7. DRY-YEAR YIELD PROGRAM IMPACTS

7.1 Dry-Year Yield Evaluation Criteria

The calibrated 2003 Watermaster Model was used to evaluate the magnitude of groundwater level and storage changes throughout Chino Basin, the change in direction and speed of specific known water quality anomalies, and the losses from storage when dry-year yield program water is stored. This was accomplished by determining and simulating a baseline and a dry-year yield scenario. The planning period used in this analysis consisted of the 25-year period from October 2003 through September 2028. This period corresponds approximately to the 25-year period of the dry-year yield agreement among Chino Basin Watermaster, IEUA, and Metropolitan Water District of Southern California (Metropolitan). The impacts listed above were estimated by:

- Preparing maps that show the maximum differences in groundwater levels at the point of peak storage and at the end of a dry-year yield extraction period. Time histories at the same wells used in the calibration were plotted to show local impacts at each of these wells.
- Preparing maps that show the plume migration tracks for the baseline and dry-year yield scenarios over the planning period. Each plume was modeled as though the contaminant of concern was a conservative (non-sorbing, non-degrading) constituent using MODPATH.
- Preparing time histories of Santa Ana River discharge for the baseline and dry-year yield scenarios and comparing these time histories for the planning period. The total water lost from storage will be estimated by subtracting the baseline time history from the dry-year yield time history.

7.2 Scenario Descriptions

The baseline and dry-year yield scenarios are described herein. The duration of each scenario is 25 years and corresponds to the duration of the dry-year yield program agreement.

7.2.1 Recharge Hydrology for the Planning Period

The recharge hydrology for the baseline and dry-year yield scenarios was modified to current and future conditions as described below.

7.2.1.1 Subsurface Inflow

Subsurface inflow for the baseline and dry-year yield scenarios was assumed identical to the values used in the calibration period of 1989/1990 through 2000/2001.

7.2.1.2 Streambed Recharge

The WLAM was used to estimate recharge in the stream reaches and recharge basins where the groundwater levels can be safely assumed not to affect recharge. Storm water recharge was increased to reflect the completion of the Chino Basin Facilities Improvement Project (CBFIP). Watermaster currently estimates that the increase in recharge due to the CBFIP will average about 12,000 acre-ft/yr and this estimate was used for both baseline and dry-year yield scenarios.

Recycled water discharges to the Santa Ana River from recycling plants were modified to reflect growth in these discharges based on projections made by the dischargers in *TIN/TDS Study – Phase 2B of the Santa Ana Watershed, Wasteload Allocation Investigation, Final Technical Memorandum* (WEI, 2002). This subsequently affects the model-computed recharge in the lower Chino Basin. Recycled water discharge estimates were increased linearly from 2004 to 2020 and were held constant after 2020 at projected 2020 discharges. Table 7-1 shows the 2004 and 2020 projected recycled water discharge used in the baseline and dry-year yield scenarios.

7.2.1.3 Deep Percolation of Precipitation and Applied Water

The deep percolation of precipitation and applied water was computed using the WLAM as done in calibration with the following differences. The land use for 1993 that was used in the model calibration was updated using 2002 digital air photos and was assumed to represent 2003 conditions. Year 2020 land use conditions were estimated by assuming all undeveloped land in 2002 was developed. Deep percolation of precipitation and applied water was estimated for each year in the baseline and dry-year yield scenarios as follows:

1. Estimate the annual deep percolation of precipitation and applied water for 2003 and 2020 land use conditions from the precipitation record of 1989/1990 through 2000/2001
2. Develop a regression equation for the annual deep percolation of precipitation and applied water estimates to annual precipitation at a precipitation gage with a long record – in this case, the Ontario Fire Station with a record of 65 years.
3. Use the regression equation to estimate a 65-year time series of annual deep percolation of precipitation and applied water.
4. Compute the average deep percolation of precipitation and applied water from the 65-year record and use that value for 2003.
5. Repeat steps 1 through 4 using 2020 land use conditions and use the resulting average for 2020 and each year thereafter.
6. For each year between 2003 and 2020, estimate the deep percolation of precipitation and applied water by linear interpolation.

