4.12 HYDROLOGY AND WATER QUALITY

The California Department of Water Resources notes (SA8-1) that its review of Sections 4.6 and 4.8 of the Draft EIR concurs with the findings expressed in the EIR. The Department states that the report adequately addresses the pertinent impacts of the proposed university campus and the expected community that will develop, and that the impacts relating to the topics addressed in these sections are either less than significant or are mitigated to being less than significant.

Additional public comments included topics such as project impacts on the groundwater basin, effects of urban runoff, site drainage, water conservation and recycling, reduction of groundwater recharge, baseline data and water demand forecasts, and others. The comments are listed by topic and responses follow.

4.12.A Basinwide Groundwater Effects and Merced Water Supply Plan

This response addresses comments FA2-1, I6-2, LA12-4, O6-1, O6-3, O15-1, O19-3, O19-4, O19-5, O24-36, O24-37, O31-28, O31-30, O31-31, O31-35, O31-37, O31-39, O31-43, O31-44, O31-45, SA13-14, SA12-8, and other comments relating to the effects of the proposed project on the groundwater basin and regional water supplies.

4.12.A.1 Characteristics of the Groundwater Basin

The groundwater basin studied in the 1995 Merced Water Supply Plan (hereinafter 1995 Plan) and 2001 Merced Water Supply Plan Update (hereinafter 2001 Plan Update) consists of a wedge of unconsolidated sedimentary deposits of sand, gravel, silt, and clay that thickens from a feather edge at the mountain front to the east to its greatest thickness near the San Joaquin River at the western edge of the area. The sedimentary deposits are estimated to be more than 12,000 feet near the San Joaquin River. The effective thickness of usable aquifer is only about 1,000 feet, however, due to saltwater in the deeper sedimentary deposits. Groundwater-level maps show that the groundwater moves in a generally east to west direction.

The reservoir of groundwater is large. About 30 million acre-feet of water are stored beneath the study area. Average annual recharge to the groundwater basin is about 600,000 afy. Basinwide, groundwater recharge approximately balances the amount of groundwater discharge, meaning that the groundwater basin is currently not in a state of overdraft.

In some areas of the groundwater basin, however, groundwater levels have declined due to increased local pumping. The 2001 Plan Update found that increased groundwater pumping has resulted in several local aquifer depressions, most notably in the southeastern, central, and northern portions of the study area. Projected population growth and increased agricultural water supply dependence on groundwater could affect the long-term water balance of the region. The 2001 Plan Update develops recommendations to balance the projected increase in groundwater extraction from the basin with adequate recharge.

4.12.A.2 Description of the Merced Water Supply Plan

The water supply discussion in the Draft EIR provided an overview of the information contained in the 1995 Plan, the most comprehensive and complete analysis available that characterized water resources in the Merced basin. While the Draft EIR was being prepared, the 1995 Plan was in the process of being revised and updated but was not available for public review. However, the specific numerical information contained in the Draft EIR regarding the 2001 Plan Update was provided from discussions with MID and their consultants, CH2M Hill.

The 1995 Plan was designed to achieve five goals:

- Manage groundwater resources.
- Provide a high quality, reliable supply of water for the cities.
- Protect and enhance the economic base.
- Protect MID's Merced River water rights.
- Maintain consensus on water supply plan.

The purpose of the 2001 Plan Update is to outline a strategic direction that should be taken to achieve the five program goals and develop planning scenarios. The planning scenarios combine potential future conditions with the strategies necessary to achieve the program goals. The 2001 Plan Update was completed by CH2M Hill in September 2001, and was accepted by the City of Merced City Council on November 5, 2001, and by the MID Board of Directors on November 6, 2001.

According to the 2001 Plan Update, since adoption of the 1995 Plan, the cooperating agencies in the Merced area have implemented many of the 1995 Plan's recommended actions. Because many of the 1995 Plan's recommendations have been implemented, and because several changes have occurred within the Plan's study area that could influence the 1995 Plan's assumptions and affect recommended alternatives, the 2001 Plan Update was prepared. Among the specific changes to the study area to be considered were the decision to locate UC Merced in the study area, the preparation of a Groundwater Management Plan for the area (AB3030), the preparation of an Agriculture Water Management Plan for the area (AB3616), changing instream flow conditions on the Merced River, and better data and understanding of the study area's water resources.

4.12.A.3 Goals and Strategies of the Water Supply Plan

The five main goals presented in the 1995 Plan were unchanged in the 2001 Plan Update; however, specific strategies within those five goals were modified for the 2001 Plan Update. The following information summarizes the main strategy changes:

- **Goal 1: Manage Groundwater Resources**. Two potential strategies were identified for managing the groundwater supply in the study area: (a) Return groundwater levels to 1999 levels and (b) allow an uncontrolled fall in groundwater levels. These strategies were identified for use in evaluating the impacts of changing groundwater levels on both the physical and economic environment of the study area.
- **Goal 2: Provide a High-Quality, Reliable Supply of Water for Cities**. Two basic strategies for meeting this goal were evaluated in the 1995 Plan: a groundwater-based approach using wells and a surface-water-based approach using surface-water treatment and delivery systems. The need for a water treatment plant, conveyance facilities for delivering untreated Merced River water to the plant, and distribution system improvements to deliver

treated water to users results in higher costs than a groundwater-based system. The 1995 Plan eliminated surface-water treatment from consideration based on the excessive relative cost of a surface supply system. This decision was reexamined and validated in the 2001 Plan Update.

A surface-water-based strategy was not an element of the final planning scenarios carried into detailed analysis for the 2001 Plan Update.

- **Goal 3: Protect and Enhance the Economic Base.** The 1995 Plan recognized that irrigation water delivered by MID is vital to the local economy since agriculture accounted for more than $1 billion of annual income to the County. Within the study area, 50 percent of the land area is irrigated with an estimated direct crop value of $660 million.

  Based on recent trends, absent intervention, changing cropping patterns and irrigation technologies will continue to reduce demand for surface water and increase the demand from private wells. Since the 1995 Plan, MID has implemented several incentive programs to address this trend. The 2001 Plan Update evaluated various planning scenarios together with following strategies for responding to the trend.

