UMass Amherst Sustainability Plan

SUSTAINABILITY PLAN

April 2005

DATE: _____

AGENCY COORDINATOR: _____

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This Sustainability Plan has been reviewed and approved by the Vice Chancellor of Administration and Finance, Joyce Hatch, of the University of Massachusetts Amherst on April 15, 2005.

Table of Contents

1.0 University of Massachusetts Overview

This document is arranged in accordance with the guidelines specified in the *Agency Sustainability Planning and Implementation Guide* for the Massachusetts State Sustainability Program. The State Sustainability Program was established in July 2002 by Executive Order No. 438, which requires state agencies to "work diligently and expeditiously to develop and implement policies and procedures to promote environmentally sustainable practices."

The University of Massachusetts Amherst (UMA) is in the unique position to educate the next generation of the professional workforce in sustainable practices. The University feels that it is important for us to first have a firm understanding of sustainable development in the workplace in order to educate future inhabitants of the workforce. For this reason the University has embraced the idea of sustainability planning and has established this document to detail University information, long term goals, short term actions, management systems, and tracking progress.

1.1 UMA's Purpose and Scope

UMA was founded in 1867 as a land-grant agricultural college set on 310 rural acres with four faculty members, four wooden buildings, 56 students and a curriculum combining modern farming, science, technical courses, and liberal arts. Over time, the curriculum, facilities, and student body outgrew the institution's original mission. By 1931, to reflect a broader curriculum, "Mass Aggie" had become Massachusetts State College. In 1947, "Mass State" became the University of Massachusetts at Amherst.

Immediately after World War II, the university experienced rapid growth in facilities, programs and enrollment, with 4000 students in 1954. By 1964, undergraduate enrollment jumped to 10,500, as Baby Boomers came of age. The next two decades saw the emergence of UMA as a major research facility with the construction of the Lederle Graduate Research Center and the Conte National Polymer Research Center. UMA entered the 21st century as the flagship campus of the state's five-campus University system.

A leading center for public higher education in the northeast, today the UMA has gained a reputation for excellence in a growing number of fields, for its wide and varied academic offerings, and for its expanding historic roles in education, research, and public service. The flagship campus of the Commonwealth's University system, the UMA currently occupies 9.3-million square feet of building space on 1,450-acres in the scenic Pioneer Valley of Western Massachusetts. The University has established itself as a major research university enrolling 24,000 students with 10 schools and colleges which offer 88 undergraduate majors, 68 master's and 48 doctoral programs. Sponsored research activities total more than $100 million a year.

To support these activities, the University maintains equipment and operations similar to those of a small city. These operations, combined with the operations necessary to feed and house 20,000 students and their families, as well as the educational and research operations performed as our primary business, create a varied and significant amount of environmental impacts.
The University operates over 1,000 laboratories which conduct chemical, biological and radioactive research and teaching. To support teaching and research in Amherst, the University maintains and operates a fleet of vehicles, a coal fired steam and power generation plant, a coal

yard, an intermediate solid waste processing facility, numerous food preparation areas, athletic facilities, grounds, roads, parking lots, mass transit, and numerous housing, research, teaching and administration buildings. In addition to the Amherst campus, the University operates various extension services throughout Massachusetts, such as the cranberry, fish, and apple orchard research stations, the Waltham, MA cooperative facility and greenhouse, the New Salem, MA astronomy station and various farms and turf facilities in the Pioneer Valley.

UMA has recognized the importance of assessing environmental impacts and developing tools to address these impacts. This work has typically been done on a departmental basis, such as Facilities and Campus Planning developing a "green building" policy, or Utilities working to reduce energy usage on campus, and Physical Plant working through the Intermediate Processing Facility to raise campus recycling rates. The University hopes to use this current initiative and our on-going EMS endeavor to expand upon existing efforts and develop them into comprehensive university-wide programs.

