4.4 HYDROLOGY AND WATER QUALITY

4.4.1 Introduction

This section of the Recirculated Draft SEIR (SEIR) discusses the existing regional hydrology and water quality conditions in the project vicinity and evaluates the potential hydrology and water impacts associated with campus development under the 2020 LRDP. The primary concerns related to hydrology and water quality are increased urban runoff and the potential of this increased runoff to result in water quality impacts and downstream flooding; short-term construction phase impacts on water quality; and effect of groundwater extraction and increased impervious surfaces on local and regional groundwater levels.

The following sources of information were used in the preparation of this section:

- Regional Water Management Group (RWMG). Merced Integrated Regional Water Management Plan (MIRWMP). August 2013.
- California Groundwater Bulletin 118. San Joaquin Valley Groundwater Basin, Merced Subbasin. Prepared by Department of Water Resources. 2004 and 2016 Interim Update.
- Clean Water Act (CWA) 2014 and 2016 Section 303(d) List of Water Quality Limited Segments and 305(b) Report (CVRWQCB). Prepared by State Water Resources Control Board Central Valley Region. April 2018.
- The Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basin. Fifth Edition. Prepared by Regional Water Quality Control Board. Central Valley Region. May 2018.
- City of Merced 2015 Urban Water Management Plan. Prepared by Carollo. Adopted 2015, amended 2017.
- Merced Groundwater Subbasin Groundwater Sustainability Plan. Prepared by Woodard & Curran, November 2019.

4.4.2 Environmental Setting

General Climate, Precipitation, and Topography

The San Joaquin Valley is surrounded on the on the east by the Sierra Nevada, on the south by the San Emigdio and Tehachapi Mountains, west by the Coast Ranges, and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The UC Merced campus is located in the central-eastern portion of the San Joaquin Valley, in the eastern portion of Merced County, and northeast of the Merced city limits. The land surrounding the campus consists of gentle rolling hills and flatland primarily used for agriculture. The general slope of this area is to the west and southwest.

The climate of the valley floor around the project region is arid to semi-arid with dry, hot summers and mild winters. Summer temperatures may be higher than 100 degrees Fahrenheit (°F) for extended periods of time; winter temperatures are only occasionally below freezing (Jones & Stokes 1998). The Merced region averages 11 to 13 inches of rain per year increasing eastward (DWR 2004). Nearly 80 percent of the annual precipitation falls in the six months between November and March (City of Merced 2012). The winter snowpack, which accumulates above 5,000 feet elevation, primarily in the Sierra Nevada, supplies the vast majority of water in the basin. The streams in the western portion of the county contribute little to the water totals in the valley because the Coast Range is too low to accumulate a snowpack and its east slope is subject to a rain shadow phenomenon, therefore producing only seasonal runoff.

Regional Drainage Basin and Surface Water Resources

The San Joaquin Valley drainage basin is a long trough that is approximately 11,000 square miles in area and is approximately 110 miles long and 95 miles wide (City of Merced 2012). The drainage basin extends from near the City of Stockton to the north to near the City of Fresno to the south, and from the Sierra Nevada on the east to the Coastal Ranges on the west.

The drainage basin is divided lengthwise into two major subbasins that drain to different locations. The San Joaquin subbasin drains the northern portion of the valley into the San Joaquin River which flows into the Sacramento-San Joaquin Delta to eventually discharge into the Pacific Ocean. Surface water in the southern portion of the valley flows into the Tulare subbasin where there is no outlet. Only during rare high flood flows, water in the Tulare subbasin reaches an outlet and drains into the San Joaquin River.

Merced County and the project area are located within the northerly San Joaquin subbasin. Merced County is further divided into two subbasins. One subbasin drains into the Merced River and the other drains into the San Joaquin River.

The San Joaquin River is the principal river within the project region. The San Joaquin River originates in the Sierra Nevada mountains and flows southwesterly to the vicinity of Mendota. It then flows northwesterly to its mouth in the Suisun Bay. Principal tributaries to the San Joaquin River include the Stanislaus, Tuolumne, and Merced Rivers. Bear Creek, Black Rascal Creek, and Fahrens Creek that flow through the City of Merced are tributaries to Merced River. In addition to the rivers and streams, there are many reservoirs, agricultural canals, laterals, and drains that also convey runoff and irrigation water through San Joaquin Valley. Canals in the project vicinity include the Main Canal, Le Grand Canal, the Fairfield Canal, and Yosemite Lateral. The Main Canal diverts water from the Merced River and discharges it into Lake Yosemite, which is located to the north of the campus. Water from Lake Yosemite is conveyed to the south by the Le Grand and Fairfield Canals. Lake Yosemite and its canals are used primarily for irrigation and secondarily, for flood control.

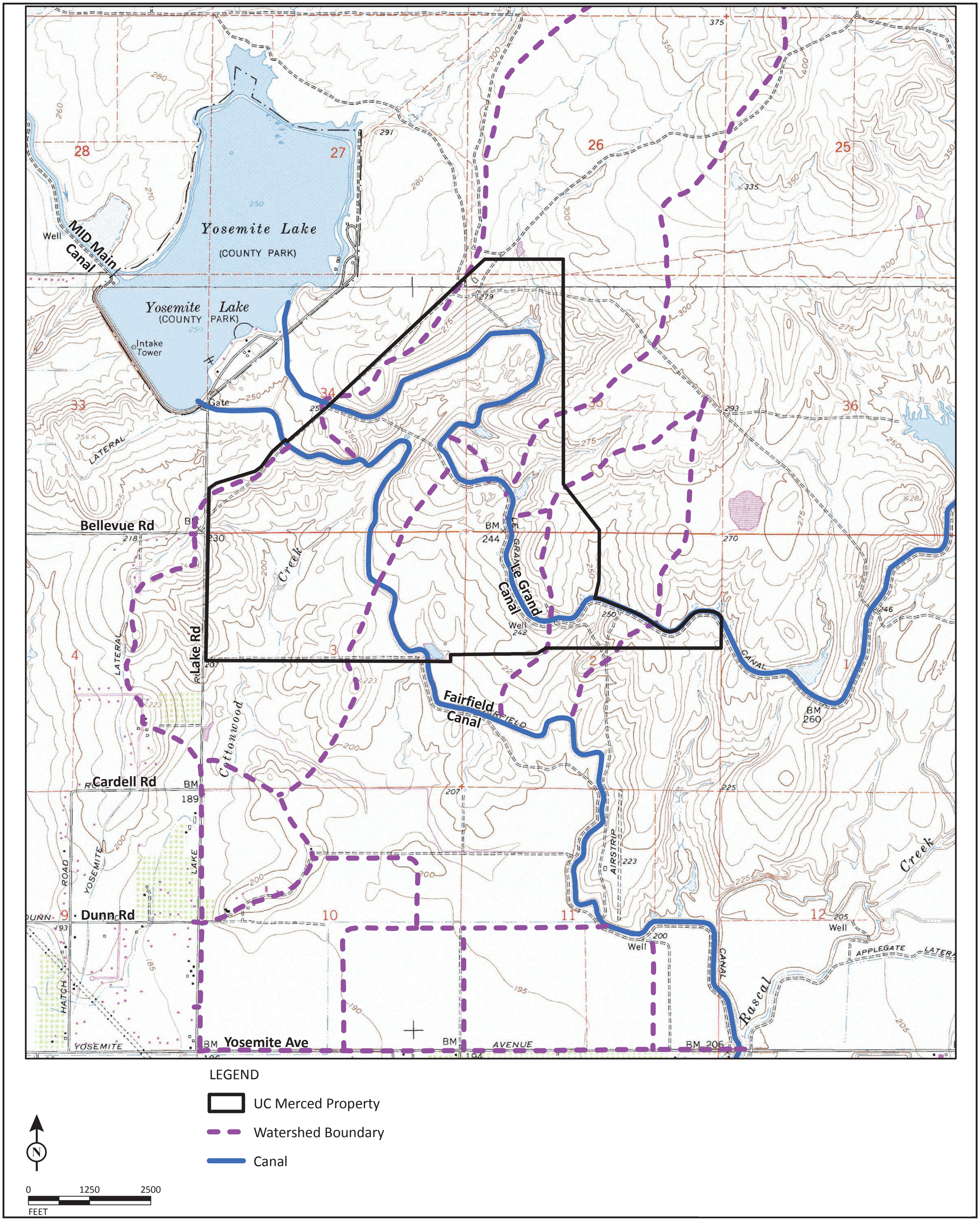
Campus Site Hydrology

The campus is located to the southeast of Lake Yosemite on the eastern side of Merced County, in a transition zone between the Sierra Nevada foothills to the east and the flat San Joaquin Valley floor to the west. The topography of the campus site is flat to undulating. The northeastern portion of the project site contains small hills and valleys while the remainder of the undeveloped portion of the campus site slopes gently from the northeast to southwest. The southern portion of the campus is generally level land. Elevations on the campus range from approximately 300 feet above mean sea level (msl) in the northeast to about 200 feet msl in the southwest near Lake Road.

