

SUSTAINABILITY

The concept of sustainability at UWM, like at campuses throughout North America, is informing planning and decision-making processes. UWM's commitment to sustainability is evidenced by the appointment of a campus Environmental Sustainability Coordinator in January 2008 and by the Draft Environmental Sustainability Plan released in July 2009. The UWM Master Plan supports and advances the objectives established by the University in the Draft Environmental Sustainability Plan. This section of the Master Plan report summarizes following:

- Goals and Objectives for Sustainability set out in the UWM Draft Environmental Sustainability Plan
- The Regulatory Context for various sustainability indicators in the physical environment
- Best Management Practices for future development
- Strategies for the Kenwood Campus

Additional and more detailed information supporting the sustainability objectives is available in Sections 2 (Assessment of Existing Hydrology and Stormwater Management Systems) and 6 (Summary of Utility and Infrastructure Issues) of the Phase A Master Plan Analysis findings and the Technical Appendix to the Master Plan. Both Appendices are documented separately.

UWM ENVIRONMENTAL SUSTAINABILITY PLAN

The 2009 UWM Draft Environmental Sustainability Plan establishes goals and objectives for sustainability in the following areas:

- Physical environment and resources
- Campus Life (sustainable food services and University housing and unions),
- Community Engagement, and
- Academics

The goals and objectives of the Environmental Sustainability Plan, as written, apply primarily to the Kenwood campus and the existing conditions at UWM. Future updates by the University will need to establish specific objectives for development at UWM locations beyond the Kenwood campus. Development at new locations provides several opportunities to plan and design with sustainability as a primary goal. To that end, recommendations are provided in the Master Plan to encourage sustainable outcomes at all UWM facilities.

The overarching goal of the Environmental Sustainability Plan is: to embrace sustainability as a core institutional value in all UWM planning, operations, and academic programs with the aim of positioning UWM as a critical stakeholder and example in education and workforce development in the Milwaukee region. The main objectives are to:

- Increase student, staff and faculty awareness and education regarding the environment, sustainability, and human impact on our natural resources and community.
- Develop and strengthen resources for expanding a sustainable UWM Campus and Community (short and long term)
- Establish new and expand existing Community Partnerships, including area schools, non-profits, and businesses
- Utilize the interdisciplinary nature of sustainability to reach out to all academic areas
- Bridge internal and external inherent gaps to foster new communication and problem solving techniques.
- Establish relevance to city and regional priorities (M7) in workforce and economic development.

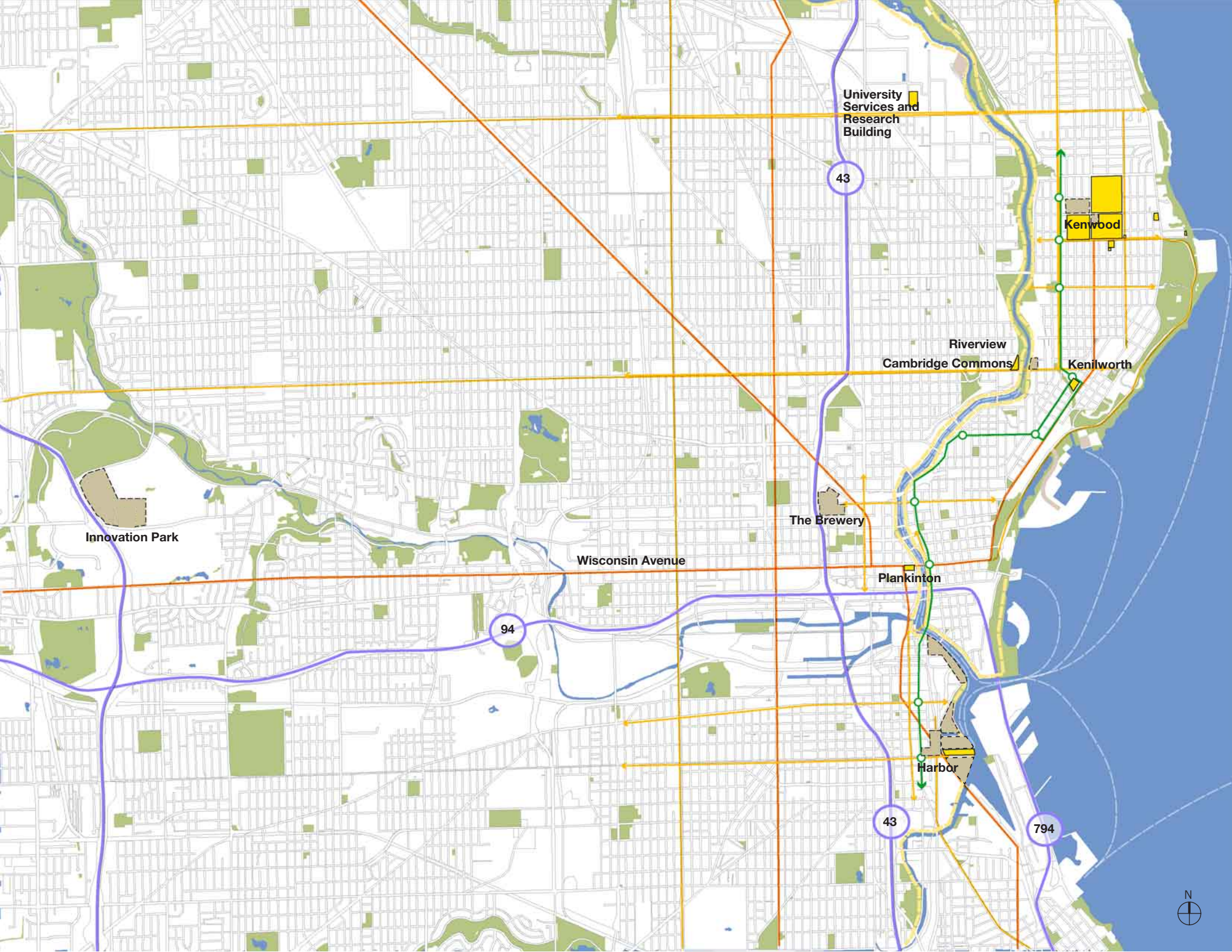
Source: UM-Milwaukee Environmental Sustainability Plan, July 2009 Draft

While the Environmental Sustainability Plan addresses broader operational and academic goals, the Master Plan focuses on those goals that relate to the physical development of UWM facilities and sites. Specific objectives and targets for resource consumption are provided for water resources, energy, emissions, transportation and natural resources / landscapes.

Achieving the targets set out in the Environmental Sustainability Plan will take place in a context of an expanding Kenwood campus as well as the development of additional UWM sites in the Milwaukee region. During the next 10 years, the Master Plan sets out a vision for an additional 1.5 million square feet on the Kenwood campus, increasing the total area of the campus to roughly 4.5 million square feet. Additional space leads to the demand for more energy, resulting in the need to design high-performance buildings and to renovate buildings to reduce consumption if the overall energy consumption and emissions objectives set out in Environmental Sustainability Plan and government mandates that apply to UWM facilities are to be achieved.

Looking ahead, an emphasis on sustainability will necessitate a focus on key indicator metrics and a reporting procedure to assess if the objectives and targets of the Environmental Sustainability Plan are being met. Like the Master Plan, the Environmental Sustainability Plan will need to be updated in response to the indicators and evolving circumstances as UWM facilities are developed.

- Highway Connectivity
- Bicycle Connectivity
- Regional Road Connectivity
- Secondary Road Connectivity
- Planned Transit Connectivity
- University Shuttle



SUSTAINABILITY OBJECTIVES(2009)

PHYSICAL ENVIRONMENT AND RESOURCES

Water Resources

- Reduce campus water usage by 20% through operations and human behavior changes from a 2005 baseline by 2012. Continue to conserve and reduce consumption incrementally each year.
- Engineer and landscape for zero-stormwater discharge from the Kenwood campus by 2020 at the roof top and ground level.

Energy

- Reduce energy consumption per square foot by 20% of the fiscal year 2005 State energy report baseline (adjusted for weather) through operations and human behavior changes. Continue to reduce consumption over time in accordance with any subsequent Executive Order issued by the Governor of Wisconsin.
- Secure renewable energy sources to supply 20% of campus use by 2020, and adjust to any other goal set forth by the Governor and State of Wisconsin, through the use of, but not limited to, solar, wind and geothermal energy.
- Reduce consumption of fossil fuel by the University fleet vehicles, through operations scheduling and by vehicle types utilizing the latest fuel efficiency standards / technology and economic feasibility for the campus.

Built Environment

- Design for the efficient use of energy in all new and existing facilities and in accordance with the Division of State Facilities Sustainable Facilities Guidelines. Apply for LEED Certification, stressing energy efficiency, whenever economically feasible.
- Utilize current space and land efficiently to optimize the use of UWM facilities and energy.

Transportation

- Double alternative transportation journeys to the campus through incentives, community partnerships and resource adjustments by 2020, relative to a 2008 baseline.
- Develop campus, community and multi-county strategy and programs to encourage the use of alternative transit, including, but not limited to pedestrian, bike, bus, train and carpooling that is relevant to all UWM sites.

Natural Resources / Landscapes

- Sustain and increase the use of native and perennial landscaping with the aim of reducing maintenance costs over time and fostering an awareness of Wisconsin ecology.
- Eliminate the use of all pesticides and synthetic fertilizers, while increasing the health of campus soil / lawns by aeration, natural compost and seeding by 2012.
- Enhance preservation strategies for Downer Woods focusing on the management of invasive species and encouraging the campus community to use the Woods for passive and active education about the environment.

Waste

- Increase recycling rates and waste minimization programs incrementally each year.
- Find new sources for current waste via City and community processors, as well as faculty research.
- Recycle 50% of all construction and demolition site waste on all campus remodeling and new construction projects, effective immediately.
- Increase the awareness of the UWM community with regard to recycling logistics, services and progress.

- Increase the reuse of campus furniture and equipment by redistribution on campus, through public sale and through donation to area non-profits.

Indoor Air Quality

- Provide the UWM community with safe, quality indoor air in all campus buildings, free of excess toxins and pollutants.

