WATER ACTION PLAN
University of California, San Diego

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Executive Summary

UC San Diego, like many municipalities, operates commercial and residential buildings, a major utility plant, fueling stations, a vehicle fleet, hospitals, research laboratories, event and convention centers, public venues (aquarium, sports facilities, music hall, etc.), shipping facilities, small businesses, a pier, as well as police and transportation services. UC San Diego is responsible for the management of physical plants and all utilities associated with them, including the generation and maintenance of this infrastructure in compliance with local, state and federal regulations and codes. Functioning as a small city, UC San Diego is one of the largest water users in the City of San Diego. Therefore, it is critical that the campus commits to water conservation.

The objective of this plan is to support, and remain in compliance with, the University of California Office of the President (UCOP) Sustainability Water Systems Policy. In doing so, this Water Action Plan (WAP) summarizes past efforts and best practices that UC San Diego has implemented to reduce potable water usage including:

- Expanding the use of recycled water to offset potable water use
- Irrigation, building, and research equipment retrofits to reduce water use
- Building standards for new construction to improve water efficiency
- Replacing turf with drought tolerant landscaping
- Collecting HVAC condensation and wastewater from Reverse Osmosis systems for reuse in irrigation.
- Smart meters

Furthermore, with consideration of UC San Diego’s unique regional conditions, this plan describes future water reduction projects that have been designed and planned to best suit the University’s water needs in the most efficient way possible. These projects will be implemented to reduce UC San Diego’s potable water usage beyond 36% by the year 2025.

In addition to outlining UC San Diego’s water usage and reduction strategies, the WAP also highlights the campus’ education and outreach to students and staff on the importance of water conservation. UC San Diego has established a solid outreach platform which will grow over time that involves the staff, students and local community.

Finally, this plan describes UC San Diego’s efforts to minimize the discharge of storm water pollutants in compliance with storm water regulations and permits.
Introduction
CALIFORNIA’S CLIMATE

California is home to a semi-arid, Mediterranean type climate. As such, the Golden State typically experiences warm, dry summers, mild winters, and regular drought events. Furthermore, in the face of climate change, it is estimated that by the end of the 21st century, “critically dry” water years could occur more frequently. Droughts are expected to increase by 8% in the Sacramento Valley region, and a substantial 32% in the San Joaquin Valley in comparison to the recorded period between years 1951 through 2000 [http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf].

During critically dry periods in California, it is extremely difficult to satisfy the state’s water demands such as those necessary for important agricultural and environmental purposes. Water shortages threaten California’s economy and local ecosystems. Thus, efforts to implement and exercise water conservation practices are critical for the future of our state.
SITE OVERVIEW
The University of California, San Diego (UC San Diego) is located in La Jolla, a small coastal community that sits adjacent to the Pacific Ocean within the City of San Diego. UC San Diego serves as both a major economic engine and an entrepreneurial powerhouse for the San Diego region and for the State of California. The 1,158-acre campus has a daily population of over fifty thousand people, 59 acres of turf landscaping in sports fields including the perimeter landscaping, and over 700 buildings and associated infrastructure. In order to support this population, landscaping, and infrastructure, UC San Diego is one of the largest water users in the city.

UC San Diego has 6 main City water utility meters and 600 campus sub-meters to track water use.

UC San Diego, along with the city as a whole, relies primarily on imported water. San Diego's drinking water comes from three primary sources: Northern California, Colorado River and local rainwater runoff. The City also produces recycled water for non-potable uses. Regionally, San Diego lies within California’s Mediterranean semi-arid climate and receives an average of only 12 inches of rain per year.

REGULATORY BACKGROUND
In response to severe drought conditions in California, Governor Schwarzenegger wrote to leadership of the California State Senate on February 28, 2008, outlining key elements of a comprehensive solution to problems in the Sacramento-San Joaquin Delta. The first element on the Governor's list was “a plan to achieve a 20 percent reduction in per capita water use statewide by 2020.” In March 2008 the 20x2020 Agency Team was convened to develop a plan to achieve a 20 percent reduction in per capita urban water use statewide by 2020. The final 20x2020 Water Conservation Plan, dated February 2010, sets forth a statewide road map to maximize the state's urban water efficiency and conservation opportunities between 2009 and 2020, and beyond.

