APPENDIX E

Water Resources Background Report

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For the
Coachella Valley
Multiple Species Habitat Conservation Plan
and
Natural Community Conservation Plan

April 2004

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Water Background Report

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I. INTRODUCTION AND OVERVIEW

Water is among the most essential needs of any community and is a particularly valuable resource in the Coachella Valley. A reliable supply of high quality water is critical to the health and welfare of valley residents, as well as the regional economy, which is largely based on golf resort industries and agriculture. Issues of water availability, quality, and management have been at the forefront of regional environmental dialogues in recent years, as the demand for groundwater continues to exceed natural supplies. Continued overdraft of this limited resource could have serious and irreversible social, environmental, and economic impacts on the region.

A. Groundwater Resources

The production of water by Native Americans in the Coachella Valley over the past 500 years was centered around the direct use and diversion of streams in mountain canyons, the digging of wells to intercept the aquifer in Indian Wells, and the exploitation of artesian wells associated with the San Andreas fault system. It was not until the twentieth century that the enormous extent of the region’s groundwater basins was recognized.

The Coachella Valley groundwater basin is a northwest-southeast trending sub-surface aquifer, which generally extends from Whitewater on the northwest, to the Salton Sea on the southeast. It is bounded by the non-waterbearing rocks of the San Bernardino and Little San Bernardino Mountains on the north and northeast, and the San Jacinto and Santa Rosa Mountains on the south and southwest.

Although interflow of groundwater occurs throughout the aquifer, it is limited by fault barriers, constrictions in the basin profile, and areas of low permeability. Based on these observations, the U.S. Geological Survey and the California Department of Water Resources have divided the groundwater basin into four distinct subbasins. Subbasin boundaries are generally based upon faults that restrict the lateral movement of groundwater and have been determined regardless of water quantity or quality. The subbasins include: Mission Creek, Garnet Hill, Whitewater River, and Desert Hot Springs. The Whitewater River subbasin encompasses nearly 400 square miles and serves as the primary groundwater repository for the Coachella Valley.

Each subbasin has been further divided into minor subareas based on geologic or hydrologic characteristics. Potable groundwater is not readily available to the Indio Hills, Mecca Hills, and Salton Sea areas due to geologic or hydrologic characteristics.

The Coachella Valley Water District (CVWD) estimates that the Coachella Valley groundwater basin contains approximately 36.5 million acre-feet of groundwater in storage in the first 1,000 feet below the ground surface (one acre-foot equals approximately 326,000 gallons). This includes groundwater contained in the Mission Creek, Garnet Hill, Whitewater River, and Desert Hot Springs subbasins, as described in Table 1.

Table 1
Groundwater in Storage
In the Coachella Valley Groundwater Basin

Subbasin	**Storage (acre-feet)***
Mission Creek Subbasin	2,600,000
Garnet Hill Subbasin	1,000,000
Desert Hot Springs Subbasin	4,100,000
Whitewater River Subbasin	
Palm Springs subarea	4,600,000
Thousand Palms subarea	1,800,000
Oasis subarea	3,000,000
Thermal subarea	19,400,000
Total Groundwater in Storage:	**36,500,000**

* in the first 1,000 feet below the ground surface
Source: "Engineer's Report on Water Supply and Replenishment Assessment 2000/2001," Coachella Valley Water District, April 2000.

B. Whitewater River Subbasin

Large portions of the Plan Area are underlain by the Whitewater River subbasin, which encompasses approximately 400 square miles and underlies much of the Coachella Valley. It generally extends from the junction of Interstate-10 and Highway 111, to the Salton Sea, approximately 70 miles to the east. The subbasin is bounded on the north and east by the Garnet Hill and San Andreas Faults, respectively, and on the south by the San Jacinto and Santa Rosa Mountains.

The Whitewater River subbasin water supply is currently overdrawn. Water extracted from the subbasin is not adequately replenished to recover completely. The upper Whitewater River subbasin is part of a management area program established by the CVWD and DWA. The overdraft rate for the management area is estimated at 70,132 acre-feet per year.[1]

1 "Engineer's Report on Water Supply and Replenishment Assessment 2003/2004," prepared by Water Resources Branch, Engineering Department, Coachella Valley Water District, April 2003.

Thermal Subarea

The Thermal subarea is characterized by confined or semi-confined groundwater conditions, with free moving water conditions present in alluvial fans at the base of the Santa Rosa Mountains. CVWD well logs have identified a lower and an upper aquifer zones in the Thermal subarea. An aquitard layer, composed of fine-grained materials that slow the vertical flow of groundwater, separates the upper and lower aquifer zones and is estimated to be between 100 and 200 feet thick throughout much of the Thermal subarea. According to CVWD, the entire Thermal subarea contains approximately 19.4 million acre-feet of groundwater in storage in the first 1,000 feet below the ground surface.

Groundwater levels in the Thermal subarea are directly related to those in the Palm Springs subarea to the west. Water moves from the Palm Springs subarea southeastward into the Thermal subarea, and when water levels in the Palm Springs subarea decline, the upper zone available for recharge at Point Happy in the Thermal subarea also declines. This trend may be changing as increased pumpage is lowering the groundwater table in the lower Thermal subarea more rapidly than in the Palm Springs subarea.