Purchasing Policy

- Purchase University materials and services based on these sustainable factors, whenever possible, meeting multiple qualifiers.
- Durable, form of the product is suited for its function to maximize its lifetime.
- Product is made from pre/post consumer or industrial recycled material.
- Product can be recycled in the end, and the campus operations are set up to do so.
- Efficiency of the product or machinery will save money by utilizing less water or energy over its lifetime.
- Product is documented to produce significantly less toxins and is preferably biodegradable. Product is harvested or made within a 500 mile radius of UWM campuses and sites.
- Product is shipped with minimal packaging (consistent with care of the product), and preferably made of recycled and/or recyclable materials.
- Purchase and monitor certified products that meet the ENERGY STAR, Green Seal Certified, NSF 140 2007, Green Guard, ISO 140001, and The Forest Stewardship Council Standards, wherever such ratings exist, and to such standards and certifications as they evolve.

CAMPUS LIFE

Sustainable Food Services

- Increase healthy, local and organic dining options on campus at an incremental rate.
- Create and maintain connections with local farmers, and utilize local produce and products on campus whenever possible, reflective of the season.
- Educate the UWM community about the benefits of local, organic food options.
- Compost all pre-cooked kitchen scrapes by 2010, and all post-kitchen scraps by 2012.

University Housing and Student Union

- Align with the Physical Environment and Resource Objectives of the Environmental Sustainability Plan.
- Establish or increase environmental awareness and education for staff and students.

COMMUNITY ENGAGEMENT

- Work with community groups and individuals to address environmental concerns that are relevant to both the campus and surrounding community.
- Collaborate with the Urban Ecology Center and other area organizations on environmental awareness campaigns.
- Make the findings and outcomes of sustainable practices and programs utilized by UWM available to the surrounding community.

SUSTAINABILITY IN ACADEMICS

- Establish quality, interdisciplinary education opportunities on environmental literacy and sustainability for all undergraduate programs.
- Relate multiple UWM academic programs to sustainability education at area K-12 Public and Technical Colleges.
- Utilize campus operations as a laboratory for sustainable research projects.

PHYSICAL ENVIRONMENT AND RESOURCES

The physical environment and resource objectives of the Environmental Sustainability Plan address water resources, energy (emissions), the built environment, transportation, natural resources and landscapes, waste management, indoor air quality, purchasing policies. Of these, natural systems / landscapes, water resources, energy (emissions), the building environment and transportation are the focus of the Master Plan.

NATURAL SYSTEMS/LANDSCAPES

The Environmental Sustainability Plan and the Master Plan encourage the preservation of natural systems and habitats on all existing and future UWM locations. The term natural systems refers to the interrelationship between the soils, topography, vegetation, and drainage patterns of a site. Collectively, these systems contribute to the habitat value of the land.

In preserving the natural systems of a site, the landscape strategies proposed for existing and future sites must respond to these systems, repair them where they have been compromised and establish built conditions that work in harmony. To that end, “working landscapes” are proposed in the Master Plan. Working landscapes are designed to not only address aesthetic values; they are also designed to be functional in response to habitats, vegetation, and drainage as well as provide shade and wind protection in the built environment.

The Environmental Sustainability Plan includes several natural systems / landscape objectives:

- Sustain and increase the use of native and perennial landscaping with the aim of reducing maintenance costs over time and fostering an awareness of Wisconsin ecology.
- Eliminate the use of all pesticides and synthetic fertilizers, while increasing the health of campus soil / lawns by aeration, natural compost and seeding by 2012.
- Enhance the preservation strategies for Downer Woods focusing on the management of invasive species and encouraging the campus community to use the Woods for passive and active education about the environment.

Source: UW-Milwaukee Environmental Sustainability Plan, July 2009 Draft

Natural Systems / Landscape Recommendations

The landscape guidelines for the Kenwood campus are intended to result in a working landscape over time. The guidelines address the objectives of the Environmental Sustainability Plan and provide a reference for landscape interventions on the Kenwood campus and future sites occupied by UWM. For more detail on the landscape proposals of the Master Plan, please see the Landscape Design Guidelines section of this report.

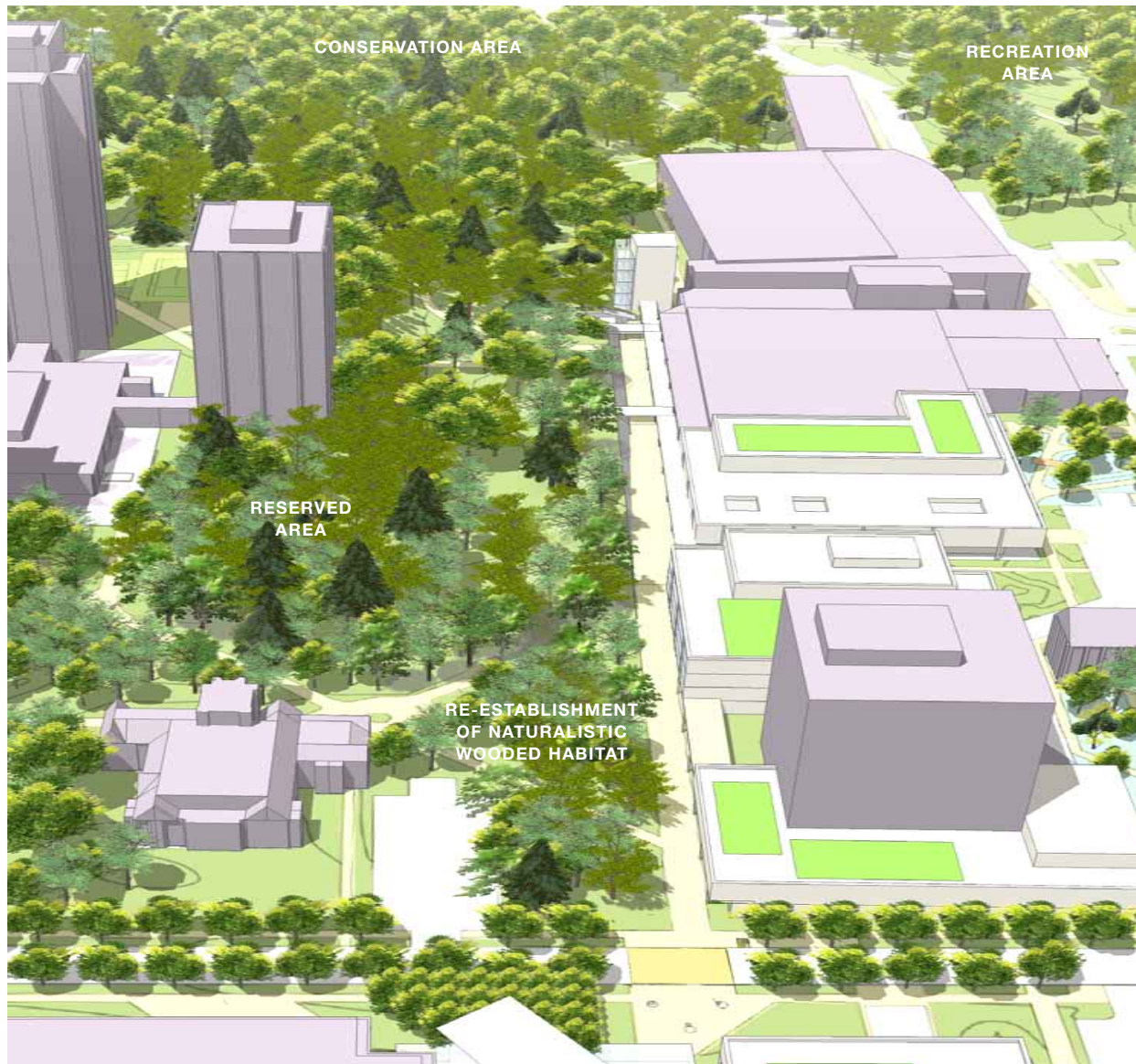
The following recommendations related to natural systems/landscapes are incorporated in the Master Plan:

Kenwood Campus

- The Downer Woods on the Kenwood campus are legally protected. Accordingly, the Master Plan preserves the woods and conceptually integrates them into the campus landscape by “reforesting” an area outside the legally protected areas. Specifically, the area between Chapman and Enderis is enhanced by the removal of parking and by tree planting. The intent is to extend the Woods southward to Hartford, thereby, making Downer Woods a more integrated feature of the campus.
- The UWM as a Zero-Discharge Zone: A stormwater masterplan, referenced below in the discussion of Water Resources, calls for the integration of landscape features with the functional requirements of stormwater management. Specifically, rain gardens, green roofs and bioswales are proposed not only for their aesthetic value but also for the functions they perform with regard to stormwater management.
- Native plant materials are proposed on the Kenwood campus to reduce the need for irrigation, synthetic fertilizers and pesticides.

Future UWM Sites

Strategies for natural systems and landscapes are site specific and must be developed during the detailed site design process in response to an analysis of the soils, topography, drainage patterns, vegetation and existing habitat conditions. Preliminary guidelines are provided for each of the Opportunity Sites.



VIEW LOOKING NORTH TO DOWNER WOODS

NATURAL SYSTEMS

Objectives:

- Sustain and increase the use of native and perennial landscaping
- Eliminate the use of all pesticides and synthetic fertilizers,
- Enhance the preservation strategies for Downer Woods

Strategies:

- Establish a "working landscape"
- Reforest areas that abut Downer Woods
- Integrate landscape features with the functional requirements of stormwater management, such as rain gardens, green roofs, and bioswales

WATER RESOURCES

UWM's goal of establishing a School of Freshwater Science reinforces the water resource related objectives of the Environmental Sustainability Plan. Further, the emerging emphasis on "water" provides UWM with the opportunity to demonstrate best management practices in the campus environment for both stormwater and potable water resources.

The water resource objectives of the Environmental Sustainability Plan are to:

- Engineer and landscape for zero-stormwater discharge from the campus by 2020 at the roof top and ground level.
- Reduce campus water usage by 20 percent through operations and human behavior changes from a 2005 baseline by 2012. Continue to conserve and reduce incrementally each year.

Source: UW-Milwaukee Environmental Sustainability Plan, July 2009 Draft

Stormwater Regulations

Stormwater management is regulated by local municipalities, the MMSD, the Wisconsin Department of Natural Resources (WDNR), and the United States Environmental Protection Agency (USEPA), and the U.S. Army Corps of Engineers (CORPS). Impacts to waterways and wetlands are also regulated by all of the above listed entities. The Kenwood Campus and the Kenilworth, Plankinton and Great Lakes sites are subject to Milwaukee's Ordinance 120 requirements.