1.2 UMA's Sustainability Team

- Brian Fitzpatrick, Environmental Management Services Program Head*
- Craig Ruberti, Environmental Management Systems Coordinator
- Donald Robinson, Director Environmental Health and Safety
- Steven Goodwin, Associate Dean College of Natural Resources and the Environment
- John Pepi, General Manager Office of Waste Management
- Jason Burbank, Campus Energy Engineer Physical Plant Utilities Office
- Ludmilla Pavlova-Gillham, Facilities Planner Facilities and Campus Planning
- Robert Hendry, Rideshare Coordinator Parking Services
- Donald Futrell Associate Vice Chancellor of Facilities and Campus Services

* Sustainability Coordinator

UMA is in the process of developing a formal environmental performance review process to compliment our existing Environmental Management System efforts. It is our recommendation that the University develop a Council on the Environment (UMACE). The UMACE will meet every two months and is expected to carefully ascertain impacts and evaluate programs that could lead to new or revised environmental policies as well as operational strategies that have the potential to:

- Enhance University compliance with applicable environmental laws, regulations, rules, policies and procedures.
- Assess and reduce environmental impacts of UMA in a manner which incorporates sound business practices.
- Promote UMA as a leader in environmental performance.
- Coordinate environmental efforts and programs, and develop reporting, tracking and management mechanisms to ensure proper performance.
- Promote environmental education for the campus community

When the UMACE is developed it will supersede the Sustainability Team, with the members of the Sustainability Team serving on committees within their realm of expertise. The goal of the UMACE is to bring decision makers to the table to develop comprehensive oversight of environmental performance. The UMACE will aid in the implementation of the campus Environmental Management System. Through comprehensive management of environmental performance the University will see dramatic increases in performance in the eight areas identified by the *Agency Sustainability Planning and Implementation Guide*.

UMA's environmental impacts are the combined effects of campus operations. The responsibility for the management of many of these different impacts lie within numerous administration departments across campus. The consumers (academic departments and students) have limited responsibility for the management of these impacts, but are very aware of the issues. UMA is in a unique position to have various experts in aspects of sustainability as part of our constituency, both in administration and on the faculty. As such, UMA has developed a team that encompasses the various administration departments and includes the insight of our faculty.

1.3 UMA's Impacts on the Environment and Human Health

In order to identify the major environmental impacts of UMA operations, the Sustainability Team developed the following tables. Appendix A outlines our major operation, Appendix B, the associated activities, and Appendix C, their environmental impacts. The Sustainability Team worked to capture all of our major operations to determine the extent of the related environmental impacts.

1.4 Priority Environmental Impact Areas

UMA grouped operational activities into the six categories of identified priorities. The University determined that we have significant environmental impacts and opportunities for reduction in of these areas. These significant areas were determined using business and environmental decisions accounting for the amount of environmental impact, as well as the costs to reduce the impacts, the associated potential savings and pay back periods, and the amount of impact which could be readily reduced. The areas identified include:

1. Climate Change and Energy Efficiency
2. Waste Reduction and Recycling
3. Mercury and Persistent Bioaccumulative Toxins Reduction
4. Sustainable Design and Construction
5. Water Conservation
6. Environmental Compliance

UMA also identified the need to address these issues in a comprehensive management fashion to ensure proper management across departmental lines.

Climate Change and Energy Efficiency

The University of Massachusetts has various environmental impacts through air emissions from heating, energy use, vehicle operations, commuter traffic, and bus services. The major source of our air emissions is from the operation of our boilers in the steam generation plant, which primarily burn coal, and use natural gas, oil, and paper cubes to offset any need. Other sources of air emissions occur as a result of daily operations of our fleet of vehicles, mass transit services, commuter traffic, research, emergency generators, painting, parts washers, and other fugitive emissions.

The University also consumes large amounts of energy and water in order to operate the campus. The University consumed 113,452,075 KWh of electricity, 466,195 Decatherms of natural gas, 600,000 gallons of diesel and #2 fuel, 39,628 tons of coal, 161,429 gallons of gasoline, and 60,854 gallons of propane in FY04. This equates to a cost of $14,709,482.00 for energy and fuel consumption in FY04.

