COACHELLA VALLEY WATER DISTRICT

ENGINEER'S REPORT ON WATER SUPPLY AND REPLENISHMENT ASSESSMENT 2000/2001

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ON
WATER SUPPLY AND REPLENISHMENT ASSESSMENT

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Prepared by
Water Resources Branch
Engineering Department

April 2000

COACHELLA VALLEY WATER DISTRICT

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I. INTRODUCTION

The Coachella Valley Water District (district) serves an area of approximately 1,000 square miles in the Coachella Valley within the Counties of Riverside, Imperial and San Diego. The Coachella Valley is located in the northwesterly portion of the arid Colorado Desert of California. High mountains border the valley to the west and north and provide an effective barrier against coastal storms; therefore, direct precipitation does not contribute significantly to the water supply on the valley floor. The groundwater basin is recharged by runoff from the adjacent mountains.

The need for supplemental water has been recognized in the valley for many years. The formation of the district in 1918 was a direct result of the concern of the residents over a plan to export water from the Whitewater River to Imperial Valley. The early residents of the valley recognized that action must be taken to reduce the lowering of the water table which was occurring as a result of their pumpage, and entered into agreements for the construction of the Coachella Branch of the All American Canal. Since 1949, the Coachella Canal has been providing water for irrigation use in an area generally from Indio and La Quinta south to the Salton Sea.

After resolution of the water supply problem in the southeastern part of the valley and the start of recreational development, the need for supplemental water in the northwestern part of the valley was recognized. As a result, the district and Desert Water Agency (DWA) entered into separate contracts to ensure that water from the State Water Project (SWP) would be available. The Coachella aqueduct which would bring Northern California water into the valley has not been constructed. Therefore, DWA and the district entered into an agreement with Metropolitan Water District of Southern California (MWD) to obtain water from the MWD aqueduct which crosses the upper portion of the Coachella Valley near Whitewater, in exchange for the two agencies' water from the SWP. Since 1973, water from this source has been used for groundwater recharge.

In addition, the district, recognizing the need for additional water, entered the water reclamation field and currently operates six facilities in the valley. Recycled water from two of these facilities has been used for golf course and greenbelt irrigation for many years, thereby reducing demand on the groundwater basin. A third facility began providing recycled water during 1997.

The district and DWA, recognizing that management of the groundwater basin in the western part of the valley extended across agency boundaries, entered into a management agreement for that area in 1976. This agreement recognized the need to operate the groundwater basin as a complete unit rather than as individual segments delineated by agency boundaries.

The district is authorized by law to levy a replenishment assessment charge to pay for certain costs associated with obtaining supplemental water for replenishment of the water supply within the district.

II. GROUNDWATER BASIN DESCRIPTIONS

A. Geology.

The Coachella Valley groundwater basin, as described by the Department of Water Resources (DWR), is bounded on the easterly side by the nonwaterbearing crystalline rocks of the San Bernardino and Little San Bernardino Mountains and on the westerly side by the crystalline rocks of the Santa Rosa and San Jacinto Mountains. The trace of the Banning Fault on the north side of San Gorgonio Pass forms the upper boundary.

The lower boundary is formed primarily by the watershed of the Mecca Hills and by the northwest shoreline of the Salton Sea running between the Santa Rosa Mountains and Mortmar. Between the Salton Sea and Travertine Rock, at the base of the Santa Rosa Mountains, the lower boundary coincides with the Riverside/Imperial County Line.

Southerly of the lower boundary, at Mortmar and at Travertine Rock, the subsurface materials are predominantly fine grained and low in permeability; although groundwater is present, it is not readily extractable. A zone of transition exists at these boundaries; to the north the subsurface materials are coarser and yield water readily.

Although there is interflow of groundwater throughout the groundwater basin, fault barriers, constrictions in the basin profile and areas of low permeability limit and control movement of groundwater. Based on these factors, the groundwater basin has been divided into subbasins and subareas as described by DWR in 1964 and the United States Geological Survey (USGS) in 1971.

The subbasins are Mission Creek, Garnet Hill, Whitewater River (Indio) and Desert Hot Springs subbasins. The subbasins, with their groundwater storage reservoirs, are defined without regard to water quantity or quality. They delineate areas underlain by formations which readily yield stored water through water wells and offer natural reservoirs for the regulation of water supplies.

The boundaries between subbasins within the groundwater basin are generally based upon faults that are effective barriers to the lateral movement of groundwater. Minor subareas have also been delineated, based on one or more of the following geologic or hydrologic characteristics: type of water bearing formations, water quality, areas of confined groundwater, forebay areas, groundwater divides and surface divides.

Following is a list of the subbasins, based on the USGS designations:

Whitewater River subbasin
Palm Springs subarea
Thermal subarea
Thousand Palms subarea
Oasis subarea
Mission Creek subbasin
Garnet Hill subbasin
Desert Hot Springs subbasin

Figure 1 (Appendix A) shows the subbasins.

The following are areas within the Coachella Valley where a supply of potable groundwater is not readily available:

Indio Hills area
Mecca Hills area
Barton Canyon area
Bombay Beach area
Salton City area

B. **Mission Creek Subbasin**.

Water bearing materials underlying the Mission Creek upland comprise the Mission Creek subbasin. The subbasin is bounded on the south by the Banning Fault and on the north and east by the Mission Creek Fault. It is bordered on the west by nonwaterbearing rocks of the San Bernardino Mountains. To the southeast of the subbasin are the Indio Hills. The area within this boundary reflects the estimated limit of effective storage within the subbasin.