The following is a list of applicable stormwater regulations for UWM landholdings in Milwaukee:

- NR 216 (Comm 60) Storm Water Discharge Permits —covers three types of stormwater discharge permits: municipal, industrial and construction site.
- NR 151 (Comm 60, Comm 82, Comm 85) Runoff Management (water quality)
- NR 116 Wisconsin's Floodplain Management Program
- Chapter 30 of the Wisconsin Statutes: Navigable Waters, Harbors and Navigation

- City of Milwaukee Ordinance—Chapter 120 (addresses increases in impervious area and peak run-off flow)
- City of Glendale Ordinance—Title 6, Chapter 5
- Milwaukee Metropolitan Sewerage District (MMSD)—Chapter 13 (defines stormwater detention requirements for the MMSD service area)
- Section 404 of the Federal Clean Water Act (regulations discharges to "Waters of the U.S).

For detailed information on compliance with the above noted regulations, please see the accompanying Technical Appendix of this report.

Sustainable Stormwater Strategies

Sustainable stormwater management and improvement strategies have been the subject of considerable study at UWM as evidenced by The UWM as a Zero-Discharge Zone: A stormwater masterplan for the UWM Campus (May 5, 2006). The Stormwater Masterplan provides an inventory of design opportunities for transforming the UWM campus into a testing site for urban stormwater best management practices. The ultimate goal is to achieve a 100 year zero discharge condition for the campus as a whole. The study catalogued the potential for green roof retrofits, downspout disconnections, and the redesign of both pedestrian and vehicular hardscaped areas. While the recommendations are specific to Kenwood, the overall approach and objectives are applicable to other sites UWM may develop in the future and have informed the recommendations of this Master Plan. The approach complements and informs the working landscape concept proposed for all UWM sites.

The sustainable stormwater management strategies to be considered on the UWM campuses and sites address three interrelated variables/metrics: 1) water quality, 2) water volume and, 3) peak rate of flow.

Water quality—impervious pavement and development prevents natural percolation of stormwater into the soils. (Note: clay soils on the Kenwood campus limit infiltration) Run-off from developed areas is contaminated by chemical pollution such as motor oil and salt resulting in water qual-

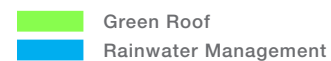
ity concerns. Proposed water treatment strategies include "green" alternatives that mimic the functions of the natural landscape and allow for treatment in the form of green roofs and rain gardens integrated into the campus landscape.

Water volume—in Milwaukee, like many older cities, stormwater is collected and flows into a single combined (sanitary and storm) sewer system. As a result, all water must be treated before it can be reintroduced into the environment. Major storm events overwhelm treatment facilities resulting in the discharge of mixed stormwater and sewerage directly into waterways. A deep tunnel system in Milwaukee is designed to prevent discharges; however significant events can overwhelm the system. The strategy for all UWM sites is to keep stormwater out of the combined sewer system by utilizing a variety of above grade management installations.

Peak Flow Rate—is a concern due to the surcharging during high intensity, short duration rainfall events. The recommended strategies for mitigating the peak flow rate include detention facilities incorporated with the landscape features of a site. Underground pipe storage may be required in densely developed areas such the Kenwood campus.



PRELIMINARY STORMWATER MANAGEMENT CONCEPT



WATER RESOURCES

Objectives:

- Engineer and landscape for zero-stormwater discharge from the campus by 2020 at the roof top and ground level.
- Reduce campus water usage by 20 percent through operations and human behavior changes from a 2005 baseline by 2012. Continue to conserve and reduce incrementally each year.

Strategies:

- Detain stormwater above ground and utilize landscape to improve water quality, dissipate volume and slow rate of flow
- Utilize green roofs, rain gardens and bioswales throughout the campus to decrease discharge rates to combined sewers.
- Daylight internal roof drains where possible and transfer run-off to rain gardens
- Utilize landscape to handle rainwater from externally drained roofs
- Decrease impervious area wherever possible
- Utilize pervious paving as appropriate

Best Management Practices

The UWM as a Zero-Discharge Zone: A stormwater masterplan for the Kenwood campus identifies a number of recommended best management practices for existing campus buildings and infrastructure as well as new facilities.

The proposed recommendations focus on horizontal surfaces and the rainwater capturing potential of those surfaces. The goal is to leave the water as diffusely scattered across these surfaces as possible. The recommended strategies for all UWM facilities and sites include:

Green Roofs: UWM should consider a policy for installing Green Roofs for all appropriate internally drained (low-slope) roof replacement projects and on new buildings. Green roofs retain stormwater and return a portion directly to the atmosphere through evapotranspiration. Facts include:

- A layer of vegetation installed on flat or low sloped roofs
- “Extensive” green roofs have a thin layer of soil and are usually composed of sedum
- “Intensive” green roofs have a thicker soil layer and contain shrubs, trees and other vegetation
- Green roofs can retain 15-90% of rainfall
- Green roofs are most effective in reducing run-off volume and rate
- Green roofs can reduce air pollution, provide habitat for wildlife and sound insulation.

Rain Gardens: UWM should adopt a policy of disconnecting externally drained roofs from the storm sewer system and draining them into rain gardens wherever possible.

Rain gardens are landscape features designed to retain and infiltrate stormwater. They are typically 6 to 18 inches deep and include plants tolerant to periodic submersion.

Rain Gardens facts: (MMSD literature)

- Small, vegetated depressions used to capture and infiltrate stormwater runoff
- Plants with appropriate soil mixture and planted with native shrubs, grasses and flowering plants
- Detention times of no more than 24 hours

Pedestrian Hardscape

UWM should adopt a policy objective of achieving a ‘zero-discharge’ State for all pedestrian hardscape areas.

Pervious paving: includes permeable concrete, paving stone or crushed stone allowing water to drain directly into the ground. In the clay soil conditions, such as the Kenwood campus (clay loams, low in organic content and usually high in clay), the excavation and creation of a drainage layer approximately 24 inches deep is required. Pervious paving is recommended where there is no option for creating a water receiving landscape. In order to avoid contamination of ground water, pervious paving is not recommended in areas of heavy traffic such as loading docks where oil and other concentrated pollutants may be present.

Other hardscape design strategies include:

- Plan for a reduction in impervious area
- Utilize French Drains and dry wells in appropriate locations (soil conditions permitting)

Vehicular Hardscape

Bio-retention swales are recommended in parking areas with adequate land area (MMSD suggests an area equivalent to 5% of the surface area drained) and suitable soil conditions. The bio-retention swales are landscapes where water is diverted and detained to treat and slow down peak flow rates. Pervious paving should be considered but only where water receiving landscapes are not possible.

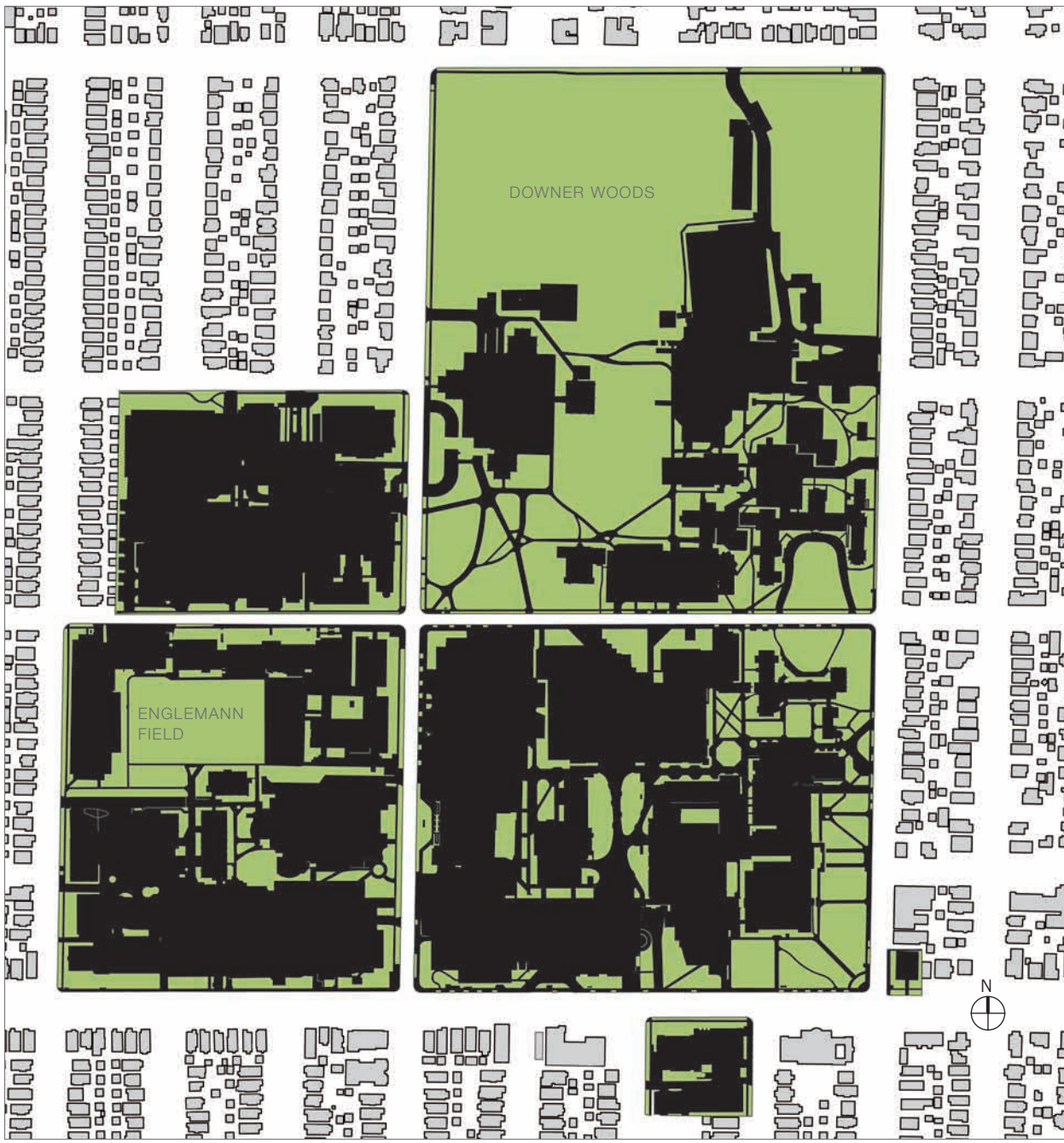
Kenwood Recommendations

The Kenwood campus is served by City of Milwaukee combined sewers and separated sanitary sewers, which convey waste water at all times and storm water during precipitation events. Excess flow is occasionally bypassed to the Milwaukee River when MMSD’s deep tunnel system is at capacity. A reduction in stormwater discharged from campus could lead to a reduction in the frequency and severity of these overflow events and, thus, is a goal for the future.

