada, New Mexico, and Utah.

Lower Division – A division of the Colorado River system that includes the states of Arizona, Nevada, and California.

Lower Division States – Arizona, California, and Nevada as defined by Article II of the Colorado River Compact of 1922.

mean sea level – National Geodetic Vertical Datum (NGVD) of 1929.

metamorphic– One of the three main groups of rock types (in addition to igneous and sedimentary) describing rocks that have been recrystallized as a result of a change in pressure and temperature.
monitoring well – A well that monitors hydrologic (water level and/or water quality) information.

overdraft – A groundwater basin condition in which the amount of water extracted exceeds the rate at which water can be withdrawn perennially without producing an undesired result (e.g., water quality degradation, land subsidence, or saltwater intrusion).

peak flow – Maximum instantaneous flow in a specified period of time.
percolation – A qualitative term applying to the downward movement of water through soil, especially the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of one or less.
perchlorate - Perchlorate (ClO_4^-) is a contaminant from the solid salts of ammonium, potassium or sodium perchlorate. Ammonium perchlorate has been used as an oxygen-adding component in solid fuel propellant for rockets, missiles and fireworks.
percolation pond – A constructed basin where treated wastewater effluent is applied to the surface and disposed of by infiltration.
permeability – A measure of a material's (rock, soil, or sediment) ability to transmit water.
pH – A measure of acidity; equal to the negative logarithm of the hydrogen ion concentration.
potable water – water fit for human consumption.
precipitation – The total measurable supply of water to all forms of falling moisture, including dew, rain, mist; snow, hail, and sleet; usually expressed as depth of water on a horizontal surface on a daily, monthly, or yearly basis.
Present Perfected Rights – With respect to the Colorado River, a water right exercised by the actual diversion of a specific quantity of water, prior to June 25, 1929, the effective date of the Boulder Canyon Project Act.
priority – A ranking with respect to diversion of water relative to other water users.
production well – A well used for groundwater extraction.
pumping level – the level at which water stands in a well when pumping is in progress.

Quantification Period – 75-year period that the Implementation Agreement and Quantification Settlement Agreement would be in effect.

reach – A specified segment of a stream, channel, or other water conveyance.
recharge basin – A constructed area of high infiltration capacity where water is applied to the surface in order to replenish groundwater supplies. See Groundwater Recharge.
recycled water – Treated wastewater effluent that is reused, often for direct irrigation purposes.
regulatory water – Water conveyed to the Valley in the Coachella Canal that is not used.
reserved water – Water "reserved" for use on a national property.
return flow- Portion of water previously diverted from a stream and subsequently returned to that stream or to another body of water.
riparian – Flora and fauna associated with stream and river banks.

salinity – A term used to refer to the dissolved minerals in water, also referred to as total dissolved solids.

sediment – Unconsolidated solid material that comes from weathering of rock and is carried by, suspended in, or deposited by water or wind.

seepage – Downward or lateral movement of water from a reservoir, canal, or pipe through a pervious or semipervious bottom.

selenium – Selenium is a non-metallic element that chemically resembles sulfur. It is relatively minor portion of the total dissolved solids (salinity) found in the Colorado River, but it has been found to have a significant impact on wildlife (birds and fish).

semi-perched aquifer – An unconfined groundwater body perched on discontinuous, impermeable or slightly permeable unit(s).

source substitution – Replacement of groundwater supply with other water sources such as imported or recycled water.

storage – The volume of water contained in or released from an aquifer in response to an addition or extraction of groundwater; also refers to the net capacity of a basin to hold surface and groundwater (the difference between inflows and outflows).

strata – layers of deposited rock, soil, etc. that are distinguishable from each other.

stratigraphy – the science of rock strata (layers), their relationships, absolute ages and the relationships between strata. Used to infer past environments; important in hydrology, mining and oil exploration.

subsidence – Sinking or settling of the ground surface due to natural or man-made causes such as removal of groundwater from aquifers (decrease in storage) which causes the aquifer soil to compress from the weight of the ground above.

tailwater – Surface water runoff occurring at the end of an irrigated field when water that had been applied exceeds soil infiltration rates.

tile water – Water collected in the tile drains on irrigated areas.

total dissolved solids (TDS) – A general measure of water quality equal to the concentration of ions dissolved in the water, or its salinity.

transmissivity – The rate at which water moves through an aquifer.

transpiration – The physiological process in which plant tissues give off water vapor to the atmosphere.

tributary – River or stream flowing into a larger river or stream.

unconfined aquifer – an aquifer whose upper boundary is defined by the water table (water is at atmospheric pressure). There is no upper confining layer.