  Performance of each planning scenario incorporating these strategies is evaluated in the 2001 Plan Update with respect to the overall goal to protect the economic base of the community.

- **Goal 4: Protect MID's Merced River Water Rights.** The 2001 Plan Update recognized that Merced River runoff is highly variable from year to year and that potentially changing regulatory conditions could result in reduced surface-water availability from the Merced River. To account for this, several regulatory flow conditions were developed. These flow scenarios were used in conjunction with the strategies to formulate various planning scenarios.

- **Goal 5: Maintain Consensus on Water Supply Plan.** As in the 1995 Plan, an extensive public participation program was developed to encourage community leaders, project stakeholders, technical experts, farmers, and agencies to provide input throughout the study.

4.12.A.4 Summary of the Water Supply Analysis

The strategies and projections of potential future conditions were combined in various ways to form discrete planning scenarios. Each scenario was evaluated for projected year-2040 water demand over 30 years of historic hydrology (1970-1999) to determine:

- Demand for surface water and groundwater in the study area
- Amount of Merced River water available for diversion
- Deficit between available surface water and surface-water demand
- Amount of required groundwater pumping to meet groundwater demand and surface-water deficit
- Effects on groundwater levels
- The amount of required intentional groundwater recharge required to arrest declining groundwater levels
- Economic and financial implications of each planning scenario

Analysis of the planning scenarios, with their range of impacts and financial implications, resulted in a preferred strategic direction that continues some current practices and recommended several additional action items, including the following:

- Begin site investigations for suitable groundwater recharge facilities to return groundwater levels to 1999 levels.
- Build recharge facilities to recharge an average of 87,000 afy. This quantity of recharge assumes that the amount of Merced River water available for diversion is consistent with the SJRA flow scenario. The recharge program would begin upon resolution of the regional governance structure.
- Add drought relief wells and urban wells as necessary to keep pace with growth.
- Begin additional urban water conservation measures.
- Convert some landscaped urban areas such as parks from groundwater to surface-water irrigation systems.
- Continue MID's incentive programs to attract customers to use surface water instead of groundwater, in order to maintain its existing customer base and to help arrest declining groundwater levels.
- Construct improvements to MID's system facilities to maintain its existing customer base (by attracting new customers to replace those lost due to urbanization).

4.12.A.5 Effects of UC Merced and the University Community on Regional Water Supplies as Identified in the 2001 Plan Update

The planning horizon for the 2001 Plan Update extends through year 2040. Projected demand for urban water use in the 2040 projections has declined slightly to approximately 118,000 afy, as compared to the long-term projection of 121,000 afy in the 1995 Plan.

The 1995 Plan projected the year 2030 water demand for UC Merced (including related community development) to be approximately 24,200 afy. This was projected as approximately 20 percent of the total urban water use in the Merced area or approximately 2.7 percent of the total applied year 2030 water demand. Modeling for the 2001 Plan Update did not explicitly forecast UC Merced growth as a separate water supply component. Future population projections were based on data provided by the Merced Area Council of Governments and UC Merced. Based on these data sources, a population increase of approximately 192,000 is projected between 1995 and 2040, which includes growth relating to the UC Merced Campus.

By taking into account all growth projected through 2040, the Planning Scenarios take into consideration all currently approved and planned future projects in the region, and evaluate the cumulative impacts of such projects on projected water supplies and strategies for achieving the Plan's goals.

The 2001 Plan Update assumed an uniform urban water demand of 310 gallons per capita per day at 2040. Using this unit rate, the annual water demand component associated with UC Merced and the adjacent community is estimated at 12,800 afy in 2040. This estimate is consistent with the water demand projections provided by UC Merced during the modeling effort. This projection was later modified to range from 7,400 to 11,700 afy depending on whether on-site wastewater treatment of recycling is used.

The analysis conducted for the 2001 Plan Update focused on long-term, regional water supply activities. The Plan Update determined that the total applied water demands within the study area for the year 2040 would be 1,160,000 afy, including 118,000 afy for urban uses, 384,000 afy for agricultural uses inside the MID, and 658,000 afy for agricultural uses outside the MID.

As discussed on page 4.8-21 of the Draft EIR, the total water demand for UC Merced at build-out would be 3,620 afy. This number represents approximately 3 percent of the total urban water demand projected in the 2001 Plan Update for 2040 and approximately 0.3 percent of the total regional water demand in 2040. As discussed on pages 4.8-43 through 4.8-48 of the UCP Draft EIR, the total water demand for the University Community at build-out would be approximately 4,550 afy, and of that total demand, 3,583 afy would come from groundwater supplies; the remaining water would be supplemented by treated wastewater for outdoor irrigation. The groundwater supplies required at build-out for the University Community would account for approximately 3 percent of projected total urban water demand in 2040 and approximately 0.3 percent of projected total regional water demand in 2040. Combined, the total groundwater demand at build-out for the UC Merced Campus and the University Community would be 7,203 afy, which would represent approximately 6 percent of the total urban water demand in 2040 and approximately 0.6 percent of the total regional water demand in 2040.

Commenters have questioned the effect on regional groundwater recharge efforts from the conversion to urban uses of the 1,419 acres of the Community site currently benefited by agricultural recharge. It should be noted that the majority of this area (approximately 1,000 acres) is within the MID Therefore, based on the 2001 Plan Update, there would be no significant net effect on the regional recharge effort from these lands since it was contemplated that MID would attract new customers through system expansions and incentive programs to replace customers lost by the conversion of agricultural lands to urban uses. During preparation of the 2001 Update, specific unit factors for deep percolation of applied water from both row crops and for urban land were developed. It was assumed that the deep percolation of water applied to row crops was 1.08 acre-feet/acre/year when surface water is used for irrigation.

The amount of water anticipated to be used during build-out of the Campus and the University Community, through the use of water conservation measures, and wastewater reuse proposed for the University Community, is thus less than what was allocated for the projects in the 2001 Plan Update. Per capita and per acre, the University Community and the Campus would use significantly less water than other developed areas within the study area, about half as much water measured on either a per capita or per acre basis.