The campus has two drainage areas: 62 acres of the campus drain to the north, while 37 acres drain to the south. The north drainage area is 48 percent impervious and the south is 73 percent impervious. The campus is divided into 21 catchment areas (small drainage basins channeled to underground storm drains).

Impervious Surfaces at Kenwood (Existing Conditions)

IMPERVIOUS SURFACES:	61 acres or 53 percent of the total campus area (excluding Downer Woods)
PERVIOUS SURFACES:	54 acres or 47 percent of the total campus area (excluding Downer Woods)
INTERNALLY DRAINED ROOFS:	23 acres or 20 percent of the total campus area (candidates for green roofs)
EXTERNALLY DRAINED ROOFS:	7 acres or 6 percent of the total campus area
PEDESTRIAN HARDSCAPE:	20 acres or 17 percent of total area
VEHICULAR HARDSCAPE:	11 acres or 10 percent of the total campus area



Kenwood Sustainable Stormwater Management Approach

The UWM as a Zero-Discharge Zone: A stormwater masterplan for the UWM Campus (May 5, 2006) provides an inventory of design opportunities for transforming the UWM campus into a testing site for urban stormwater best management practices. The stated goal of the study: to recreate a run-off rate and volume comparable to pre-settlement conditions and to operate within the parameters established by the hydrological behavior of the site in its undisturbed condition.

The stormwater masterplan documents the physical potential of the existing Kenwood campus development pattern to meet a stringent peak discharge rate of 0.5 cfs/acre for a 100 year storm event as proscribed by Chapter 13 of the MMSD's Discharge Regulations and Enforcement Procedures. The study defines the parameters for zero discharge and the physical implications for the campus but does not provide an exhaustive engineering study or financial optimization analysis. The study included the creation of a computer stormwater management model (SWMM) to serve as the primary predictive tool for the proposals. The model was validated against water flow data and utilized for initial analysis of a green roof for internally drained low-slope roofs and the use of downspout disconnections to rain gardens on externally drained roofs.

The Master Plan endorses the goals of the stormwater study to reduce the rate and volume of stormwater that enters the combined sewer system. To that end, the above noted best management practices are incorporated in the Master Plan. In general terms, the following design recommendations are proposed to guide all stormwater planning and design on the Kenwood campus.

- Detain stormwater above ground and utilize landscape to improve water quality, dissipate volume and slow rate of flow
- Utilize green roofs, rain gardens and bioswales throughout the campus to decrease discharge rates to combined sewers.
- Daylight internal roof drains where possible and transfer run-off to rain gardens
- Utilize landscape to handle rainwater from externally drained roofs
- Decrease impervious area wherever possible
- Utilize pervious paving as appropriate

Pavilion Gateway

The Stormwater Masterplan recommendations are incorporated in a demonstration project known as The Pavilion Gateway. The project details the redesign of four acres of the UWM campus to meet the goal of zero discharge. Key recommendations are incorporated into the campus Master Plan but with modification where necessary to accommodate new development not anticipated in the study.

The Pavilion Gateway vision is to mimic a creek bed and create a new pedestrian path through campus, weaving water and walking into a compelling story. Three guiding ideas inform the design of the project. 1) to create aesthetically interesting water features out of every stormwater "capture" in the study area; 2) to create a coherent pedestrian path that incorporates the separate rainwater features; and 3) to create more clearly defined campus spaces that still meet servicing and functional demands.

The Pavilion Gateway includes distinct rain gardens with similar functions but which are different in character. The gardens feature planting based on the function of the gardens and the microclimate of the context.

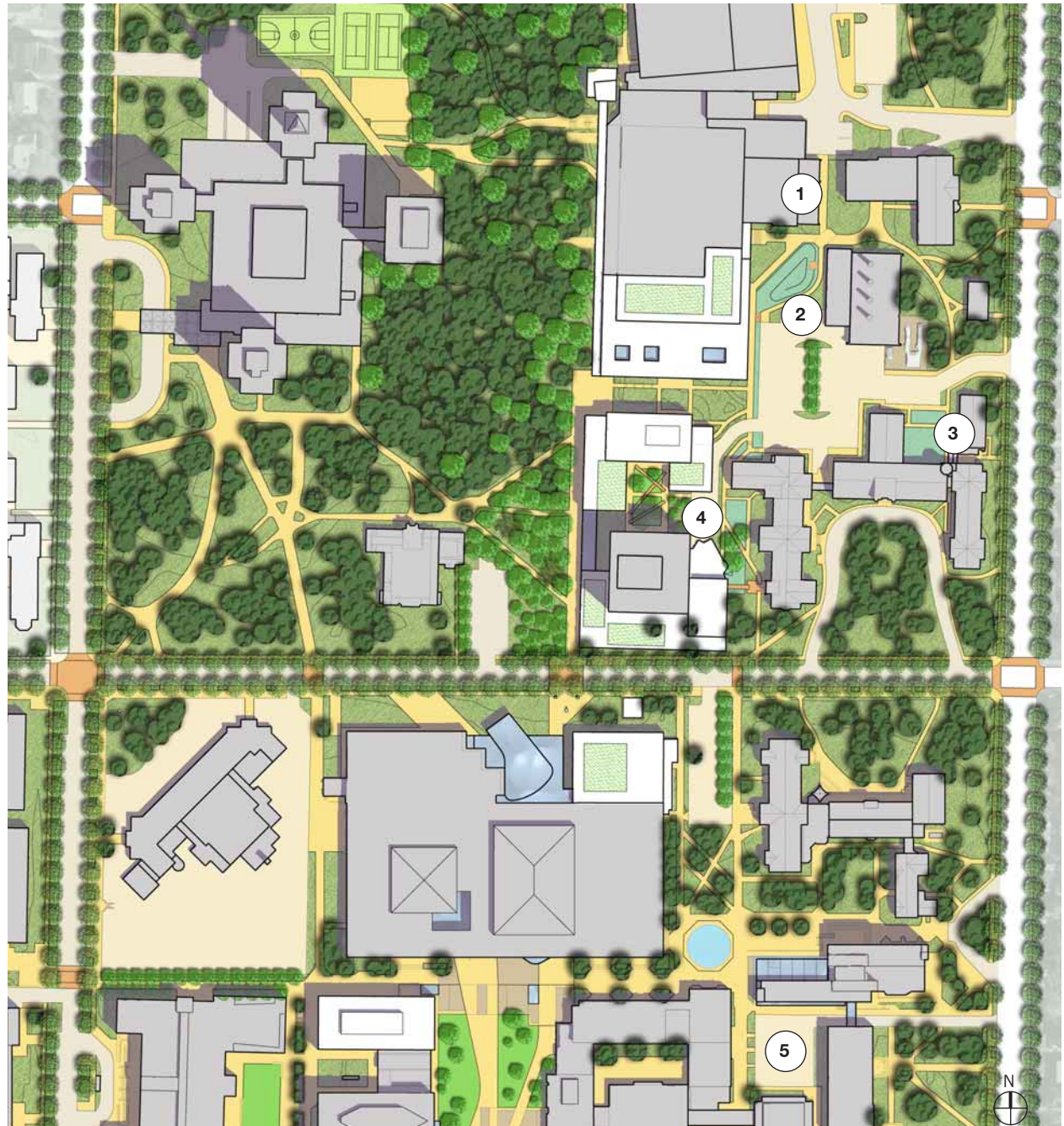
- **Pavilion Gateway Garden**—located in the service area between Sabin Hall and Klotsche, this garden creates a pedestrian plaza and features permeable paving and native plant materials. It serves as the northern entry to the path from the Pavilion Garage. The area retains its function as an emergency access drive and for accessible parking spaces.
- **The Spiral Garden**—is envisioned as a spiral swale with plantings capable of handling a high volume of water. The swale gathers runoff from the entire basin along the Pavilion Gateway path. Water flows into the Spiral Garden from the south, where it soaks into the ground or enters the storm sewer system at a prescribed rate. It is designed to act as a temporary detention basin but will have standing water for short periods of time in extreme conditions. The spiral form lengthens the exposure of run-off to the biological processes that clean it. It will feature a wooden pier to allow observation and sampling of water leaving the garden.

- **Merrill Court Garden**—is envisioned as a patio featuring permeable pavers surrounded by concentric bands of low maintenance flowering and shade-loving perennial plants and ground covers.
- **Upper Gardens**—are envisioned as the southern Hartford Avenue gateway to the pedestrian path. They feature three panels of rain garden zones separated by weir walls and an observation bridge.
- **Lot 16 (Curtin Hall)**—is transformed into a public plaza space defined on the west by the Pavilion Gateway path.

Pavilion Gateway Plan Features

1. Pavilion Gateway Garden
2. The Spiral Garden
3. Merrill Court Garden
4. Upper Garden
5. Lot 16 Landscaping

Note: The proposals of the original plan for an experimental garden north of Norris are not incorporated due to development of the site in the Master Plan.



Potable Water

The new School of Fresh Water Science sets the tone for demonstrating leadership in potable water management for both existing and proposed facilities. While water supply is not the key concern given the abundant resource of Lake Michigan, conservation is an important consideration with regard to the energy and chemicals required to convey and, then, treat water at the Jones Island Wastewater Treatment Plant (located to the east of UWM's Great Lakes Research Facility).

Environmental Sustainability Plan Potable Water Goal

Goal: Reduce campus water usage by 20 percent through operations and human behavior changes from a 2005 baseline by 2012. Continue to conserve and reduce incrementally each year.