Thousand Palms Subarea

The Thousand Palms subarea extends along the southwesterly edge of the Indio Hills and is small in comparison to the Thermal subarea. According to CVWD, the Thousand Palms subarea contains approximately 1.8 million acre-feet in groundwater storage in the first 1,000 feet below the ground surface.

The southwesterly boundary of the Thousand Palms subarea has been determined based on distinctive groundwater mineral characteristics. Groundwater in the Thousand Palms subarea contains high concentrations of sodium sulfate, while groundwater in other subareas of the Whitewater River subbasin is generally composed of calcium bicarbonate. This is largely attributed to limited recharge to the Thousand Palms subarea.

The subarea is recharged by runoff from the Indio Hills, but the quantity of recharge is limited. Inflow from other subbasins is believed to be substantially limited, and there is little evidence of intermixing with the Thermal subarea to the south. With limited recharge, there is little opportunity for “dilution” from inflow groundwater, and there is a greater impact of native sodium sulfate on groundwater quality.

C. Desert Hot Springs Subbasin

The Sky Valley community, in the northerly portion of the General Plan planning area, is underlain by the Desert Hot Springs subbasin. According to CVWD’s “Engineer’s Report on Water Supply and Replenishment Assessment, 2003-2004,” the Desert Hot Springs subbasin contains approximately 4.1 million acre-feet of groundwater in storage in the first 1,000 feet below the ground surface.

Groundwater in this subbasin is characterized by high concentrations of fluoride, total dissolved solids, sodium sulfates and other undesirable minerals, which have limited its use for agricultural and domestic water purposes. The presence of high mineral concentrations is largely due to faulting along the margins of the subbasin. Several of the subbasin’s boundaries are defined by faults, including the Mission Creek, Indio Hills, San Andreas, and Mecca Hills Faults. The Coachella Valley Water District does not extract groundwater from the Desert Hot Springs Subbasin, given its high concentration of undesirable minerals. Instead, domestic water for the Sky Valley and Indio Hills communities is extracted by CVWD from the Mission Creek Subbasin to the west.

D. Mission Creek Subbasin

Although the Mission Creek Subbasin does not underlie the General Plan study area, it is the source of domestic water for the Sky Valley and Indio Hills communities in the northerly portion of the expanded General Plan planning area. The Subbasin is located west of the Desert Hot Springs Subbasin and extends west to the base of the San Bernardino Mountains. Water depths below the ground surface, as determined by the U.S. Geological Survey in 1971, range from a maximum of 425 feet in the northwesterly portion, to flowing wells at a minimum depth in a narrow strip along the Banning Fault northwest of Seven Palms Ridge.[2]

Based on CVWD's "Engineer's Report on Water Supply and Replenishment Assessment, 2003-2004," the Mission Creek Subbasin has approximately 2.6 million acre-feet of groundwater in storage in the first 1,000 feet below the ground surface. It is naturally recharged by surface and subsurface discharge, most of which is from Mission Creek, and Little and Big Morongo Creeks. The water report also indicates that a steady water level decline of approximately 0.5 to 1.5 feet per year has been observed since 1952. This subbasin is discussed further below.

E. Groundwater Production

Water delivery services are provided by several water agencies and municipalities in the Coachella Valley, including the Coachella Valley Water District, Desert Water Agency, Imperial Irrigation District, Myoma Dunes Mutual Water Company, and Mission Springs Water District, and the cities of Coachella and Indio.

Although there are nearly 37 million acre-feet of groundwater in storage in the Coachella Valley, potable water is extracted from only two of the region's subbasins. The Whitewater River Subbasin is the primary source of groundwater production (extraction) occurs. This water is used for domestic and agricultural purposes and golf course irrigation in the upper and lower Coachella Valley. Groundwater is also produced from the Mission Creek Subbasin for use in the City of Desert Hot Springs and the unincorporated communities of Sky Valley and Indio Hills. Given the limited amount of development overlying the Garnet Hill Subbasin, no groundwater is extracted from this subbasin at this time. Due to faulting and geothermal activity in the Desert Hot Springs Subbasin, its groundwater is characterized by high concentrations of fluoride, total dissolved solids (TDS), sulfates, and sodium, which renders it unsuitable as a potable water source. However, limited quantities of groundwater are extracted from this subbasin for use in spas and mineral baths in the City of Desert Hot Springs and surrounding unincorporated areas.

F. Consumptive Demand

The historical demand for water in the Coachella Valley has been largely focused around agricultural, urban, and golf course irrigation uses. In 1936, total water demand in the valley was approximately 96,300 acre-feet.[3] By 1999, demand had increased to approximately 668,900 acre-feet, which represents nearly a seven-fold increase over 63 years. Historical water demand trends are illustrated in Table III-?, below.

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[2] "Engineer's Report on Water Supply and Replenishment Assessment 2003/2004," prepared by Water Resources Branch, Engineering Department, Coachella Valley Water District, April 2003.

[3] "Coachella Valley Water Management Plan," Coachella Valley Water District, October 2002.