The resulting estimates of deep percolation of precipitation and applied water are *expected value* estimates for any given year. These estimates assume a gradual increase in recharge and that the vadose zone will buffer year-to-year variations from wet and dry periods. The deep percolation of precipitation and applied water estimates are identical for the baseline and dry-year yield scenarios.

7.2.1.4 Supplemental Water Recharge

Supplemental water is recharged in the Chino Basin by the Chino Basin Watermaster pursuant to the 1978 Chino Basin Judgment (Case No. RCV 51010, Chino Basin Municipal Water District *vs*. City of Chino *et al.*) and the 2000 Peace Agreement. Table 7-2 lists the future estimates of supplemental water recharge for the baseline scenario for the Chino North MZ and shows the locations of this recharge. The allocation of recharge to individual recharge facilities is based on the requirement to balance recharge and discharge as described in the OBMP Peace Agreement that was executed in July 2000. This is described in more detail below.

Recharge of recycled water in the Temescal MZ and PBMZ were assumed to total 9,000 acre-ft/yr (per Don Williams, City of Corona). The supplemental water recharge estimates are identical for the baseline and dry-year yield scenarios.

7.2.2 Baseline OBMP Scenario

The baseline scenario is based on a modified version of water supply plan from the Implementation Plan in the OBMP Peace Agreement (July 2000). The water supply plan from the Implementation Plan contains future groundwater production plans for all producers in the Chino Basin. Black and Veatch modified the water supply plan for those water purveyors that are participating in the dry-year yield program and WEI used the water supply plan from the Implementation Plan data for the remaining producers.

Water purveyors participating in the dry-year yield program include the Cities of Chino, Chino Hills, Ontario, Pomona and Upland, the Cucamonga County Water District, and the Monte Vista Water District. Appendix D contains information on the well capacities for these purveyors. Appendix D also includes the water supply plan for these entities for the baseline scenario. Figure 7-1 shows the baseline groundwater production time history. Groundwater production in the basin ranges from 196,000 acre-ft/yr in 2003/2004 to about 210,000 acre-ft/yr in 2019/2020 and thereafter.

Watermaster's replenishment obligation was estimated using the following assumptions pursuant to the Judgment, the OBMP and the OBMP Peace Agreement:

- The initial increase in stormwater recharge that is anticipated from the CBFIP is about 12,000 acre-ft/yr with a goal of about 20,000 acre-ft/yr.
- OBMP desalter capacity is increased from the current level of 8 million gallons per day (mgd) in 2002/2003 to 40 mgd as per the water supply plan from the Implementation Plan. The desalters will have a replenishment obligation equal to their groundwater production. Half of this replenishment obligation will come from decreased rising water and new induced streambed recharge in the Santa Ana River.
- The Judgment allows a 5,000 acre-ft/yr overdraft of Chino Basin through 2017.

Table 7-2 contains the replenishment obligation pursuant to the Judgment and the OBMP Peace Agreement, and ranges from about 30,000 acre-ft/yr in 2003/2004 to about 34,000 acre-ft/yr in 2019/2020 and is constant thereafter. An analysis of actual recent production in the Chino Basin suggests that the production and replenishment estimated in Table 7-2 may be slightly higher than will actually occur in first few years of the baseline scenario. For consistency with the OBMP planning documents, the production and replenishment estimates in Table 7-2 were used.

The locations and magnitude of recharge shown in Table 7-2 were based on the requirements of the Peace Agreement to balance recharge and discharge in every area and sub-area. This requirement must be met over some period of time and was interpreted herein as a long-term requirement. Thus, in an individual season or year there might not be a balance between recharge and discharge. This requirement is critical to the management of the subsidence-prone area in the western part of the Chino Basin. Watermaster is currently involved in an investigation to develop a management program for this subsidence-prone area. Until that management program is developed it was assumed herein that Watermaster replenishment and groundwater production would be managed such that groundwater levels would remain near or above current levels. Current groundwater levels were assumed to be the groundwater levels at the end of the calibration period of the 2003 Watermaster Model – that is, Fall 2001. Replenishment in the rest of the basin would be managed to maximize replenishment of the desalter from a combination of reduced rising water to the Santa Ana River and increased streambed recharge from the Santa Ana River.