Upper Basin - The part of the Colorado River watershed above Lee Ferry, Arizona; that covers parts of Arizona, Colorado, New Mexico, Utah, and Wyoming.

Upper Division - A division of the Colorado River system that includes the states of Colorado, New Mexico, Utah, and Wyoming.

water conservation – Planned management to prevent or reduce loss or waste of water to enhance beneficial uses.

water table – The depth at groundwater is first encountered; the top of the zone in which all pore spaces are totally filled with water.

watershed – The topographic area from which a surface water body or groundwater system derives its water.

wetlands – Periodically, seasonally, or continuously submerged landscapes populated by species and/or life forms differing from adjacent communities.

xeriscaping – Water efficient landscaping utilizing native, drought-tolerant desert plant species.

GEOLOGIC TIME SCALE

Time	Era	Period	Millions of Years Before Present	Epoch
Phanerozoic	**Cenozoic**	Quaternary	**0**	Holocene
			0.01	Pleistocene
		Tertiary	**1.6**	Pliocene
			5.3	Miocene
			24	Oligocene
			37	Eocene
			57	Paleocene
	Mesozoic	Cretaceous	**66**	
		Jurassic	**144**	
		Triassic	**208**	
	Paleozoic	Permian	**245**	
		Carboniferous	**286**	
		Devonian	**360**	
		Silurian	**408**	
		Ordovician	**438**	
		Cambrian	**505**	
Precambrian			**570**	

Appendix C

Appendix C
Monitoring and Data Management

The primary objective of the monitoring and data management program is to evaluate the effectiveness of the water management programs and projects identified in the Plan. Although a significant amount of data is currently collected, opportunities exist for improvements in data collection, sharing and evaluation. This section describes the existing program, actions that will be implemented to enhance the existing program and eliminate data gaps. New elements to be added to the monitoring and data management program are identified.

C.1 EXISTING PROGRAM

The hydrologic system of the Coachella Valley has been extensively monitored by a number of agencies for many years. This section provides a general overview of the types of data currently being collected and action items that will be implemented to improve the existing program.

C.1.1 Weather Data

The principal weather data of interest in the Coachella Valley include precipitation, temperature and evapotranspiration as these influence water demands and local water supplies. The National Climate Data Center maintains records for 12 weather cooperative stations of which six are active. In addition, under the California Irrigation Management Information System (CIMIS), DWR maintains six active weather stations in the Valley that report precipitation, temperature, humidity, wind and solar radiation. Four of the CIMIS stations also report daily evapotranspiration (ETo). The District uses the CIMIS station data to calculate ETo for the five ET zones that have been identified and presents this information on their website. The ETo data are used to schedule irrigation times and durations. CVWD also maintains a system of early warning precipitation gauges in the Santa Rosa Mountains to monitor flash flooding. CVWD reports weather data along with the ET information on its website.

ACTION ITEM: Summaries of annual precipitation and ETo should be presented in the annual engineer's reports on water supply and replenishment assessment (see **Section 7.2.1.8**).

C.1.2 Hydrologic Data

Like weather data, stream flow measurements are collected by several agencies. As indicated in **Section 6**, the USGS maintains 16 stream gauging stations in the Valley of which 14 stations collect real time data. The other two gauges are measured periodically. The USGS gauging data are available on the agency's website. CVWD collects flow data for the CVSC and the individual surface drains that flow into the Salton Sea once each month. Currently, the total flow (including storm flows) to the Salton Sea is not measured.

ACTION ITEM: CVWD will work with the USGS to restore the gauging station on the CVSC at Lincoln Street to provide continuous flow recording.

