

University of California, Merced 2009 Long Range Development Plan

Project Overview



*2009 Long Range
Development Plan - Photo
Credit: UC Merced*

Located on an 815-acre site in California's fastest growing region, the University of California, Merced's 2009 Long Range Development Plan creates a 21st century urban framework for the University of California's first new campus in 40 years. The plan was adopted by the Regents of the University of California in March 2009.

The plan's approach embraces economic, social and environmental sustainability in all aspects of its built environment, operations and approach to programming. The foundation for the plan is a campus that has already achieved remarkable results:

- LEED Gold minimum for all structures
- First-generation students make up 52% of the student body while 47% come from low income backgrounds.
- Campus buildings use 50% less energy and 40% less water than comparable projects.
- An onsite photovoltaic solar farm generates 20% of annual and 60% of peak electricity needs.
- Enrollment has increased 525% within the first five years of operation.

In 2020, when enrollment reaches 10,000, UC Merced will be the first zero-net-energy, zero-waste and zero-net-emissions campus in America. At full buildout, the 25,000 student campus will house 50% of its student body on a car-free, pedestrian-oriented campus edged by 30,000 acres of permanently preserved vernal pool grasslands.

Location:

5200 N. Lake Road
Merced California 95353
United States

Project Owner:

Regents of the University of California

Submitting Architect:

UC Merced Physical Planning Design and Construction

Project Completion Date:

January, 2012

Project Site:

Previously Undeveloped Land

Project Type:

Education – College/University (campus-level)

Project Site Context/Setting:

Rural

Other Building Description:

New

Building or Project Gross Floor Area:

6,250,000 square feet

BOMA Floor area method used?:

No

Hours of Operation:

8am-10pm

Total project cost at time of completion, land excluded:

\$6,000,000,000.00

Design & Innovation



*Sustainability Strategies -
Photo Credit: UC Merced*

The plan incorporates sustainable design concepts to integrate land use, circulation, water and open space in the heart of California's Central Valley.

Edged by 30,000 acres of vernal pool grasslands, the high-density plan for the UC system's first new campus in 40 years accommodates 25,000 students and housing for 12,500.

Key environmental issues are the presence of the world's largest concentration of vernal pool grasslands to the north and east, its location in a region facing air quality attainment issues, and the challenge of water resources. The goals were to preserve the grasslands, limit emissions generated by vehicular travel, reduce the use of water and be energy self-sufficient.

Through deployment of photovoltaics, energy-efficient buildings and a strategic land-use plan, the campus will be zero-net-energy, zero-waste and zero-net-emissions by 2020.

The plan is oriented around a car-free core designed for bicycles, transit and pedestrians. Phase 1 buildings are achieving 50% of benchmarks energy design targets – even though they were designed to achieve 70% of targets.

Innovations include distributed energy centers, flat roof building standards for both energy production and energy research, material choices that reduce energy demand and visible infrastructure to promote a living laboratory for sustainable design.

Regional/Community Design



*San Joaquin Valley - Photo
Credit: UC Merced*

The site is in California's Central Valley, an agricultural region with some of the nation's poorest economic indicators. The population has the lowest level of college attainment in the state, the highest levels of child poverty, and among the highest unemployment in America. It is also the state's fastest-growing region due to high birth rates. By 2035, it will be 60% Latino.

The design challenge is not limited to environmental and economic efficiency. It includes a social sustainability target of developing a vibrant academic space in a region with few opportunities for young people to experience the environment of a college campus.

Building design evokes underappreciated agricultural architecture, and programming promotes 24-hour activity – creating vibrant, memorable places that add social purpose to the spatial framework.

50% of UC Merced's students are first-generation students, and the neighborhoods have been designed to be safe venues within a 10-minute walk to the core. The campus promotes community connectivity by programming public activities, a multimodal transit center and job nodes along the west and south.

Transportation alternatives include an integrated bicycle and pedestrian network along two irrigation canals that bisect the site. Iconic canal bridges serve as pedestrian landmarks.

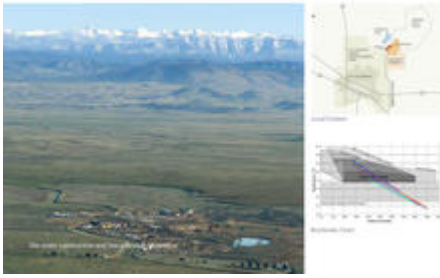
Metrics

Estimated percent of occupants using public transit, cycling or walking:

45%

Land Use & Site Ecology

Local Context



Sierra Nevada and Construction - Photo Credit: UC Merced



Land Use Plan - Photo Credit: UC Merced



Long Range Plan at Buildout - Photo Credit: UC Merced

The plan is based on a compact orthogonal grid that evokes classic Central Valley downtowns, promotes efficient land use, and is oriented to maximize rooftop solar collection. Within the grid, landscape design applies a low-water typology that is contextual and includes tree and shrub selections intentionally designed to attract native birds and other wildlife.