4.12.A.6 Change in Water Demand Compared to Existing Conditions

As noted in the Draft EIR, the Merced Hills Golf Course currently uses approximately 600 afy of groundwater and surface water for irrigation purposes. For purposes of the water demand analyses, it was assumed that the golf course uses only groundwater for irrigation because in a water-critical year, surface water would not be available to the golf course. Under this analysis, the net new demand on groundwater sources at the UC Merced site would be approximately 3,020 afy.

In addition, as explained in the UCP Draft EIR, the calculation of the total groundwater demand of 3,583 afy for the proposed University Community does not account for the cessation of ongoing groundwater extraction to support the existing agricultural and recreational uses within the UCP area. The new net demand for groundwater, over and above the existing groundwater demand of 1,054 afy, is approximately 2,529 afy.

Accounting for a total existing water use on both the Campus and University Community sites of 1,654 afy, the new net groundwater demand for the Campus and the University Community would be 5,539 afy.

As explained in the UCP Draft EIR (pg. 4.8-24), in normal rainfall years the UCP area currently uses approximately 2,285 to 5,630 afy of surface water supplied by MID. Because neither the Campus nor the University Community would use this surface water, it would become available for MID to use in carrying out the strategies of the 2001 Plan Update to increase groundwater recharge and provide incentives for farmers to use surface water rather than groundwater for irrigation.

4.12.A.7 Long-Term Groundwater Supplies In the Basin

The cumulative analyses of the UC Merced Campus and the University Community in the Draft EIRs prepared for the two projects focused on the effectiveness of the management programs recommended in the 1995 Plan. According to the 2001 Plan Update, these recommended programs are structured to protect the Merced groundwater basin and maintain groundwater levels at 1999 levels. The results of the modeling predict that with implementation of the 2001 Plan Update's recommendations, the water supply will meet the region's future water needs and support the water demand associated with the UC Merced Campus, as well as the University Community, on a basinwide and regional level.

The success of this program to stabilize groundwater levels largely depends upon the amount of water that will recharge to the aquifer through intentional recharge together with MID system improvements and incentive programs designed to allow MID to maintain its existing customer base and deliver a target quantity of surface water.

4.12.A.8 Effect of the Recharge Program

The 2001 Plan Update concluded that, without intervention, groundwater levels would decline. The decline would be the result of increased groundwater pumping. The increased dependence on privately pumped groundwater is attributed to numerous reasons, including droughts, increased use of advanced irrigation technologies, demand hardening resulting from the increase in permanent crops in the region, and the ease and speed of attaining groundwater relative to surface water. All of these phenomena were taken into consideration in developing a key recommendation of the 1995 Plan and the 2001 Update: the implementation of an intentional recharge program. Under the recharge program, in wet years when surface water is available, surface water would be diverted from the Merced River to shallow basins constructed in suitable locations in the area. Modeling for the 2001 Plan Update assumed that this water would be conveyed by MID facilities during the early and late portions of the irrigation season, coinciding with the availability of canal capacity and not interfering with flood control. In dry years, when adequate surface water is not available to meet full agricultural and intentional recharge demands, no water would be conveyed to the recharge basins and regional water demands would be met by increased groundwater pumping. The modeling showed that the volume of water recharged in wet years would provide sufficient water to meet dry year pumping needs.

Information from the modeling of various scenarios from the 2001 Plan Update is presented below. Target diversions from the Merced River vary from a minimum of 506,000 to 585,000 afy. Due to the hydrologic variability of the river, the average annual actual river diversions vary from 472,000 to 514,000 afy.

Table 4.12-1
Merced Water Supply Plan Summary of Merced ID Operations at 2040
(Values averaged annually over 30-year historic hydrology)

Agricultural Community's Preference for MID Supplied Water:	Planning Scenario							
	Current Preferences			Low Preferences	High Preferences		Intermediate Preferences	
Alternative:	**1A**	**1B**		**2**	**3A**	**3B**	**4A**	**4B**
Instream Flow Regime:	SJRA	SWRCB		SJRA	Existing	SJRA	SJRA	SWRCB
MID Operations (tafy)								
Target River Diversions	536	582		506	571	580	556	585
River Diversions	495	472		483	514	509	497	473
Intentional Recharge	87	115		134	36	43	66	83

From 2001 Plan Update, Table 4-2

It is important to note that modeling for the 2001 Plan Update assumed that applicable minimum flow requirements and additional flow scenario obligations would be met prior to diversions of surface water for irrigation and intentional recharge.

According to MID data, from 1970 to 1999, MID diverted an average of 523,000 afy from the Merced River. The maximum was 694,500 afy in 1984 and the minimum 192,900 afy in 1977. Modeling for the 2001 Plan Update shows that with full implementation of the Update's recommended program, and under the assumed year-2040 water demands over 30 years of historic hydrology (1970-1999), MID would divert an average of 495,000 afy, which includes surface water for intentional and in-lieu recharge. During wet years, when excess water is available, the MID would divert up to a maximum of 536,000 afy, which includes surface water for intentional and in-lieu recharge.

During some years, surface-water deliveries and deliveries to recharge would curtailed due to insufficient surface-water availability. However, all cases are based on the presumption that MID will continue first to meet the applicable Merced River minimum flows requirements, including the SJRA and its VAMP flow objectives, through the year 2040. Therefore, it will not be necessary to draw more water from the Merced River than has been drawn historically to implement the 2001 Plan Update's recommendations. As a result, implementation of the Plan will not cause detrimental effects to the Merced River or to species or habitat that depend on the Merced River.

The 2001 Plan Update's analysis considered the effect of weather conditions including droughts. The historic hydrologic series used in the 2001 Plan Update's analysis contained several severe and sequential dry years. Consequently, modeling determined that irrigation deliveries and deliveries to recharge would be curtailed in some years due to insufficient surface-water availability. However, in all cases, the recommended program provides for MID to meet the applicable Merced River minimum flows requirements, in addition to the SJRA and its VAMP flow objectives, through 2040.