The draft of this plan served as a basis for legislation that was enacted in November 2009 to incorporate into law (Senate Bill X7 7) the goal to achieve a 20 percent reduction in urban per capita water use in California by 2020.

In support of these regulations, the University of California, Office of the President (UCOP) issued a UC Sustainable Practices Policy (Appendix A) that requires all University of California campuses to reduce their potable water use 36% by the year 2025 and to develop a Water Action Plan that outlines how they will achieve their water reductions.
PURPOSE OF THE WATER ACTION PLAN

In compliance with UCOP’s UC Sustainable Practices Policy, UC San Diego has developed this Water Action Plan (WAP). The purpose of UC San Diego’s WAP is to (1) identify the present and future measures the university will implement to reduce potable water use by 36%, (2) develop and implement a solid education and outreach platform to encourage behavior change, and (3) establish benchmark goals to go beyond the 36% reduction in potable water use.

These benchmarks include:

1) Continuously look for new opportunities to implement measures that will reduce potable water use and support the overall goals of the WAP.

2) Develop water standards for different types of building occupancy use (e.g., research, industrial, administrative).

3) Research and investigate conceptual projects and new technology for potential project development. Use the university as a “living laboratory” for water conservation innovation.

WATER ACTION PLAN COMMITTEE

The UC San Diego WAP is a collaborative document developed by the Water Action Plan Committee (WAPC), which includes representatives from the following departments:

- Environment, Health, and Safety (EH&S)
- Facilities Management (FM)
- Housing, Dining, and Hospitality (HDH)
- Planning, Design and Construction (PD&C)
- Scripps Institution of Oceanography (SIO)
- Sports Facilities
- University Center

The WAP is a living document and will be reviewed and updated as necessary.
BOUNDARIES OF THE WATER ACTION PLAN
The WAP boundaries are shown in Figure 1 below. The UC San Diego WAP includes the main campus, east campus, off-campus housing, and Scripps Institution of Oceanography. Leased facilities, off-site facilities, and buildings outside operational control have been excluded from this plan.

Figure 1: Water Action Plan Boundaries – Black Borders
Potable Water Use Reduction
POTABLE WATER USE BASELINE

In accordance with the UC Sustainable Practices Policy, UC San Diego’s potable water use per capita is calculated by dividing the gallons of potable water used per fiscal year (based on City water meter billing data) by the weighted campus user (WCU).

Per Capita Potable Water Use = Gallons of potable water used per fiscal year / WCU

WCU = (A + B + C) + 0.75 [(D - A) + (E - B) - F]

A= Number of students resident on-site
B= Number of employees resident on-site
C= Number of other individuals resident on-site and/or staffed hospital beds
D= Total full-time equivalent student enrollment
E= Full-time equivalent of employees (staff + faculty)
F= Full-time equivalent of students enrolled exclusively in distance education.

The calculated baseline, shown in Figure 2, is the average of potable water usage per capita (as defined above) from Fiscal Years July - June 2005/06, 2006/07, and 2007/08 with the goal to reduce potable water use from the baseline by 36% by 2025.

Figure 2: UC San Diego's Annual Campus Potable Water Use from 2005/2006 - 2007/2008
WATER ACTION PLAN IMPLEMENTATION TRACKING AND REPORTING

UC San Diego water use is tracked each fiscal year and reported to UCOP. The Water Action Plan is updated to reflect the status of water reduction projects and the addition of new projects.

WATER USE OVERVIEW

UC San Diego potable water usage is broken down into eight categories which include:

- Housing
- Industrial
- Irrigation
- Laboratories
- Office
- UC San Diego Health (La Jolla)
- Restaurants
- Other

The four largest water usage categories consist of housing, industrial, irrigation, and laboratories, while the remaining four categories (office, UC San Diego Health – La Jolla, restaurants, and other) make up less than 25% of total water use. General Water Usage graphs for each fiscal year can be found in Appendix B.
WATER REDUCTION PROGRESS TO DATE

Figure 3 summarizes UC San Diego’s potable water reductions to date.