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 vegetation. Water level measurements in the spring of 1961 between Wells 03S05E04L02S and 03S05E04M01S 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. Similar measurements of Wells 3S04E13H01S and 03S04E13N01S on either side of the Banning Fault indicated a vertical difference of 250 feet in water elevation over a horizontal distance of 4,900 feet. Water levels are higher on the north side of both faults.

All known wells in the subbasin were drilled in Recent sands and gravels. At depths ranging from 20 to 170 feet, the wells pass through unconsolidated Recent material and encounter semi-consolidated and interbedded sands, gravels and silts similar to exposures of the Ocotillo conglomerate in the Indio Hills or the Cabazon fanglomerate exposed at Whitewater Hill. Although these Pleistocene deposits are the main source of water, water also occurs in Recent alluvium where the water table is sufficiently shallow.

Water levels in the Mission Creek subbasin were determined in the 1971 USGS investigation. Measured depths below ground surface of water in the subbasin range from a maximum of 425 feet in the northwestern portion to flowing wells, as a minimum, in a narrow strip along the Banning Fault northwest of Seven Palms Ridge. Although semi-confined groundwater is present, as indicated by the flowing wells, it is believed that the greater portion of the groundwater body is unconfined. Movement of water within the subbasin is generally southwest. However, in spite of the moderate to high permeability of the water bearing materials, the flat gradient suggests the rate of movement is not great. Historic water levels indicate a general rise within the subbasin between 1938 and 1952. Since 1952, a steady water level decline of 0.5 to 1.5 feet per year has been observed.

Surface runoff and groundwater inflow from the Little San Bernardino Mountains and Indio Hills bring high concentrations of undesirable mineral constituents into the lower southerly portion of the Mission Creek subbasin easterly from approximately Palm Drive in the City of Desert Hot Springs.

C. **Whitewater River Subbasin**.

The Whitewater River subbasin, known also as the Indio subbasin, comprises the major portion of the floor of the Coachella Valley 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.

The limit of the Whitewater River subbasin along the base of the San Jacinto Mountains and the northeast portion of the Santa Rosa Mountains coincides with the Coachella Valley groundwater basin boundary. The Whitewater River subbasin in this vicinity includes only the Recent terraces and alluvial fans. The Garnet Hill Fault, which extends southeastward from the north side of San Gorgonio Pass to the Indio Hills, is an effective barrier to groundwater movement from the Garnet Hill subbasin into the Whitewater River subbasin. 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.

The Whitewater River subbasin is divided into four subareas: Palm Springs, Thermal, Thousand Palms, and Oasis subareas. The Palm Springs subarea is the forebay or main area of recharge to the subbasin, and the Thermal subarea comprises the pressure area within the basin. The other two subareas are peripheral areas having unconfined groundwater conditions.

The historic fluctuations of water levels within the Whitewater River subbasin indicate a steady decline in the levels throughout the subbasin prior to 1949. After 1949, levels in the lower Thermal subarea (south of Point Happy), where imported Colorado River water is used for irrigation, rose sharply, although elsewhere in the subbasin water levels continued to decline.

With the use of Colorado River water from the Coachella Canal there had been less demand on the groundwater basin below Point Happy. Water levels in the deeper aquifers rose from 1949 to the early 1980s. However, water levels in the area have again declined, at least partly due to increasing urbanization and groundwater usage.

1. **<u>Palm Springs Subarea</u>**.

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 unconfined groundwater occurs. The valley fill materials within the subarea are essentially heterogeneous alluvial fan deposits exhibiting little sorting and with little content of fine grained material. Thickness of these water bearing materials is not known; however, it exceeds 1,000 feet. 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 subbasin occurs primarily in the Palm Springs subarea. The major natural sources include infiltration of stream runoff from the San Jacinto Mountains and the Whitewater River, and subsurface inflow from the

San Gorgonio Pass subbasin. Deep percolation of direct precipitation on the Palm Springs subarea is considered negligible.

Before the current artificial recharge program began, depth to water in the subarea ranged from 200 feet below the surface near Cathedral City to nearly 500 feet at the northwestern end of the subbasin near the spreading works downstream of Windy Point.

2. **Thermal Subarea**.

Groundwater of the Palm Springs subarea moves southeastward into the interbedded sands, silts, and clays underlying the central portion of the Coachella 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, as a result, 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 water under these conditions is present in the major portion of the Thermal subarea and is caused by differences in piezometric 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 name aquiclude in reference to it. Therefore, the term aquitard is used for this zone of less permeable material which 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. Semiperched 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 Coachella Valley groundwater basin, but serves only that portion of the valley southeasterly of Washington Street. The top of the lower aquifer zone is present at a depth 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 arcuate zone approximately one mile wide, the aquitard is apparently lacking and no distinction is made between upper and lower aquifer zones.

The upper aquifer zone in the Thermal subarea is similar in lithology to the lower aquifer, although it is not as thick. Subsurface inflow to the upper zone is less than that to the lower aquifer zone. When water levels in the Palm Springs subarea drop, the cross sectional area of the upper zone available for recharge at Point Happy is reduced.

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.

The Thermal subarea contains the division between the upper and lower Whitewater River subbasins 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 has risen, while the water table in the area northerly from Point Happy has been dropping. This division forms the lower (southern) boundary of the management area of the DWA/district Management Agreement. Water table measurements have shown no distinction between the Palm Springs subarea and the Thermal subarea. The only distinction has been the hinge effect in the Thermal subarea at Point Happy, where groundwater levels until recently were stabilized, neither rising nor falling significantly (See Section C.1, Page 14). As discussed elsewhere, this may be changing, as increased pumpage is once again lowering the groundwater levels in the lower subarea. The district has a study underway to evaluate the entire groundwater basin.