Table 2
Historical Water Demand in the Coachella Valley, 1936 – 1999
(acre-feet/year)

Component	1936			1999		
	Upper Valley	Lower Valley	Total	Upper Valley	Lower Valley	Total
Agricultural						
Crop Irrigation	11,300	71,300	82,600	900	331,600	332,500
Greenhouses	0	0	0	0	800	800
Total	11,300	71,300	82,600	900	332,400	333,300
Municipal/Industrial						
Municipal	6,900	4,000	10,900	145,600	57,300	202,900
Industrial	0	0	0	0	1,100	1,100
Total	6,900	4,000	10,900	145,600	58,400	204,000
Fish Farms/Duck Clubs						
Fish Farms	0	200	200	0	21,100	21,100
Duck Clubs	0	1,300	1,300	0	4,300	4,300
Total	0	1,500	1,500	0	25,400	25,400
Golf Course						
Golf Course	1,300	0	1,300	77,700	28,500	106,200
Total	1,300	0	1,300	77,770	28,500	106,200
Total Demand:	**19,500**	**76,800**	**96,300**	**224,200**	**444,700**	**668,900**

Source: "Coachella Valley Water Management Plan," Coachella Valley Water District, November 2000.

Agricultural development in the Coachella Valley, which began around the turn of the twentieth century and was concentrated in the eastern valley, included the production of a wide range of fruit and vegetable crops, such as dates, grapes, and citrus. As shown in Table 2 above, the agricultural demand for water in 1936 was approximately 82,600 acre-feet. By 1999, this figure had increased more than four-fold to approximately 333,300 acre-feet, and agricultural development accounted for nearly 50% of all water consumption in the valley. This dramatic increase is due to the rapid expansion of irrigated agriculture in the lower valley during the second half of the twentieth century. From 1948 to 1999, the number of irrigated acres increased from about 23,000 to 72,800 acres.[4] The growth in agriculture was, at least in part, facilitated by the completion of the Coachella Branch of the All-American Canal by the U.S. Bureau of Reclamation in 1949. The canal delivered imported Colorado River water to the eastern Coachella Valley for irrigation purposes, and this supplemental water source made additional agricultural activity possible.

Urban demand for water, including municipal and industrial usage, has also increased substantially, from approximately 10,900 acre-feet in 1936 to 204,000 acre-feet in 1999. In 1936, urban water usage accounted for about 11% of total water demand in the Coachella Valley, but by 1999, it accounted for nearly 31% of total demand. This is largely due to rapid residential and commercial growth, particularly in the upper Coachella Valley, over the past two decades. Industrial demand continues to be low, constituting only 0.2% of total regional demand.

[4] Ibid.

Approximately 1,000 acres of fish farm ponds are located in the Coachella Valley, most of which occur in the lower valley.[5] Fish farms are water-intensive operations, which involve the raising and selling of a variety of fish, including tilapia, catfish, and striped bass. As shown in Table 2, total water demand for fish farms has increased dramatically since 1936, but in 1999 accounted for only about 3% of total demand in the Coachella Valley. Duck clubs also represent a small component of total water demand, accounting for only 0.6% of all water demanded in 1999. Regional duck clubs are located north of the Salton Sea and provide ponded water for ducks and other waterfowl during their winter migration.

The greatest increase in water demand since 1936 is the result of golf course development in both the upper and lower portions of the valley. In 1936, golf courses accounted for about 1.3% of total water demand in the Coachella Valley. By 1999, golf course demand had increased to 15.8% of total regional demand, which is evidence of the tremendous success and importance of the golf course resort industry in the Coachella Valley.

G. Groundwater Overdraft

The rapid increase in water demand in the Coachella Valley has resulted in overdraft of the limited groundwater supplies. Overdraft represents a condition in which the amount of groundwater extracted exceeds the amount of groundwater recharging the basin. One method of determining the extent of overdraft is to compare the change in freshwater storage in the Coachella Valley's groundwater subbasin. In 1999, the change in freshwater in storage in the Coachella Valley was estimated at 136,700 acre-feet per year. This means that approximately 136,700 acre-feet of groundwater withdrawn from the basin were not replaced.

The following table illustrates the disparity between inflows and outflows to the groundwater basin. Inflows include natural recharge by mountain runoff, artificial recharge with Colorado River water, flows from outside the groundwater basin, and return flows from irrigation and septic tank water that is reabsorbed through the ground surface. Outflows include groundwater pumpage, evapotranspiration, flow to the Salton Sea, and flow to subsurface drains, which were installed to intercept poor quality return flows and impede their percolation of return flows into the aquifer.

5 Ibid.

Table 3
Comparison of Historical Inflows and Outflows
In the Coachella Valley, 1936-1999
(acre-feet)

Water Balance Component	Total Flows 1936	Total Flows 1999
Inflows		
Natural Recharge	32,600	16,800
Agricultural Returns	37,200	130,700
Domestic Returns	4,300	59,200
Golf Course Returns	500	39,300
Wastewater Percolation	200	16,500
SWP Recharge	0	88,800
Inflows from outside area	12,900	11,500
Inflows from Upper Valley	59,100	29,400
Total Inflows	**146,800**	**392,200**
Outflows		
Groundwater Pumpage	92,400	376,100
Flows to Drains	3,200	55,800
Evapotranspiration	21,100	4,900
Net Flow to Salton Sea	5,300	-400
Outflows to Lower Valley	59,100	29,400
Total Outflows	**181,100**	**465,800**
Annual Change in Storage	-34,300	-73,600
Annual Change in Freshwater Storage	-41,800	-136,700
Cumulative Change in Storage since 1936	-34,300	-1,421,400
Cumulative Change in Freshwater Storage since 1936	-41,800	-4,684,000

Source: Table 3-4, "Coachella Valley Water Management Plan," Coachella Valley Water District, October 2002.