Figure 3: UC San Diego’s Annual Campus Potable Water Use per Capita. UC San Diego reached 20% reduction from the Baseline in FY 2015/16.

Appendix C lists water reduction projects that either have been completed, are ongoing, or are proposed for the future. Water reduction projects and practices that have already been implemented are described below.

Expanding the Use of Recycled Water to Replace Potable Water Use

UC San Diego currently uses recycled water for more than 25% of campus irrigation and is continuing to expand the number of areas irrigated with recycled water rather than potable water. In addition, the use of recycled water has been expanded for industrial use in the cooling towers at the Central Utilities Plant and on east campus reducing potable water use by more than 60 million gallons per year.

Credit: UC San Diego EH&S
Water Efficient Design Standards for New Buildings

UC San Diego requires new major construction projects to be planned, designed and built as resource efficient facilities. At a minimum, all future buildings will meet Leadership in Energy and Environmental Design (LEED) Silver or Gold Standards. LEED buildings consider the building site, water efficiency, energy efficiency and other environmental standards. An example is the Platinum rating of the new Charles David Keeling Apartments which is the first LEED Platinum student housing in the University of California system. For a full list of LEED certified buildings see Appendix D.

Campus Irrigation and Landscaping

The campus uses electronic controllers to efficiently irrigate the landscape in periods of only 4-6 minutes per cycle. The UC San Diego landscape staff is trained to identify signs of overwatering and water leaks in the irrigation system. In addition, the irrigation system itself tracks unusually high water use, which may signal a leak. In the event of a reported water leakage, UC San Diego’s Facilities Management department responds with an irrigation maintenance crew.

UC San Diego has implemented water saving strategies including the planting of low water, drought-tolerant vegetation in 75% of the irrigated campus landscape, turning off irrigation during wet winter months, and turning off irrigation to 54,000 square feet of turf to save 1.53 million gallons of water per year. The campus has retrofitted approximately 7,900 standard sprinklers with high-efficiency rotating nozzles, saving 10 million gallons of water per year. Meters that measure soil moisture that accurately target watering and a computer controlled irrigation system that tracks current weather data and adjusts watering based on temperature and humidity have been installed in select locations on campus and continue to be installed.

Since 2014, the campus has eliminated 352,000 square feet of turf saving 9 million gallons of water per year. A large recreation turf field (Muir Field), for example, was replaced with artificial turf in 2015.

Smart Meters

UC San Diego is installing Sensus “smart” meters throughout campus that transmit water use data in real time to a central web interface. Access to water use data in real time enables the campus to identify areas that have water leaks and to identify areas where additional water conservation is needed. To date, 400 smart meters have been installed.
**Laboratory Single Pass Cooling Retrofits**

As a major medical and research institution, UC San Diego houses many autoclaves. Older cold-water flow autoclaves use between 50-100 gallons of continuous cold water per hour in order to cool the discharged water before it enters the municipal sewer system. In order to reduce this impact of water usage, UC San Diego has installed over 100 WATER-MIZER autoclave retrofits. These retrofits monitor the drain temperature and apply cold water to adjust the discharge only when needed. The installation of a single WATER-MIZER saves 75%-90% of the normal water flow rate of a single cold-water flow autoclave. This averages a water savings at UC San Diego of 1,000 gallons per day, per autoclave retrofit. New autoclaves are equipped with the WATER-MIZER.

UC San Diego has also distributed more than 300 Findensers to labs, which has saved an estimated 22 million gallons of potable water per year. Instead of using flowing water from a sink to cool liquids in laboratories, a Findenser is used as a ‘super air condenser.’ The design includes an internal glass condenser with more surface area than traditional condensers and an external, finned (to increase surface area) aluminum jacket. Between the two layers, a small amount of water is permanently sealed. The higher surface area of both the internal and external layers allows for higher heat transfer capacity and eliminates the need for single pass cooling. Findensers also significantly reduce the risk of water leaks and flooding from this process.

**Plumbing Retrofits**

UC San Diego installs water efficient plumbing fixtures in new buildings and is replacing aging infrastructure with water efficient fixtures (e.g., shower heads, faucets, low flow urinals, etc.).