7.2.3 Dry-Year Yield Scenario

The dry-year yield scenario is identical the baseline scenario except that the production pattern for the purveyors involved in the program has been modified to allow puts to occur by *in lieu* recharge. During put years, the participating purveyors will reduce their pumping by up to 25,000 acre-ft and use surface water from Metropolitan in lieu of Chino Basin groundwater. During take years, the participating purveyors will reduce their demands on Metropolitan and produce up to an additional 33,000 acre-ft of groundwater. Figure 7-1 shows the time history of pumping provided by Black and Veatch for evaluation of the dry-year yield scenario. Total pumping over the planning period is the same as the baseline scenario. Watermaster replenishment for the dry-year yield scenario is identical to the baseline scenario that is shown in Table 7-2.

7.3 Evaluation of the Baseline OBMP Scenario

7.3.1 Groundwater Levels

Figures 6-15a, 6-15b, and 6-15c illustrate the assumed groundwater levels for start of the baseline scenario in Fall 2003 for Layers 1, 2, and 3, respectively. Figures 7-2a, 7-2b, and 7-2c illustrate the model-estimated groundwater levels for the end of the baseline scenario in Fall 2028 for Layers 1, 2, and 3, respectively. The orientation of the groundwater contours in the vicinity of the Santa Ana River in Figure 7-2a suggests Santa Ana River streambed recharge is occurring. Appendix B contains projected groundwater level time histories for the baseline scenario for all the wells that were used in the calibration.

Figures 7-3a, 7-3b, and 7-3c illustrate the model-estimated change in groundwater level over the 25-year planning period for the baseline scenario. Throughout the duration of the baseline scenario, groundwater levels in the western part of the Chino Basin remain near or above the Fall 2001 groundwater levels. Groundwater levels in the other parts of Chino Basin declined over the planning period to levels that support decreased rising water to the Santa Ana River and increased streambed recharge from the Santa Ana River. Groundwater levels declined the most in the Fontana area – as much as 30 to 40 feet near the far eastern edge of the Fontana area. In the subsidence-prone area in the western part of Chino Basin, groundwater levels showed almost no change. The area north of the subsidence-prone area showed a slight increase in groundwater levels due to the shifting of Watermaster's replenishment to this area as shown in Table 7-2. The effect of the desalters is evident in the south-central part of Chino Basin where groundwater levels declined in excess of 25 feet.

7.3.2 Movement of Water Quality Anomalies

Figure 7-4 illustrates the locations of point source groundwater contaminant plumes in Chino Basin at the beginning of the 25-year planning period, and their estimated locations at the end of the planning period for both the baseline and dry-year yield scenarios. The current locations of the plumes were mapped from recent data (2002) and are described in Section 3.5. These current locations were assumed to be the initial plume locations at the start of the planning period. Particles were placed along the margins of the plumes, and MODFLOW, a particle-tracking code, was used to simulate the movement and final locations of the plumes. Note that this particle-tracking simulation of contaminant movement in groundwater does not simulate groundwater and contaminant dispersion, contaminant sorption to soil particles, or any persistent contaminant source term. The simulation results for the baseline scenario are discussed below for each contaminant plume (see Figure 7-4 while reading):