Figure 4.4-1, Campus Site Watersheds, shows the watersheds that make up the campus site. As the figure shows, the watersheds are aligned in a northeast to southwest direction in general and are bisected by Le Grand and Fairfield Canals that traverse through the campus. The primary drainage feature within the project area is Cottonwood Creek, an intermittent creek that historically had its headwaters in the northeastern portion of the campus site and drained in a southwesterly direction towards Lake Road. However, the topography of the campus site has been substantially altered from historical conditions due to three to four separate phases of development. Prior to any land development on the campus site, the site was altered in conjunction with agriculture. During the 1860s, many local ranchers and farmers began to develop small-scale irrigation projects, and between 1903 and 1909, the Crocker-Huffman Land & Water Company constructed the Fairfield Canal extending from Lake Yosemite to the south, passing through the project site. In 1922, Merced Irrigation District (MID) purchased the Crocker-Huffman system and at some point in the mid to late 1920s, MID substantially altered the alignment and geometry of Fairfield Canal. Sometime between 1922 and 1927, the MID built the Le Grand Canal. Although the canals were developed to follow the contours of the land, nonetheless, the canals resulted in the interruption of the sheet flow of runoff that drained generally from northeast to southwest across the current campus site. Construction of the canals resulted in the truncation of the headwaters of Cottonwood Creek that were located within the north-central portion of the current campus site. Additionally, the project site was altered by the construction of ponds for cattle watering, and in the southern portion of the current campus site, the land was leveled and placed under irrigated pasture. **Figure 4.4-1** is based on a 1987 USGS topographic map. The USGS topographic map shows that by 1987, the intermittent Cottonwood Creek originated to the south of Fairfield Canal.

In the 1990s, the project site was further altered by the construction of a golf course. The Merced Hills Golf Course was constructed on approximately 200 acres in the north-central portion of the current campus site and opened to the public in 1995. The development of the golf course also affected the headwaters of Cottonwood Creek as a man-made lake (now called Little Lake) and a pond (Lower Pond) were constructed in the area of the creek below Fairfield Canal. The golf course was closed in 2002, when the site was approved for the development of the campus. At the time that the campus site was acquired by the University, headwaters of Cottonwood Creek were substantially absent from the campus site, and the creek was located on UCLC land to the south of the campus, fed by some runoff from the campus site and by runoff from the two irrigation pivots.

The first phase of the campus (Phase 1) was developed beginning in 2002 on the northern 80 acres of the 200-acre Merced Hills Golf Course, in the area occupied by the clubhouse facilities (UC Merced 2001; County of Merced 2001). In 2011, upon receipt of applicable permits and approvals from the U.S. Army Corps of Engineers (USACE) and California Department of Fish and Wildlife (CDFW), other portions of the former golf course site were developed with campus facilities. The second major phase of campus construction (UC Merced 2020 Project) commenced in 2016 and is currently underway to the south of the first phase. **Figure 4.4-2, UC Merced Campus Site (June 2016),** is an aerial photograph of the campus as of June 2016 before construction of the 2020 Project was commenced. As the photograph shows, traces of the former creek channel can be seen south of Fairfield Canal, but a clear continuous creek is not visible on the campus. A creek alignment can be seen in the area of the irrigation pivot. Since 2016, as part of the 2020 Project, Little Lake has been modified and Lower Pond has been filled. Furthermore, lands to the east and south of these waterbodies have been graded and filled for the development of parking lots. **Figure 4.4-3, UC Merced Campus Site (June 2018),** shows the campus in June 2018. As the aerial photo shows, at the present time only a small segment of the creek remains on the southern portion of the current campus site within the irrigation pivot area.



SOURCE: UC Merced, 2019; USGS 7.5-minute Topo Quads - Merced, Calif. (1987) and Yosemite Lake, Calif. (1987)

FIGURE **4.4-1**

Campus Site Watersheds

SOURCE: UC Merced, 2019

FIGURE 4.4-2

UC Merced Campus Site (June 2016)

SOURCE: UC Merced, 2019

FIGURE 4.4-3

UC Merced Campus Site (June 2018)

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Flooding

The Federal Emergency Management Agency (FEMA) provides information on flood hazard and frequency for cities and counties on its Flood Insurance Rate Maps (FIRM). FEMA identifies designated zones to indicate flood hazard potential. In general, flooding occurs along waterways, with infrequent localized flooding also occurring due to constrictions of storm drain systems or surface water ponding. The San Joaquin River and its tributaries that flow through Merced, Stanislaus and Fresno Counties form part of the drainage system for over 9,000 square miles of the Sierra Nevada and foothill region. High flows of moderate duration in these rivers and streams can result in flooding and can occur from intense rainstorms. In addition, snowmelt in the Sierra Nevada can produce high flows of longer duration during the spring. Bear Creek, Black Rascal Creek, and Fahrens Creek, which are part of the Merced County Streams Group, flow through the City of Merced and are tributaries to the San Joaquin River. Lack of channel capacity and problems of erosion and sedimentation, which further reduce channel capacity, are responsible for flooding along all of the creeks in the Merced County Streams Group (Merced County General Plan Chapter V).

There are areas southeast of the campus that are located in FEMA Zone A, which includes areas subject to inundation by the 1 percent annual flood event. Zone A is determined to have no base flood elevations. None of the watercourses within the campus (the two canals and the limited headwaters of Cottonwood Creek) are included in the 100-year floodplain as defined by FEMA.

Lake Yosemite has a 53-foot-high earthen dam located along the lake's southwest side. The lake is owned by the Merced Irrigation District (MID) and is regulated by the DWR Division of Safety of Dams (DSOD). The area to the west and southwest of the lake would experience a gradual flooding if the earthen dam were to fail (Merced County 2004). Failure of the earthen dam would occur if the lake were overtopped by water. According to the MID, the crest of Lake Yosemite Dam is approximately 4 feet higher than the edge of the rim of the lake (Merced County 2004).

The Le Grand and Fairfield Canals traverse the northern and central portions of the campus. These canals are constructed with earthen embankments and are subject to erosion. The canals are owned and operated by MID. According to MID, the campus could experience flooding if the embankments failed or if the tops were over filled due to excess volume of water. In addition, the levees could also fail due to burrowing animals within the levees. According to MID, the canals often need to be repaired due to erosion caused by seepage and animal burrowing (Merced County 2004).

Surface Water Quality

As noted in the Merced County General Plan EIR, surface water quality in Merced County varies on a regional level with higher quality water originating in the Sierra Nevada to the east and deteriorating as it moves towards and through the valley. Activities that impact surface water quality in the region include agricultural irrigation and animal confinement operations, forest management, municipal and industrial uses, storm water, mineral exploration and extraction, hazardous and non-hazardous waste disposal, and dredging. Surface water quality is also affected by naturally high concentrations of salts and selenium in the western portions of San Joaquin Valley (Merced County 2013).

The CWA Section 303(d) requires states to adopt water quality standards for all surface waters in the United States. Section 303 (d) establishes the Total Maximum Daily Load (TMDL) process to assist in guiding the application of state water quality standards, requiring states to identify streams whose water quality is "impaired" (affected by the presence of pollutants or contaminants) and to establish the TMDL or the maximum quantity of a particular constituent that a water body can assimilate without experiencing adverse effect. Where multiple uses exist, the water quality standard must protect the most sensitive use. The State Water Control Board (SWRCB) and the applicable Regional Water Quality Control Board (RWQCB) are responsible for implementing and ensuring compliance with the provisions of the federal CWA and the California Porter-Cologne Water Quality Control Act. Several water bodies in Merced County are, or have been, listed as impaired pursuant to Section 303(d). These include several reaches of the San Joaquin River, Bear Creek, Deadman Creek, and Merced River.

Groundwater Resources

Four groundwater subbasins within the larger San Joaquin Valley Groundwater Basin underlie Merced County. The largest is Merced subbasin (Subbasin 5-22.04), followed by Turlock and Chowchilla subbasins, all to the east of the San Joaquin River, and the Delta-Mendota Groundwater subbasin to the west. The campus is located in the Merced Subbasin. This subbasin covers a surface area of approximately 491,000 acres (CA DWR, Bulletin 118), and includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The subbasin boundary on the southern border follows westerly along the Madera-Merced County Line (Chowchilla River) (DWR 2004). As stated in the MIRWMP, there are three groundwater aquifers in the Merced Subbasin: an unconfined aquifer, a confined aquifer, and an aquifer in consolidated rocks. The unconfined aquifer occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the western half of the subbasin at depths ranging from about 50 to 200 feet, except in the western and southern parts of the area where clay lenses occur and semi-confined conditions exist. The confined aquifer occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water (MIRWMP 2013). The unconsolidated deposits were laid down during the Pliocene Age to present, and include continental deposits, lacustrine and marsh deposits, older alluvium, younger alluvium and flood basin deposits. The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits (DWR 2004). The aquifer system in consolidated rocks occurs under both unconfined and confined conditions (MIRWMP 2013). The consolidated rocks include the Ione formation, the Valley Springs formation, and the Mehrten formation. In the eastern part of the subbasin, the consolidated rocks generally yield small quantities of water except for the Mehrten formation, which is an important aquifer (DWR 2004).

Groundwater flow in the Merced subbasin is generally from northeast to southwest following the regional dip of the basement rock and sedimentary units, although groundwater pumping creates localized cones of depression and irrigation may cause mounding, complicating flow patterns and causing them to change over time (Merced Groundwater Basin Groundwater Management Plan 1997). There were two depressions south and southeast of the City of Merced during 1999 (DWR 2004). The response of the aquifers to changes in pumping and irrigation is relatively rapid, and localized flow directions are affected by these changes.