3. **Thousand Palms Subarea**.

The small area along the southwest flank of the Indio Hills is named the Thousand Palms subarea. The southwest boundary of the subarea was determined by tracing the limit of distinctive groundwater chemical characteristics. Whereas a 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.

The 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.

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.

4. **Oasis Subarea**.

Another peripheral zone of unconfined groundwater that is different 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 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 lithologic 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.

D. **Garnet Hill Subbasin**.

The area northeast of the Garnet Hill Fault and the Whitewater River subbasin, named the Garnet Hill subbasin, was separated as a distinct subbasin by the USGS 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 water 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 100 feet.

Although some recharge to the subbasin may come from Mission Creek and other streams which 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.

E. **Desert Hot Springs Subbasin**.

The coalescing alluvial fan deposits underlying the Dillon Road Piedmont Slope are the water bearing materials of the Desert Hot Springs subbasin.

The northeasterly boundary of the subbasin along the base of the Little San Bernardino Mountains from Little Morongo Canyon southeast to Thermal Canyon coincides with the northeasterly boundary of the groundwater basin. The southwest boundary of the subbasin is set by the Indio Hills and the San Andreas and Mission Creek Faults.

The Mission Creek Fault forms the boundary from Little Morongo Canyon southeast to Pushawalla Canyon in the Indio Hills. Semiwaterbearing materials of the Indio Hills border the subbasin along the south boundary of Pushawalla Canyon, from the Mission Creek Fault east to the Indio Hills Fault. From Pushawalla Canyon to the southeast end of the Indio Hills, the boundary is defined by the Indio Hills Fault. The San Andreas Fault separates the Desert Hot Springs subbasin from the Whitewater River subbasin beneath the alluvial debris cone of Fargo and Thermal Canyons, located between the Indio Hills and the Mecca Hills.

Between the Indio Hills Fault and the San Andreas Fault at the southeast end of the Indio Hills, the subbasin boundary is the contact between Recent alluvium and Plio-Pleistocene formations. The subbasin merges with the Mecca Hills to the southeast and the boundary is the southeastern side of Thermal Canyon from the San Andreas Fault to the Mecca Hills Fault. The boundary continues easterly along the southeast wall of a tributary wash to outcrops of crystalline basement rock of the Little San Bernardino Mountains near Interstate Highway 10.

The water bearing materials in the subbasin are primarily coarse-grained and poorly sorted alluvial fan deposits, principally of the Ocotillo formation, but also including the overlying Recent deposits. In the vicinity of Thousand Palms Canyon, fine grained interbeds are present in the Recent deposits. Although Recent fanglomerates cover most of the land surface, exposures of the Ocotillo conglomerate are present throughout the subbasin. Principal exposures occur at Miracle Hill, along the northeast flank of the Indio Hills, and near the southeast end of the subbasin. Recent alluvium in the subbasin ranges in thickness from a thin edge to over 100 feet. The thickness of the underlying Ocotillo conglomerate is estimated to be in excess of 700 feet. Well drillers' logs commonly describe the material as being cemented.

The area overlying the Desert Hot Springs subbasin is not extensively developed except in the vicinity of the city of Desert Hot Springs. Hot water from springs along the northeast side of the Mission Creek Fault supplies hot water spas in the area. However, the high concentration of undesirable minerals in the groundwater throughout the subbasin has limited its contribution to agricultural or domestic water resources for the valley.

III. WATER SUPPLY

A. **Coachella Valley.**

In 1964 DWR estimated that the subbasins in the Coachella Valley groundwater basin contained, in the first 1,000 feet below the ground surface, approximately 39,200,000 acre-feet of water. For the capacities of the subbasins, see Table 1 (Appendix B).

Currently, only the Whitewater River subbasin is developed to the point where any significant production occurs. The natural supply of water to the northwestern part of the valley is not keeping pace with the basin outflow due mainly to large consumptive uses created by the resort-recreation economy and permanent resident population. The imported Colorado River supply through the Coachella Canal is used solely for irrigation. Annual deliveries of Colorado River water through the Coachella Canal of approximately 300,000 acre-feet are a significant component of southeastern valley hydrology.

Historical water level declines and conditions producing those declines have been extensively described by the USGS and DWR.

Although water levels have been declining throughout most of the subbasins since 1945, water levels in the southeastern portion of the valley had risen until recently because of imported water from the Coachella Canal and resulting decreased pumpage in that area. Increasing urbanization and increased groundwater use have caused water level declines in the last few years.

Water surface elevations in the northwestern area of the valley are highest at the northwest end of each subbasin, illustrating that groundwater flow is from the northwest to the southeast in the valley. Comparison of the 1936 water level and the 1973 water level shows that water levels declined more than 100 feet in parts of the Palm Springs subarea and more than 70 feet in parts of the Palm Desert area during the 37-year period.

District Drawing Nos. 12A and 12B show the water level in the basin by years and are incorporated in this report by reference. Figures 2a, 2b, 3a and 3b (Appendix A) show representative examples of the water level in the basin by years. These drawings display data showing the water level in the upper Whitewater River subbasin and in the lower Whitewater River subbasin. There has been a gradual lowering of the water table in the Mission Creek and Garnet Hill subbasins. In some portions of the southerly Thermal and Oasis subareas, local water level decline apparently is accelerating. See Figure 3b, (Appendix A).

B. **Water Replenishment**.

Alleviation of the upper Whitewater River subbasin overdraft was initiated by the district and DWA when the two agencies contracted with the State of California (state) to purchase Northern California water from the SWP. The entitlements under the contracts for the two agencies are shown in Table 2 (Appendix B).