The table above indicates that groundwater pumpage, which includes groundwater pumped for agricultural and domestic purposes, is currently the largest component of outflow from the basin and represents 80% of all outflows. The greatest source of inflow is agricultural return, which represents about 33% of all inflows. However, agricultural return is typically characterized by high concentrations of total dissolved solids, making it unsuitable as a potable water source. Therefore, except for the return water, which is intercepted by tile drains, agricultural return reduces the amount of freshwater in storage.

Overdraft can result in serious social, environmental, and economic consequences, including the loss of groundwater in storage, diminishing water quality, seawater intrusion, and increased costs associated with the drilling and installation of deeper wells and larger pumps. Overdraft also increases the potential for land subsidence, which is the sinking of the land surface. Subsidence can cause ground fissuring, damage to structural foundations and irrigation and other subsurface pipelines, and changes in drainage patterns. Surface fissures associated with ground subsidence were observed in 1948 near the intersection of Adams Street and Avenue 52 near the City of La Quinta. As much as 7 centimeters of ground subsidence was recorded in the City of Palm Desert from 1996 to 1998.[6] Both of these instances are believed to be the result of groundwater overdraft.

[6] Ibid.

H. Supplemental Water and Replenishment Program

A number of replenishment and conservation programs have been implemented by local water agencies to combat the ongoing depletion of groundwater supplies in the Coachella Valley. Perhaps the most important of these has been the importation of Colorado River water to the Coachella Valley.

The Coachella Valley Water District (CVWD) and Desert Water Agency (DWA) are two of 29 agencies that have contracted for State Water Project (SWP) supplemental water resources. Under this contract, water from northern California would be transported to the valley via the Coachella Aqueduct. However, given the extraordinary costs associated with the construction of such a project, the aqueduct has not yet been built.

Until the system is constructed, CVWD and DWA have entered into an agreement with the Metropolitan Water District of Southern California (MWD). The arrangement allows CVWD and DWA to exchange their SWP water entitlements for like amounts of water from MWD's Colorado River Aqueduct, which passes the northern portion of the Coachella Valley. The aqueduct is tapped where it crosses the Whitewater River, and the exchange water is diverted to nineteen spreading ponds near Windy Point, where it percolates to replenish the Whitewater River Subbasin. Water is also diverted from the aqueduct near its crossing of State Highway 62, where it is conveyed to recharge basins located adjacent to Mission Creek and recharges the Mission Creek Subbasin.

CVWD's entitlement to SWP water is 23,100 acre-feet/year, and DWA's is 38,100 acre-feet/year, for a combined total of 61,200 acre-feet/year.[7] However, the actual quantity of supplemental Colorado River water diverted to the Coachella Valley fluctuates each year, depending on precipitation levels in northern California, where SWP water originates, and drought conditions in southern California, which require that water be directed toward the Los Angeles basin. Since the inception of the exchange program in 1973, nearly 1.7 million acre-feet of Colorado River water have been delivered through the MWD Aqueduct.

CVWD has also constructed a pilot recharge facility just south of Lake Cahuilla in the City of La Quinta and has determined that groundwater recharge can be successfully accomplished in the lower Coachella Valley, where subsurface aquitards that reduce the rate at which groundwater flows are avoided. The pilot facilities, which have operated since 1995 and were expanded in 1998, have been successful in recharging about 30,000 acre-feet per year. Recharge in this area will benefit water users in La Quinta and the Valerie-Jean area.

Colorado River water is also delivered to the Coachella Valley via the Coachella Branch of the All-American Canal for crop and golf course irrigation, municipal irrigation, duck clubs, and fish farms. The canal extends from the Imperial Dam near the Mexican border, northwest to Lake Cahuilla near the City of La Quinta, and has a capacity of approximately 1,500 cubic feet per second (cfs).[8] In 1999, it delivered approximately 276,300 acre-feet of water to the Coachella Valley, representing about 41% of total water demand in the basin.[9]

[7] Ibid.
[8] Ibid.
[9] Ibid.

The 1931 Seven Party Agreement divides California's share of Colorado River water among seven California agencies, including CVWD and Imperial Irrigation District (IID). Under the agreement, CVWD and IID share the third party priority for Colorado River water, but IID has the first option to take as much third priority water as it can put to reasonable and beneficial use within its service area. A new tentative agreement, known as the Quantification Settlement Agreement, has been drafted and proposes that an average of approximately 456,000 acre-feet per year be made available to CVWD during the lifetime of the agreement (75 years). Approval of this agreement would provide CVWD with reasonable assurances of a continued supplemental water resource.

I. Recycled Water

To further reduce the impacts of development on groundwater supplies, CVWD has implemented the use of "recycled" or tertiary (third stage) treated wastewater for golf course, landscape, and other irrigation purposes. Wastewater typically undergoes two levels of treatment before it is released to percolation ponds and reintroduced into the groundwater table. Tertiary treated wastewater, however, undergoes an additional stage of treatment, making it suitable for irrigation and decreasing, to some extent, the demand for groundwater. Recycled water was first used in the Coachella Valley in 1965. According to CVWD, usage remained below 500 acre-feet per year until the late 1980s, when its usage increased dramatically. By 1999, usage in the upper valley reached 8,100 acre-feet.[10] In 1999, CVWD recycled approximately 1,500 acre-feet of fish farm effluent for agricultural irrigation and use by duck clubs and fish farms in the lower valley.