Aerators have been installed on laboratory faucets to reduce the volume of water while maintaining similar water pressure (saves 7.5 gallons per minute from a lab faucet without an aerator). 476 aerators have been installed in Pacific Hall, Muir Biology, Bonner Hall, Natural Sciences Building, Urey Hall, York, CMME, CMMW and Leichtag saving more than 2 million gallons of potable water per year.
Fire Sprinkler and Hydrant Testing Water Capture for Reuse
The campus has implemented practices to capture fire-sprinkler and hydrant testing water for reuse in the Central Utilities Plant cooling towers.

HVAC Condensation Collection for Reuse
Currently, UC San Diego has three buildings on campus that collect condensation from heating and air conditioning units, reverse osmosis system wastewater, and cooling tower blow down for reuse in toilet flushing and irrigation. The collected water is treated with ozone, gravity settling, and ultra violet before being reused. One building alone (Biomedical Research Facility II) generates 11,000 gallons of collected water for reuse a day.

The campus is currently working on a project to collect and reuse HVAC condensation for irrigation in additional buildings.

Reporting Water Leaks
Campus staff are trained to report water leaks to the UC San Diego Facilities Management Help Desk: (858) 534-2930 or email wsc@ucsd.edu. Leaks in housing areas are reported to the HDH Service Center: (858) 534-2600.
OUTREACH, COLLABORATION & EDUCATION

UC San Diego continuously involves the campus community in conserving water. Campus organizations such as AQUAholics Anonymous, the EcoNauts and the Sustainability Resource Center on campus contribute to day to day educational outreach to UC San Diego students and staff. Through these organizations, students, staff, and faculty are directly involved in campus outreach and education.

The AQUAholics Anonymous group distributes educational materials regarding water conservation at outreach events on campus, such as Earth Day, and has organized and implemented water conservation activities and programs, including Residence Hall Water Savings Competitions and a Combat AQUAholism Film and Art Competition.

UC San Diego AQUAholics Anonymous website: http://aquaholics.ucsd.edu/

Educational signs are posted throughout campus to inform the campus community of landscaped areas that are using recycled water for irrigation and areas that have been re-landscaped to conserve water.

Community collaborations include the following:

- Water management through campus planning: UC San Diego promotes water conservation by replacing higher water demand landscapes with lower water demand landscapes, and planning projects using drought tolerant vegetation and native plants to aid in water reduction.

- Partnerships with local water agencies: UC San Diego partners with the San Diego County Municipal Water Authority and the City of San Diego Public Utilities Department Long Range Planning and Water Resources Division to expand the campus recycled water system and to collaborate with on campus outreach events.
UC San Diego does not currently capture and reuse rainwater to offset potable water use. Opportunities to do so will be explored in the future. UC San Diego is collaborating with the City of San Diego on a Storm Water Capture Feasibility Study for the region.

UC San Diego manages storm water in accordance with the following permits: (1) the National Pollutant Discharge Elimination System (NDPES) Phase II Small MS4 General Permit; (2) the NPDES General Permit for Industrial Storm Water Discharges (IGP); (3) the NPDES Wastewater Discharge Permit for seawater and storm water discharges at Scripps Institution of Oceanography (SIO); and (4) the NPDES General Permit for Storm Water Discharges Associated with Construction Activity. All of these permits have been developed and adopted by the California State Water Resources Control Board (SWRCB) and are regulated by the San Diego Regional Water Quality Control Board (RWQCB). Each of these is described below.

**PHASE II SMALL MS4 GENERAL PERMIT, NON-TRADITIONAL (ORDER NO. 2013-0001-DWQ):**

UC San Diego’s implements a comprehensive storm water management program that includes public education/outreach and participation; illicit discharge detection and elimination; pollution prevention for daily campus operations; construction site storm water runoff control; and post-construction storm water management in new development and re-development.

The Phase II program includes water quality objectives pertaining to campus operations and all construction. In addition, post construction guidelines are required to maintain the quality of storm water emanating from project sites after completion and occupancy. Opportunities for capturing and re-using storm water will be evaluated to meet post construction design requirements.