Since the facilities necessary to transport State Project water into the valley have not been constructed, the two agencies entered into an agreement with MWD to exchange their entitlements to State Project water for Colorado River water from the MWD aqueduct which crosses the upper valley.

The agreement allows for the exchange of like amounts of water, in accordance with the two agencies' entitlements. The quantities of water delivered to date are shown in Table 3 (Appendix B). The effectiveness of the replenishment program has been demonstrated by rising water levels in the immediate recharge area and by slowing water level declines in some upper Whitewater River subbasin wells as shown in Figure 2a (Appendix A). Since the beginning of 1996, the two agencies have been purchasing additional water from the State Water Project and from other agencies with a surplus to replenish the basin (see Table 3).

C. **Management Area**.

The district and DWA have recognized the need to manage the upper Whitewater River subbasin as a complete unit rather than as individual segments underlying the individual agencies' boundaries. This management area consists of the Palm Springs and Thousand Palms subareas and the portion of the Thermal subarea experiencing a significantly declining water table.

The management area was established to encompass the area of groundwater overdraft as evidenced by declining water table conditions, and includes portions of DWA and the district.

Groundwater production in the management area is defined as the extraction of groundwater by pumping or any other method within the boundaries of the area, or the diversion within the area of surface supplies which naturally replenish the groundwater supplies within the area and are used therein. Production within the management area is estimated to be as shown in Table 4 (Appendix B).

Based on long-term conditions, natural inflow into the management area is approximately 49,000 acre-feet per year and natural outflow from the same area is approximately 25,000 acre-feet per year.

1. **Southern Boundary**.

The southern boundary of the management area separates the upper Whitewater River subbasin from the lower Whitewater River subbasin and extends diagonally across the valley from Point Happy northeast to the Indio Hills near Jefferson Street. This boundary was determined to be the extent of the area in which groundwater levels had ceased to decline significantly over the previous years. Approximately 60 wells are monitored annually to maintain surveillance over this boundary.

Observations have indicated groundwater declines during the past ten years in portions of the lower Whitewater River subbasin, particularly the Oasis subarea. This decline is due to expanding urban uses in the lower valley, as well as changes in agricultural practices.

Further studies of the recent declines in groundwater are underway. These studies suggest that there is the need to establish recharge programs in the lower valley.

2. **Consumptive Use**.

One of the most difficult water requirement parameters to quantify is the water which is consumed by animals and plants. It is generally estimated by identifying the quantity of water extracted from the basin and subtracting that quantity which is returned as nonconsumptive use via septic tanks, leaching fields, percolation of water applied to plants, and other means. A simplified approach accepted by most hydrologists is to express the consumptive use as a percentage of total water production. In 1971, the USGS estimated consumptive use to be approximately 60 percent for the valley. The data in Table 5 (Appendix B) were developed using this estimate.

3. **Overdraft**.

The management area's water supply is overdrawn and it will remain so even with the importation of water from outside the basin. Overdraft of the basin and its subbasins will continue with or without further development; however, overdraft will increase with increased development. In effect, the groundwater subbasin is being mined, since it will not be replenished sufficiently to recover fully.

Eventually, imported water may offset groundwater overdraft on an annual basis. With continued growth, it is anticipated that the per capita water production will decrease as some property changes from irrigated agricultural to residential, with a saving in water consumption. Even so, water requirements are likely to continue to place demands on groundwater in storage.

A groundwater replenishment program is needed to arrest or reduce declining water levels and to avoid any detrimental conditions that would otherwise occur.

D. **Area of Benefit**.

A review of the groundwater subbasins which underlie the boundaries of the district indicates that only one area is being recharged with supplemental water. This area is the upper Whitewater River subbasin.

The other subbasins in the Coachella Valley (lower Whitewater River, Mission Creek, Garnet Hill and Desert Hot Springs subbasins) currently do not receive any supplemental water under this program and therefore are excluded from further consideration in the current recharge program.

The area of benefit for purposes of this report is shown on Figure 4 (Appendix A).

E. **Future Activities**.

Recharge occurs in the lower Whitewater River subbasin as an indirect result of importation of Colorado River water via the Coachella Canal. The presence of confining aquitards prevents most of the percolation of the Colorado River water into the deeper aquifers. The water table in the deep aquifers has declined in the recent past due to increased pumpage, primarily to serve expanding urban uses and changes in agricultural practices. If further study indicates that the recent declines are the beginning of a long term trend, supplemental water in the form of direct recharge, over application, and in lieu programs will be developed to recharge this area of the basin and to slow or reverse the downward trend.

The district is currently preparing a water management plan for the Coachella Valley. Our goal is to ensure a dependable long-term supply of high quality water for all valley water users. This plan will affect the entire groundwater basin south of the San Andreas fault. A Program Environmental Impact Report is also in the preliminary stages of preparation. Meetings with various groups of water users have been held to keep the public informed of the program. While there are currently no replenishment assessments in the lower Whitewater subbasin, we anticipate implementation of a program in the near future.

One direct recharge program could be located just south of Lake Cahuilla. An abandoned gravel pit has been converted to a golf course. This site appears to be ideally located for a potential recharge area for the Thermal subarea, given its proximity to Lake Cahuilla and its relative freedom from aquitards. Recharge in this area will benefit producers in the La Quinta-Valerie Jean portion of the Thermal subarea and extend southward along the west side of the valley through the Oasis subarea to Travertine at the county line.

A recharge test facility is in operation at a location which would primarily benefit the Oasis Subarea and may have limited impact on the remainder of the lower valley. After operating the test replenishment pond since July of 1995, groundwater quality changes at this location show that recharge may be feasible. Larger ponds were constructed at this test facility during 1998 and expanded tests are continuing.