Off-campus stormwater from adjacent native grasslands flows onto and through the open space and street systems, then into the chain of ponds and streams created within the North and South Bowls, where it is detained and eventually released downstream. The campus's outer loop road serves as an environmental buffer, keeps vehicles off campus, uses bioswales to channel off-campus stormwater and provides access to the perimeter vistas to the Sierra Nevada and Lake Yosemite.

Campus topography is defined by three watershed segments formed by the irrigation canals, which pass through the campus at different elevations. The canals act as shaded riparian bioswale corridors to cleanse rainwater.

Stormwater management is made more complex by impervious, expansive clay soils. Design standards for street cross sections, and the requirement to provide 30% pervious surfaces on individual blocks, provide local detention and cleansing and reduce storm flow velocities.

Bioclimatic Design



*Sustainability Strategies -
Photo Credit: UC Merced*



*Sustainability Strategies -
Photo Credit: UC Merced*

The Coast Ranges to the west buffer the site from Pacific Ocean weather systems. Summer temperatures are warm to hot and arid, with clear skies, no rainfall and cool evenings. The winters in Merced are mild, with occasional rains and frequent, heavy fogs. In the winter, 30 days of fog are not unusual. Winds come from the northwest during the summer and the southeast during the winter.

The daily temperature variation of up to 30 degrees creates conditions for saving energy through passive environmental systems design in buildings, which employ the cooler evenings to reduce cooling load during the day and the warmer days to reduce heating needs in the evenings.

Natural solar income and other renewable sources will meet all of UC Merced's energy needs. The north/south orientation of the plan's orthogonal grid is designed to maximize solar collection.

Design standards incorporate a system of shaded pathways to protect pedestrians from the intense Valley sun, wind and inclement weather. Attention to shade creation through building design, low-water landscape and siting will generate a temperature differential of 20 degrees and enable outdoor human activity to occur in relative comfort and reduce building load.

Light & Air



Social Sciences and Management Building - Photo Credit: UC Merced

The plan's design standards include daylighting in 75% of interior spaces, operable windows for small spaces and curtain walls along primary views of the grasslands.

The first Classroom Office Building provides a model of the plan's implementation. As applied within the plan, the design includes double-pane low-e glass, glass trellises, and window overhangs to reduce solar heat gain and glare. The building includes energy-efficient lighting, daylighting controls, and carbon dioxide sensors that adjust airflow depending on occupancy.

A variable-air-volume, dual-fan dual-duct HVAC system with direct digital controls uses chilled water from the nearby Central Plant's 2 million gallon thermal energy storage tank to cool the building, also reducing energy costs.

Because of the diurnal temperature swing, and favorable conditions during the swing seasons, and the fairly regular wind, operable windows have also been incorporated. When opened, these windows are designed to disable space conditioning and avoid wasted energy.

Metrics

Daylighting at levels that allow lights to be off during daylight hours:

75%

Views to the Outdoors:

75%

Within 15 feet of an operable window:

40%

Water Cycle



Stormwater Management Strategies - Photo Credit: UC Merced

The goal of the plan is to improve water run-off quality and increase local water infiltration through its integrated bioswale system.

The campus hydrology network must accommodate 1600 ac. ft. of rain water from adjacent grasslands. This is accommodated through the North and South Bowls and the integrated stormwater management and visible green streets network in the public right of way. By working to decrease concentrations of polluted water while providing water for street trees and other vegetation, the plan's bioswales bioremediate water, mimic natural hydrology and position stormwater as a resource, not a hazard.

The campus has made the investment to include two sets of piping, one to provide potable water and the other to supply reclaimed water for irrigation. On site stormwater storage and treatment are contemplated for future phases.

The landscape design approach eschews turf grass for passive outdoor spaces. Native landscaping with interpretive signage makes the campus a botanical teaching tool for low-water plants. The campus is already using 40% less water than benchmarks. As of 2012, all irrigation will be nonpotable -- saving 80% of typical Valley potable water consumption.