For the purposes of planning in the context of the UWM mission, it is assumed that the above noted reduction targets apply only to the Kenwood campus. The existing facilities at the Great Lakes Research Facility require significant quantities of potable water for mission-related research. As the facility evolves into the future School of Freshwater Science water consumption is likely to increase. For this reason, GLRF and the School of Freshwater Science are excluded from the 20% reduction target.

Source: UW-Milwaukee Environmental Sustainability Plan, July 2009 Draft

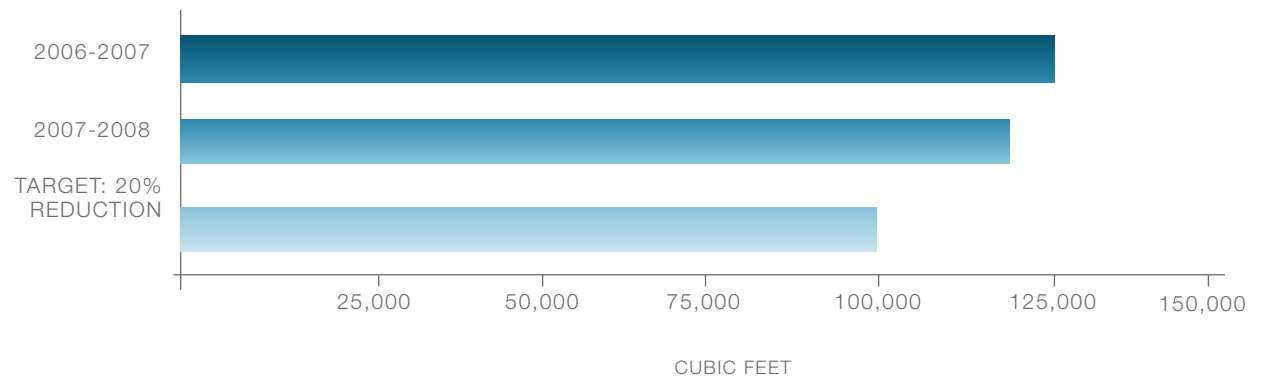
Best Management Practices

LEED-EB offers detailed guidance for reducing water consumption in the built environment for both existing and new buildings. Beyond buildings, the concept of creating "working landscapes" requires the use of native plant materials and the introduction of operational polices that focus on potable water conservation. Irrigation is discouraged on any UWM site except during the early stages of establishing new landscapes or where grey water recovery or rainwater harvesting systems are in place.

UWM's expansion beyond the Kenwood campus offers several opportunities for demonstrating best management practices in potable water conservation that complement the "water mission" of the School of Freshwater Science. Specific opportunities to be explored in the design process for new facilities and sites, include, among others:

- Recovery of gray water for non-potable water uses
- Rainwater capture for non-potable uses
- Composting toilets and other technologies that minimize the use of potable water
- Landscape strategies that minimize the need for potable water use for irrigation (rainwater capture and grey water could be utilized for irrigation)

WATER CONSUMPTION: EXISTING AND TARGET (KENWOOD)



Kenwood Campus Recommendations

Annual water consumption on the Kenwood campus was 124,086 cubic feet in 2006-07 and 117,024 in 2007-08, a decrease of 6%. The Great Lakes Research Facility experienced a considerable increase in potable water use from 2006 to 2008, (172,047 cubic feet in 2006-07 and 306,655 in 2007-08) indicative of the growing nature of the research program. This increase illustrates the opportunity to offset potable water needs through rainwater harvesting and potential measures for conserving water. Freshwater consumption is expected to increase as the new School programs grow and advance.

UWM has taken steps in recent years to reduce water consumption on the Kenwood campus. The Wisconsin Energy Initiative in the year 2000 enabled the University to reduce consumption by 46.6 million gallons annually. The initiative involved:

- Toilet replacement: 97% of toilets on campus, suitable for cost-effective upgrades, were changed to low-flush models (1.6 gallons per flush)
- Facet replacement: 97 % of faucets, suitable for cost-effective upgrades, were changed to either 0.5 or 1.5 GPM (gallons per minute) low-flow faucet restrictors.
- Showerhead replacement: 74 percent of all showerheads, primarily in Sandburg Hall, were replaced with 2.5 GPM adjustable spray showerheads.

UWM has taken steps in recent years to reduce water consumption on the Kenwood campus. The Wisconsin Energy Initiative in the year 2000 enabled the University to reduce consumption by 46.6 million gallons annually.

ENERGY

Energy use in UWM facilities is inextricably tied to the types and amount of space provided, the efficiency of the buildings (operational and envelope), operational practices, the maintenance of equipment and the efficiency of energy generation. Looking ahead, these will be important considerations as UWM seeks to expand on the Kenwood campus and at other locations in the metropolitan area.

The objectives of the UWM Environmental Sustainability Plan and Executive Orders issued by the Governor of Wisconsin establish energy conservation and performance targets for existing and future UWM facilities. As a result, a coordinated approach to energy and space management is recommended. It will be challenging for UWM to expand while decreasing overall energy consumption, especially given the amount of energy intensive research space proposed.

It should be noted that energy management and planning will likely receive greater attention in the coming years due to increased public focus on climate change and the need to reduce fossil fuel consumption and the associated greenhouse gas emissions. Guidance and strategies will evolve in response to changing technology, government mandates and cost considerations.

UWM Environmental Sustainability Plan Energy Objectives:

Energy planning for UWM facilities will be guided through the year 2020 by the following objectives, which fall into two categories:

Energy

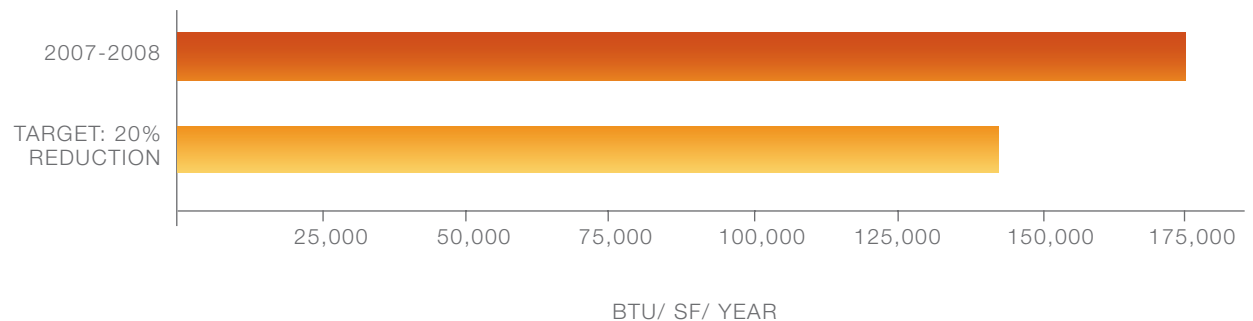
- Reduce energy consumption per square foot by 20% of the fiscal year 2005 State energy report baseline (adjusted for weather) through operations and human behavior changes. Continue to reduce consumption over time in accordance with any subsequent Executive Order issued by the Governor of Wisconsin. Note that this goal will be challenging to realize given the increasing intensity of use of buildings.
- Secure renewable energy sources to supply 20% of campus use by 2020, and adjust to any other goal set forth by the Governor and State of Wisconsin, through the use of, but not limited to, solar, wind and geothermal energy (this does not necessarily require this to be achieved at each UWM location).

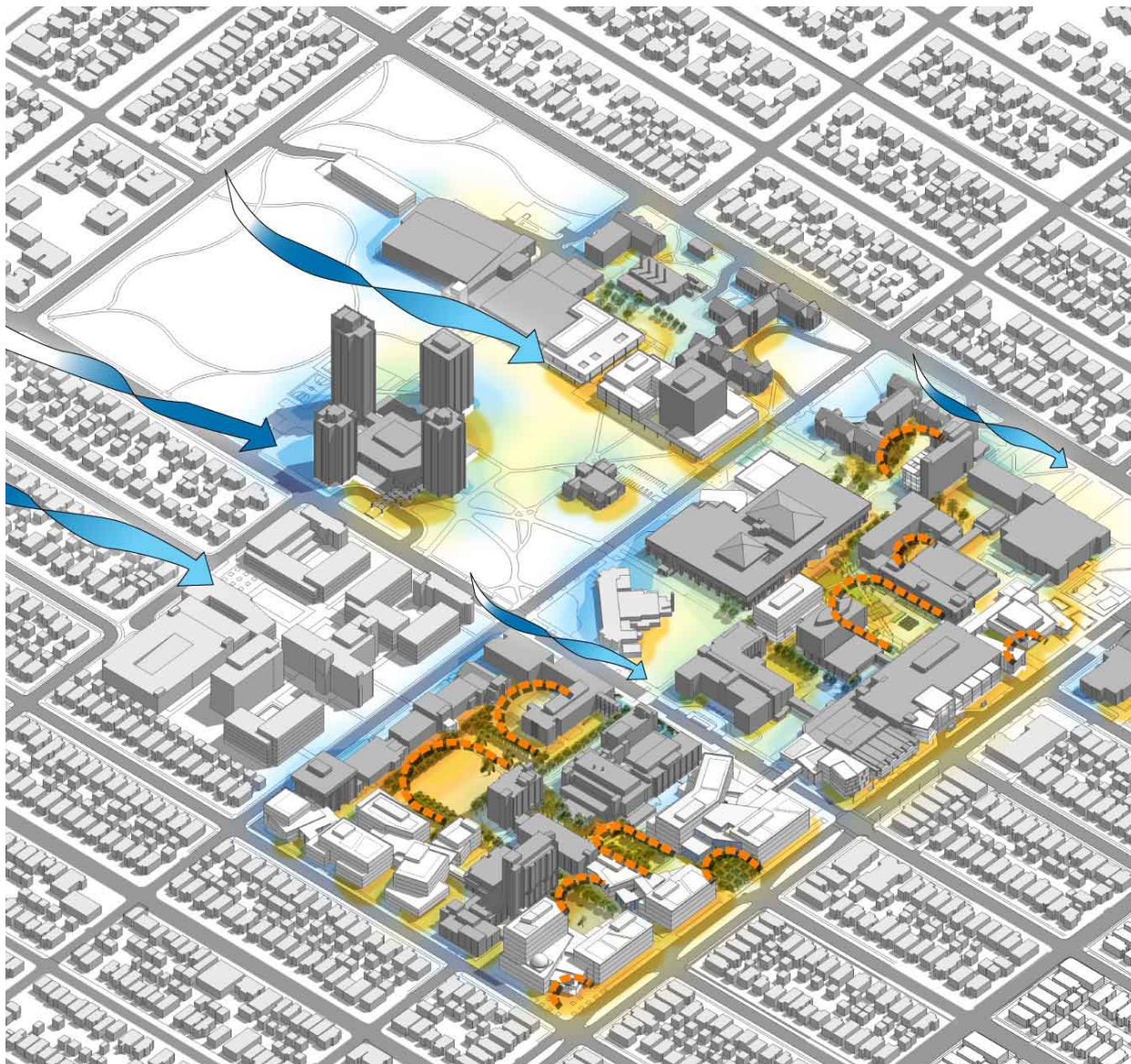
Built Environment

- Design for the efficient use of energy in all new and existing facilities and in accordance with the Division of State Facilities Sustainable Facilities Guidelines. Apply for LEED Certification, stressing energy efficiency, whenever economically feasible.
- Utilize current space and land efficiently to optimize UWM facilities and energy.