Another aspect of the water management plan could be the prevention of intrusion by Salton Sea water into the fresh water aquifers. To maintain surveillance on the water quality in the critical area, we have constructed a multiple zone piezometer well through which we compare water quality at four different points below the ground surface. After five years of data collection at this site, we are evaluating a site for an additional well of this type.

The district also continues to explore other sources of recharge water for the western part of the valley.

IV. REPLENISHMENT PROGRAM

The replenishment program currently in effect consists of obtaining supplemental water from the MWD Colorado River aqueduct in exchange for DWA and district entitlements of State Project water, and recharging the groundwater basin within the management area. The supplemental water is obtained through a turnout from the MWD aqueduct at Whitewater and follows the natural channel of the Whitewater River to spreading facilities located near Windy Point. Water entering the basin at this location results in groundwater recharge, which benefits the entire upper Whitewater River subbasin, as described in the reports of the analytical work by the USGS (Tyley and Swain). Their work using analog and digital computer models of the upper Whitewater River subbasin clearly demonstrates that recharge of supplemental water at Windy Point benefits the entire area. Figure 5 (Appendix A) shows Swain's projection of the impact of supplemental water recharge on the upper Whitewater River subbasin as compared to no supplemental recharge. The water level in the year 2001 with supplemental recharge is approximately 30 to 40 feet higher in the Palm Desert area than without any supplemental recharge. Swain's projections have recently been substantiated through a comparison between measured well levels and projections of water level decline over the same period.

In 1984, MWD, DWA and district entered into an agreement during high flows on the Colorado River to allow for the advance delivery of Colorado River water to Coachella Valley. This replenished the basin more rapidly and allowed the capture and storage for future needs, of water which otherwise would have been lost to the Gulf of California. It allowed MWD to bank about 600,000 acre-feet of water in our basin as a hedge against shortages along Southern California's coastal plain during drought. Until the banked water is needed, Coachella Valley well owners benefit by higher water tables and lower pumping costs. When MWD needs the water, it will take both its Colorado River water and Coachella Valley's annual state project entitlements as long as necessary or until the banked allotment is exhausted. During the dry periods, when MWD is using both sources, DWA and district entitlements will be drawn from this previously delivered and stored water. The two Coachella Valley agencies pay the state the costs of the water delivered to MWD in exchange for the transfer of the banked water.

V. REPLENISHMENT ASSESSMENT

A. **State Water Code**.

Sections 31630 through 31639 of the State Water Code authorize the district to levy and collect water replenishment assessments for the purpose of replenishing groundwater supplies within the district. The code defines production, producer, and minimal pumper for replenishment purposes as follows:

> Production" or "produce" means the extraction of ground water by pumping or any other method within the boundaries of the district or the diversion within the district of surface supplies which naturally replenish the ground water supplies within the district and are used therein.
>
> Producer" means any individual, partnership, association or group of individuals, lessee, firm, private corporation, or any public agency or public corporation, including, but not limited to, the Coachella Valley Water District.
>
> Minimal pumper" means any producer who produces 25 or fewer acre-feet in any year.

The replenishment assessment is based on production within the upper Whitewater River subbasin within the boundaries of the district and is limited to the area of benefit.

Production by minimal pumpers is exempt from assessment. There are approximately 30 to 40 minimal pumpers in the area of benefit. These producers were determined to be minimal pumpers by a thorough field investigation of the use of the wells. These are predominantly small wells used for domestic or limited irrigation purposes. Maximum pumpage by the minimal pumpers in the area of benefit would be less than 1,250 acre-feet per year, or less than one percent of total annual production.

The code defines replenishment assessment and it states that assessments may be levied upon all water production within the area of benefit, provided the assessment charge is uniform throughout said area of benefit. The replenishment assessment charge is a monetary charge authorized by the State Water Code and uniformly applied to extractions of groundwater within certain specified geographic boundaries of the district for payments of an imported water supply purchased to supplement naturally existing water supplies. Charges for the water supply are limited to certain costs.

In the initial twelve years of the replenishment program, only the variable operation, maintenance, power and replacement component of the transportation charge, and the delta water charge could be included in the calculation. However, in 1991 the legislature passed and the governor signed into law AB 1070. This bill continues to limit the charges assessable against production, but includes an additional component of the transportation charge, the off-aqueduct power component. The district has also been allowed, under the water code, to include in its calculations surplus or excess water charges, payments to DWA for similar payments by DWA to the state, the cost of importing and recharging water from sources other than the SWP and the cost of treating and distributing reclaimed water. The replenishment assessment charge considered in this report is based on the most recent and reliable information available with respect to applicable costs or charges.

The district has additional costs associated with the replenishment program which include continuing engineering studies and well meter installation and maintenance. These costs and the cost of treating and distributing reclaimed water are not included in determining the replenishment assessment charge.

B. **State Water Project Costs**.

SWP costs are based on the fiscal year. Calculation of the replenishment assessment charge may be found in Table 7 (Appendix B).

The allowable replenishment assessment charge shown in Table 7 is based on those charges reimbursable to DWR for SWP facilities which are necessary either for the conservation and development of a project water supply (delta water charge), the conveyance of such supply to SWP service areas (variable OMP&R and off aqueduct power facilities component of the transportation charge), or certain other costs associated with obtaining replenishment water. In turn the district is reimbursed for these charges by levying a replenishment assessment upon water producers benefiting from the water replenishment program. The amount of the replenishment assessment cannot exceed those costs set forth in section 31633 of the state water code and applicable at the time of the levy.