Water demand due to the development of the campus and growth associated with the development of the campus is accounted for in the Water Supply Plan and therefore will not have any impacts on the Merced River or other aquatic resources. See also the discussion in Section 4.8.

Droughts were incorporated into the modeling in terms of forecasting total water demand and surface hydrology and water availability. The Land Use and Water Demand Model analyzed 30 years of historic hydrology. It also considered other related factors such as evapotranspiration and precipitation. The model calculated that during certain years, sufficient surface water is not available to meet agricultural demands. In those years, the deficit is met by increased groundwater pumping. The recommended rate of groundwater recharge and MID surface-water deliveries are designed to accommodate droughts without taking more water from the river as compared to historic diversions.

The information developed through modeling demonstrates that implementation of the 2001 Plan Update's recommendations can therefore be achieved without drawing any additional water from the Merced River over and above amounts that have historically been drawn. This scenario would be true under even the most stringent regulatory flow scenario.

4.12.A.9 Methods of Recharge

With respect to the location of recharge basins, site-specific field investigation of potential large-scale recharge sites has not yet been conducted. For the purposes of cost estimating and groundwater modeling, the 2001 Plan Update assumed that recharge sites would be constructed in areas that are underlain by sandy soils but are not underlain by low permeability aquitards. These potential recharge areas would be located in areas remote from significant surface-water recharge sources such as the Merced River. Based on these criteria, an area east of Highway 99 (the approximate eastern extent of the Corcoran clay) but below the lower permeability soils, termed "soils of the low terraces" and "soils on the high terraces" in the Merced County Soil survey, has been identified for recharge. This potential area for recharge sites is generally a band about 2 to 6 miles wide, east of Highway 99, extending from Atwater to Planada. Within this area, about 1,000 acres of recharge basins would be constructed. The exact size and location of the basins is dependent on soil characteristics and land use considerations and will be determined during the implementation phase of the Water Supply Plan.

4.12.A.10 Role of Conservation

The recommended program is less dependent on urban water conservation and is not directly dependent on the substitution of surface water for groundwater to supply urban groundwater uses. Total applied water demand in 2040 is projected at 1,160,000 afy. The urban demand component of this total is 118,000 afy, or about 10 percent. Minor adjustments to this total due to increased and decreased levels of conservation would not substantially impact the ultimate recharge requirements for long-term stabilization of the aquifer. Modeling conducted for the 2001 Plan Update assumed moderate levels of future conservation at rates below the historic trend to provide a conservative forecast of 2040 urban pumping. In the year 2000, total urban pumping in the study area was estimated at 59,000 acre-feet, or 330 gallons per capita per day.

Modeling for the 2001 Plan Update assumed that by the year 2040, conservation measures would reduce per capita demand to 310 gallons per capita per day, or a reduction of 0.15 percent per year for 40 years.

4.12.B Localized Groundwater Effects

This response addresses comments FA1-30, I38-1a, LA9-11, O6-4, O6-6, O15-2, O19-3, O19-5, O31-33, SA1-7, SA1-12, as well as other similar comments concerning the potential effects of groundwater withdrawal from wells installed on campus on existing nearby wells. Most of these comments are made relative to both the Campus and the University Community wells; therefore, the discussion below addresses these concerns first for the Campus project and then for the Campus in conjunction with University Community project.

As stated in the Draft EIR for the proposed campus, the City of Merced has committed to supply potable water to the Campus and would be responsible for the installation of wells and water supply pipelines that are necessary to serve the project. During the preparation of the Draft EIR, the City noted that potable water to the Campus would be provided from on-site wells with a connection to the City's water distribution system to serve as backup. With this understanding of the potential manner in which water would be supplied, the Draft EIR discusses the environmental effects from the development of on-site wells as well as a connection to the City's distribution system.

Since the circulation of the Draft EIR, the City has noted that it would explore both on-and off-campus locations to install new wells necessary to serve the proposed Campus (Cahill 2001). The Campus site is underlain by the Mehrten formation, which is a major water-bearing formation in the Merced area and the main source of potable water in Merced. Aquifer tests conducted in 1996 on the irrigation well located on the Merced Hills Golf Course revealed that the hydraulic conductivity of the Mehrten deposits tapped by this well was high. These conditions suggest that some amount of potable water could be supplied by one or more on-site wells. However, because the potential production has not been tested, it is possible that all the potable water supply through the full development of the Campus may not be feasible from on-site wells. The City notes that site-specific hydro-geologic evaluation, including test wells and pumping tests, which would provide a better understanding of the feasibility of on-campus water supply wells, has not yet been completed. Such tests would determine the size, location, and depth of wells that could be established on the Campus. Necessary well tests will be completed at the time the City undertakes its well siting and other engineering work for project well development. These tests and other factors such as the potential for conflict with existing wells in the general vicinity would be taken into consideration by the City in determining whether it would install on-site wells or would serve the Campus via its water distribution system using existing or new wells located elsewhere in the City's SUDP (Cahill 2001).

Some commentors have suggested that the possibility of on-site recharge, including possibly removing near-surface hardpans, be examined. Such an examination would require an extensive drilling program to adequately characterize the lateral and deep site stratigraphy to make sure that no deeper hardpans or clay zones are present that could limit the potential for recharge. The cost of such a drilling program could be prohibitive and may not be justifiable. It should also be noted that because wells to serve the Campus would be large production wells that would tap into the deep formation under the site, shallow recharge of the upper aquifer would not be appropriate. The deeper aquifer is best recharged on a regional basis.

Should new wells be installed on the Campus, because of the standard steps that are taken by the City of Merced in siting and designing groundwater wells, including consideration of the needs of existing wells, nearby wells including those on properties along Lake and Bellevue roads and County-owned wells on Lake Yosemite Regional Park, would not be adversely affected from the operation of the new wells. Furthermore, the City would monitor well operations and groundwater levels to ensure that other wells are not affected. As discussed below, off-peak pumping and storage are other measures that are employed by the City to avoid daily fluctuations in groundwater levels in other nearby wells, including the type of daily fluctuations in water levels in county park wells that have been observed by the County to occur as a result of pumping water from the Flying M Ranch irrigation well.