Groundwater from the subbasin is used by the City of Merced (including UC Merced), other water districts and private users. The groundwater aquifer in the Merced Subbasin is not adjudicated, and because of this there are no defined legal pumping rights for the users and there are no legal constraints on groundwater pumping. In 2004, annual urban and agricultural extractions from the subbasin were estimated at 54,000 acre-feet (AF) and 492,000 AF, respectively; other extractions equal approximately 9,000 AF (DWR 2004). The 2013 MIRWMP projects water demand in the subbasin to be approximately 67,800 acre-feet per year (AFY) for municipal use, and approximately 365,700 AFY for agricultural use. Average annual agricultural water demands within the subbasin are projected to remain constant through 2035 (MIRWMP 2013).

Due to limited surface water supplies and the amount of pumping exceeding recharge, the Merced Subbasin has been operating under overdraft conditions for many years. The historical groundwater elevation maps indicate declining water levels and existence of several groundwater depressions in the Merced Subbasin. Well hydrographs for the area provide further evidence of declining groundwater levels and depletion of groundwater storage. Although the subbasin was classified as mildly overdrafted in the 2008 Merced Area Groundwater Pool Interests (MAGPI) Groundwater Management Plan (GWMP), the subbasin is included in the California Department of Water Resources (DWR) list of critically overdrafted basins. According to the DWR Bulletin 118, the average annual overdraft is estimated to be about 44,000 AFY. DWR's classification of the Merced subbasin as critically overdrafted will likely drive regional groundwater management policies for the next 20 years.

Groundwater Quality

The Merced Subbasin groundwater is generally calcium-magnesium bicarbonate at the basin interior, sodium bicarbonate to the west, and calcium-sodium chloride waters exist at the southwest corner of the basin (DWR 2004). Total dissolved solids (TDS) values in the eastern two-thirds of the Merced Subbasin generally measure less than 500 mg/L (MIRWMP 2013). In general, groundwater with high concentrations of TDS is present throughout the Merced Subbasin, generally located at depths between 400 to 800 feet. Saline waters originating from ancient marine sediments are migrating upward and mixing with freshwater in the basin. This process results from natural conditions; however, pumping of deep wells within the western and southern parts of the Merced Subbasin may cause these saline waters to upwell and mix with fresh water more rapidly than under natural conditions (MIRWMP 2013). The subbasin does have localized water quality impairments, including high hardness, iron, nitrate, and chloride.

Groundwater Management

To meet the requirements of the 1993 Groundwater Management Act (AB 3030), Merced Area Groundwater Pool Interests (MAGPI) entered into a Memorandum of Understanding (MOU) with the California DWR to support water management programs. In 1997, MAGPI published a Groundwater Management Plan (GWMP) update that describes the Merced Subbasin's physical characteristics, water quality conditions, and methods to sustain groundwater. In 2008, MAGPI updated the GWMP to address the legislative requirements of SB 1938 and SB 1672. The goal of these updates was to monitor, protect, and sustain groundwater in the Merced Subbasin.

In 2008, MAGPI established a subcommittee to encourage cooperative planning among additional aspects of water resources management beyond groundwater management and to lay the groundwork for development of the first Merced IRWM Plan (MIRWMP 2013). In 2012, MAGPI transferred responsibility for development of the MIRWMP to the interim Regional Water Management Group (RWMG), which is composed of the City of Merced, County of Merced, and Merced Irrigation District (MID). The interim RWMG is responsible for overseeing this first Merced IRWM planning process. The Merced IRWM process has been a strongly stakeholder-driven process. The RWMG is advised by a Regional Advisory Committee (RAC) that represents the broad interests of the Merced Region and shapes the direction of the IRWM program (MIRWMP 2013). The first Merced Integrated Regional Water Management Plan (MIRWMP) was adopted in 2013. The MIRWMP has identified the correction of overdraft conditions as one of the highest priorities for the region. Both the GWMP and the MIRWMP identify various strategies to address overdraft in the subbasin, including groundwater recharge, water conservation and education, conjunctive use of water resources, wastewater reclamation and recycling, and construction and operation of additional facilities.

In 2014, the SGMA was signed into law to provide a framework for management of groundwater supplies by local agencies and restricts state intervention, if required. SGMA provides an opportunity for local agencies overlying the basin to form a Groundwater Sustainability Agency (GSA), which is the primary agency responsible for achieving sustainability. As part of the region's compliance with SGMA, the County of Merced and water districts and cities within the Merced Subbasin formed three GSAs: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1). The three GSAs coordinated efforts to develop the GSP for the Merced Subbasin (Woodard & Curran 2019). The Draft GSP was published in July 2019, the final GSP was completed in November 2019. The GSAs have commenced proceedings to adopt and submit the final GSP to the California Department of Water Resources by January 31, 2020, for its approval.

SGMA requires that GSPs describe the projects and management actions to be implemented as part of bringing the Subbasin into sustainability. The primary means for achieving sustainability in the basin will be reduction in groundwater pumping achieved through implementation of an allocation framework to allocate the sustainable yield of the basin to the GSAs. A water allocation framework has been the subject of much discussion during GSP development. The GSAs have agreed that they intend to allocate water to each GSA but have not yet reached agreement on allocations or how they will be implemented. Such an agreement will be developed during GSP implementation (Woodard & Curran 2019).

The GSP identifies a shortlist of 12 priority projects that met a series of screening criteria for implementation as well as a longer list of possible future projects that were identified during GSP development. Projects will either increase surface water supplies to augment the sustainable groundwater yield or will increase groundwater recharge, which will in turn increase the amount of groundwater that may be sustainably used (Woodard & Curran 2019). The GSP also includes management actions to be implemented by the GSAs, including the development and implementation of an initial groundwater allocation framework and a demand reduction management action that includes implementation of programs to encourage voluntary reductions, and mandatory reductions if needed. Based on modeling of current and projected Subbasin conditions, absent implementation of any new supply-side or recharge projects, current agricultural and urban groundwater demand in the Merced Subbasin would need to be reduced by approximately 10 percent in order to balance out the change in groundwater storage over a long-term average condition.

As noted in the GSP, implementation of the GSP will be a substantial undertaking that will include implementation of the projects and management actions as well as GSAs administration, public outreach, implementation of the monitoring programs and filling data gaps, development of annual reports, and development of a 5-year update and report. The GSAs have developed an implementation schedule. Demonstration by 2040 of stable groundwater elevations on a long-term average basis, combined with the absence of undesirable results, will support a determination that the basin is operating within its sustainable yield, and thus that the sustainability goal has been achieved (Woodard & Curran 2019).

4.4.3 Regulatory Considerations

Federal Laws and Regulations

Clean Water Act

In 1972, the Federal Water Pollution Control Act—also known as and hereafter referred to as the Clean Water Act (CWA)—was amended to require National Pollutant Discharge Elimination System (NPDES) permits for discharge of pollutants into the "waters of the United States" that include oceans, bays, rivers, streams, lakes, ponds, and wetlands from any point source. In 1987, the CWA was amended to require that the U.S. EPA establish regulations for permitting under the NPDES permit program of municipal and industrial storm water discharges. The U.S. EPA published final regulations regarding storm water discharges on November 16, 1990. The regulations require that municipal separate storm sewer system (MS4) discharges to surface waters be regulated by an NPDES permit.

In addition, the CWA requires the states to adopt water quality standards for water bodies and have those standards approved by the U.S. EPA. Water quality standards consist of designated beneficial uses—e.g., wildlife habitat, agricultural supply, fishing, etc.—for a particular water body, along with water quality criteria necessary to support those uses. Water quality criteria are prescribed concentrations or levels of constituents—such as lead, suspended sediment, and fecal coliform bacteria—or narrative statements that represent the quality of water that supports a particular use. Because California has not established a complete list of acceptable water quality criteria, the U.S. EPA established numeric water quality criteria for certain toxic constituents in the form of the California Toxics Rule (40 CFR 131.38).

Water bodies not meeting water quality standards are deemed "impaired" and, under CWA Section 303(d), are placed on a list of impaired waters for which a Total Maximum Daily Load (TMDL) must be developed for the impairing pollutant(s). A TMDL is an estimate of the total load of pollutants from point, nonpoint, and natural sources that a water body may receive without exceeding applicable water quality standards (with a "factor of safety" included). Once established, the TMDL is allocated among current and future pollutant sources discharging to the water body.

CWA Permits for Discharge to Surface Waters

CWA Sections 401 and 402 contain requirements for discharges to surface waters through the NPDES program, administered by the U.S. EPA. In California, State Water Resources Control Board (SWRCB) is authorized by the U.S. EPA to oversee the NPDES program through the RWQCBs (see related discussion under **Porter-Cologne Water Quality Control Act**, below). The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits. The permit contains requirements of allowable concentrations of contaminates contained in the discharge.