The delta water charge is a charge for the construction of SWP conservation facilities such as Oroville Dam and Lake, Frenchman Dam and Lake, Antelope Dam and Lake, delta facilities, and other additional conservation facilities throughout the state, including Southern California.

The transportation charge is a charge for use of the SWP facilities to transport and deliver water from Northern California to the vicinity of each contractor's turnout. Such facilities include portions of the California aqueduct and various pipelines, lakes and power facilities.

Another significant cost included within the allowable transportation charge shown in Table 7 is SWP power requirements. Each year, the DWR develops short and long range aqueduct operation studies. These studies are needed to project the amount of electrical capacity and energy required to deliver the contractors' requested entitlement water in future years.

The estimated power load requirements for SWP can vary significantly, depending on the actual balance of water supply and water demand in a given year, and these load requirements primarily depend on annual statewide hydrologic conditions. The aqueduct operation studies used in developing projected SWP power are based on median year hydrologic conditions. Pumping an acre-foot of SWP water to Southern California requires approximately 4,500 kilowatt hours of electrical energy at an estimated cost of approximately $315. The energy costs have increased significantly since the start of SWP deliveries and vary from year to year. Because low cost power contracts have ended, energy must be obtained by developing new facilities or must be purchased on the open market. In many recent years, energy cost increases have outpaced the cost of living indexes.

An amount is collected annually for the cost to maintain the Whitewater Spreading Area. The amount included for fiscal year 2000-2001 is $100,000.

The estimated cost of supplemental water purchased during fiscal year 1999-2000 was $6.5 million. This amount is being borrowed from district reserve funds and future replenishment calculations are to be increased at the rate of approximately 12 percent until all amounts has been repaid to the reserve account. This 12 percent rate assumes that the Department of Water Resources rates for the delta water charge and variable OMP&R and off aqueduct power facilities components of the transportation charge will remain constant.

Based on the total amount borrowed for surplus water purchases, it will take approximately 8 years to repay the borrowed reserve funds, with the rate ultimately being in the $60 to $65 per acre-foot range. The amount of $3,203,850 is being collected during fiscal year 1999-2000 and $5,166,180 is included in the fiscal year 2000-2001 calculation.

C. **Assessed Production**.

Producers within the district are listed in Table 8 (Appendix B) together with their estimated fiscal year production and their total estimated fiscal year replenishment assessment. The amount of fiscal year production has been assumed to be equal to the total production in the preceding calendar year. See Figure 6 (Appendix A) for a graphic representation of production. Producers will be charged only for actual water produced. However, it is expected that overall production will increase in the current fiscal year over past production due to increased housing starts, a more favorable economic climate and the addition of new producers.

The replenishment charge per acre-foot is based on the calculations in Table 7 (Appendix B).

VI. CONCLUSION AND RECOMMENDATION

Information on the present condition of the groundwater supply within the district indicates that there are five groundwater areas in an overdraft condition. These areas are the upper Coachella Valley's Mission Creek, upper Whitewater River, Garnet Hill and Desert Hot Springs subbasins and localized portions of the lower Whitewater River subbasin. However, only one of these areas, the upper Whitewater River subbasin, is being recharged with supplemental water under this program and therefore, subject under the law to a replenishment assessment.

Because the average natural water inflow into the upper Whitewater River subbasin is less than the production, the replenishment program, using supplemental water, must be continued.

Using the replenishment assessment calculation, the replenishment assessment charge would be $65.12 per acre-foot. However in calendar year 1999, 17,200 acre-feet more water was produced than had been estimated.

The resulting decrease in assessment of $5.98 per acre-foot results in a calculated assessment rate for fiscal year 2000-2001 of $59.14 per acre-foot.

Therefore, it is recommended that the replenishment charge of $59.14 be levied upon all producers within the area of benefit in accordance with the state water code.

VII. BIBLIOGRAPHY

The following is a partial bibliography of material related to the water supply in the Coachella Valley that was used in preparing this report.