In the event that site-specific investigations indicate that on-site wells are not feasible or could not be operated without adversely affecting adjacent wells, or both, the City may decide not to site the new wells on the Campus. In that case, the City will serve the Campus from its existing system and would add new wells elsewhere in the region to serve the Campus and other projected growth as needed. According to the City, the hydro-geological conditions underlying Merced are appropriate for the installation of new wells and no question exists with respect to the feasibility of additional wells on the flatlands of Merced (Cahill 2001).

The existing municipal water supply system consists of 18 wells with a combined pumping capacity of 67 million gallons per day (mgd), four elevated storage tanks with a capacity of 1.5 million gallons, and about 500 miles of pipeline. The pumping capacities of the municipal wells range from 1,000 to 4,000 gallons per minute (gpm), with more than half the wells having capacities greater than 2,200 gpm. The system is fully interlinked and therefore a well in one part of Merced may be the source of the water that is provided to another distant part of the city. The groundwater quality is generally good and requires limited treatment for potable use. However, some constituents introduced from human-made sources have affected some of the older shallower City wells in the past and the City has had to replace or rebuild wells to address these contaminants (City of Merced 2001). While older City wells tap the shallower aquifer (generally less than 240 feet from ground surface), newer City wells are deeper (greater than 600 feet from ground surface) and draw water from the Mehrten deposits.

In 2000, the City supplied 22,212 afy of water to its customers, at an average rate of 19.8 mgd and a peak rate of 36.5 mgd. The City projects that water demand within the City SUDP will increase to 32,855 afy by 2010 and to 41,209 afy by 2020. The maximum daily demand in this time period will increase to 55.7 mgd by 2010, and to about 70 mgd by 2020 (City of Merced 2001). UC Merced is accounted for in this total.

The City has projected its future potable water demand based on population projections and has developed an Urban Water Management Plan (UWMP) for purposes of ensuring that the future needs of residents and businesses in the City's SUDP are planned for and adequately addressed. The City however has stated that planning for new wells including the number and locations of wells that would be needed at full build-out of the SUDP is not conducted several years in advance. New well development by the City is conducted on a near-term basis rather than the longer horizon of overall water supply planning. The City maintains planning tools that allow continuous evaluation of its water supply system. Using these tools, the City determines when and where more improvements are needed to serve the needs of its residents and businesses. In this connection, the City has developed a Water Distribution System Model, which is used to identify deficiencies in the system. Once the area that is deficient is identified, the City then conducts location studies to determine the exact location of the new well or water tank. Observed or projected deficiency is used to determine the need for a new well. Currently, based on observed deficiencies in the system, the City is examining the siting of two new wells in the Western Industrial Park area and in southeastern Merced. Because the City expects that growth will occur mainly in northern and northeastern Merced, deficiencies will develop in that area in the future and it expects that new wells will be sited in that area (Cahill 2001).

It should be noted that the 1995 Water Supply Plan stated that up to 72 new wells would be needed by 2030 to serve the projected growth in the cities of Atwater, Livingston, Merced, in the UC Merced Campus, and in unincorporated eastern Merced County. This number was reported in the Draft EIR. Closer examination of those data shows that the estimate included 20 new wells to serve UC Merced. As shown below, the campus would at best require the installation of two large production wells; therefore, the number is erroneously high.

Because municipal wells are large-capacity production wells, as a matter of standard practice the City uses prudent siting as well as other measures to avoid one well affecting other nearby wells. In general, municipal wells are located a mile apart so as to avoid drawdown effects on adjacent wells that are installed in the lower aquifer. The City also notes that as the SUDP gets built out and new municipal wells are installed closer to the City's edges, the City will take nearby agricultural wells (which are typically drilled in the Mehrten formation) into account in determining the location of new municipal wells (Tucker 2001). The City also employs off-peak pumping and storage to reduce the potential for effects on other wells (Hubkey 2001).

Water demand at the full development of the proposed Campus would be 3,620 afy (not accounting for the reduction that would be achieved if recycled water and stored storm water are used for irrigation and other nonpotable uses). This level of annual consumption equates to about 2,244 gpm of water. Based on City of Merced's current average well size of about 2,200 gpm, it appears that one large-capacity well would be adequate to serve the Campus. However, because the exact capacity of any future well cannot be predicted until a site-specific evaluation is completed, it would be more reasonable to assume that the City may need to install up to two new wells to serve the Campus. Based on the information from the City, it appears that the exact location of these new wells to serve the Campus cannot be determined at this time with any precision. However, as discussed above, drawdown effects of these new wells would be avoided by the use of the City's standard well development practices. Because drawdown effects would be avoided, impacts on water quality would also not occur. Based on existing city wells, installation of these wells would affect no more than 1.5 acres per well site and, therefore, should there be sensitive resources present at these future well locations, the impacts from Campus-related well development would not be substantial. For all of these reasons presented above, well development to serve the Campus would not result in significant environmental impacts that would require mitigation.

As discussed in the Draft EIR, the University Community project also proposes to obtain potable water from on-site wells. The Draft EIR reports the amount of groundwater that would be needed to serve the community. The community's projected consumption of 3,583 afy could likely be served by about two large production wells.

The County has initiated site-specific investigations of the feasibility of large production wells on the UCP project site. The entire Community Plan Area is underlain by the Mehrten formation, and in the area south of Cardella Road, this formation is also overlain by a continuous aquitard, separating the Mehrten formation from the upper aquifer. Hydrogeologic conditions in this area appear to be very similar to those within the City of Merced SUDP. The presence of a continuous aquitard would assure that if wells were installed in the Mehrten formation in this area, other shallower wells along Lake Road that draw from the upper aquifer would not be affected.

Because the community wells would pump from the Mehrten formation, at the time that these wells are to be sited, site-specific location studies will be required to ensure that they are sited to avoid drawdown effects on nearby City and other large production agricultural wells. Such site-specific studies will also be required to confirm that local hydrological conditions will support long-term withdrawals to supply the community without provision for local recharge.