- ***Chino Airport*** – At the beginning of the planning period, the Chino Airport plume underlies and extends southwest of the Chino Airport. During the baseline scenario, the leading edge of the plume traveled approximately 1.75 miles in the southeasterly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and local groundwater pumping at desalter wells and other local wells. The plume location at the end of the planning period is south and east of Pine and Euclid Avenues, underlying the northern reaches of Prado Flood Control Basin. The County of San Bernardino is under a Cleanup and Abatement order to remediate this plume. It is unlikely that this plume will be allowed to migrate as shown herein. The County will likely be required to install new wells and a treatment system to control and remove this plume.
- ***CIM*** – At the beginning of the planning period, the CIM plume underlies the western portion CIM property, just east of Central Avenue. During the baseline scenario, the leading edge of the plume traveled approximately 2 miles in the southeasterly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and local groundwater pumping at desalter wells and other local wells. The plume location at the end of the planning period is east of Prado Avenue and north of Pine Avenue, slightly upgradient of the northern reaches of Prado Flood Control Basin. CIM is under a Cleanup and Abatement order to remediate this plume. It is unlikely that this plume will be allowed to migrate as shown herein. CIM has installed wells and a treatment system to control and remove this plume.
- ***GE Flatiron*** – At the beginning of the planning period, the GE Flatiron plume extends south of Mission Boulevard along Euclid Avenue. During the baseline scenario, the leading edge of the plume traveled approximately 0.5 miles in the southerly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient, local groundwater pumping, and recharge at the Ely Basins. The recharge at Ely Basins deflects the plume to the northwest. The leading edge location at the end of the planning period extends south of State Highway 60 between Euclid and Grove Avenues. GE is under a Cleanup and Abatement order to remediate this plume. It is unlikely that this plume will be allowed to migrate as shown herein. GE has installed wells and a treatment system to control and remove this plume.
- ***GE Test Cell*** – At the beginning of the planning period, the GE Test Cell plume is located south of Ontario Airport, extending southwest of Mission Boulevard to Grove Avenue. During the baseline scenario, the leading edge of the plume traveled approximately 0.6 miles in the southwesterly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and local groundwater pumping. The leading edge location at the end of the planning period directly underlies State Highway 60 just west of Euclid Avenue. GE is under a Cleanup and Abatement order to remediate this plume. It is unlikely that this plume will be allowed to migrate as shown herein. GE will likely be required to install new wells and a treatment system to control and remove this plume.
- ***Kaiser*** – The location of the Kaiser plume on Figure 7-4 was estimated by past modeling studies through the mid 1980's and was updated through the 2003 Watermaster Model calibration through 2001. Kaiser stopped monitoring in the early 1990's. Thus, the projection described herein is very approximate. At the beginning of the planning period, the elongated Kaiser plume extends in a southeasterly direction from the former Kaiser Steel site to Mission Boulevard. During the baseline scenario, the leading edge of the plume traveled approximately 1.25 miles in the southerly direction, and becomes elongated in an east-west direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and groundwater pumping at wells owned by Jurupa Community Services District. The plume location at the end of the planning period is aligned along State Highway 60 from about Interstate 15 on the west to about Etiwanda Avenue on the east.
- ***Milliken Landfill*** – At the beginning of the planning period, the Milliken Landfill plume extends southwest from the landfill site, just south of Mission Boulevard. During the baseline scenario, the

leading edge of the plume traveled approximately 1.4 miles in the southwesterly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and local groundwater pumping. The plume location at the end of the planning period is just southeast of the intersection of Riverside Drive and Haven Avenue. It is unlikely that this plume will be allowed to migrate as shown herein. The RWQCB will require the County of San Bernardino to remediate this plume if it presents a threat to offsite wells.

- ***Upland Landfill*** – At the beginning of the planning period, the Upland Landfill plume extends just south from the landfill site, north of Foothill Boulevard. During the baseline scenario, the leading edge of the plume traveled approximately 1 mile in the southwesterly direction. The primary factors affecting plume migration during the simulation are the regional hydraulic gradient and local groundwater pumping. The plume location at the end of the planning period is located north of the intersection of Interstate 10 and Euclid Avenue. It is unlikely that this plume will be allowed to migrate as shown herein. The RWQCB will require the City of Upland to remediate this plume if it presents a threat to offsite wells.
- ***Un-named VOC Plume*** – At the beginning of the planning period, the Un-named VOC plume underlies a broad area south of Riverside Drive, north of Kimball Avenue, west of Grove Avenue, and east of Archibald Avenue. During the baseline scenario, the leading edge of the plume did not travel south of its initial (current) position. The plume was largely consumed by production at the Chino-1 Desalter well field. The remarkable decrease in plume size during the planning period is largely a result of the assumed absence of a VOC source accompanied by desalter pumping and treatment.
- ***Stringfellow*** – At the beginning of the planning period, the Stringfellow plume underlies Pyrite Creek and extends from the Jurupa Mountains in a southwesterly direction. Perchlorate has been detected in groundwater as far south as the Santa Ana River (see Figure 7-4). During the baseline scenario, the leading edge of the plume traveled approximately 3 miles in the northwesterly direction to be consumed by the Chino-2 Desalter well field. The primary factors affecting plume migration during the simulation are recharge along the Santa Ana River and groundwater pumping at desalter wells. . It is unlikely that this plume will be allowed to migrate as shown herein. The DTSC is currently investigating the perchlorate plume emanating from the Stringfellow site and will likely require the dischargers associated with Stringfellow to remediate this plume prior to the plume impacting the desalter wells.