Construction General Permit

The SWRCB administers the NPDES *General Permit for Discharges of Storm Water Runoff Associated with Construction Activity* (Construction General Permit). In order to cover a construction project disturbing 1 acre or more of land under the General Construction Permit, the entity responsible for the project must submit a Notice of Intent to the State Board prior to the beginning of construction. Effective July 1, 2010, all dischargers are required to obtain coverage under the Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009, as amended by 2010-0014-DWQ and 2012-006-DWQ.

The Construction General Permit requires that projects develop and implement a Storm Water Pollution Prevention Plan (SWPPP), identifying potential sources of pollution and specifying runoff controls during construction for the purpose of minimizing the discharge of pollutants in storm water from the construction area. The documents required to register the project under the Construction General Permit include a site map which shows storm water collection and discharge points, general topography both before and after construction, drainage patterns across the project site and "best management practices" (BMPs) to be followed during construction to minimize pollutant discharge. The permit registration documents also include a risk assessment, which determines the BMPs and the level of monitoring required during construction. The risk level is based on the potential for sediment transport and whether the project is in the watershed of a sediment-impaired water body. The SWPPP must list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

Municipal Separate Storm Sewer System Permit

In 1987, in recognition that diffuse, or non-point, sources were significantly impairing surface water quality, Congress amended the CWA to address non-point source storm water runoff pollution in a phased program requiring NPDES permits for operators of MS4s, construction projects, and industrial facilities. Phase I, promulgated in 1990, required permits for facilities of these types generally serving populations over 100,000, construction permits for projects five acres or greater, and industrial permits for certain industries. The Phase II program expanded on the Phase I program by requiring operators of small MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted storm water runoff. Phase II is intended to reduce these adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of storm water discharges. Under Phase II of the NPDES program, SWRCB has issued three general permits: (1) Municipal permits – required for operators of small MS4s, including universities, (2) Construction permits – required for projects involving one acre or more of construction activity, and (3) Industrial permits. The municipal permit requires development and implementation of a guidance document identifying all permit requirements. The goal of the guidance document or Storm Water Management Plan is to reduce the discharge of pollutants to the Maximum Extent Practicable, as defined by the U.S. EPA. "Minimum Control Measures" (MCMs) is the term used by the U.S. EPA for the six MS4 program elements aimed at achieving improved water quality through NPDES Phase II requirements.

Safe Drinking Water Act

The 1986 federal Safe Drinking Water Act requires each state to develop a wellhead protection plan to describe how areas around wells will be protected from potential contamination. A major element of a wellhead protection program is the determination of protection zones around public supply wellheads. Within these zones, potential protection measures could include limitations on land uses to preclude industrial or agricultural uses with the potential to result in spills of chemicals or overuse of fertilizers and other chemicals.

Federal Flood Insurance Program

Congress responded to increasing costs of disaster relief by passing the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. These acts reduce the need for large publicly funded flood control structures and disaster relief by restricting development on floodplains. FEMA administers the National Flood Insurance Program (NFIP) and issues FIRM for the areas participating in the program. These maps delineate flood hazard zones. The campus is not within a 100-year flood zone. It is located in Zone X, which is defined by FEMA as being outside the floodplain with a 0.2 percent annual chance of flooding.

State Laws and Regulations

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act), which is the state's clean water act, provides the statutory authority for SWRCB and the Regional Water Quality Control Boards (RWQCB) to regulate water quality and was amended in 1972 to extend the federal CWA authority to these agencies (see **Clean Water Act**, above). The Porter-Cologne Act established the SWRCB and divided the state into nine regions, each overseen by a RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, but much of the daily implementation of water quality regulations is carried out by the nine RWQCBs.

Under the Porter-Cologne Act, the RWQCBs are given the responsibility and authority to prepare water quality plans for areas within the region (Basin Plans), identify water quality objectives, and issue NPDES permits and Waste Discharge Requirements (WDRs). Water quality objectives are defined as limits or levels of water quality constituents and characteristics established for reasonable protection of beneficial uses or prevention of nuisance. NPDES permits, issued by RWQCBs pursuant to the CWA, also serve as WDRs issued pursuant to the Porter-Cologne Act. WDRs are also issued for discharges that are exempt from the CWA NPDES permitting program, discharges that may affect waters of the state that are not waters of the United States (i.e., groundwater), and/or wastes that may be discharged in a diffused manner. WDRs are established and implemented to achieve the water quality objectives (WQOs) for receiving waters as established in the Basin Plans, as described below. Sometimes they are combined WDRs/NPDES permits.

Basin Plan

The Porter-Cologne Act provides for the development and periodic review of water quality control plans (also known as basin plans). The basin plan for the Central Valley Region, which encompasses both the Sacramento River and San Joaquin River Basins, designates beneficial uses for the area's surface and groundwater resources. **Table 4.4-1, Beneficial Uses Identified in Basin Plan for Potential Receiving Waters and Groundwater Basin in the Project Area** presents the beneficial uses identified in the Basin Plan for the water bodies in the project area. The Basin Plan also includes water quality objectives for all surface waters in its region, including San Joaquin River. Specific objectives are provided for the larger water bodies within the region as well as general objectives for surface and groundwater. In general, narrative objectives require that degradation of water quality not occur because of increases in pollutant loads that will impact the beneficial uses of a water body. Water quality criteria apply within receiving waters and do not apply directly to runoff. Basin plans are primarily implemented by using the NPDES permitting system to regulate waste discharges so that water quality objectives are met. The closest receiving water body to the proposed project that has water quality objectives set by the CVRWQCB is the San Joaquin River. Specific objectives for concentrations of chemical constituents are applied to bodies of water based on their designated beneficial uses. Water quality objectives applicable to all groundwaters have been set for bacteria, chemical constituents, radioactivity, tastes and odors, and toxicity (CVRWQCB 2018).

California Water Code

The use of water in the State is governed by the California Water Code or Title 23 of the California Code of Regulations. Title 23 requires that water resources must be put to beneficial use to the fullest extent of which they are capable, and that the waste, unreasonable use, or unreasonable method of use of water is illegal. The conservation of water is encouraged as a reasonable and beneficial use in the interest of the people and for the public welfare.

Groundwater Management Legislation

Several new and existing laws provide framework for groundwater management in the state. The Groundwater Management Act (AB 3030), which took effect in 1993, permitted certain local agencies to develop groundwater management plans. SB 1938 which was enacted in 2002 requires agencies to prepare and implement groundwater management plans to remain eligible for funding administered by the Department of Water Resources for groundwater or groundwater quality projects. In 2009, SB X7-6 established a program for tracking seasonal and long-range groundwater elevation trends in hundreds of California basins. AB 359, that was passed in 2011, requires local agencies to identify recharge areas in groundwater management plans in order to seek state funding for groundwater projects.

Table 4.4-1
Beneficial Uses Identified in Basin Plan for Potential Receiving Waters and Groundwater Basin in the Project Area [1]

	MUN	AGR		IND			Recreation			Freshwater Habitat		Migration		Spawning		Wild	NAV
							REC 1		REC 2								
		Irrigation	Stock watering	Process	Service Supply	Power	Contact	Canoeing and Rafting	Other noncontact	Warm	Cold	Warm	Cold	Warm	Cold	Wildlife habitat	Navigation
Surface Water																	
San Joaquin River (Sac Dam to the mouth of the Merced River)	P	E	E	E			E	E	E	E		E	E	E	P	E	
Yosemite Lake							E		E	E	E					E	
Groundwater Basin																	
Merced	P*	P*	P*	P*	P*												

Source: Central Valley RWQCB 2018.
Notes:
[1] *Only uses allowed in project area; see Basin Plan for other categories of beneficial uses.*
P = Potential Beneficial Use.
E = Existing Beneficial Use.
P= Unless otherwise designated by the Regional Water Board, all groundwaters in the Region are considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply (MUN), agricultural supply (AGR), industrial service supply (IND), and industrial process supply (PRO) (RWQCB 2018).*

Sustainable Groundwater Management Act (SGMA)

SGMA, a three-bill legislative package composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), was passed in September 2014. The legislation provides a framework for sustainable management of groundwater supplies by local authorities, with a limited role for state intervention when necessary to protect the resource. The legislation lays out a process and a timeline for local authorities to achieve sustainable management of groundwater basins. It also provides tools, authorities and deadlines to take the necessary steps to achieve the goal. For local agencies involved in implementation, the requirements are significant and can be expected to take years to accomplish. The State Water Resources Control Board may intervene if local agencies do not form a Groundwater Sustainability Agency (GSA) and/or fail to adopt and implement a Groundwater Sustainability Plan (GSP). The SGMA implementation steps and deadlines are shown in **Table 4.4-2, Sustainable Groundwater Management Act Implementation Steps and Deadlines.**

Table 4.4-2
Sustainable Groundwater Management Act
Implementation Steps and Deadlines

Implementation Step	Implementation Measure	Deadlines
Step One	Local agencies must form local Groundwater Sustainability Agencies (GSAs) within two years	June 30, 2017
Step Two	Agencies in basins deemed high- or medium-priority must adopt Groundwater Sustainability Plans (GSPs) within five to seven years, depending on whether a basin is in critical overdraft	January 31, 2020 for critically overdrafted basins January 31, 2022 for high- and medium-priority basins not currently in overdraft
Step Three	Once plans are in place, local agencies have 20 years to fully implement them and achieve the sustainability goal	January 31, 2040 for critically overdrafted basins January 31, 2042 for high- and medium-priority basins not currently in overdraft

SGMA applies to basins or subbasins designated by the DWR as high- or medium-priority basins, based on a statewide ranking that uses criteria including population and extent of irrigated agriculture dependent on groundwater. The 2018 Draft Basin Prioritization indicates that 109 of California's 517 groundwater basins and subbasins are high- and medium-priority basins. The Merced Subbasin is classified as a Critically Overdrafted Basin and a High Priority Basin.