Source: UM-Milwaukee Environmental Sustainability Plan, July 2009 Draft

ENERGY REDUCTION REQUIRED BY 2020 (KENWOOD)





MICROCLIMATES



ENERGY & EMISSIONS

Objectives:

Energy

- Reduce energy consumption per square foot by 20% of the fiscal year 2005 State energy report baseline
- Secure renewable energy sources to supply 20% of campus use by 2020

Built Environment

- Design for the efficient use of energy in all new and existing facilities and in accordance with the Division of State Facilities Sustainable Facilities Guidelines. Apply for LEED Certification, stressing energy efficiency, whenever economically feasible.
- Utilize current space and land efficiently to optimize the use of UWM facilities and energy.

Strategies:

- Reduce operating costs by applying efficiency upgrades at the building level
- Capture low-grade waste heat at the Central Plant boiler stacks
- Conduct a comprehensive analysis of extending the Lake intake to a depth where water temperatures are colder
- Utilize Lake Michigan as a solar collector
- Investigate the option for an independent district heat pump loop to serve future buildings along Kenwood and Cramer

Regulatory Considerations

In recent years both State government and the governor's office have issued legislation and executive orders for reducing energy consumption in State facilities.

Executive Order 145 (EO 145)

The mandates established by the Governor of Wisconsin in EO 145 are reflected in the above noted objectives of the Environmental Sustainability Plan. The specific requirements are:

- Reduce actual energy usage per square foot by at least 20% by 2010. (from the baseline fiscal year FY 05 State energy report)
- Ensure that new State facilities are constructed to be 30 percent more efficient than commercial code
- Address sustainable operations and maintenance practices
- Pursue demonstration projects at State facilities regarding use of photovoltaic and other renewable technologies to generate electricity and use alternative fuels for heating and cooling
- Develop sustainability and energy efficiency goals, the budget and management review, the purchasing of renewable energy, and the implementation of the sustainable building guidelines.

In response to EO 145, the Department of Administration, Division of State Facilities released a Sustainable Facilities Policy and Guidelines, which endorses LEED-EB guidelines. By adopting LEED-EB guidelines and implementing sustainable practices in the facilities it owns and leases, the Department of Administration's goal is to reduce energy consumption and conserve resources. EO 145, does not require certification per the procedures of the US Green Building Council's LEED-EB Green Building Rating System, but contains minimum performance standards based on LEED tools and approaches, as well as measurement and reporting requirements.

Best Management Practices

Looking ahead, UWM will be expected to manage and plan for efficient utilization of energy in a context of increasing square footage. The Master Plan illustrates a potential increase in the range of 1.3 million square feet on the Kenwood campus. Including other potential locations, a total 1.5 million square feet could be added to the UWM space inventory over the next 20 years. This excludes increases associated with potential acquisitions at the Opportunity Sites. The energy challenge over the next 20 years will be to decrease consumption in existing facilities while adding space to the UWM inventory.

The Division of State Facilities, Sustainable Facilities Policy and Guidelines, October 2007 which promote the use LEED-EB guidelines for future buildings provides a well established framework for addressing several active and passive design strategies to reduce energy consumption. A greater focus is provided for energy efficiency in the executive orders and other governmental mandates and by the Energy Usage Intensity targets recommended in the Master Plan.

In response to UWM's Environmental Sustainability Objectives, EO 145, and the Sustainable Facilities Policy issued by DSF, several recommendations are proposed and coordinated with the Master Plan. The recommendations fall into following categories:

- Efficiency and Conservation
- Passive Design Strategies
- Energy Usage Intensity (EUI) Targets
- Renewable Energy

Efficiency and Conservation

Reducing energy consumption in existing UWM facilities is a key consideration in meeting the reduction targets of the Environmental Sustainability Plan and EO 145. A range of efficiency improvements are possible including HVAC upgrades, lighting retrofits and other adjustments to the building systems. As major renovations are carried out on existing buildings in association with programmatic moves, the University will have the opportunity to renovate buildings with specific efficiency targets in mind. Reducing energy consumption in existing buildings will be necessary to offset the increased demand generated by new buildings proposed in the Master Plan. Several conservation measures are proposed:

- Efficiency Upgrades: complete buildings system upgrades and renovation projects with energy conservation as a key goal. Reduce electrical demand in buildings.
- Education programs: UWM should develop programs to educate faculty, staff and students about energy use and encourage them to conserve energy. Empowering the campus community to divert money from energy bills to capital investment and programmatic support can provide strong incentives to conserve energy.
- Operations: Coordination of building occupancy / building use to reduce wasteful operation of almost empty buildings during non-peak hours.
- Metering Installation: The lack of metering by building hinders efforts to determine where the energy is consumed (other than the Central Plant).
- Self funding revolving fund: the University is encouraged to develop a strategy for self funding improvements through the use of a revolving loan fund that will be paid back from the resulting energy savings. Many institutions have instigated "green loan funds" which are funding mechanisms that encourage and support capital investment to reduce energy use and costs.

Passive Design

Building orientation is an important factor determining the energy requirements for future buildings, especially those that do not have a large internal heating or cooling load generated by lab equipment or high occupancies. Where possible, buildings should be oriented on an east – west axis to ensure optimal solar design opportunities and passive design techniques. External shading devices are required where significant east and west exposure could increase cooling loads on buildings.

Landscape can play an important role in providing shade and wind protection in the campus environment in addition to the stormwater management benefits. Designing landscapes to address functional as well as aesthetic goals can help reduce heat islands (horizontal surfaces such as parking lots that absorb solar radiation), and shade buildings to decrease cooling loads.

LEED-EB at a minimum will address many of the building envelope and other architectural strategies that contribute to energy efficiency.

Future Efficiency Strategies

As UWM looks to future expansion, a detailed energy plan and strategy is needed for all University sites to ensure that energy can be managed and emissions reduced. This will require efficiency improvements, changes to operational and management practices, behavioral changes in the campus population and a transition to renewable energy sources.

Beyond the Kenwood campus, the total expansion is contingent on several strategic decisions that will be made incrementally over the next ten years or more. Preliminarily a projected 1,095,000 square feet is expected in the Innovation Park, the Brewery and the Harbor. Recommendations are provided in the Master Plan for guiding the sustainable development of future UWM sites. The Division of State Facilities Sustainable Facilities Policy and Guidelines offers guidance on the utilization of LEED in the design and construction of State facilities, and in response to Executive Order 145.

Creating new sites such as the Innovation Park will afford UWM the opportunity to establish district energy systems. At a district level waste heat from one facility can be recovered to provide heat or energy needs for an adjacent building. The interrelationship between buildings in a campus setting offer several opportunities that should be considered in future.

Energy Usage Intensity (EUI) Targets 2010-2020

The metric for energy consumption in buildings is Energy Use Intensity (EUI) measured in total British Thermal Units (BTU) per square foot per year. In fiscal year 2008, buildings on the UWM Kenwood campus had an average EUI of 175,000 BTU / SF / year.

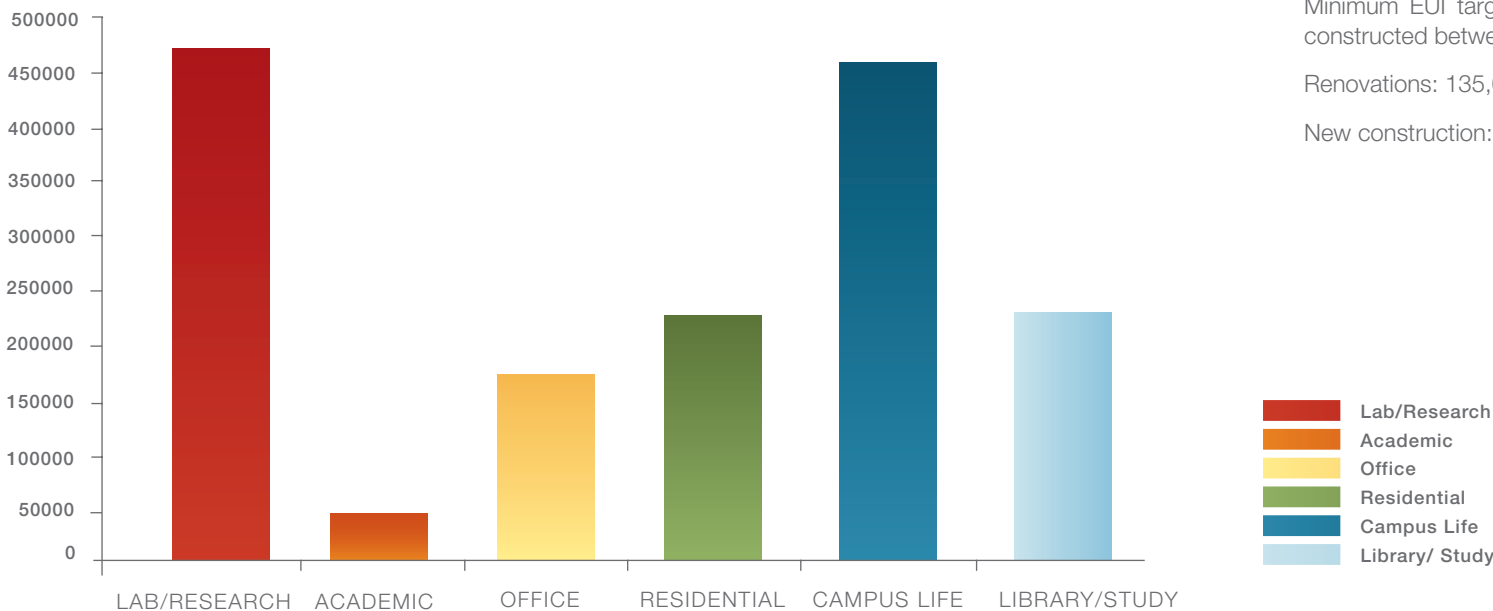
As UWM plans future buildings and renovations at any location, energy performance will need to be a consideration. To assist in this effort, EUI targets are recommended for both renovation and new construction by space type. The targets are provided to improve the efficiency of UWM facilities with the understanding that the targets will need to be set higher over time in response to changing technology and advancements in building design.