J. Water Quality

Groundwater quality is dependent upon a number of factors, including the water source, type of water-bearing materials in which the water occurs, water depth, proximity to faults, presence of surface contaminants, and quality of well maintenance. Although the Coachella Valley groundwater basin has historically provided high quality water, regional water quality has declined since the 1930s.

The concentration of total dissolved solids (TDS) in the Coachella Valley groundwater basin has increased since the 1930s. In 1935, TDS levels in the groundwater basin were about 250 mg/L. Current TDS levels are higher on average, ranging from 152 to 889 mg/L in the upper aquifer, and 131 to 198 mg/L in the lower aquifer.[11] This is partly due to declining water levels, which allow total dissolved solids to migrate from the semi-perched zone down into the upper and lower aquifers. High TDS concentrations are associated with the importation of recharge water and the application of fertilizers, but are also associated with major faults. Near the San Andreas Fault and the presumed extension of the Garnet Hill Fault, TDS concentrations exceed 1,000 mg/L.[12]

Nitrate concentrations have also increased over time. During the 1930s, nitrate levels were typically less than 4 mg/L throughout the valley.[13] However, by the late 1970s, nitrate levels had increased to more than 45 mg/L in wells adjacent to the Whitewater River. High nitrate levels are primarily associated with the application of fertilizers and the discharge of effluent from septic tanks and wastewater treatment plants.

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[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Ibid.

The water quality of the Coachella Valley groundwater basin is also impacted by the addition of salts, which are added through natural recharge, wastewater percolation, fertilizers, irrigation, artificial recharge, and intrusion from the Salton Sea. In 1936, the net salt addition to the Coachella Valley groundwater basin was approximately 12,000 tons per year. By 1999, this figure increased to about 265,000 tons per year. Approximately 65% of the regional salt addition occurs in the lower Coachella Valley, and most of this is associated with the use of imported Coachella Canal water. The installation of tile drains beneath agricultural lands is credited with removing much of the salt from agricultural drainage.

K. Water Resources and Habitat Preservation

Regional surface waters provide important habitat for a variety of wildlife species. Natural water bodies, including the Salton Sea comprise approximately 43,460 acres (3.80%) of the Multiple Species Habitat Conservation Plan Area.[14] Man-made water features, including the Whitewater River recharge ponds and Lake Cahuilla, account for about 816 acres (0.07%) of the planning area.

The freshwater marshes and wetlands of the Salton Sea provide important nesting and foraging habitat for migratory waterfowl, as well as numerous species of fish, including some endangered and threatened species. However, rising salinity levels in the Salton Sea due to evaporation and the release of domestic and agricultural wastewater into the sea have damaged this sensitive habitat.

Washes, seeps, and springs in the Dos Palmas Preserve/ACEC and Oasis Springs Ecological Preserve provide habitat for the federally listed desert pupfish and other species. Other water sources, including agricultural drains, canyon streams, desert fan palm oases, and the Coachella Valley Stormwater Channel, offer riparian habitat, which supports populations of common and sensitive wildlife species. Preservation of these water sources, and the quality of water within them, is critical to the survival and propagation of numerous wildlife species.

[14] "Administrative Draft Review, Coachella Valley Multiple Species Habitat Conservation Plan/Natural Communities Conservation Plan," prepared by Coachella Valley Mountains Conservancy, August 2000.

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II. MISSION CREEK SUBBASIN

The Mission Creek Subbasin is of particular importance to the Coachella valley Multiple Species habitat Conservation Plan (MSHCP), especially to the extent to which important natural communities and associated species are dependent upon it. It has also become progressively more important as a source of domestic water for this heretofore slow growing portion of the MSHCP Plan Area. The subbasin and its conditions are described below.

A. Existing Conditions

The Mission Creek Subbasin is bounded on the south by the Banning Fault and on the north and east by the Mission Creek Fault, on the west by nonwater-bearing rocks of the San Bernardino Mountains, and on the south and southeast by the western slopes of the Indio Hills. Both the Mission Creek fault and the Banning fault are effective barriers to groundwater movement as evidenced by offset water levels, fault springs, and changes in the vegetation. Water level measurements in the spring of 1961 between wells 3S/5E-4L2 and 3S/5E-4M1 indicated a vertical difference in the groundwater table elevation of 255 feet in a horizontal distance of 1,600 feet across the Mission Creek fault.

It is estimated that between the high ground water elevations that occurred during the 1935-1936 season and a depth of 1,000 feet below the ground surface, the Mission Creek Subbasin had a storage capacity of approximately 2,600,000 acre-feet of groundwater within the first 1,000 below the ground surface. The subbasin is naturally recharged by surface and subsurface inflows, most of which comes from Mission Creek and Little and Big Morongo Creeks. Water depths below the ground surface, as determined by the U.S. Geological Survey in 1971, range from a maximum of 425 feet in the northwesterly portion, to naturally flowing (artesian) wells in a narrow strip along the Banning Fault.[15] Although semi-confined groundwater is present, as indicated by the flowing wells, it is believed that the greater portion of the groundwater is unconfined. Movement of the water within the subbasin is generally southward, confined along the Banning Fault and the Indio Hills and following surface topography. A steady water level decline of approximately 0.5 to 1.5 feet per year has been observed since 1952.[16] According to data collected at CVWD's Well No. 3407, located at Dillon Road and Little Morongo Drive, the subbasin water level has dropped from 760 feet above sea level in 1955 to 715 feet in 1998.[17]

[15] "Engineer's Report on Water Supply and Replenishment Assessment," Coachella Valley Water District, April 2000.
[16] Ibid.
[17] "Water Master Plan for Mission Springs Water District," ASL Consulting Engineers, August 2000.