Low-flow plumbing fixtures and waterless urinals have already reduced water consumption below baseline buildings.

Metrics

Percent reduction of regulated potable water:

10%

Is potable water used for irrigation:

Yes

Percent of rainwater from maximum anticipated 24 hour, 2-year storm event that can be managed onsite:

100%

Energy Flows & Energy Future



The Central Plant is the core of the campus energy strategy - Photo Credit: UC Merced

Currently, the campus Central Plant stores thermal energy in off-peak hours for cooling during peak hours. Water stored in the Central Plant tank overnight is discharged through the chilled water loop the following day to cool buildings without requiring activation of the plant's chillers. This spreads out cooling loads over a 24-hour day and requires less chilled water – thus saving energy without sacrificing comfort.

Under the plan's zero-net-energy approach, the campus generates as much electricity as it uses through a portfolio of solar, wind, waste-to-energy and energy efficiencies.

As implemented in Phase 1, the campus currently generates 20% of its annual electricity needs from a 1MW on-site solar array and will generate 100% by 2020. In addition, UC Merced's existing buildings are achieving 50% energy savings based on design benchmarks. These savings are exceeding the as-designed 70% benchmarks ahead of schedule, making UC Merced's implementation particularly unique and innovative.

These savings are being accomplished through (1) passive building systems such as solar shading and thermal massing, (2) building technologies, (3) the Central Plant's Thermal Storage Tank and (4) a centralized Building Energy Management system.

Metrics

Total pEUI:

11 kBtu/sf/yr

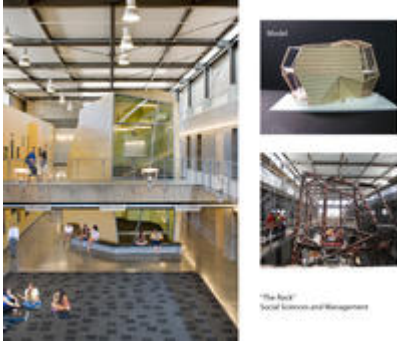
Net pEUI:

8 kBtu/sf/yr

Upload Energy Data Attachment:

 [Phase1.pdf](#)

Materials & Construction



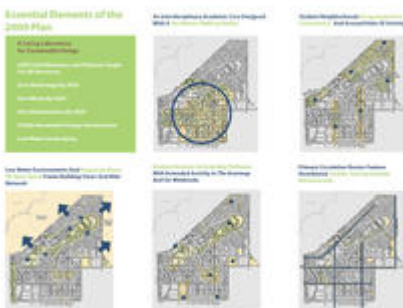
Social Sciences and Management Building - Photo Credit: UC Merced

UC Merced committed to purchasing materials to local and regional materials to support the local economy and achieve LEED Platinum targets. To date, six buildings have achieved LEED Gold, with the remainder pending. As the largest concentration of LEED-certified buildings in the region, the site has become a living teaching tool for local contractors, designers and architects. On a typical Phase 1 building, exemplary performance is the norm. For Phase 1, 70% of waste was recycled or diverted from local landfills, 48% of materials were from recycled content and 43% of materials were manufactured regionally. Glass, concrete and steel composed in utilitarian forms evoke regional architectural industrial structures. Building overhangs provide a shaded pedestrian realm, with color accents along pedestrian corridors that provide views into internal active ground floor uses.

In the academic core, warm earth tones derived from the local landscape are used as accent features. Color in residential and student life areas reflect the agricultural palette of the Valley. The overall impact is an appealing range of tones that blend into the natural and agriculturally influenced environment.

Indoor materials with low-VOC content were specified for all campus buildings.

Long Life, Loose Fit



A flexible, orthogonal grid - Photo Credit: UC Merced

The campus is organized on a flexible and expandable grid system to organize land uses and infrastructure. Blocks vary in size with a minimum dimension of 300'. Rights-of-way vary in widths but are scaled to support the circulation and open-space objectives of the plan. Utilities

are aligned within rights-of-way to ease maintenance and retrofitting.

Campus buildings are designed to provide the social, economic and environmental benefits that derive from lasting 50 to 100 years. To design for longevity, spaces and building shells are oriented for flexible re-use wherever possible. Present-day ground-floor offices can be easily converted into commercial storefronts and library space into offices – all without heavy construction. Durable materials, such as glass, concrete and steel, in simple forms, reduce maintenance costs.

Collective Wisdom & Feedback Loops



*Developing the Plan - Photo
Credit: UC Merced*

Development of this plan was an inclusive, democratic effort among dozens of stakeholders. Workshops held over 18 months with students, faculty, staff and the general public provided critical input during the planning process. Flagship events among faculty, staff, students and designers were the actual genesis of the plan's sustainability targets.