7.3.3 Hydrologic Balance and Storage

The hydrologic balance for the baseline scenario is shown by management zone in Tables 7-3a through 7-3e. The hydrologic balance includes estimates of groundwater flow between management zones. Of particular interest is the groundwater flow from Chino North, Chino South, and Temescal MZs to the PBMZ and subsequent contributions to rising water at Prado Dam. The subsurface outflow from Chino North MZ to the PBMZ decreased over time by about 5,500 acre-ft/yr. The stream recharge in the Chino South MZ increased about 12,000 acre-ft/yr from whence it flows to the desalter well field. The 2003 Watermaster Model projected that the yield of Chino Basin will increase about 17,500 acre-ft through the recharge plan described in Table 7-2 and the construction and operation of the desalters.

Table 7-4 lists the inflow components to the PBMZ and includes a reckoning of the volumes of rising water at Prado Dam from the inflowing management zones. These estimates were made by assuming that half of the stream flow recharge in the PBMZ contributes to rising water and that remaining rising water is allocated to the inflowing management zone based on the magnitude of groundwater inflow to the PBMZ. For the baseline scenario, the average rising water contribution from the Chino North and Chino

South MZs is estimated to be about 400 acre-ft/yr and 100 acre-ft/yr, respectively, or about 500 acre-ft/yr from the Chino Basin.

Table 7-5 and Figure 7-6 show the estimated time history of Santa Ana River discharge by calendar quarter for the planning period. The increase in discharge over time is cause by increases in recycled water discharged to the Santa Ana River and is not related to the operation of the Chino Basin in the baseline scenario. The operation of the Chino Basin in the baseline scenario is projected to reduce the rate of increase in discharge of the Santa Ana River over time.

The total storage in the Chino Basin declined monotonically during the baseline scenario from a high of 5,940,000 acre-ft in Fall 2003 to 5,730,000 acre-ft in Fall 2028 – a decline of about 210,000 acre-ft. Figure 7-12 shows the estimated groundwater storage for the Chino Basin during the planning period. The modeling results suggest that the total storage in the basin appears to be asymptotically approaching a level near 5,700,000 acre-ft. The modeling results suggest that less than half of the replenishment will come from decreased rising water and new induced streambed recharge in the Santa Ana River.

7.4 Evaluation of the Dry-Year Yield Program Impacts

7.4.1 Change in Groundwater Levels

Figures 6-15a, 6-15b, and 6-15c illustrate the assumed groundwater levels for start of the baseline scenario in Fall 2003 for Layers 1, 2, and 3, respectively. Figures 7-7a, 7-7b, and 7-7c illustrate the model-estimated groundwater levels for the end of the dry-year yield scenario in Fall 2028 for Layers 1, 2, and 3, respectively. The orientation of the groundwater contours in the vicinity of the Santa Ana River in Figure 7-7a suggests significant Santa Ana River streambed recharge is occurring. Appendix C contains projected groundwater level time histories for all the wells that were used in the calibration.

Figures 7-8a, 7-8b, and 7-8c illustrate the model-estimated change in groundwater levels over the 25-year planning period for the dry-year yield scenario. Throughout the duration of the dry-year yield scenario, groundwater levels in the western part of the Chino Basin remain near or above the Fall 2001 groundwater levels. Basin-wide, the general spatial trend water level changes follows that of the baseline scenario with some differences caused by the operation of the dry-year yield program:

- At the point of maximum storage during the dry-year yield program (2007), water levels are higher basin-wide compared to the baseline – especially in the northern and western portions of Chino Basin. In particular, Figures 7-10a, 7-10b, and 7-10c show that in 2007 water levels are about 10-30 feet higher in the area north of the Turner Basins and in the vicinity of CCWD's Chino Basin well field, and within most of MZ-1 – especially in the Montclair and Pomona areas.
- At the conclusion of a three-year extraction period during the dry-year yield program (2018), water levels are lower basin-wide compared to the baseline – especially in the northern portions of Chino Basin. In particular, Figures 7-11a, 7-11b, and 7-11c show that in 2018 water levels are about 10-25 feet lower in the area north of the Turner Basins and in the vicinity of CCWD's Chino Basin well field, and in the area surrounding the Montclair Basins. Overall, the total storage in the Chino Basin at the end of the three-year extraction period is about the same as the baseline storage for the same point in time – 2018.
- At the conclusion of the dry-year yield program (2028), water levels are lower compared to the baseline in some northern portions of the Chino Basin. In particular, Figures 7-9a, 7-9b, and 7-9c show that in 2028 water levels are 20-30 feet lower in the area north of the Turner Basins and in the

vicinity of CCWD's Chino Basin well field, and in the area surrounding the Montclair Basins. Overall, the total storage in the Chino Basin at the end of the three-year extraction period is about the same as the baseline storage for the same point in time – 2028.

7.4.2 Change in Movement of Water Quality Anomalies

Figure 7-4 shows the simulated location of the groundwater contaminant plumes in Chino Basin at the end of the planning period (2028) for the both the baseline and dry-year yield scenarios. All plume locations are virtually identical for both scenarios, indicating that the change in direction and speed of movement of these plumes caused by the dry-year yield program is not significant.

7.4.3 Changes in Hydrologic Balance and Storage

The hydrologic balance for the dry-year yield scenario is almost identical to the baseline with subtle differences showing up in reduced streambed recharge in Chino South MZ and the time history of storage. Table 7-5 shows the estimated time history of Santa Ana River discharge, by calendar quarter, for the baseline and dry-year yield scenarios. Table 7-5 also shows the difference in surface water discharge caused by the dry-year yield Program. The dry-year yield program increases the discharge in the Santa Ana River by a total of about 16,000 acre-ft over the 25-year period and is equivalent to an average increase of about a 1 cubic feet per second (cfs) in the Santa Ana River discharge, or about one quarter of one percent of the total discharge in the Santa Ana River. The water quality impacts associated with this change in discharge are negligible.

The total storage in the Chino Basin declined similarly to the baseline scenario; however, the storage levels varied more abruptly due to the "put" and "take" periods – The decline in storage was at a lower rate during "put" periods and dropped more steeply during "take" periods. This is demonstrated in Figure 7-12.

The OBMP Peace agreement defines the *operational storage requirement* as the storage or volume in the Chino Basin that is necessary to maintain safe yield and sets an initial estimate of the *operational storage requirement* at 5,300,000 acre-ft which corresponded to the then estimated storage in the year 2000. The year 2000 estimate of storage developed from the baseline scenario is about 5,980,000 acre-ft. The *safe storage* was defined as the maximum storage in the basin that will not cause significant water quality and high-groundwater related problems. The *safe storage capacity* is the difference between the *operational storage requirement* and the *safe storage* and thus was initially set at 500,000 acre-ft. Thus, *safe storage* was initially estimated at 5,800,000 acre-ft. Given the revised year 2000 estimate of storage, *safe storage* is about 6,480,000 acre-ft.

The *safe storage capacity* in the OBMP Peace Agreement was set at 500,000 acre-ft based on the observation that the change in storage during the base period for the determination of the safe yield (1965 through 1974) was at about 400,000 acre-ft and that the storage in the basin was declining prior to the base period. It seemed reasonable that the basin could be operated at these prior levels without causing significant water quality and high-groundwater related problems. The recharge and production plans in the OBMP that are represented in the baseline scenario will result in the basin being operated at lower groundwater levels than that envisioned during the development of the OBMP. Thus, the concept of *safe storage* is not relevant for the CBWM-IEUA-Metropolitan proposed dry-year yield program analyzed herein. In fact, the maximum storage reached during the dry-year yield scenario is 5,950,000 which is about the storage reached in 2000 and is otherwise less than the storage level of the year 2000. The effect on yield from the lowering of storage will be to increase yield by minimizing groundwater losses to the River at Prado Dam and by increasing the recharge of the basin from the Santa Ana River. Thus, the dry-dear yield program is entirely consistent with the goals of the OBMP and the storage management program in the OBMP Peace Agreement.