As discussed above in **Section 4.4.2** under Groundwater Resources, the three GSAs that are responsible for the Merced Subbasin have completed a final GSP. The GSAs have commenced proceedings to adopt and submit the final GSP to the California Department of Water Resources by January 31, 2020, for its approval.

Local Plans and Policies

UC Sustainability Policy

UC Sustainable Practices Policy (Sustainability Policy) sets forth policy goals in nine areas of sustainable practices, including sustainable water systems. The policy notes the following:

I. Sustainable Water Systems With the overall intent of achieving sustainable water systems and demonstrating leadership in the area of sustainable water systems, the University has set the following goals applicable to all locations:

1. Locations will reduce growth-adjusted potable water consumption 20% by 2020 and 36% by 2025, when compared to a three-year average baseline of FY2005/06, FY2006/07, and FY2007/08. Locations that achieve this target early are encouraged to set more stringent goals to further reduce potable water consumption. Each Campus shall strive to reduce potable water used for irrigation by converting to recycled water, implementing efficient irrigation systems, drought tolerant planting selections, and/or by removing turf.

2. Each location will develop and maintain a Water Action Plan that identifies long term strategies for achieving sustainable water systems. The next update of the plan shall be completed in December 2016.

3. Each campus shall identify existing single pass cooling systems and constant flow sterilizers and autoclaves in laboratories and develop a plan for replacement.

4. New equipment requiring liquid cooling shall be connected to an existing recirculated building cooling water system, new local chiller vented to building exhaust or outdoors, or to the campus chilled water system through an intervening heat exchange system if available.

With regard to Water Action Plans, the policy notes:

> *"Each Water Action Plan will include a section on Water Usage and Reduction Strategies that describes the applicable types of water comprising water systems, including but not limited to potable water, non-potable water, industrial water, sterilized water, reclaimed water, stormwater, and wastewater; reports water usage in accordance with the methods set forth in these procedures; considers setting more stringent potable water reduction goals if the location has already achieved a 36% below baseline reduction in per capital potable water consumption; outlines location-specific strategies for achieving the target for reduced potable water consumption; encourages implementation of innovative water-efficient technologies as part of capital projects and renovations (e.g., installation of WaterSense certified fixtures and appliances, graywater reuse, rainwater harvesting, and watershed restoration); addresses use of non-potable water sources, and*

how those sources factor into overall sustainable water systems strategy; and analyzes the identified water use reduction strategies using a full cost approach."

"Each Water Action Plan will include a section on Stormwater Management developed in conjunction with the location stormwater regulatory specialist that: (a) addresses stormwater management from a watershed perspective in a location-wide, comprehensive way that recognizes stormwater as a resource and aims to protect and restore the integrity of the local watershed(s); (b) references the location's best management practices for preventing stormwater pollution from activities that have the potential to pollute the watershed (e.g., construction; trenching; storage of outdoor equipment, materials, and waste; landscaping maintenance; outdoor cleaning practices; vehicle parking); (c) encourages stormwater quality elements such as appropriate source control, site design (low impact development), and stormwater treatment measures to be considered during the planning stages of projects in order to most efficiently incorporate measures to protect stormwater quality."

UC Merced Water Action Plan

In 2014, in compliance with the Sustainability Policy, UC Merced prepared a Water Action Plan that includes all the required elements, including: (1) targets and actions to reduce consumptive use of water, and (2) targets and actions to manage stormwater and protect the watershed (UC Merced 2014). The WAP includes education and outreach, and identifies the following actions for some of the major goals included in the plan:

Reduce Water Use on the Campus

Short Term Actions (0-3 Years)

- Implement landscape irrigation practices meeting or exceeding AB 1881 (Model Water Efficient Landscape Ordinance)
- Meet or exceed "Urban Water Conservation" elements of SB X7-7 (Water Conservation Act of 2009)
- Complete Sustainable Sites Initiative pilot landscape around SE2 building
- Maximize USGBC LEED water conservation credits for LEED-NC and LEED-EBOM
- Maximize AASHE STARS water conservation credits
- Install weather-controlled, ET landscape water monitoring system
- Meter, monitor and share UCM real-time water use data using online dashboards
- Transition unnecessary turf to energy smart, California-friendly landscapes or hardscape

Intermediate Term Actions (3-5 Years)

- Implement campus landscape master plan
- Consider adopting Sustainable Sites Initiative Guidelines and Performance Benchmarks
- Create demonstration arboretum for energy smart, Central Valley-friendly plantings

Long Term Actions (5-10 Years)

- Explore developing student internships for implementation of water neutrality projects

Implement Innovative Water-Efficient Technologies

Short Term Actions (0-3 Years)

- Maximize USGBC LEED water conservation credits for LEED-NC and LEED-EBOM
- Maximize AASHE STARS water conservation credits
- Optimize water early leak detection by leveraging Badger Meter Beacon system
- Install only U.S. EPA WaterSense and/or Energy Star approved fixtures and appliances
- Explore using water budgets as a tool to foster innovation and creativity in water efficiency
- Experiment with monitoring-based commissioning approach to water use reduction and leak detection
- Conduct regular campus water audits

Intermediate Term Actions (3-5 Years)

- Consider piloting use of low-flow water measurement sensors in residence halls
- Consider water-efficient and conservation practices for campus cooling towers and central plants

Long Term Actions (5-10 Years)

- Explore feasibility and implementation of distributed wastewater treatment opportunities such as on-site wastewater treatment facility
- Explore amending campus planning, design and construction policies to require leading- edge sustainable water systems
- Explore the use of full-cost pricing in analyzing payback periods for sustainable water systems

Protect & Restore Integrity of Local Watershed

Short Term Actions (0-3 Years)

- Continue reducing stormwater runoff volume and improve water quality
- Maximize USGBC LEED and AASHE STARS stormwater credit

Intermediate Term Actions (3-5 Years)

- Explore creation of applied model for UCM watershed
- Incorporate green infrastructure and low-impact development strategies into site design in order to manage 30-50% of total volume runoff on-site
- Continue incorporating retention basins into site design and development to capture 100% of campus stormwater under normal precipitation conditions

Long Term Actions (5-10 Years)

- Explore feasibility and implementation of distributed wastewater treatment opportunities such as on-site wastewater treatment facility
- Explore feasibility of using captured rainwater for irrigation and non-potable use in buildings

Prevent Stormwater Pollution Resulting from Campus Activities

Short Term Actions (0-3 Years)

- Include and coordinate stormwater management plan with 2020 project
- Continue labeling stormwater inlets to remind constituents that dumping in the storm sewer is harmful to water quality
- Develop and implement a campus and community outreach program on the importance of keeping campus free of trash and other threats to stormwater quality
- Inventory herbicides and pesticides used on campus to assess risk they may have to stormwater

Intermediate Term Actions (3-5 Years)

- Develop and implement UC Merced's Stormwater Management Plan (SWMP) based on mitigation of UC Merced campus high-risk pollutants

<u>*Long Term Actions (5-10 Years)*</u>

- Continue to implement campus SWMP and revise as needed to address emerging threat to stormwater

Protect Stormwater Quality

<u>*Short Term Actions (0-3 Years)*</u>

- Include stormwater monitoring and protection measures in construction contract language
- Develop and implement a campus and community outreach program on the importance of keeping campus free of trash and other threats to stormwater quality
- Inventory herbicides and pesticides used on campus to assess the risk they may pose to stormwater

<u>*Intermediate Term Actions (3-5 Years)*</u>

- Develop and implement UC Merced's Stormwater Management Plan (SWMP) based on mitigation of UC Merced campus high-risk pollutants

<u>*Long Term Actions (5-10 Years)*</u>

- Continue to implement the campus SWMP and revise as needed to address emerging threats to stormwater

4.4.4 Impacts and Mitigation Measures

Significance Criteria

This SEIR uses significance criteria derived from Appendix G of the *State CEQA Guidelines*. For the purpose of this SEIR, impacts related to hydrology and water quality would be significant if implementation of the 2020 LRDP would:

- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would result in:
  - substantial erosion or siltation on or off site;
  - substantially increase the rate or amount of surface runoff in a manner which would result in flooding on or off site;

  - create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems, or provide substantial additional sources of polluted runoff; or
  - Impede or redirect flood flows; or
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

Issues Not Discussed Further

The following CEQA checklist issues are not evaluated further in this SEIR because they are adequately addressed in the 2009 LRDP EIS/EIR.

- violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality

Construction Activities under the 2020 LRDP

Impacts on water quality from the development of the campus were evaluated in the 2009 LRDP EIS/EIR and were found to be less than significant. As with the 2009 LRDP, construction activities under the Draft 2020 LRDP could result in soil erosion and release of sediment into receiving waters. However, according to federal law, all construction projects that involve disturbance of more than 1 acre of land are subject to NPDES regulations related to stormwater. All such projects are required by law to prepare and implement a SWPPP during construction. The SWPPP must be kept on site during construction activity and made available upon request to representatives of the RWQCB. The objectives of the SWPPP are to (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity; and (2) identify, construct, and implement stormwater pollution prevention measures to reduce pollutants in stormwater discharges during and after construction. The SWPPP is required to include a description of potential pollutants and the manner in which sediments and hazardous materials present on site during construction (including vehicle and equipment fuels) would be managed. The SWPPP must also include details of how the sediment and erosion control BMPs would be implemented. Adherence to NPDES regulations would ensure that adverse impacts on water quality from construction activities on the campus are avoided.

Campus Operations under the 2020 LRDP

Direct and indirect impacts on water quality from campus operations were evaluated in the 2009 LRDP EIS/EIR and were found to be less than significant. Direct water quality impacts could result from discharge of stormwater pollutants into receiving waters, and indirect water quality impacts could result from the discharge of treated wastewater effluent. As with the 2009 LRDP, campus operations under the

Draft 2020 LRDP could result in direct and indirect impacts on water quality. However, for the same reasons noted in the 2009 LRDP EIS/EIR and set forth below, the impacts on water quality would be less than significant.

Stormwater Discharges

As with the 2009 LRDP, construction activities associated with the implementation of the 2020 LRDP would involve site grading and excavation activities that could cause erosion and sedimentation that could degrade the receiving water quality. Spills or leaks from heavy equipment and machinery (petroleum products and other heavy metals) in staging areas and building sites could also adversely affect receiving water quality. To reduce or eliminate construction-related water quality effects and to comply with the requirements of the CWA, before onset of any construction activities, as required by law, UC Merced or its contractor(s) would obtain coverage under the State NPDES General Construction Permit. UC Merced would be responsible to ensure that construction activities comply with the conditions in this permit, which requires development of a SWPPP, implementation of BMPs identified in the SWPPP, and monitoring to ensure that effects on water quality are avoided or minimized. Compliance with the state law would ensure that the water quality impact from construction activities would be less than significant. Further, the 2020 LRDP would limit almost all of the planned development to the area designated CMU and would therefore involve disturbance of less land area than the area analyzed under the 2009 LRDP. This impact is adequately addressed in the 2009 LRDP EIS/EIR.

Wastewater Discharges

As with the 2009 LRDP, implementation of the 2020 LRDP would not result in discharges that would cause the City of Merced's wastewater treatment plant (WWTP) to violate water quality standards or waste discharge requirements. Wastewater generated on the campus is currently discharged to the City of Merced sewer system and is treated at the City's WWTP. Wastewater generated on the campus under the proposed 2020 LRDP would also be collected and conveyed to the WWTP for treatment and disposal. The City of Merced WWTP discharges treated effluent under a waste discharge requirement order (WDR) from the RWQCB. The WDR establishes limits on the volume and concentrations of constituents in the treated effluent that is discharged by the WWTP. An exceedance of a WDR can occur under two conditions: the total volume of wastewater received by the WWTP exceeds the plant's treatment capabilities, or the wastewater contains constituents that cannot be adequately treated by the WWTP such that discharge of treated effluent exceeds the permit limits established in the WWTP's WDR.

The 2020 LRDP is not anticipated to produce a substantial increase in wastewater and would be within the treatment capacity of the WWTP (See **Section 4.10, Utilities and Service Systems**). Wastewater from the campus under the 2020 LRDP would be similar to wastewater discharged from other parts of the City and would not contain constituents that could cause the City's WWTP to exceed the waste discharge requirements that apply to the discharge of treated effluent. The use of hazardous materials, including biohazardous materials, would occur in the teaching and research laboratories on the campus. The Campus Department of Environmental Health and Safety (EH&S) has developed and implemented comprehensive programs to handle these wastes on the campus. EH&S has established drain disposal guidelines for all campus laboratories. These guidelines prohibit the discharge of hazardous materials into sinks and drains on the campus. As campus development under the 2020 LRDP would adhere to EH&S requirements and also comply with State law, it would not discharge effluent that could cause the WWTP to exceed the WWTP's waste discharge requirements and thereby result in a significant impact on water quality. This impact is adequately addressed in the 2009 LRDP EIS/EIR.

Methodology

The impacts of campus development on surface water hydrology, water quality, and the groundwater resources are analyzed qualitatively based on the proposed 2020 LRDP. A quantitative evaluation is not possible given the programmatic nature of the proposed LRDP.

4.4.5 LRDP Impacts and Mitigation Measures

LRDP Impact HYD-1: Campus development under the 2020 LRDP would not substantially interfere with groundwater recharge nor substantially decrease groundwater supplies. (*Less than Significant*)

Interfere with Groundwater Recharge

Development of additional impervious surfaces such as new buildings, roads, paths and parking lots, would occur on the campus under the 2020 LRDP, which would normally have the potential to reduce recharge of the underlying aquifer. However, campus development under the 2020 LRDP would not substantially reduce recharge compared to existing conditions for a number of reasons. The campus is located in an area that is known to have soil types with low to moderate recharge potential. There are substantial amounts of clay in the campus site soils, which restrict the ability of surface water to percolate into the groundwater aquifer. Also, there is a clay hard pan near the ground surface that further inhibits the potential of surface water to infiltrate down to the groundwater aquifer. Therefore, groundwater recharge under pre-development conditions is generally low on the campus site. Second, compared to the 2009 LRDP, campus development under the 2020 LRDP would be more compact and limited to the 274-acre area designated CMU. Further, the Campus's Water Action Plan sets forth a number of near- and long-term actions that include: (1) incorporating green infrastructure and low-impact development strategies into site design in order to manage 30 to 50 percent of total volume runoff on-site, and (2) continue incorporating retention basins into site design and development to capture 100 percent of campus stormwater under normal precipitation conditions. Therefore, implementation of the 2020 LRDP would not substantially interfere with recharge such that aquifer volume would be affected, and the impact related to groundwater recharge would be less than significant.

With respect to small-scale projects that may be located within lands designated CMU, CBRSL or ROS, due to the small size and nature of these projects and for the same reasons set forth above, they would be unlikely to substantially affect groundwater recharge. The impact would be less than significant.

Decrease Groundwater Supplies

As discussed in **Section 4.10, Utilities and Service Systems** under **LRDP Impact UTL-1**, the 2009 LRDP EIS/EIR analyzed the potential impacts of campus development under the 2009 LRDP on water supply, based on the assumption that by 2030, campus enrollment would increase to 25,000 students and that the campus would have an employee population of 6,560 faculty and staff for a total of 31,560 persons. The 2009 LRDP EIS/EIR estimated a water demand of 2,387 AFY for the campus by 2030 and compared it to 8,073 AFY included for the campus in the City's 2005 Urban Water Management Plan (UWMP). As noted in **Section 3.0, Project Description**, UC Merced is now expected to grow at a slower pace than originally anticipated, such that by 2030, the enrollment level is expected to be 15,000 students, and the faculty and staff projection for 2030 is also substantially lower than previously projected and analyzed in the 2009 LRDP EIS/EIR. Additionally, in 2015, the City prepared and adopted a new UWMP, and in 2017 SGMA was passed that requires sustainable management of groundwater supplies by local authorities and lays out a process and a timeline for local authorities to achieve sustainable management of groundwater basins. Given this change in the proposed project and the conditions in which it would be implemented, the impact of campus development under the 2020 LRDP was evaluated for its potential to decrease groundwater supplies.

As noted under **LRDP Impact UTL-1**, based on a water use factor of 31.4 gallons per capita per day (gpcd) and the revised 2030 population projections for the campus, projected water demand for the campus was estimated to be approximately 623 AFY by 2030 (WYA 2018).[1] This estimate is considered conservative because it does not take into account further reductions in campus water use due to UC Merced's implementation of its Water Action Plan in compliance with the UC Sustainable Practices

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1 In 2019, UC Merced revised its 2030 population projection down to include a smaller increase in faculty and staff than previously projected in 2018. Please see memorandum in **Appendix 4.10** which shows that based on the revised population projection, the campus's 2030 water demand would be about 612 AFY, and not 623 AFY. As a result, the water demand estimate in the WSE and in the impact analysis above is a conservative estimate.

Policy. As noted above, the UC Merced Water Action Plan includes a number of short-term (within 0 to 3 years), intermediate-term (within 3 to 5 years), and long-term (within 5 to 10 years) actions to reduce water use on the campus. These actions include, but are not limited to, implementation of landscape irrigation practices meeting or exceeding AB 1881 (Model Water Efficient Landscape Ordinance); meeting or exceeding "Urban Water Conservation" elements of SB X7-7 (Water Conservation Act of 2009); installing weather-controlled, ET landscape water monitoring system; transitioning unnecessary turf to energy smart, California-friendly landscapes or hardscape; optimizing water early leak detection by leveraging Badger Meter Beacon system; installing only U.S. EPA WaterSense and/or Energy Star approved fixtures and appliances; conducting regular campus water audits; considering piloting use of low-flow water measurement sensors in residence halls; exploring the feasibility and implementation of distributed wastewater treatment opportunities such as on-site wastewater treatment facility; and considering water-efficient and conservation practices for campus cooling towers and central plants.