In the event that site-specific investigations indicate that all of the University Community's needs cannot be met by on-site wells, the water supplier to the UCP area will install the needed wells on lands to the south and west of the Community. Environmental effects of such off-site wells would be minimal for the same reasons explained above with respect to City wells that would serve the Campus, provided that the same type of well siting and operation practices are implemented as are followed by the City of Merced.

4.12.C Other Water Supply Issues

This response addresses comments O19-5, O24-31, O24-35, O24-36, O24-37, O24-38, O31-34, O31-36, O31-38, O31-47, and I6-2, as well as other similar comments, which relate to baseline data and water demand forecasts. In addition, this response addresses comments I38-1a, LA6-15, O29-6, and PH2-2, which concern groundwater recharge and use of groundwater.

At build-out, the UC Merced Campus would generate a total water supply demand for 3,620 afy of water (potable water of 2,310 afy and irrigation water of 1,310 afy).

As stated above, the UC Merced Campus would be designed as a water-conservative campus and, as such, would incorporate water efficiency concepts and technology. Using high-efficiency fixtures and dry fixtures, it is appropriate to use a factor of 70 gallons per person per day. The residential component of Campus activities includes students and faculty living on the Campus. In general, the students would have shared cooking, washing, and bathroom facilities and would, thus, experience economies of scale in water use. Please see Section 4.19.C for further explanation regarding Campus water infrastructure.

Since 1970, MID has diverted surface water to supplement groundwater recharge, and continued increases in groundwater recharge is part of the updated Water Supply Plan. The UC Merced Campus would not interfere with the groundwater recharge efforts of MID or other water agencies. The project would not line or otherwise alter the recharge capabilities of MID canals on the Campus site. It also provides for an adequately wide right-of-way along the canals to allow MID to enhance canal capacity in the future, should that be necessary for delivery of water for recharge in other parts of the County. Development of the Campus and Community will have no effect on water supplied for irrigation through the canals, or on the operation of the canals. To the extent feasible, given the site geologic conditions, the project would encourage groundwater recharge through the use of detention and retention basins as well as grassy swales for the conveyance of site runoff (as opposed to the use of underground storm drains). The University is also currently supporting the water agencies in their planning efforts through participation in the Water Supply Plan Update process and is committed to implementing water conservation and other measures as they are identified through the planning process to minimize the use of groundwater.

The City of Merced is the public water system for the proposed UC Merced Campus and, as such, has prepared a UWMP. The City of Merced's UWMP, dated October 2001, represents the 2000 UWMP and is the 5-year update of the first plan. The City of Merced's water supply comes entirely from groundwater, with 18 wells with a combined well capacity of 46,500 gpm or 67.0 mgd. Current water use is 22,212 afy or 19.8 mgd. As projected in the 2000 UWMP, water use by the year 2020 is estimated to be 41,209 afy or 36.8 mgd, an increase of 71 percent (City of Merced 2001).

As stated above, groundwater levels have been decreasing since 1971. However, the cooperating agencies of the updated Water Supply Plan have recognized the importance of maintaining sufficient water levels and have agreed on developing a strategy to maintain groundwater levels at 1999 levels, approximately 160 feet above mean sea level (City of Merced 2001). The City of Merced is supporting this recharge strategy. The groundwater recharge program will determine the location of groundwater recharge facilities, the agency or agencies that will operate and maintain recharge facilities, and cost sharing (City of Merced 2001). Sites that are found not to be appropriate for recharge due to contamination or other reasons would not be used for this purpose.

The 2000 UWMP summarizes previous reports, and in doing so, notes that the 1995 UWMP concluded that under the baseline water use estimates, the City water demand would exceed annual safe yield (30,000 afy) around the year 2005. The 1995 UWMP recommended that the City continue to implement the modified moderate conservation program and that the City monitor water usage and annually assess the moderate program. Based on current data, although it is expected that water use will increase by 71 percent by 2020, with groundwater recharge, the 30,000 afy will be sufficiently augmented to meet the future water demands (City of Merced 2001).

The Draft EIR analyzed the cumulative effect of supplying water to both the Campus and the University Community. Only the Campus would obtain water from the City of Merced. The University Community would depend upon wells for potable water, but is not proposing to connect to the City of Merced's system.

4.12.D Downstream Pollution from Site Runoff

This response addresses comments FA2-2, FA3-1, SA1-8, SA1-9, SA1-10, and O31-34, as well as other similar comments, which are concerned with the quality of site storm water runoff.

The EIR provides a discussion of the storm drain conveyance system and storm runoff storage. The conveyance system is designed to convey a 10-year event. Larger events may result in on-campus ponding of storm water but would not result in any additional discharge from the Campus, since the drainage system has been designed to contain the volume of runoff from the

100-year, 24-hour storm event in a series of detention/retention ponds. These ponds would discharge to the Fairfield Canal operated by the MID.

Typical pollutants found in urban runoff include heavy metals such as copper, lead, zinc, and cadmium (though lead concentrations have decreased since the elimination of leaded gasoline), nutrients, bacteria and viruses, organic chemicals such as hydrocarbons and pesticides, and sediments from soil erosion. Data collected during the numerous urban runoff programs have shown that the quality of urban storm water runoff can be quite variable from location to location and from storm to storm. Although the reasons for the variability have not been fully quantified they can be due to differences in activities and land use in the watershed, amount of impervious surface, traffic volume, and storm event characteristics (e.g., volume, intensity, antecedent dry period). However, the data do indicate that the higher the degree of urbanization the higher the concentrations of pollutants are likely to be. Table 4.12-2 below presents data from the Bay Area Stormwater Management Agencies Association (BASMAA) Monitoring Data Analysis Report (Woodward-Clyde 1996) summarizing data collected in Santa Clara, Alameda, and Contra Costa counties. The table also presents data collected in *Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report* (Los Angeles County 2000), which are water quality data for runoff from Cal State University, Northridge. The data collected in Los Angeles County are reported by land use and are more recent than the BASMAA data and show generally lower concentrations. The Los Angeles data for residential and commercial land uses were similar. The reasons for the significantly lower concentrations are unknown but could be due to reductions in automobile contributions to pollution since newer cars emit less pollutants than older cars. Table 4.12-1 also lists water quality standards as defined in *A Compilation of Water Quality Goals* (RWQCB 2000).