C.1.3 Well Logs

Well completion reports document information about the construction and underground formations at a water well. According to State law, well completion reports must be prepared and filed with DWR within 60 days of the construction, alteration, abandonment, or destruction of any water well, cathodic protection well, groundwater monitoring well, or geothermal heat exchange well. Well completion reports are confidential documents that are not available for public inspection; however, they are available to governmental agencies for studies, to the well owner or anyone who obtains written permission from the well owner and to anyone performing an environmental cleanup study associated with unauthorized releases if the study is conducted under the order of a regulatory agency. CVWD is the DWR designated repository for filing drillers logs of wells drilled in the Coachella Valley area.

ACTION ITEM: To improve the usability of the well completion reports for future investigations, data from all well completion reports will be entered into a centralized GIS database that allows visualization of the well construction data. This will support well survey programs and will provide information concerning pump efficiencies and kilowatt/acre-feet data.

C.1.4 Production

Groundwater production and surface water diversion data are critical to an understanding of the amount of water being extracted from a groundwater basin and for basin management. Division 2 Part 5 of the California Water Code requires each person (i.e., well owner/operator) within the counties of Riverside, San Bernardino, Los Angeles, and Ventura extracting more than 25 acre-feet/year of groundwater to file a "Notice of Extraction and Diversion of Water" with the State Water Resources Control Board. In addition, CVWD's and DWA's enabling legislation require that all production subject to replenishment assessment shall be reported on a monthly basis. The reporting threshold for pumpers (designated minimal producers) within the CVWD boundary is 25 AFY, while the threshold for DWA is 10 AFY. With the exception of wells in the Garnet Hill subbasin, all production wells exceeding these thresholds are required to have a measuring device capable of measuring and registering the amount of water produced. Both CVWD and DWA maintain records of production within their respective areas.

In the East Valley, not all wells are metered. Currently, CVWD notifies pumpers that have not reported their production and determines the amount of production subject to replenishment assessments.

ACTION ITEM: There is a need to maintain up-to-date groundwater production records in East Valley to properly manage the basin and to fairly allocate basin management costs to producers. CVWD will:

- Conduct an updated survey of production wells in the East Valley to determine the owner/operator, location, operational status and production reporting for each well.
- Use power records and pump tests to develop more accurate estimates of pumping by unmetered wells.
- Require installation of meters on wells where necessary to obtain accurate production data.

C.1.5 Water Levels

The depth to groundwater in wells provides a measure of the change in groundwater storage. CVWD monitors water levels for nearly 600 public and private wells in its service area three times per year on a rotating basis (approximately four month interval). These data are stored in a database and are plotted as hydrographs. Other agencies monitor groundwater levels in their own wells but these data are not collated in a central location.

SBx7-6 (part of the 2009 Comprehensive Water Package) adopted by the California Legislature requires local agencies to monitor and publically report groundwater elevations of their groundwater basins to better manage those resources. In the Coachella Valley, this legislation is not expected to significantly impact the existing monitoring programs.

ACTION ITEM: CVWD will need to apply to DWR and be designated as the monitoring and reporting entity for the Valley. DWR will work with CVWD to determine reporting requirements for the groundwater elevation data to DWR.

ACTION ITEM: In response to the public reporting requirements of SBx7-6, additional water level information will be presented in the annual engineer's reports for each groundwater basin. Well hydrographs will reflect the areal distribution of wells in the basin.

ACTION ITEM: Measured water levels will be compared to modeled levels to document progress toward meeting the WMP objectives.

C.1.6 Water Quality

Surface and groundwater quality monitoring is performed by a number of agencies in the Valley. Water purveyors are required by State Law to monitor and report the quality of their water sources. Reporting of delivered water quality is done through annual consumer confidence reports provided to each customer. Water quality results are also reported to the California Department of Public Health (CDPH) and are publicly available on the SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA) website. Tribes monitor the quality of their wells and maintain records; however, these data are not publicly available for all tribes. CVWD also monitors the quality of its imported water supplies on a monthly basis and its drains on an annual basis. CVWD conducts monitoring of selenium concentrations in the drains and the CVSC as required by the CVMSHCP.

ACTION ITEM: Maintain monitoring and reporting activities. Monitor for new requirements and adjust as needed.

C.1.7 Subsidence

Land subsidence is the lowering of the ground surface due to groundwater withdrawal or seismic activity. Seismic-induced movements may cause subsidence on the depressed side of a fault, or relatively small-scale subsidence can also occur when dry soils are saturated with water due to seismic activity.