The City's 2015 UWMP estimated and included a demand of 1,406 AFY for the campus in 2030. The total demand of 623 AFY associated with the campus under the 2020 LRDP is substantially less than 1,406 AFY of campus water demand anticipated in the City's UWMP. For comparison purposes, the total water demand in the City's service area in 2030 would be 30,006 AFY. The campus' demand would represent about 2.1 percent of the City's total demand. The 2015 UWMP concluded that the City of Merced has an adequate groundwater supply to meet water demands during normal, single-dry, and multi-dry years (WYA 2018). Furthermore, as noted in the 2015 UWMP, groundwater extraction has been reduced since 2013 in response to severe drought conditions. It is anticipated that the amount of groundwater being pumped will not rebound to pre-drought levels because the City recently became fully metered and water conservation measures will remain in effect. UC Merced would also continue to minimize its water use and implement the short-, intermediate-, and long-term actions set forth in its Water Action Plan.

As discussed in **Section 4.4.2**, the three GSAs that manage the Merced Subbasin have completed their GSP which lists priority projects and management actions that the GSAs will implement to reduce water demand, recharge the basin, and increase supply from non-groundwater sources. Plan implementation is to begin in early 2020. As noted earlier, based on modeling of current and projected subbasin conditions, absent implementation of any new supply-side or recharge projects, current agricultural and urban groundwater demand in the Merced Subbasin would need to be reduced by approximately 10 percent in order to balance out the change in groundwater storage over a long-term average condition. As described above, the City's 2015 UMWP includes a water demand projection for the UC Merced campus of 1,406 AFY. This water demand projection was developed based on a larger buildout population and a higher per capita water use by 2030. As noted in the WSE, the previous UC Merced water use factor of 39 gallons per capita per day (gpcd) has been reduced to 31.4 gpcd based on actual water use data for the last 10 years on the UC Merced campus, a reduction of about 19.5 percent. Thus, the projected UC Merced water demand by 2030 is currently estimated to be approximately 623 AFY. This projected water demand is 56 percent lower than the projected water demand for the campus included in the City's 2015 UWMP. Therefore, on both a per capita basis and total demand basis, the Campus has reduced its demand substantially from previous levels and the reductions are significantly more than the required 10 percent water demand reduction identified in the GSP to bring the groundwater subbasin into balance. The Campus is continuing to implement actions to reduce use of potable water. The Campus will also continue to work with the City and MID to identify other sources of water, including the use of canal water for irrigation and other non-potable uses.

In summary, although the Merced Subbasin is in a state of overdraft, the overdraft in itself is not a limitation on the City's ability to draw water from the aquifer. Additionally, UC Merced would implement its Water Action Plan to reduce water demand and facilitate recharge. Further, the City and MID are proactively managing the subbasin to reverse the overdraft trend. Although the implementation of the 2020 LRDP would increase the amount of groundwater that would be withdrawn from the Merced Subbasin compared to existing conditions, however, the amount is substantially less than the amount accounted for UC Merced in the City's UWMP and may be an even smaller amount with the implementation of the UC Merced Water Action Plan. Therefore, the project would not require extraction of groundwater in excess of what is planned and due to the relatively small amount involved, would not, in itself, substantially decrease groundwater supplies. The impact would be less than significant.

With respect to small-scale projects that may be located within lands designated CMU, CBRSL or ROS, due to the small size and nature of these projects and for the same reasons set forth above, they would be unlikely to substantially decrease groundwater supplies. The impact would be less than significant.

Mitigation Measures: No mitigation is required.

LRDP Impact HYD-2: Campus development under 2020 LRDP would not substantially alter the existing drainage pattern of the campus site through alteration of a water course or through the addition of impervious surfaces such that it would result in substantial erosion or siltation on or off site, result in flooding on or off site, contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems, or impede or redirect flood flows. ***(Less than Significant)***

Historically, the campus site was not served by a storm drain system. Storm water that fell on the site would sheet flow in a southerly direction. With the construction of the two on-site canals, Fairfield and Le Grand Canals, the flow of storm water runoff was interrupted in various locations, causing storm water to pond on the upgradient side of the canal levees. This condition still continues. Historically, the runoff from the east side of the campus site generally sheet-flowed in a southeasterly direction onto adjacent lands where it would evaporate or percolate. Storm water from the western portion of the campus site that did not percolate would run offsite in a southerly to southwesterly direction to eventually drain into Cottonwood Creek. Historically, the headwaters of the creek were located on the campus site but were cut off with the construction of the canals and the Merced Hills Golf Course prior to the acquisition of the site by the University for the campus. The creek at the present time is located within the irrigation pivot area in the southern portion of the campus site. It runs in a south southwesterly direction on the east side of Lake Road, crossing under Lake Road in a culvert near Cardella Road, to continue east to its confluence with Fahrens Creek. Historically, some flooding occurred on the east side of Lake Road due to a capacity constraint in the culvert under Lake Road.

With the development of the Phase 1 campus and the ongoing 2020 Project, storm water from developed surfaces is collected by the campus storm drain system and discharged into a number of detention facilities that are designed to hold flows from a 100-year, 24-hour storm. The collected storm water either percolates or evaporates and is not discharged off site at this time.

At the time that the 2009 LRDP EIS/EIR was prepared, it was anticipated that increased runoff from most of the campus would be disposed of in Fairfield Canal. The 2009 LRDP EIS/EIR noted that with the development of the campus, the on-site drainage pattern would be altered and additional runoff that is generated would be collected by the storm drainage system, detained, and then discharged into Fairfield Canal at a discharge rate established by MID. Because the canal is not used during fall and winter to convey irrigation water, under normal conditions, Fairfield Canal would have capacity to handle the storm water discharged by the campus. To ensure that storm water in excess of the capacity of the canal is not discharged into the canal, MID would install water elevation detectors in the canal which would determine when releases to the canal would be allowed. MID indicated that in the event that the entire capacity of Fairfield Canal is needed to convey floodwaters from Lake Yosemite, the campus's storm water detention facilities must be designed to hold runoff from large storm events until such time that capacity in the canal becomes available to receive campus runoff. Therefore, storm water detention facilities would be designed to detain storm water flows that would result from a 100-year, 24-hour storm event. Because storm water from a small southerly portion of the campus was expected to continue to discharge into Cottonwood Creek, the 2009 LRDP EIS/EIR noted that the increased runoff from that area would also be detained in a detention basin along the east side of Lake Road and released at an appropriate rate such that no downstream flooding in Cottonwood Creek would occur. The 2009 LRDP EIS/EIR concluded that with the provision of adequate detention facilities, the increased runoff from campus development would not result in off-site flooding, erosion, or siltation.

As with the prior LRDP, existing drainage patterns would be altered by the construction of new facilities under the 2020 LRDP. However, the area on the campus site that would be developed would be limited to about 274 acres of CMU lands. This area does not include the current alignment of Cottonwood Creek, and the creek would not be directly altered. New construction would, however, have the potential to increase the rate and amount of runoff, and if the runoff were to be discharged uncontrolled to surface waters, it could result in (or exacerbate) flooding as well as potential hydromodification (i.e., erosion and scour) in downstream drainages. However, such downstream impacts would be avoided. New development on the campus would comply with UC Sustainable Practices Policy and the UC Merced Water Action Plan which requires that the integrity of the local watershed be protected and restored, and sets forth a number of short-term, intermediate-term and long-term actions for the campus to implement, including but not limited to: continue reducing storm water runoff volume and improve water quality; maximize USGBC LEED and AASHE STARS storm water credit; explore creation of applied model for UC Merced watershed; incorporate green infrastructure and low-impact development strategies into site design in order to manage 30 to 50 percent of total volume runoff on-site. Further, the Campus will continue incorporating retention and detention basins and other stormwater features into site design and development; these basins would be operated so that all flows under normal rainfall conditions would be retained and under larger storm conditions including the 100-year, 24-hour storm, the flows would be detained and released at rates that would not exceed the existing peak and total flows. Ample land is available on the campus site for the development of storm water detention and retention facilities.

Lastly, no portion of the campus site is within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map. Further, there are no water courses within the CMU area of the campus that would be developed with new facilities. Therefore, no impact related to impeding or redirecting flood flows would occur.

In summary, campus development under 2020 LRDP would generate increased storm water runoff, but with the implementation of LID strategies and green infrastructure as well as the provision of storm water detention and retention facilities, UC Merced would control both the peak flows and the total volume of storm water runoff before discharge into any receiving waters and would avoid potential flooding and erosion/siltation impacts in downstream areas. The impact from changes in storm water runoff from campus development would be less than significant.

With respect to small-scale projects that may be located within lands designated CMU, CBRSL or ROS, due to the small size and nature of these projects and for the same reasons set forth above, they would be unlikely to substantially alter storm water flows. The impact would be less than significant.

Mitigation Measures: No mitigation is required.