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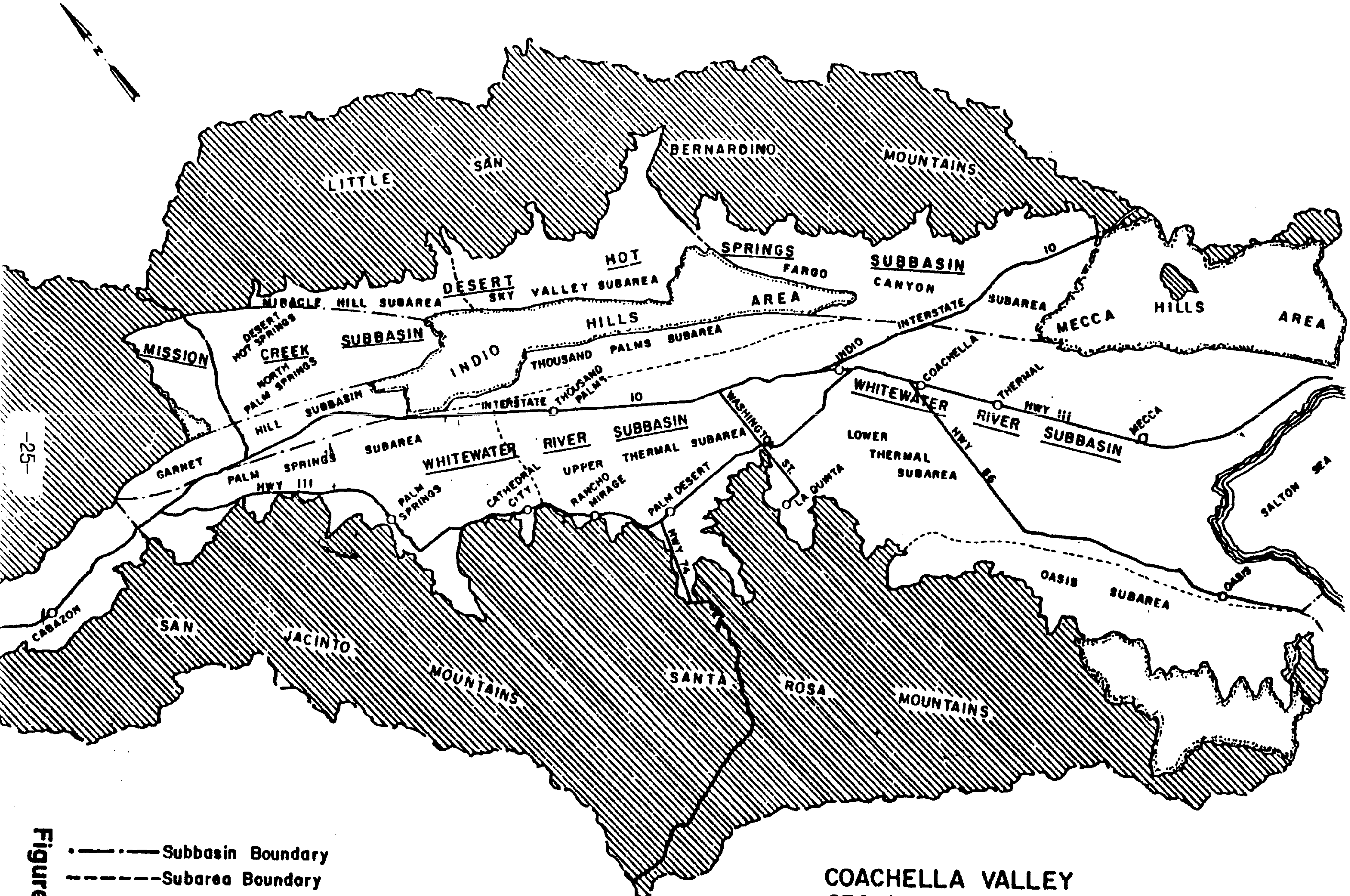
APPENDIX A