Significant time and resources were dedicated to tours of the physical site, electronic communication and feedback, photographing and documenting participants to put "fingerprints" on the plan and facilitated workshops.

As the plan has been implemented, post-occupancy surveys, interviews and analysis has enabled designers and campus staff to monitor sustainability efficiencies. Third-party analyses by the New Buildings Institute and the National Renewable Energy Laboratory as well as university researchers have helped fine-tune implementation. Energy functions and efficiencies are continually monitored for improvement through the building and water data gathered by the Central Plant's electronic control room.

The plan will be developed in four phases. Phase 1 (5,000 students, 1.25 MSF Academic Core) is almost complete. Phase 2 (10,000 students, 2.5 MSF) is currently in the design phase. Phase 3 will accommodate 20,000 students (5 MSF) just before midcentury. Phase 4 will bring the campus to 25,000 students. (6.25 MSF)

Other Information

Cost and Payback Analysis:

The application of sustainability measures has resulted in significant cost savings for the campus. The combination of renewables and energy-efficient buildings saves the campus more than \$1 million a year in energy costs.

Process and Results:

An integrated monitoring system tracks energy use for the campus. UC Merced uses this data to stretch beyond energy-efficiency targets. The campus uses what it learns from this information to inform future projects.

Rating System(s) Results:

Rating System:

LEED-NC

Rating Date:

2012

Score or Rating

Result:

Gold (6 buildings)

Additional Images



Recreation is embedded throughout - Photo Credit: UC Merced



Landscape Plan - Photo Credit: UC Merced

Interconnected Systems for Mobility and Carbon Neutrality

The Long Range Development Plan has been developed to be a platform for mobility, planning and infrastructure.

- 1. Interconnected Mobility Network**
The plan includes interconnected transportation systems for transit, bicycle, pedestrian, and active mobility. The systems are designed to provide a seamless and integrated experience to and within the campus and community.
- 2. Shared Space**
Design includes shared space design for pedestrian, bicycle, and active mobility. The design includes shared space design for pedestrian, bicycle, and active mobility. The design includes shared space design for pedestrian, bicycle, and active mobility.
- 3. Carbon Neutrality Strategy**
The plan includes a carbon neutrality strategy for mobility, infrastructure, and active mobility. The plan includes a carbon neutrality strategy for mobility, infrastructure, and active mobility. The plan includes a carbon neutrality strategy for mobility, infrastructure, and active mobility.

Circulation Pattern - Photo Credit: UC Merced

The 20th Street Development Case

20th Street 2.0 and Main Street 4.0

- Reproductible ground floor development with student and community uses.
- Pedestrian and bicycle friendly design.
- Pedestrian and bicycle friendly design.
- Pedestrian and bicycle friendly design.

Main Street 2.0 - Photo Credit: UC Merced

A pedestrian public space

The Gateway District Research and Development Plan

- Aerial view of the Gateway District showing green spaces and pedestrian paths.
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- Aerial view of the Gateway District showing green spaces and pedestrian paths.

Gateway District - Photo Credit: UC Merced

Multipurpose Recreation Management

The South Bowl view towards the Aquatics Center

- View of the South Bowl towards the Aquatics Center.
- View of the South Bowl towards the Aquatics Center.
- View of the South Bowl towards the Aquatics Center.

South Bowl - Photo Credit: UC Merced

8. Grand Ellipse for access and traditional building



The Grand Ellipse

- Maximize open space for access and traditional building
- Place all building mass around the Ellipse and create an edge program at the Grand Ellipse
- Integrate public space for recreation and building context
- Create pedestrian edge program for traditional building context



Grand Ellipse - Photo Credit: UC Merced

The Natural Edge



Campus Loop Road

- Integrate open space within a building to maximize open space for walk and bicycle transportation. Integrate building program with open space to create a natural edge program at the Loop Road
- Integrate energy infrastructure (solar/wind) for campus sustainability mission, and air circulation, and solar panels
- Integrate open space within building to create building program



Loop Road - Photo Credit: UC Merced

Project Team and Contact Information

Primary Submission Contact:

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Project Team:

| Role on Team | First Name | Last Name | Company | Location |
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| | Cliff | Lowe | Cliff Lowe Associates | |
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| Associate Planner | Suzanne | Kallmann | UC Merced | Merced, CA |
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| | | | | |
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