Minimum EUI targets by space type for future buildings constructed between 2010 to 2020 are as follows:

Renovations: 135,000 BTU / sf / year

New construction: 90,000 BTU / sf / year

FUTURE UWM GSF BY CATEGORY



Renewable Energy

The State mandate to provide renewable energy is an important consideration for future UWM energy and emissions planning. During the planning process, renewable energy options including wind turbines, photovoltaic solar panels, solar thermal and geothermal systems were examined for the Kenwood campus, all of which proved to be difficult to implement in an urban environment at a meaningful scale. The following summarizes the findings of this investigation and provides a context for considering renewable energy on UWM facilities. It also identifies a renewable energy recommendation for the Kenwood campus.

Solar

Solar – Photovoltaic: Solar Photovoltaics provide one renewable energy option but need to be considered relative to the scale required to meet demand and costs. Kenwood campus peak electrical loads in 2009 totaled 12.7 MW. Generating 8 percent of electrical peak load or about 1 MW would require two acres of collector surface, the area of approximately two Englemann Fields. Such an investment would not reduce the required size of any electrical systems and could potentially offset 3% of the campus electrical use. A better and more practical use of solar energy would be to feature demonstration installations to deliver small amounts of energy. At present, solar photovoltaics are one of the least cost effective ways to invest in renewable energy. The scale required for a meaningful installation and the current costs per kWh are not favorable.

Solar Thermal: Solar Thermal can be utilized for domestic water and/or hydronic space heating. Most installations are found in residential locations where thermal loads are low. UWM building thermal loads are much larger and the size of solar collector plates required to adequately serve hydronic heat load would be not be practical relative to cost and size. Solar thermal systems could be used to supplement domestic hot water needs in UWM residence halls; an approach that has been tried on many campuses.

The State mandate to provide renewable energy is an important consideration for future UWM energy and emissions planning.

Wind

Wind turbine project factors include consideration of local and State codes, turbine siting issues, safety, connection configuration, power use and financing strategies. Wind potential is measured in average wind power density in Watts per square meter. The annual wind power density at Kenwood is approximately 100-200 W/m². Assuming the lower end of the range of 100 W/m² and a wind turbine at a height of 70 to 80 meters, the wind power available is 110 W/m². Hub heights for turbines in the 0.5-1.65 MW size range vary from 65 m to 80 m. Turbine “fall” areas must be planned for construction and potential tower collapse. There are no areas on Kenwood campus with a 100 meter diameter circle of clear area.

Horizontal axis turbines also require a clear area to prevent ice being flung off the blades and causing injury. Noise and interference with local electronic transmissions for TV and communications are also a concern when siting a turbine.

Wind power for UWM facilities would be limited to multiple smaller turbines that in general have poorer performance and a higher cost per kWh generated. As with solar power, small demonstration projects can be coordinated with the existing electrical system but would not make a significant impact on the campus renewable energy portfolio and would not be competitive with other approaches to providing renewable energy to campus. A better outcome would be to focus on State wide or University of Wisconsin System initiatives to deliver renewable power such as Retail

Wheeling, which is not currently allowed in the State’s tariffs. Retailing wheeling involves siting wind turbines in an area more favorable to wind and is not constrained by the urban context. Wind power generated off-site could be connected to the grid and the UW System would receive credit for this power. Given the size and scale of the concept, it may be better addressed at the UW-System level.

Biomass

Biomass Energy Resources includes municipal wood waste and solid waste. Solid fuel plants require regular deliveries of fuel and on-site storage that is not possible on the Kenwood campus or other sites under consideration.

Geothermal – Lake, district heat pump system,

Energy from Lake Michigan may be considered a geothermal source since it acts as a heat sink for UWM cooling loads. UWM has in place a system of pipes to draw water from Lake Michigan and a permit to draw water from the Lake from April through November and return water to the lake after passing through the chiller and turbine condensers. During the winter, the system is not utilized.

SUN AND SHADOW: SOUTHERN EXPOSURE

1. North Precinct
2. Southwest Precinct
3. Southeast Precinct



Southern Exposure



Kenwood Baseline Energy Consumption

In planning for future energy performance of UWM facilities, Fiscal Year (FY) 2005 consumption data will serve as the baseline comparison per the direction of EO 145. In FY 2005 UWM facilities required 505,520 MMBTUs of heat and 62,634,200 kWh of electricity. Since 2005, the electrical demand and kilowatt-hour usage has increased. Energy consumption in UWM campus buildings is well above other institutions in the University of Wisconsin System, except UW-Madison, and nearly double the campuses with the best performance.

Summary of Major Recommendations for reducing energy consumption at Kenwood

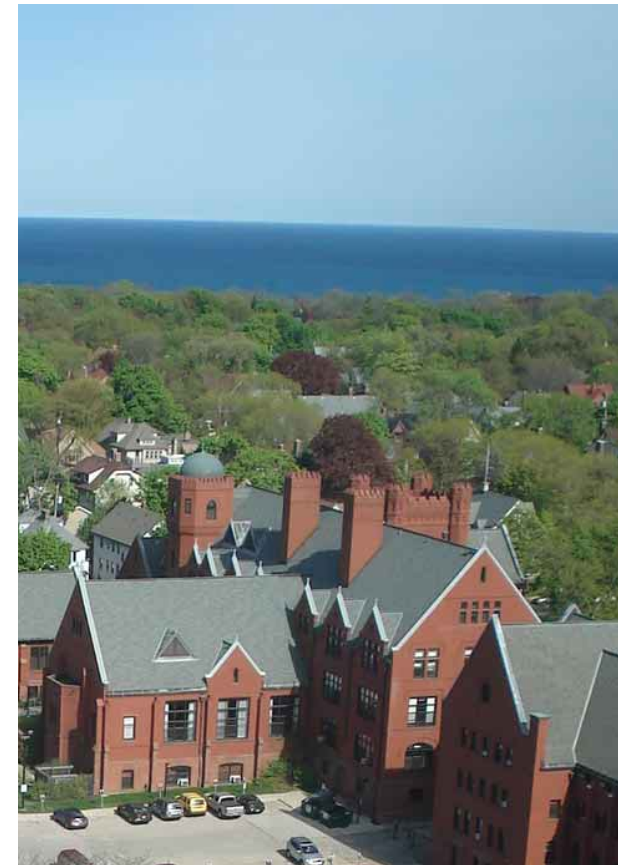
Several strategies are proposed to meet the State's challenge to conserve energy and develop renewable sources of energy:

1. Efficiency upgrades at the building level offers the opportunity to reduce operating costs. Five buildings are included in an energy performance contract at Kenwood: EMS, Cunningham, Bolton, Enderis, and Curtin. Expected energy savings based on financial grade audits of the buildings will result in an estimated 20% reduction. The estimated savings are as follows:
 - Electrical: 3,802,946 kWh – 27.1%
 - Steam: 21,102 klbs – 31.7%
 - Chilled water: 38,551 tons/day – 37.8%
2. Heat Recovery: Capturing low-grade waste heat at the Central Plant boiler stacks would make better use of fossil fuel energy (dependent of developing demand for low temperature hot water). For new development create a separate distribution system using lower temperature water for building heating.
3. Cooling System: Conduct a comprehensive analysis of extending the Lake intake to a depth where water temperatures are colder and more constant and not subject to fluctuations in surface temperatures. Currently fluctuations in water temperature affect chiller efficiency.
4. Geothermal Energy: Utilize Lake Michigan as a solar collector with the aim of deriving additional value from existing piping and make use of renewable solar energy captured by the Lake. Currently, the Kenwood cooling

system utilizes Lake water to absorb heat from campus. This system improves the efficiency of the Central Plant and provides the opportunity to expand the use of Lake water for improving the efficiency of the heating system. This opportunity is significant. It offers a means of bringing renewable, solar energy captured by the Lake to the campus for building heating. This approach would utilize conventional readily available equipment to reduce fuel consumption but would not significantly decrease carbon emissions unless the system included a Combined Heat and Power (CHP) plant. Under this scenario, new development would be served by a separate low temperature hot water distribution loop for building heating.

5. District Heat Pump – investigate the option for an independent district heat pump loop to serve future buildings along Kenwood and Cramer. The proposed system would be a closed loop of direct buried HDPE piping to provide heating energy and remove heat rejected from heat pump systems located in new buildings. It is envisioned that multiple buildings could be served off of one heat pump plant that will act as a heating and cooling module. This approach can reduce total number of distributed machines and take advantage of building diversity to provide a more reliable redundant energy source for buildings. (note: The system would need to incorporate on-campus electric production if Scope 1 and Scope 2 eCo2 emission reductions are to be achieved). New buildings would feature conventional but low-temperature heating water and chilled water loops.

Each of the above strategies requires further study and should be the focus of the University over the coming years as renovation and new construction is proposed.



THE KENWOOD CAMPUS AND LAKE MICHIGAN

EMISSIONS

Emissions planning is an area of increased concern on many campuses in North America brought on by a growing awareness of climate change issues among faculty, staff and students.

The UWM Environmental Sustainability Plan addresses emissions reduction targets indirectly through the energy efficiency and conservation targets. More specific guidance is provided in Wisconsin Act 141 which requires that 20% of total annual electricity used by state facilities be satisfied by the purchase of renewable electrical energy by DOA by end of 2011. Based on this guidance, a target greenhouse gas emission reduction of 20% is assumed in the Master Plan, primarily for electricity.