In 1996, the USGS, in cooperation with CVWD, established a geodetic network of monuments to monitor vertical changes in land surface in the East Coachella Valley. In 2007, USGS published the results of the latest monitoring program (USGS, 2007). The 2007 report identified at least four areas in the Coachella Valley that had experienced significant land surface elevation changes, indicating that land subsidence occurred in three of the areas (Palm Desert, Indian Wells and La Quinta) and both subsidence and uplift apparently occurred in one of the areas (Indio-Coachella) between February 26, 2003 and September 25, 2005. Other local areas in the Coachella Valley also may have deformed, but the size of these areas and the amount of deformation generally are small compared with the Palm Desert, Indian Wells and La Quinta areas. All the areas where significant subsidence was detected – Palm Desert, Indian Wells and La Quinta – coincide with or are near areas where groundwater pumping generally caused groundwater levels to decline.

ACTION ITEM: Due to the critical importance of avoiding aquifer compaction and property damage as a result of land subsidence, CVWD will:

- Continue contracting with USGS to monitor the extent of land subsidence
- Implement the WMP with the goal of eliminating overdraft
- Consider construction of extensometers at critical locations to monitor subsidence

C.1.8 Reporting

CVWD and DWA each prepare annual engineer's reports on water supply and replenishment assessment for the groundwater basins within their respective service areas that subject to a groundwater replenishment assessment. These reports describe the groundwater basins, water supply conditions, groundwater production, replenishment program and the annual replenishment assessment charged for production within each basin. Annual reports are currently prepared for the Mission Creek, Upper Whitewater River and Lower Whitewater River subbasins. No reports are prepared for the Desert Hot Springs or Garnet Hill subbasins as production from these basins is not currently subject to a replenishment assessment.

ACTION ITEM: The following recommendations will enhance the informational value of these reports:

- Include data on annual precipitation and stream flows to better document natural inflows to the groundwater basins.
- Document the amounts of in-lieu recharge that takes place through the delivery of recycled or imported water to reduce groundwater production.
- Document the total amounts of imported water delivered to users in each subbasin.
- Provide additional groundwater level hydrographs for wells in each subbasin to better indicate the changes in groundwater levels.
- Provide an accounting of the amounts of water stored in the basin on behalf of other entities including but not limited to Metropolitan and IID.

C.1.9 Data Gaps

Specific data gaps identified in this 2010 WMP Update are:

- Surface water flow data to estimate potential yield from stormwater capture projects.
- Lack of a centralized groundwater database that allows all water agencies to share data.
- Uniform reporting of urban water use by user class to track water conservation efforts.
- Groundwater production data for wells in the East Valley, especially agricultural wells.
- Non-uniform coverage of water quality data especially regarding perchlorate.

ACTION ITEM: Evaluation of data gaps will be performed on an on-going basis to identify areas where insufficient data are being collected in the Valley. The monitoring program will be updated to ensure provision of data needed to manage water resources and the effectiveness of WMP activities.

C.2 NEW MONITORING AND DATA EVALUATION ELEMENTS

To eliminate the data gaps identified above, several new programs/project are considered essential.

C.2.1 Water Resources Database

Currently, each water agency maintains its own water resources database. These databases generally include groundwater production, water level and water quality data. CVWD maintains separate groundwater production, water level and water quality databases for wells that it monitors. Tribes maintain water data for their wells. However, no common database exists that would allow ready access to all data for the basin.

ACTION ITEM: A water resources database will be developed for the Valley which will be used as a mechanism for data sharing among the participating water agencies and tribes. As a minimum, the database will be capable of storing well ownership data, well logs, groundwater production, water level and water quality data. The database will be capable of interfacing with other outside database systems as needed for reporting and utilizing common data. The database will have suitable access control to keep some data, such as well logs, confidential where required by State law. The scope of the database will be developed jointly by CVWD, DWA, the tribes and the water purveyors.

C.2.2 New Monitoring Wells

CVWD has installed a number of monitoring wells over the past 15 years. Two nested monitoring wells were constructed near the Salton Sea to monitor changes in water levels and water quality for potential indications of saline intrusion into the production aquifers. A monitoring well network was constructed in conjunction with the Martinez Canyon Demonstration Recharge projects and the Thomas E. Levy Groundwater Replenishment Facility. CVWD, DWA and USGS installed and operate monitoring wells near the Whitewater Recharge Facility.