B. Mission Springs Water District (MSWD)

The Mission Springs Water District's service area is approximately 135 square miles and includes the communities of Desert Hot Springs, North Palm Springs, West Garnet, Desert City, Painted Hills, Mission Lakes Country Club, Desert Crest Country Club, Dillon Mobile Home Park, Holmes Trailer Park, Caliente Springs Recreation Vehicle Resort, Sands Mobile Home Park, Palm Springs Crest, and West Palm Springs Village.

Currently, the District obtains all of its supply from groundwater (i.e., wells) located within Mission Creek subbasin for all these communities, with the exception of West Palm Springs Village which is served by wells in the San Gorgonio Pass Subbasin.

C. Trends and Overdraft

The Mission Creek Subbasin is currently in an overdraft state. Groundwater is extracted by CVWD and MSWD as the principal source of potable water for the Desert Hot Springs area, Sky Valley and nearby communities. As this area has developed, groundwater production has increased and groundwater levels have declined since the late 1940's. Currently, groundwater levels are declining at the rate of 1.5 – 2 ft/yr. CVWD) and MSWD extract groundwater from the subbasin utilizing wells. Other private parties also obtain water from the aquifer.

Population Trends in the MSWD Boundaries

Table 4 represents historical, current and projected future population figures for the MSWD's service area (Southern California Association of Governments, 2000).

Table 4
Population Breakdown
Per Census Tract

1990 Census Tract ID	% of Tract in District	1980	1990	1994	1998	2000	2005	2010	2015	2020
43806	6.4%	29	306	360	431	602	848	1,093	1,306	1,528
44501	46.8%	1,371	2,128	2,302	2,757	4,239	5,485	6,669	8,048	9,639
44502	96.34%	7,041	14,636	17,794	21,312	21,980	24,575	27,116	30,090	33,531
TOTAL		8,441	17,070	20,456	24,500	26,821	30,908	34,878	39,4444	44,698

Source: MSWD Water Master Plan, prepared by ASL Consulting Engineers, May 2000

Historical Water Demands

Table 5 represents MSWD's annual water production, which consists of water consumption plus all unaccounted-for waters.

Table 5
Mission Creek Subbasin
Annual Historical Water Production

Year	Total Production Acre Feet	Population Service Area
1978	1,516	-
1979	2,633	-
1980	3,001	8,441
1984	3,906	-
1988	4,952	-
1990	5,928	17,070
1994	6,959	20,455
1995	7,086	-
1996	7,434	-
1997	7,505	-
1998	7,055	24,500

Source: MSWD Water Master Plan, prepared by ASL Consulting Engineers, May 2000

Table 6 represents MSWD's near-term population and water demands.

Table 6
MSWD's Future Demands Based
On Demand/Population Factor

Year	Projected Population*	Projected Demand Acre Feet	% Increase
2005	30,907	10,283	37%
2010	34,878	11,604	55%

Source: MSWD Water Master Plan, prepared by ASL Consulting Engineers, May 2000
* Data from SCAG population projection for the district area
* % INCREASE – Percent increase from 1997 demand (7,505 AF)

MSWD Service Area Build-out

According to the MSWD Water Master Plan (ASL Engineering Consultants, May 2000), the maximum General Plan population at buildout in the MSWD service area is projected at 101,968. The District's build-out evaluation was projected based on evaluating current population, approved Specific Plans, increased density (i.e. future development) within areas that are currently considered developed (infill), and population from General Plan-based residential development. According to the MSWD Water Master Plan, this maximum buildout population could result in water production demand of 238.9 mgd or 32,340 acre-feet per year. It should be noted that, consistent with overall development densities elsewhere in the Coachella Valley, this projection is very high and is unlikely to be realized.

Long Term Supply Projections

In 1978, the District withdrew 456 million gallons (1,400 acre feet) of water from the Mission Creek Subbasin. In 1988, pumpage grew to 1,575 million gallons (4,834 acre-feet). By 1998, the withdrawal increased to 2,312 million gallons (7,096 acre feet). As mentioned above, the Mission Creek Subbasin is overdrafted and cannot continue to support the Districts water demands indefinitely. Table 7 correlates the decrease in basin water level to the total amount of storage estimated in the basin.

Table 7
Mission Creek Subbasin
Water Levels

Year	MSWD Mission Creek Subbasin Withdrawal (ac-ft/yr)	Estimated Subbasin Capacity (af)	CVWD Well No. 3407 Water Level** (ft)	Estimated Water Level Drop (ft)
1955	Less than 540	1,519,800	760’	0’
1978	1,399	1,448,600	744’	16’
1988	4,832	1,409,400	733’	27’
1998	7,094	1,341,800	715’	45’
2005*		1,270,600*	695’*	65’*
2010*		1,235,000*	680’*	80’*
2050*		451,800*	460’*	300’*

Source: MSWD Water Master Plan, May 2000. pg 3-6
* Projections assuming past trend continuation
** Well 3407 is located at Dillon Road approximately 3/4-mile east of Little Morongo Drive.