4.4.6 Cumulative Impacts and Mitigation Measures

Cumulative Impact C-HYD-1: Development of the campus under the 2020 LRDP, in conjunction with other past, present, and reasonably foreseeable future development in the project area, could cumulatively increase surface runoff but would not increase local and regional flooding. (*Less than Significant*)

Development of the campus under the proposed LRDP would increase the total amount of impervious surfaces and therefore increase surface runoff within the on-site watersheds. This increased runoff would discharge into Bear Creek via Cottonwood Creek. Other development in the project area would also increase the amount of impervious surfaces in the project area and increase stormwater discharges to Bear Creek. Cumulative effects are, therefore, discussed below in terms of the effects on Bear Creek.

Like other creeks of the Merced Streams Group, Bear Creek has historically experienced serious flooding problems that have stemmed from the lack of channel capacity which is aggravated by erosion and overgrowth of vegetation within the channel. Furthermore, high flows of moderate duration in this creek and other streams occur from intense rainstorms and result in flash flooding. In addition, snowmelt in the Sierra can produce high flows of longer duration during the spring. Channel capacity, especially within Bear Creek, has become even more inadequate relative to the flows as more impervious surfaces have been added in the creek's watershed, causing increased runoff to be discharged to the creek.

UC Merced would release some limited stormwater into Cottonwood Creek, which is a tributary to Bear Creek. As discussed above, the stormwater control system for the campus would include on-site retention and detention facilities that would be operated so that all flows under normal rainfall conditions would be retained and under larger storm conditions including the 100-year, 24-hour storm, the flows would be detained and released at rates that would not exceed the existing peak and total flows. This would preclude downstream flooding. Similarly, all other development in the watershed of Bear Creek would also be required to detain additional storm water generated by new impervious surfaces. The City of Merced Vision 2030 General Plan requires new development to use existing detention facilities or construct storm water detention facilities as part of new development. Because additional storm water runoff will be controlled and discharged at rates that would reduce the potential for flooding, the cumulative impact related to flooding is considered to be less than significant.

Mitigation Measures: No mitigation is required.

Cumulative Impact HYD-2: **Development of the campus under the 2020 LRDP, in conjunction with other past, present, and reasonably foreseeable future development in the project area, would not substantially interfere with groundwater recharge but would deplete groundwater supplies and contribute to the overdraft of the regional groundwater aquifer. (*Significant; Significant and Unavoidable*)**

The Merced Subbasin is the primary source of water in eastern Merced County and serves the water demand of urban areas as well as agricultural areas, although agricultural land uses also use surface water delivered by MID. The subbasin has a surface area of about 491,000 acres, and a total storage capacity of 15.7 million AF to a depth of 300 feet, and 42.2 million AF to the base of fresh water. DWR has estimated that the natural recharge into the basin to be 47,000 AF, and the City estimates that the applied recharge is about 243,000 AF. Extractions for urban and agricultural uses are 54,000 AF and 492,000 AF respectively, with another 9,000 AF of other extractions. Surface inflow values have not been determined (City of Merced 2012). As of 2007, the subbasin is in a state of mild decline with a cumulative decrease in storage of approximately 720,000 AF from about 1980 to 2007 (City of Merced 2012). Based on monitoring data, average groundwater levels in the subbasin declined by about 14 feet between 1980 and 2010 (City of Merced 2012). As noted earlier, the subbasin is listed by the state among the basins that are in critical overdraft.

Impact Related to Groundwater Recharge

Urban development within the subbasin would increase the amount of land area that is under impervious surfaces and would thereby have the potential to reduce recharge of the underlying aquifer. However, the City requires new development to minimize impervious surfaces and to collect and discharge runoff from new impervious surfaces into stormwater detention basins that are either existing or built as part of new development. Runoff discharged into the detention basins percolates into underlying soils and serves to recharge the aquifer. In instances where storm water is discharged into a downstream waterway, such as a creek or a canal, that storm water also contributes to recharge. Similarly, as discussed under **LRDP Impact HYD-1** above, UC Merced will implement a number of actions included in its Water Action Plan to minimize the amount of new runoff that is generated and would also require runoff to be retained or detained in storm water detention basins. Therefore, cumulative development within the subbasin, including development on the campus, would not substantially affect the groundwater aquifer by interfering with recharge.

Impact Related to Groundwater Withdrawal

The City of Merced relies solely on groundwater for its potable water supply. The City's wells pump from the Merced Subbasin which is a non-adjudicated groundwater basin with no limits on pumping. As the supplies the City relies upon are neither in the process of adjudication nor the subject of any new legislation limiting them, the City does not anticipate legal factors that could limit its ability to withdraw the needed amount of groundwater in the near term. However, because the Merced Subbasin has been identified by the state as being in a critical state of overdraft, the City and MID, as part of MAGPI and the MSGSA, have developed plans to address the overdraft condition, which include development of new sources of water other than groundwater to sustain the City's projected population growth. The City is pursuing the following additional sources of water.

- Beginning in 2020, the City plans to exchange recycled water for untreated surface water from MID. The untreated surface water from MID will be used to irrigate a number of landscaped areas within the City.
- The City's 2014 Water Master Plan identifies that the City needs to increase its water supply in the future. The recommended alternative to increase supply involves the construction of a 10 million gallon per day Surface Water Treatment Plant (SWTP) by 2030 that will receive untreated surface water from MID. The City expects to receive an average of 4,000 AFY from MID.
- The City's WWTF is capable of producing 12 mgd of tertiary filtered wastewater, which may be used for a variety of non-potable uses. The City currently does not have the infrastructure to distribute the recycled water produced at the WWTF throughout the City. The City currently uses recycled water for flushing out sewer and storm drains, irrigating landscapes and agriculture, and maintaining wildlife areas. The City will also provide residents with recycled water if they come to collect it at the WWTF. The City anticipates an increase in recycled water use in the future, primarily by agricultural users.

The City is also working with other regional partners, including MID, Merced County, and UC Merced, to address water supply. As stated in the City's 2015 UWMP, the following efforts are being taken or planned to be undertaken to address the long-term overdraft conditions, as identified in the GWMP and MIRWMP (City of Merced 2017).

- **Groundwater Recharge**: MID has implemented in-lieu recharge programs to reduce groundwater pumping. A regional Groundwater Feasibility Study was recently completed and identified areas within the region that would provide optimal artificial recharge.

- **Water Conservation and Education**: The City considers water conservation and education an important aspect of its overall groundwater management efforts. The City has implemented watering restrictions, provided rebates for water efficient fixtures, and distributed educational information.

- **Conjunctive Use of Water Resources**: Conjunctive use is defined as the coordinated use of both groundwater and surface water in an effort to optimize water sources. The City and MID are planning to use surface water from MID canals to irrigate landscape within the City and UC Merced.

- **Wastewater Reclamation and Recycling**: The City's Wastewater Treatment Facility is capable of producing approximately 12 million gallons per day of highly treated recycled water which can be used in-lieu of groundwater for irrigation.

- **Construction and Operation of Facilities**: The construction of groundwater and surface water facilities are discussed in the GWMP as potential projects in the future, which would contribute to recycling, conservation, groundwater recharge, and storage. These projects include the use of non-potable water for irrigation of public land and agriculture; expanding surface water facilities for use in areas without current access; construction of recharge facilities in areas of groundwater decline; adding wetland buffer zones around drainage and recharge areas to promote infiltration; construction of additional surface water storage facilities.

As noted in **Section 4.4.2**, a GSP has been prepared for the Merced Groundwater Subbasin for compliance with SGMA. With the adoption of the GSP, the three GSAs will adopt a sustainability goal for the Merced Subbasin to achieve sustainable groundwater management on a long-term average basis by increasing recharge and/or reducing groundwater pumping, while avoiding undesirable results. The GSP includes a shortlist of 12 priority projects to be implemented over a 20-year period to either increase surface water supplies to augment the sustainable groundwater yield or to increase groundwater recharge. The GSP also includes a demand reduction program that proposes to implement voluntary and mandatory reductions, if needed. Pursuant to the GSP, the University is exploring a partnership with MID for the purpose of reducing groundwater reliance.

The implementation of the GWMP, MIRWMP, and the GSP would reduce the potential for groundwater levels to decline further. However, the effectiveness of the plans remains to be demonstrated. Furthermore, because the groundwater basin is a state of overdraft and because a substantial increase in groundwater withdrawal is anticipated in the next 20 years due to regional growth, conservatively it is concluded that regional growth would result in a significant cumulative impact on the subbasin.

While the water demand estimate for the campus reflects high levels of water conservation, UC Merced will continue to explore additional ways of reducing the use of potable water. UC Merced would implement its Water Action Plan which is specifically designed to reduce the demand for potable water.

All of these efforts by UC Merced would reduce the proposed project's contribution to the significant cumulative impact. However, even with these measures, the project's contribution to the significant cumulative impact would be considerable. **Cumulative Mitigation Measure C-HYD-2** is included to address this cumulative impact.

Mitigation Measures:

Cumulative MM C-HYD-2: UC Merced shall work with the regional water agencies, including the City of Merced and MID, to develop programs to expand conjunctive use capabilities, increase recharge, and reduce groundwater demand.

Significance after Mitigation: While implementation of the various plans developed by the City and other water agencies, and the implementation of **Cumulative Mitigation Measure C-HYD-2** would reduce the effect of the cumulative demand on the groundwater aquifer, neither the University nor the City can predict with any certainty that the rate of overdraft will not increase with future urban development within the City's service area. Therefore, the impact would be a significant and unavoidable impact.

4.4.7 References

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