The BASMAA report compared the data collected to acute USEPA Water Quality Standards. Based on the analysis of over 150 data points, the only metals to exceed the standards were copper (10 percent of samples), lead (1 percent of samples) and zinc (5 percent of samples) (based on dissolved concentrations). Further analysis was conducted on the copper data since they had the highest percentage of water quality exceedances. The report concluded that dissolved copper in streams is not likely to be a recurrent toxicity problem for all except possibly the most highly urbanized watersheds in the Bay Area.

The standards shown in Table 4.12-2, provided for purposes of illustration, are receiving water standards. As shown in Table 4.12-2, pollutants measured at the California State University, Northridge campus in runoff were also very low in comparison with the standards used for comparison. Note that the standards in Table 4.12-2 represent standards for dissolved concentrations in receiving waters. The data for pollution concentrations in runoff show total concentrations prior to dilution in receiving waters and reduction in dissolved solids due to combination with sediment and other solids in receiving waters.

Table 4.12-2
Average Pollutant Concentrations Measured in Urban Runoff

	Standards[1] (μg/l)				
Pollutant (μg/L)	Municipal[2]	Aquatic Life[3] Acute	BASMAA	University (Los Angeles County)	Percent Dissolved
Copper	1,300	3.6-50	47	24	54-66
Lead	15	14-280	108	4.9	small
Zinc	No standard	No standard	284	138	47-57
Chromium	50 (total)	180-1,700	22.5	3.6	dl[5]
Cadmium	5	0.95-19	1.94	SID[4]	dl[5]
Nickel	100	140-1,500	34.1	4.7	
Total Suspended Solids	No standard	No standard	113.2	95	

[1] Taken from RWQCB (2000).

[2] Maximum contaminant levels are directly applicable to groundwater and surface-water resources when they are specifically referenced as water quality objectives in the pertinent Water Quality Control Plan. In the Central Valley Basin Plan, the beneficial use MUN is listed as "potential" for the San Joaquin River at Bear Creek's confluence.

[3] Range is a function of hardness of water (mg/ L as $CaCO_3$).

[4]SID=statistically invalid data, not enough data above detection limit collected.

[5]dl=not enough samples had concentrations above detection to draw conclusions.

Storm water runoff from the new campus will be regulated either under a Phase 1I NPDES General Permit or under an individual permit. The USEPA Phase 1I regulations require the implementation of the following six program elements or "minimum control measures:"

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Postconstruction Runoff Control
- Pollution Prevention/Good Housekeeping

In addition, the Phase 1I regulations specify that implementation of BMPs consistent with the storm water management program constitutes compliance with the standard of reducing pollutants to the maximum extent practicable (Section 122.34, page 68843). The permit also requires that the applicant ensure long-term operation and maintenance of controls and determine measurable goals for the control measures. Phase 1I NPDES permits are to be issued consistent with the Interim Permitting Approach policy that relies on BMPs in the first-round permits and expanded or better tailored BMPs in subsequent permits, where necessary, to provide for the attainment of water quality standards.

In decisions on appeals of storm water NPDES permits, the SWRCB has affirmed that storm water discharges must not cause or contribute to exceedances of water quality objectives in receiving waters. The SWRCB has endorsed the USEPA approach by specifying that municipalities must report instances where they cause or contribute to exceedances, and then must review and improve BMPs so as to protect receiving waters. The SWRCB has determined that implementation of BMPs constitute compliance to the maximum extent practicable.

This project will be regulated under the Phase 1I general permit, which assures that tailored BMPs will be implemented to assure that water quality standards are achieved and receiving waters are protected.

Furthermore, because the MID is interested in ensuring the quality of water discharged to its canals, it has placed restrictions on the discharge including the following:

- The Campus cannot release water at a rate greater than the volume of a 10-year, 24-hour storm in less than 48 hours.
- The water has to drop to zero velocity before it could be discharged (this requirement prevents the direct discharge from the storm drainage conveyance system to the canal without passing thorough a basin).
- If water is pumped into Fairfield Canal, the Campus would ensure that the water in the pond it is pumped from is never less than 12 inches deep to prevent bottom sediments from being drawn into the discharged water.
- The Campus would need to ensure that no trash, oil, or grease is released into the canal if release is through a control structure.

In the state general NPDES permit for construction activities, the SWRCB identified infiltration, detention/retention, and biofiltration as appropriate postconstruction stormwater management BMPs. The site drainage plan for the proposed Campus includes the use of detention/retention and biofiltration BMPs. The amount of treatment provided by dry detention (i.e., ponds that drain after storm events) is highly variable, and the extent of pollutant removal depends upon the concentration and type of pollutants entering the basin, the maintenance of the basin, and the detention time. For planning purposes the *City of Portland Storm Water Quality Facilities Design Guidance Manual* (City of Portland Stormwater Quality Facilities 1995) uses a value of 45 percent for total suspended solids, 50 percent for lead, 20 percent for zinc, and 25 to 30 percent for nitrogen and phosphorous. These efficiencies are attained by settling the solids from the storm water. These efficiencies may represent expected efficiency values for the UC Merced Campus facilities if the release water is held (as opposed to allowing time for infiltration). The Los Angeles County data for Cal State University, Northridge, indicate that about 50 percent of the copper and zinc are dissolved, as well as a small amount of lead. For the other metals listed in Table 4.12-2, not enough samples had concentrations above detection levels to draw conclusions. In general, dry detention ponds are best at treating solids and less efficient at treating dissolved constituents. Table 4.12-3 below summarizes information on the efficiency of detention basins in treating storm water.

Table 4.12-3
Summary of Removal Efficiencies for Dry Detention Ponds

Sediment	Metals	Pesticides
60-90 percent Efficiency decreases with particle size. Evidence suggests that maximum removal for well-designed facilities is limited by the BMP specific irreducible concentration.	20-80 percent Performance varies depending on design and fraction of metals dissolved versus particulate fraction, as well as settleability of particulate fraction.	Limited data on efficiency of BMP in removing pesticides. Removal of pesticides may accompany removal of dissolved organic matter and, thus, may be enhanced by increased residence time.