Mission Creek Subbasin Recharge[18]

Mission Springs Water District, Coachella Valley Water District, and Desert Water Agency (DWA) are jointly addressing the steady water decline in groundwater levels in this area. This collaboration is resulting in the recharge of the Mission Creek Subbasin with Colorado River water obtained from Metropolitan Water District in exchange for a portion of CVWD’s and DWA’s State Water Project entitlement. A recharge spreading facility has been constructed by DWA east of State Highway 62 adjacent to the Mission Creek Wash. This facility is in the upper elevated portion of the subbasin and is well situated on highly permeable soils to recharge the subbasin. Metropolitan Water District recently constructed a 48-inch turnout on its Colorado River Aqueduct to allow delivery of water. DWA owns approximately 160 acres of land adjacent to the Aqueduct on which approximately 110 acres of recharge basins were constructed. The facility is designed to recharge up to 25,000 acre-ft in any one year. Based upon current production, the Mission Creek Recharge Project would use about 6% of the available Exchange water or up to 3,700 acre ft/yr of the current SWP entitlement.[19] It is anticipated that between 5,000 and 10,000 acre-feet per year will be delivered to the spreading facility, and in wetter years, up to 15,000 acre-feet may be spread.[20] DWA will assess MSWD customers a replenishment fee to help recover the costs of the groundwater recharge program.[21]

Groundwater Quality[22]

Groundwater quality in the Mission Creek Subbasin ranges in characterized by calcium –bicarbonate to sodium sulfate. Total dissolved solids (TDS) concentrations are generally below State Secondary MCLs of 500 mg/l. Colorado River Aqueduct water delivered to the Mission Creek Subbasin recharge facility, has TDS concentrations that range between 600 and 670 mg/l., higher than the TDS concentration of existing groundwater in the subbasin. Thus, the spreading of the imported Colorado River Aqueduct water in the groundwater subbasin is likely to slightly elevate TDS concentrations in the subbasin.

18 “Coachella Valley Water Management Plan Draft Program EIR,” prepared by CVWD, June 2002. page 9-27
19 Ibid. page 3-28.
20 “Water Master Plan for Mission Springs Water District,” ASL Consulting Engineers, August 2000.
21 Woody Adams, Senior Service Planner, Desert Water Agency, letter to City of Desert Hot Springs, July 24, 2000.
22 “Hydrogeologic Evaluation, Well Siting, and Recharge Potential Feasibility Study Mission Creek Groundwater Subbasin,” prepared by Richard C. Slade & Associates LLC, May 2000.

Recharging of the groundwater subbasin, regardless of the source of the water, must meet the guidelines of the Basin Plan promulgated by the Regional Water Quality Control Board.

Based on groundwater chemistry, the Mission Creek Subbasin can be divided into three regions: a sodium sulfate zone south and east of Desert Hot Springs; and a calcium-sodium bicarbonate-chloride zone near North Palm Springs; and a calcium-sodium bicarbonate-sulfate zone west of Desert Hot Springs and north of North Palm Springs. The sodium-sulfate zone is characterized by unusually high quantities of sodium cations and sulfate anions.

The water in this zone also contains unhealthful (greater than 1.4 ppm) amounts of fluoride, higher than recommended levels of sulfate (250 ppm), and high TDS concentrations. It is thought that the presence of fluoride is an attribute of the deep tectonic processes, thermal water, near surface weathered igneous and metamorphic basement rock or near surface volcanic rocks. None of these geologic conditions are directly associated with the fluorides in the Mission Creek Subbasin, however, all of the conditions apply to the Desert Hot Springs Subbasin to the northeast of the study area and separated from the area by the Mission Creek fault.

It is therefore thought that the high fluoride concentrations seen in the southeastern portion of the study area are the result of a southward groundwater leakage through the Mission Creek fault. This is also evidenced by water level contours and sulfate and TDS concentrations that mimic the fluoride contours. Sulfate and TDS concentrations within the Desert Hot Springs Subbasin are significantly higher than those southwest of the Mission Creek fault and so the contours indicate a clear trend of groundwater leakage across the fault. The presence of sewage treatment facilities in this zone may in the long run contribute to increasing sulfate, nitrate and TDS concentrations. The water quality data indicate an area with poor quality ground water which should be avoided when placing new domestic water wells.

Water Background Report

Coachella Valley
Multiple Species Habitat Conservation Plan
&
Natural Community Conservation Plan

III. DESERT HOT SPRINGS SUBBASIN

Introduction
MSHCP maps delineate mesquite communities in areas underlain by the Desert Hot Springs Subbasin. In order to provide somewhat of an idea of the survivability of these mesquite communities based upon water availability, this study is being done.

A. Location and Subbasin Description[23]

The Desert Hot Springs Subbasin is bounded by the Little San Bernardino Mountains on the northeast, the Indio Hills and Mission Creek fault on the southwest, and the Mecca Hills on the southeast. The subbasin is further divided into three subareas, including the Miracle Hill Subarea, Sky Valley Subarea and the Fargo Canyon Subarea. It is estimated that between the high ground water elevations that occurred during the 1935-1936 season and to a depth of 1,000 feet below the ground surface, the Desert Hot Springs Subbasin has a capacity for storing about 4,100,000 acre-feet of groundwater. Although the subbasin is quite extensive and overlies it is only sparsely developed. The coalescing alluvial fan deposits underlying the Dillon Road Piedmont Slope are the water-bearing materials of the Desert Hot Springs Subbasin. These water-bearing materials in the primarily consist of coarse-grained, poorly sorted alluvial fan deposits, which are principally of Ocotillo conglomerate estimated to be more than 700 feet thick. Recent fanglomerates cover most of the land surface, and recent alluvium in the subbasin ranges in thickness from a thin edge to more than 100 feet.