ACTION ITEM: Additional monitoring wells will be constructed as needed in conjunction with recharge facilities (Levy, Martinez, and Indio) to monitor recharge effectiveness.

C.2.3 Additional Water Quality Monitoring

Water Quality Assessment and Monitoring Plan

Since there is no comprehensive water quality monitoring program or database for the Valley.

ACTION ITEM: A water quality assessment will be performed. This assessment will document existing water quality monitoring and reporting activities, compare the existing programs to federal and state standards, monitoring, and reporting requirements, identify data gaps, and identify needed revisions to monitoring programs to fill those gaps. This assessment will be performed jointly by the Coachella Valley water agencies and tribes.

ACTION ITEM: Water quality data will be incorporated into the Water Resources Data Base described above.

Perchlorate

Perchlorate has been identified as an important water quality parameter. Historically, Colorado River water has been used for irrigation in the Valley; however, perchlorate concentrations were only detected in the late 1990s. Due to source control measures implemented in Nevada, perchlorate concentrations in Colorado River water are now undetectable. However, seven isolated wells in the basin have detected perchlorate concentrations at or exceeding the State MCL of 6 µg/L. CVWD monitored all of its wells for perchlorate in 2000 and 2001 for the unregulated contaminant rule and then voluntarily using a low detection method in 2003-2004. In 2008-2009, CVWD performed two compliance tests for each well. All wells were below detection limits (<4 µg/L). Future monitoring will consist of one sample every 9 years. CVWD also tests the Canal water annually for perchlorate and the current levels are below the detection limit.

Due to a lack data for private and tribal wells, it is not currently possible to assess the extent of groundwater that contains perchlorate exceeding the MCL and determine whether elevated perchlorate levels exist.

ACTION ITEM: CVWD will work jointly with the water agencies and tribes to investigate the distribution of perchlorate in water supply wells in the Valley.

C.3 GROUNDWATER MODEL UPDATE AND RECALIBRATION

CVWD developed a groundwater flow model of the Whitewater River and Garnet Hill subbasins as part of the 2002 WMP. Calibration of the model was based on data for the period of 1936 through 1996. The original model was peer-reviewed by three eminent hydrogeologists and modelers. Projected pumping and recharge was based on anticipated production patterns in the early 2000s. For this update, the production and recharge data were updated to reflect general historical conditions for 1997 through 2005. Based on current information, the model appears to reasonably reflect groundwater conditions since 1996. As pumping patterns change in the future, modifications of the model may be necessary to allow its continued use as a water management tool.

ACTION ITEM: The following actions will be taken:

- Update and recalibrate the CVWD groundwater model based on the most current information. The update should include current pumping, recharge and return data, recent well log data and new recharge locations. The recalibration should compare the historical groundwater levels and drain flows with the simulated values over the calibration period and adjust model parameters to improve the model results.
- Conduct a peer review of the updated model to ensure that it reasonably reflects current modeling practices and conditions in the groundwater basin.
- Develop a new planning interface and database that can be linked with land use plans and agricultural activities to better distribute pumping and return flows to the model.
- Develop and calibrate a water quality model capable of simulating the changes in salinity and possibly other conservative water quality parameters. This should be done in coordination with preparation of the salt/nutrient management plan.

C.3.1 Water Demand and Conservation Monitoring

Section 6 indicated that significant progress has been made toward reducing urban water demands in the Valley. SBx7-7 requires additional reporting of urban per capita water usage to demonstrate progress toward meeting the State's 20 percent urban water reduction goal. SBx7-7 also requires reporting for agricultural use.

ACTION ITEM: The following measures will be implemented by CVWD:

- Actively participate in DWR's Urban Stakeholder Committee, which is intended to meet some of the public participation process requirements of SBx7-7, to ensure that the adopted technical procedures are appropriate for the Coachella Valley.
- Develop a coordinated approach among the water purveyors for calculating urban per capita water usage including methodologies for determining service area population.
- Determine whether to report per capita consumption on an individual agency or regional basis.
- Of the several options, as spelled out within SBx7-7 for agricultural reporting, determine which is optimal for the District and implement the appropriate option for compliance.

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