7.4.4 Material Physical Injury

Three tests were used to determine if the proposed dry-year yield program would result in material physical injury to any of the Parties to the Judgment or to Chino Basin itself:

- Groundwater levels problems including:
  - Increased groundwater-level related problems such as groundwater rising causing injury to structures or agriculture, liquefaction, and the mobilization of contaminants in the vadose zone.
  - Decreased groundwater-level related problems such as excessive groundwater production costs, excessive loss of production capacity, and subsidence.
- Redirection and transport of known water quality anomalies
- Losses from storage to increased rising groundwater in the lower Chino Basin that in turn could degrade the water quality in the Santa Ana River and reduce the yield of the Chino Basin.

These are the same tests that were used in the OBMP Program Environmental Impact Report (IEUA, 2000).

7.4.4.1 Groundwater Level Problems

There is no material physical injury to a Party to the Judgment or Chino Basin from the projected groundwater level changes from either the baseline or dry-year yield scenarios. The only location where a significant increase in groundwater level occurs in the baseline scenario is in the vicinity of the recharge basins in Upland and Montclair (College Heights, Upland, Montclair, and Brooks Street Basins) where the depth to water is 300 feet or greater.

Under the baseline scenario, groundwater levels are projected to remain about unchanged in the western third of the basin. Groundwater levels decrease about 15 to 20 feet in the center of Chino Basin and decrease up to 40 feet at the far eastern edge of the basin, north of the Jurupa Hills. Groundwater levels are projected to decline 25 feet or more in the vicinity of the OBMP Desalter well fields. Slight increases in production costs will occur and slight decreases in production capacity might occur. The added cost of production will more than be offset by the savings provided by the avoided purchase of supplemental water for Desalter replenishment. Production costs could increase about $3.50 per acre-ft (assuming $0.10 per kilowatt-hour (KWHR), 60 percent pumping efficiency, and an average additional lift of 20 feet). The producers that are impacted by operating the basin about 20 feet lower under the baseline scenario are the City of Ontario, Cucamonga County Water District, Fontana Water Company, and Jurupa Community Water District, whose combined production averages about 80,000 acre-ft during the baseline scenario. The increased power cost totals about $240,000 per year. Operating the basin at this lower level avoids the cost of purchasing about 24,600 acre-ft/yr of supplemental water at a cost of about $6,000,000 if the supplemental water consisted of SWP water and about $2,000,000 if it were recycled water. The power cost for producing groundwater with the dry-year yield program would be slightly less than the baseline because Chino Basin will be operated at slightly higher levels.

Under the baseline and dry-year yield scenarios, the groundwater levels in the subsidence-prone part of Chino Basin are projected to remain near or above current levels. This occurs because of the recharge program described in Table 7-2 and because groundwater pumping patterns in the subsidence-prone area were adjusted to maintain groundwater levels near or above current levels. This is a minimum necessary condition to minimize subsidence and ground fissuring in this area. Groundwater levels in this area should be managed using this criterion until Watermaster can implement a long-term management program for subsidence; after which groundwater levels in this area would be managed according to the long-term management program. The design and operation of the final dry-year yield program should be required to maintain groundwater levels near or above current groundwater levels until the long-term management program is implemented; and will need to maintain groundwater levels according to the long-term management program.

7.4.4.2 Redirection and Transport of Known Water Quality Anomalies

There is no material physical injury related to the redirection and transport of known groundwater contaminant plumes from the operation of the dry-year yield program. The model-projected change in direction and speed of movement of these plumes caused by the dry-year yield program is not significant.

7.4.4.3 Losses from Storage

There is no material physical injury related to losses of water from storage. The dry-year yield Agreement contains provisions for the Watermaster and IEUA to assess Metropolitan for these losses if they occur. From a financial perspective, Watermaster and IEUA are kept whole and there will be no loss of yield from Chino Basin. The model projects a slight outflow with the dry-year yield program that is primarily a decrease in recharge from the Santa Ana River and not an increased outflow. Therefore, there will be no water quality impact to the Santa Ana River. In the development of the dry-year yield scenario, Black & Veatch assumed that the losses from storage would be about two percent annually of the water stored in the dry-year yield account. The model projections suggest that this loss rate is reasonable although the actual loss rate could be as low as one percent.