Table 8 indicates the total storage capacity of individual subareas located within the Desert Hot Springs Subbasin.

Table 8

Subarea	**Total Storage Capacity* Acre-Feet**
Miracle Hill Subarea	400,000
Sky Valley Subarea	1,400,000
Fargo Canyon Subarea	2,300,000
Total	**4,100,000**

23 "Engineer's Report on Water Supply and Replenishment Assessment," Coachella Valley Water District, April 2000.

B. Miracle Hill Subarea

The portion of the Desert Hot Springs subbasin along the Mission Creek fault, in which there is extensive development of hot-water wells, is known as the Miracle Hill subarea. It covers approximately 12 square miles and includes the northeastern portion of the community of Desert Hot Springs. A principal use of groundwater in this area is to provide the hot mineral water to several spa hotels and mobilehome parks. The boundary separating the subarea from the Sky Valley subarea is a surface drainage divide. Ground water levels indicate that underflow across this boundary moves from Miracle Hill subarea southeastward into the Sky Valley subarea.

More than 130 water wells have been drilled in the Miracle Hill subarea. Approximately half of these are active and pump water primarily for spa use. Depth to water ranges from 12 feet below ground surface near the Mission Creek fault to over 300 feet in the southeast portion of the subarea. Water level data in the Miracle Hill subarea suggest several barriers to ground water movement. The barriers appear to trend parallel to the Mission Creek fault with which they are probably associated. Structural conditions within the subarea are complex and the barrier effects are not well understood. Movement of groundwater in the subarea is generally southeastward except within the narrow strip between the main Mission Creek fault and the secondary parallel fault that follows the northeast flank of Miracle Hill.

The water temperatures in 34 wells of the Miracle Hill subarea were measured in the spring of 1961, and the values range from 82°F to 200°F. The average value was 118°F. Water temperatures measured in 16 wells along the southwest side of the Mission Creek fault in the Mission Creek subbasin range in value from 74°F to 86°F. This difference is probably a reflection of the barrier effect of the fault and suggests that ground water is heated on the northeast side of the fault with limited movement across the fault.

C. Valley Subarea

The central portion of the Desert Hot Springs subbasin, in which ground water movement is toward Thousand Palms Canyon, is the Sky Valley subarea. The subarea extends 11 miles from the Miracle Hill subarea southeasterly to the trace of the Indio Hills fault and covers approximately 35 square miles. The trace of the Indio Hills fault is the boundary of the Sky Valley and Fargo Canyon subareas. The fault coincides with a ground water divide and is probably an effective barrier to ground water movement.

Groundwater and other hydrologic data in the Sky Valley subarea are sparse. Only 15 water wells are known in this area and of these, 8 were active, pumping only small quantities of groundwater for domestic (primarily residential irrigation) use. Movement of water within the subarea is southeasterly from the Miracle Hill subarea and southwesterly from the vicinity of Fan Canyon, converging on the Thousand Palms Canyon, where rising water is present throughout the year. The gradient of the water table is moderate. Groundwater is probably unconfined in the greater part of the subarea.

D. Fargo Canyon Subarea

The portion of the Desert Hot Springs subbasin south and east of the Indio Hills fault is the Fargo Canyon subarea. It covers approximately 57 square miles and extends 17 miles from the Sky Valley subarea to the southeast limit of the subbasin. The northwest half of the area is underlain by coarse, alluvial fans of Recent age. To the southeast, Recent deposits are confined to stream channels cut into the Ocotillo conglomerate. Data on the occurrence of groundwater within the Fargo Canyon subarea is even less than in the Sky Valley subarea. Nine wells are known to have been drilled in the Fargo Canyon subarea, all in the vicinity of Dillon Road. Two of these wells were active, pumping water for domestic use and for irrigation of approximately 200 acres of young citrus trees.

Water levels measured in these wells during the spring of 1961 range in depth from 717 feet to 17 feet. Although the data are not sufficient to determine the configuration of the water table, the measured levels along Dillon Road suggest that ground water movement in the northwest portion of the subarea moves southeasterly, and the groundwater is probably unconfined.

Groundwater in this subbasin is characterized by high concentrations of fluoride, total dissolved solids, sodium sulfates and other undesirable minerals, which have limited its use for agricultural and domestic water purposes.[24] The presence of high mineral concentrations is largely due to faulting along the margins of the subbasin.

As noted above, faulting is associated with geothermal activity, which warms the earth's crust. As subsurface temperatures rise, minerals contained within the subbasin's sediment profiles are more easily dissolved and mixed with groundwater, increasing the overall mineral content of the water. In some portions of the subbasin (Miracle Hill subarea) groundwater temperatures can reach up to 200°F and is the primary source of mineral spa waters in the City of Desert Hot Springs. The Coachella Valley Water District does not extract groundwater from the Desert Hot Springs Subbasin, given its high concentration of undesirable minerals. Instead, domestic water for the Sky Valley and Indio Hills communities is extracted by CVWD from the Mission Creek Subbasin to the west.[25]

[24] Steve Bigley, Coachella Valley Water District, personal communication, March 13, 2001.
[25] Ibid.