The UWM Environmental Sustainability Plan reinforces the goals of Wisconsin Act 141 through two objectives related to reduction of emissions resulting from UWM operations and activities:

- Secure renewable energy sources to supply 20% of campus use by 2020, and adjust to any other goal set forth by the Governor and State of Wisconsin, through the use of, but not limited to, solar, wind and geothermal energy.
- Reduce consumption of fossil fuel by the University fleet vehicles, through operations scheduling and by vehicle types utilizing the latest fuel efficiency standards / technology and economic feasibility for the campus. (Note: transportation emissions and reduction considerations are addressed in the transportation chapter of this report).

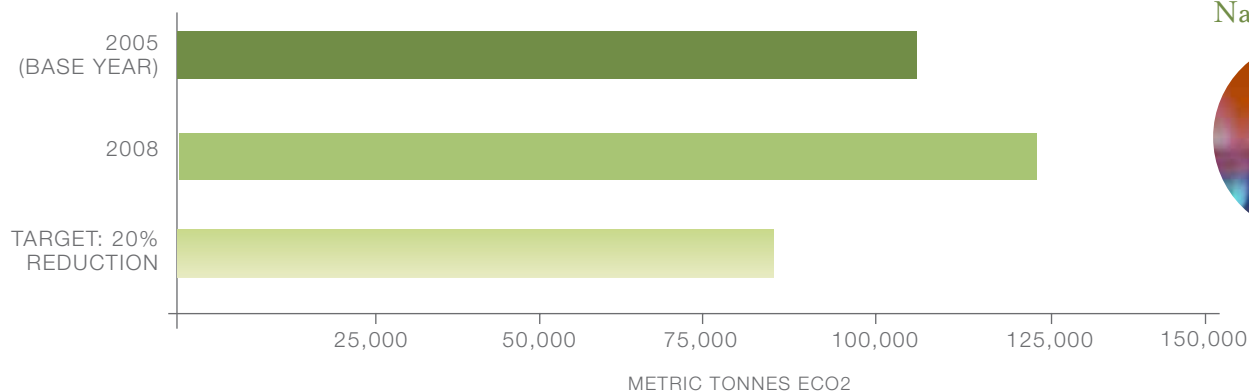
Regulatory Considerations

Wisconsin Act 141 requires State agencies and University Campuses to purchase 10 percent of their energy from renewable sources beginning in fiscal year 2008 and to increase this amount to 20 percent by 2011. Both of these measures support the UWM goal of achieving a 20 percent reduction in CO₂ emissions by 2020.

Best Management Practices

The above noted energy efficiency goals and the targets for renewable energy all assist in the reduction of greenhouse gas emissions associated with University activity.

EMISSIONS: 2005, 2008, AND TARGET



EMISSIONS SOURCE TYPES



Emission Reduction Recommendations

The methodology for calculating green house gas emissions at UWM was established by the Greenhouse Gas Protocol (GHG Protocol) developed by the World Resources Institute and World Business Council for Sustainable Development. In the base year of 2005, UWM emissions totaled 106,308 MTeCO₂ in three main categories or scopes:

Scope 1: Emissions resulting from stationary consumers of fossil fuel such as the Central Plant as well as the campus fleet of vehicles. In 2005, Scope 1 emissions totaled 26,806 MTeCO₂. (metric tonnes of carbon dioxide equivalents).

Scope 2: Emissions resulting from consumption of purchased electricity. In 2005, Scope 2 emissions totaled 54,679 MTeCO₂. (Note: it is assumed this includes 20% renewable energy content as per the provisions of Wisconsin Act 141).

Scope 3: Emissions resulting for indirect activities attributable to UWM including commuting and air travel purchased by the University. In 2005, the estimated Scope 3 emissions were 35,220 MTeCO₂. (Note: The majority of the Scope 3 emissions are related to commuter travel. There are no data for commuter related CO₂ emissions for 2005. In response, 2008 data were utilized to estimate the 2005 total. In 2008, 25,668 students produced 25,550 MTeCO₂. Assuming that amount of emissions from commuters increased proportionally with other students, emissions in 2005 were likely around 24,250 MTeCO₂ for a student population of 24,387).

Emission Reduction Targets and Strategies at Kenwood

To reduce UWM emissions by 20% from the base line year of 2005 by 2020 will require multiple actions. The 2020 total emissions target (Scopes 1-3) requires a reduction from 106,308 MTeCO₂ to 85,046 MTeCO₂, a decrease of 21,262 MTeCO₂.

In support, several strategies are recommended in the Master Plan.

Scope 1 Emissions Reduction Strategies

Emissions sources owned and controlled by the University will be difficult to reduce as the campus grows in size. Reductions will require greater efficiency in existing facilities and operations. The following are recommended strategies to that end:

1. Reduce Steam Load—through efficiency measures at several existing buildings (improve schedules, reduce outdoor air intake).
2. Heat pump loop for new buildings—create a heat pump system to recover exhaust gases from the Central Plant stacks to provide heat to all new buildings proposed in the Master Plan without additional Scope 1 emissions. A low-temperature hot water loop serving the new buildings would be required to implement this system. This would increase plant efficiency by an estimated 15 percent if all new buildings are 30 percent more efficient than building code as required by EO145. The addition of circulating heat pump loop and heat pumps in buildings will, however, increase Scope 2 emissions.

Scope 2 Emissions Reduction Strategies

Electricity is delivered at a net efficiency of 25-30% and is generated with a mix of coal, hydroelectric and nuclear power has an emissions factor 4 to 5 times that of natural gas. Scope 2 emissions can be reduced at the building level through efficiency and conservation efforts, and improvements in controls and equipment management. Performance Contracts are being utilized to assist with this opportunity.

Over the long-term, federal regulation could require utility companies to switch to lower carbon fuels thereby decreasing emissions in UWM facilities. UWM may need to consider purchasing Renewable Energy Credits (RECS) or Carbon Credits to achieve the desired reduction targets.

Potential reduction strategies include:

1. Reduce building electrical loads / increase efficiency of building operations. To offset the impact of new buildings, existing buildings will need to be more energy efficient. Strategies include energy efficient equipment and fixtures, improvements to air handling systems, operation schedules and more reliance on daylighting.
2. Combined Heat and Power Production – preliminary analysis indicates that use of a natural gas turbine generator combined with heat recovery for campus heating would result in an estimated reduction of 20,000 MTeCO₂ per year. (additional analysis required)
3. Solar Technologies—small scale demonstration projects could reduce emissions slightly.
4. Renewable energy credits could be purchased as last resort.

Scope 3 Emission Reduction Strategies

The majority of the Scope 3 emissions originate from commuter travel to the University or about 23% of the total.

Potential reduction strategies include:

1. Providing more proximate or on-campus housing (700 bed residence hall is estimated to reduce Scope 3 by 730 MTeCO₂ and but would increase Scope 1 and 2 emissions by 1,840 MT)
2. Increasing campus fleet efficiency from 22 to 40 mpg could reduce emissions by almost 50% (small number compared to campus wide emissions)
3. Carpooling—only 3 percent of faculty and 6 percent of staff carpool to campus.

Emissions Reduction Scenarios

To meet the objective of reducing CO₂ emissions by 20%, the three scopes will need to be addressed all of which are intertwined with energy use on the campus. To that end, three scenarios were explored in the Master Planning process to estimate emissions on the Kenwood campus in the target year of 2020. A brief description of the scenarios and the estimated outcomes are summarized as follows:

Scenario 1: Conservation measures implemented in existing buildings per the 2009 Performance Contracts.

Total estimated emissions - 101,495 MTeCO₂

Scenario 2: Construction of new buildings at Kenwood to be more efficient than existing buildings per EO145. The estimated emissions for existing buildings with conservation implemented plus the new buildings being served in the same manner as existing buildings (high pressure steam and chilled water).

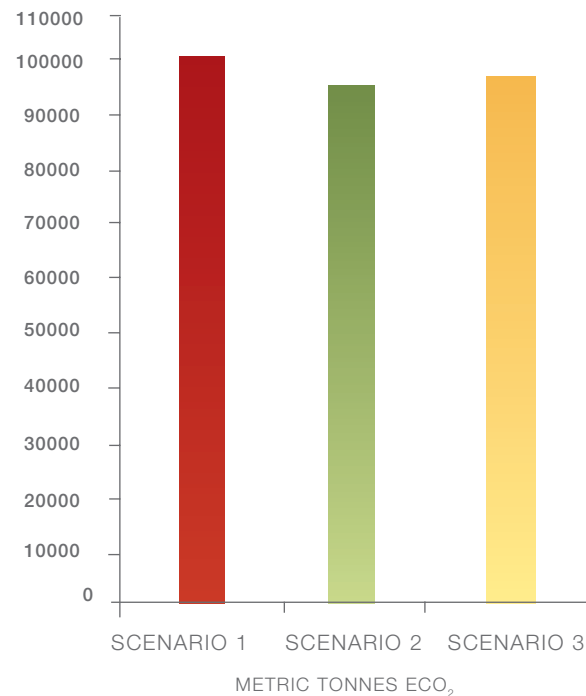
Total estimated emissions: 95,318 MTeCO₂

Scenario 3: All buildings are included in conservation / efficiency efforts and new buildings are served from a central heat pump loop.

Total estimated emissions: 96,339 MTeCO₂

As noted, the target emissions level for 2020 is approximately 85,000 MTeCO₂. As summarized above emissions reductions coupled with preliminary emissions estimates for proposed facilities exceeds the target in all three scenarios. To meet the target, UWM will need to consider options for increasing renewable energy use or consider purchasing carbon offsets.

EMISSIONS REDUCTIONS SCENARIOS



Bibliography

Wasley, James, et al., "UWM as a Zero-Discharge Zone, A stormwater Master Plan for the UWM Campus", May 2006

Wasley, James, et al., "The Pavilion Gateway Demonstration Project", May 2006

Nelson, Kate M., "UW-Milwaukee Environmental Sustainability Plan—Draft", July 2009

Nelson, Kate M., "UW-Milwaukee Sustainability Plan—Draft", July 2008

Division of State Facilities, Sustainable Facilities Policy and Guidelines, October 2007 Downloaded December 2009 <http://www.doa.State.wi.us/category.asp?linkcatid=783&linkid=135&locid=4>

University of Wisconsin System Administration, Physical Planning Guide —Planning Tools, 2011-13 Capital Budget, November 2008