In summary, untreated urban runoff does not usually exceed water quality criteria for aquatic organisms except possibly in highly urbanized areas. Even though the precise level of treatment provided by a BMP, such as a detention pond, cannot be predicted in advance, operation of the detention ponds to maximize treatment and the implementation of a campus-wide storm water management plan in compliance with NPDES requirements will reduce the likelihood that concentrations will exceed water quality criteria. Fairfield Canal drains into Bear Creek, which eventually drains to the San Joaquin River. However, the drainage size of the Bear Creek basin is several orders of magnitude larger than the eventual developed size of the Campus at 910 acres. Thus, the fully developed Campus would contribute only a very small fraction of storm water drainage into the Bear Creek system and ultimately into the San Joaquin River.

4.12.E Site Drainage

This response addresses comments LA5-3, LA5-14, LA5-15, LA5-16, LA5-17, LA5-18, LA6-3, O31-29, O6-5, and SA2-1, as well as other comments, which raise similar issues concerning site drainage and the storm water drainage systems. Please also see Section 4.4.E for a description of the treatment of MID irrigation facilities.

The Draft EIR described the manner in which site runoff would be collected and discharged into Fairfield Canal. MID currently operates its canals and storm drainage system in the Lake Yosemite area in a manner that does not overwhelm downstream users and prevents flooding. MID would use an automated instrumentation control system to coordinate discharges and would ensure that cooperation in the coordinated planning and operation of storm drainage facilities continues. The Campus will also install high-water-level shutoff sensors at its storm drainage pumping stations to regulate discharges into Fairfield Canal. In addition, the detention and retention facilities for the UC Merced Campus would be constructed by the University. These facilities would have the capacity to store storm water from a 100-year, 24-hour storm event, further ensuring that downstream users would not be adversely affected by excess water from the storm drainage system on the UC Merced Campus. Mitigation Measures 4.8-6(a) and 4.8-6(b) have been added to the Draft EIR in response to this comment. The Draft EIR has also been revised to clarify that storm water from the Campus will be discharged only to Fairfield Canal, and not to any of the other MID-owned facilities in the area, including Lake Yosemite, which is an agricultural regulating reservoir. Please see Volume 2, Section 7 of this Final EIR. Because storm water discharges from the Campus would be coordinated with discharges from the

University Community, and water would be discharged only if capacity exists in the canal, the combined effects of the flows from both projects would be less than significant.

MID does not use Fairfield Canal for irrigation during the fall and winter months (November 1 to March 31), but instead uses it to transport storm water. Storm water would be diverted from the Campus and the University Community into Fairfield Canal where it would flow to Bear Creek. MID does not plan to retain any of these storm water flows for delivery to its customers during the period from April 1 to October 31. Therefore, usage of the canal for storm water transport purposes does not constitute a new appropriation of surface water.

4.12.F Water Conservation and Recycling

This response addresses comments I38-1, I38-3, I38-4, I38-7, and SA1-11a, as well as other similar comments, regarding water conservation and recycling, antidegradation issues and salt degradation, and groundwater quality.

The proposed Campus would be designed as a water-conservative campus, and it is recognized that the need for water conservation is important to the success and development of the 25,000-student Campus. Based on the University's adoption of the U.S. Green Council's Leadership in Energy and Environmental Design (LEED™) water conservation recommendations for high-efficiency fixtures and dry fixtures (e.g., dry urinals), a balance occurs between the estimated wastewater generation and nonpotable water demand within the Campus itself, on an annual basis. The Campus is incorporating several elements from the LEED™ green building system, including:

- Water-efficient landscaping – limit or eliminate the use of potable water for landscape irrigation
- Innovative wastewater technologies – reduce generation of wastewater and potable water demand, while increasing local aquifer recharge
- Water use reduction – maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems

In addition, water service to all Campus facilities will be metered to help manage Campus supplies and inform the design of future facilities. Wastewater flows will also be monitored to help manage Campus operations.

It is possible that every drop of potable water delivered to the Campus could be beneficially used at least twice and possibly three times (i.e., interior use, toilet flushing, and irrigation). It is not possible to say exactly when, however, the water recycling facility of the Campus plan would be implemented because it is not known exactly how fast the Campus population would grow and when the need to incorporate water recycling would begin. When planning for this facility is initiated, the Campus will consider source control to avoid salt degradation of groundwater from the use of recycled water.

While the state has had an antidegradation policy in place since 1968, it is only recently that it has received more attention from the RWQCB. If degradation (to groundwater or surface water) exists, best practicable treatment and control measures may be required as determined on a case-by-case basis. The Draft EIR fully recognizes the potential implications of the state's antidegradation policy on the City of Merced's existing wastewater treatment plant, and further the Draft EIR recognizes that a water recycling plant serving the Campus could eliminate this antidegradation issue completely for the University.

Nitrogen, in its various forms, discharged from wastewater facilities in the Central Valley is becoming a dominant water quality constituent of concern with regards to the California Toxics Rule, Federal Drinking Water Standards, and the state/federal antidegradation policies. In urban water recycling, reclaimed wastewater is used for irrigation of landscaping or turf. Nitrogen is required by plants and is often applied as an inorganic fertilizer. Hence, the nitrogen in the domestic sanitary wastewater could be beneficially used as fertilizer, and the expense and energy required to produce inorganic fertilizer avoided. In addition, the nitrogen would not be discharged into a surface water body, potentially creating degradation of water quality that might harm downstream beneficial uses.

4.12.G Other Concerns

Comment FA1-26 requests clarification of the proposed Campus area. The UC Merced Campus would be located immediately east of Lake Yosemite Regional Park, in the southwestern portion of the VST and County of Merced lands. This site is south and west of the old proposed campus location shown in the SSEIR, and is not within the 100-year floodplain of Bear or Rascal creeks.

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