UC San Diego’s Storm Water Management Plan, source control best management practices, and an inventory of the treatment controls that have been installed throughout campus to prevent storm water pollution are included on UC San Diego’s Storm Water Management Program web page: [http://stormwater.ucsd.edu](http://stormwater.ucsd.edu)
INDUSTRIAL GENERAL PERMIT (ORDER NO. 2014-0057-DWQ):
The UC San Diego Nimitz Marine Facility in Point Loma and Fleet Services at the Campus Services Complex on main campus are each regulated by an NPDES industrial storm water permit. Each facility has developed and implements a Storm Water Pollution Prevention Plan (SWPPP) that identifies pollutants of concern associated with activities at that facility and the best management practices (BMPs) that will reduce or eliminate these pollutants from storm water runoff. Source control BMPs that target pollutants of concern are implemented such as good housekeeping, preventive maintenance, spill and leak prevention and response, material handling and waste management, erosion and sediment controls, and employee training. In addition, storm water treatment controls have been installed at both sites that target pollutants of concern. For Fleet Services, for example, a water polishing treatment system was installed that removes oil and grease, petroleum hydrocarbons, and sediment. At the Nimitz Marine Facility, two modular wetland treatment systems were installed that remove metals, sediment, and oil and grease from runoff.

Storm water management activities include: weekly inspections of outdoor material storage areas and fueling areas; monthly inspections to look for evidence of dry weather flows or other storm water pollutants and to evaluate BMP implementation; and an annual comprehensive evaluation of the SWPPP and BMPs. UC San Diego collects storm water samples from these sites to verify that the source control and treatment control management measures are effective.
NPDES PERMIT NO. CA0107239:
The western portion of the UC San Diego, SIO campus discharges into a marine area that has been designated by the SWRCB as an “Area of Special Biological Significance.” There are 34 of these special areas along the coastline in California (2 of which are in San Diego). The California Ocean Plan prohibits the discharge of waste into an ASBS. UC San Diego has obtained an Ocean Plan Exception from the SWRCB to discharge return seawater from SIO and storm water into ASBS 31. The Ocean Plan Exception includes conditions to ensure that discharges into the ASBS do not (1) alter “natural water quality,” (2) adversely impact the biological communities, or (3) compromise protection of ocean waters for beneficial uses. These conditions have been incorporated into an NPDES permit developed by the San Diego Regional Water Quality Control Board.

UC San Diego has implemented source control BMPs and installed structural treatment control BMPs to prevent pollutants from reaching the ASBS. For example, four urban runoff media filters have been along the coastline to divert and treat urban runoff before it discharges onto the beach. UC San Diego monitors storm water run-off as well as the receiving water to evaluate the effectiveness of these BMPs.

CONSTRUCTION STORM WATER PERMIT (ORDER 2009-0009-DWQ, AS AMENDED BY 2010-0014-DWQ AND 2012-0006-DWQ):
Construction projects on campus that disturb one acre or larger are managed in accordance with the Construction Storm water Program Requirements identified in the General Permit including developing and implementing a site specific Storm Water Pollution Prevention Plan (SWPPP) which emphasizes the use of appropriately selected, correctly installed and maintained pollution reduction BMPs that will prevent construction pollutants from contacting storm water and leaving the project site. The SWPPP must:

A. Identify pollutant sources associated with construction activities that may affect the quality of storm water discharges.

B. Identify and prevent non-storm water discharges.

C. Identify, construct, and implement storm water pollution prevention measures (BMPs) to reduce or eliminate pollutants in storm water discharges from the construction site, both during construction and after construction is completed.
Storm water runoff from the construction site is monitored and analyzed based on the calculated risk level of project.

Throughout the construction period, a qualified SWPPP Practitioner (QSP) conducts and documents inspections and evaluations as detailed in the SWPPP, including but not limited to: weekly site inspections, quarterly site inspections, pre-rain event inspections within 24 hours prior to a rain event, post-rain event inspections within 24 hours after a rain event, every 24 hours during an extended rain event (lasting longer than one day), and maintenance inspections.

Opportunities to capture and reuse storm water to off-set potable water use and meet post-construction design requirements will be evaluated for projects subject to the Construction General Permit.