FIGURES



—·—·—·— Subbasin Boundary
- - - - - - Subarea Boundary

COACHELLA VALLEY
GROUNDWATER BASIN
SUBDIVISIONS

Figure 1

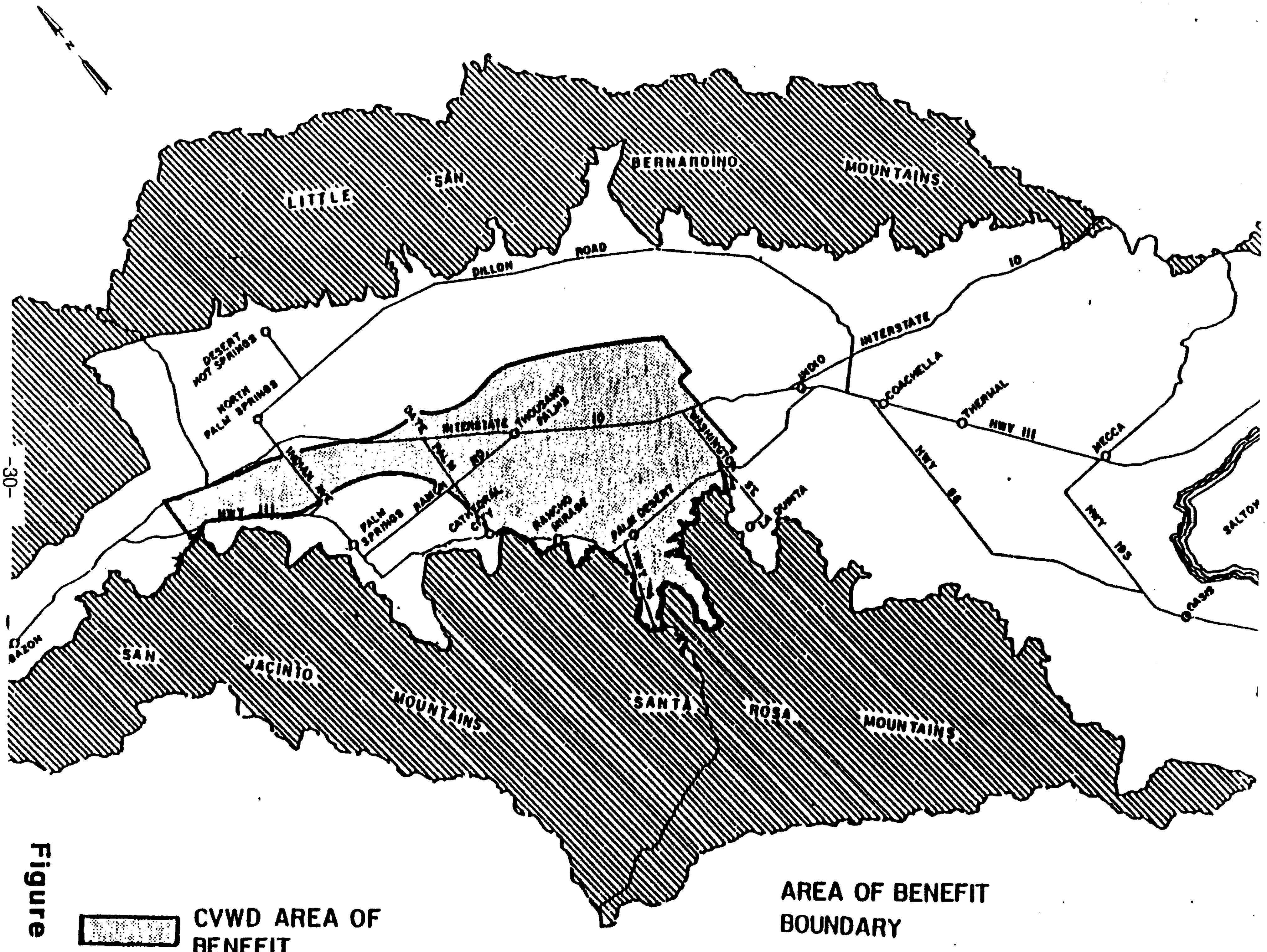

LITTLE SAN BERNARDINO MOUNTAINS
DILLON ROAD
INTERSTATE 10
DESERT HOT SPRINGS
NORTH PALM SPRINGS
INDIO
COACHELLA
THERMAL
HWY III
MECCA
HWY 86
HWY 195
OASIS
SALTON
THOUSAND PALMS
INDIAN AVE
HWY III
PALM SPRINGS
CATHEDRAL CITY
RANCHO MIRAGE
PALM DESERT
WASHINGTON ST.
LA QUINTA
SAN JACINTO MOUNTAINS
SANTA ROSA MOUNTAINS
CVWD AREA OF BENEFIT
AREA OF BENEFIT BOUNDARY

Figure 4

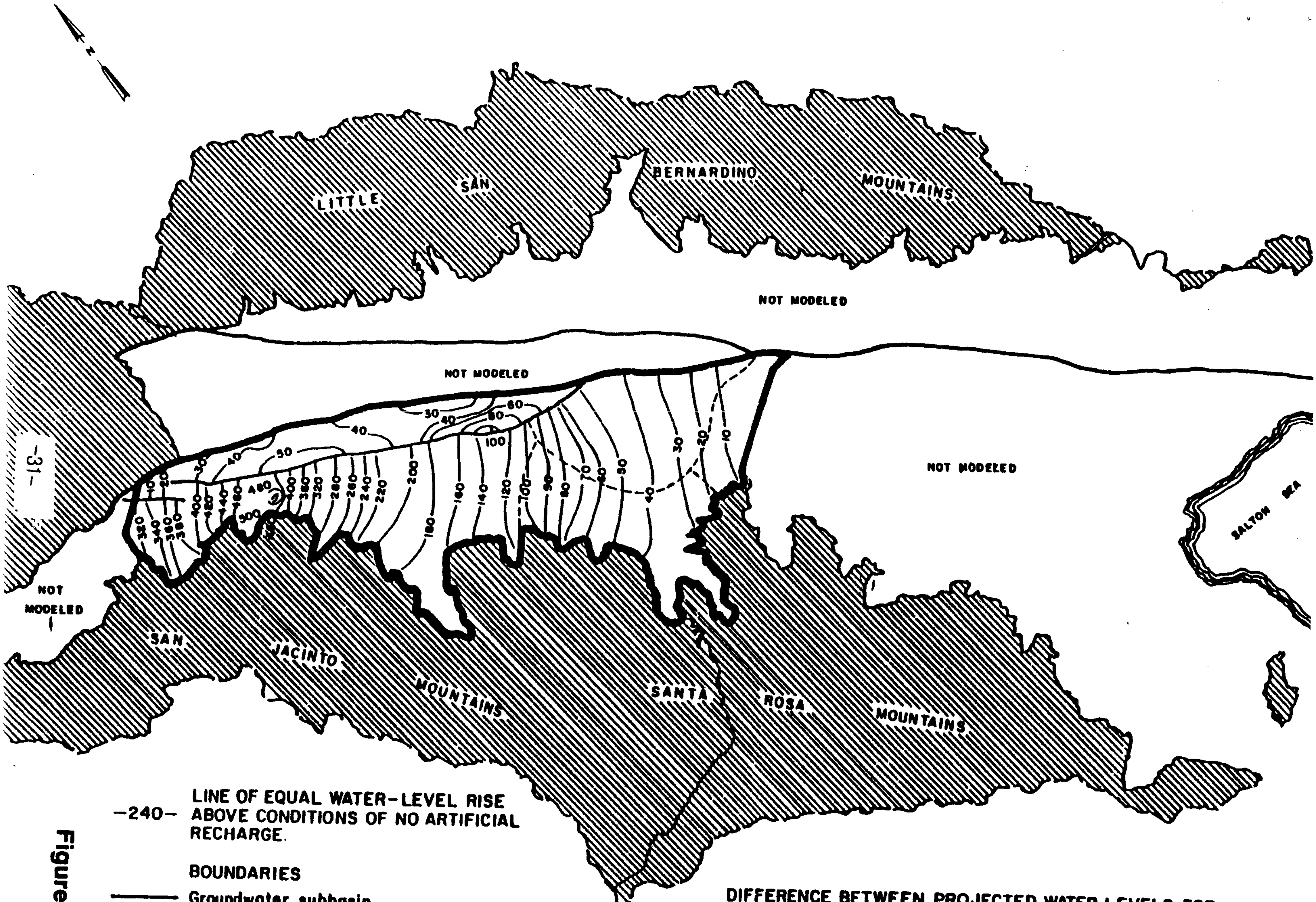


Figure 5

DIFFERENCE BETWEEN PROJECTED WATER LEVELS FOR 2001 UNDER PROJECTED PUMPAGE CONDITIONS AND ARTIFICIAL RECHARGE COMBINED WITH PROJECTED PUMPAGE CONDITIONS. (DRAWING BASED ON TYLEY & SWAIN, 1977)