Climate Change/Energy Efficiency

Agency Operations	Activities	Environmental Impacts
Heating & Power Plant	▪ Coal offloading, storage, and trans. ▪ Fossil Fuel burning	▪ Air Emissions ▪ Water contamination ▪ Natural Resources Depletion ▪ Storm water pollution
Fleet Services, Transit Services, and Commuter	▪ Vehicle and Equipment Maintenance ▪ Vehicle and Equipment Painting ▪ Fueling Operations ▪ Vehicle and Equipment Operation	▪ Air Emissions ▪ Water contamination ▪ Natural Resources Depletion ▪ Storm water pollution
Building Operations	▪ Research and Teaching ▪ Office and Storage ▪ Housing and Food Preparation ▪ Heating and Cooling	▪ Air Emissions ▪ Natural Resources Depletion ▪ Water Use ▪ Energy Use

Current Initiatives:

- Ride Share

  The UMA Rideshare Program provides an alternative to drive alone vehicles by assisting UMA employees and off-campus students with the formulation of carpools. The goals of the UMA Rideshare Program are to:
  - Reduce the commuter traffic to UMA.
  - Improve the environment and air quality of the region.
  - Offer an economic alternative to full cost UMA parking permits.

  Rideshare services are offered free of charge to any employee or off-campus student on the Amherst campus. Services offered include carpool matching service, Guaranteed Ride Home, and commuter information on transit services and park and ride lots. Benefits of participation include reduced parking permit fees, preferred parking spaces, and free one day passes to accommodate occasional need to drive alone.

- Central Heating Plant

  The new Central Heating Plant will use the latest pollution control technologies including advanced combustion turbine low Nitrogen Oxide burners, advanced Selective Catalytic Reduction and Oxidation Catalyst pollution control technologies, and will include a combined cycle system comprised of 'topping' and 'bottoming' steam turbines, in addition to its combined heat and power process systems. When completed, the CHP will utilize advanced technologies, while meeting some of the most stringent air quality permit requirements for a combustion turbine facility of its kind in the United States. Its combined heat and power applications together with its advanced cogeneration systems will result in the highest thermodynamically efficient cycles possible. Its recycling of municipal wastewater plant effluent for boiler make-up water will reduce the demand for process water on the local public drinking water system (fed by groundwater wells) by 200,000 gallons per day.

  The University also plans on utilizing the excess steam to generate a significant amount of energy, which will be consumed by campus. The energy created will not contribute additional emissions, but will eliminate much of the strain put on local energy production facilities, such as the coal fired plant at Mount Tom. The Utilities department will also continue to research the application of renewable energy products, such as the photovoltaic lights utilized in University parking lots. The utilization of these lights has decreased the University's consumption of energy.

- Energy Reduction Program

  The Physical Plant, in conjunction with the Division of Capital Assessment Management (DCAM), will soon be completing a $50 to $80 million energy conservation project for the campus. The Capital Improvement project will be funded by utility savings over the next ten years. A key goal of the project is to improve campus building performance in conjunction with saving on operating costs. Since the contractor will guarantee the performance of the measures, the agreement is commonly called a performance contract. Some of the more obvious components to undergo renovation will be lighting and lighting controls, new chillers and other building mechanical improvements, water conservation measures including low flow toilets, and steam and electric distribution improvements including building metering.

- Sustainable Design

  The University developed a commitment to Green Building design through our Green Building Design Policy and New Building Council. The University developed a policy which states that we will commit to a resource and energy conservation program based on continual improvement in the design and construction of new buildings and major renovations. UMA will:
  - Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity;
  - Use resources efficiently by designing buildings that minimize energy and water use and maximize use of natural daylight, exceeding code minimums where appropriate and feasible;

- Use environmentally preferable products, including (but not limited to) those without toxic ingredients and those which contain recycled content;
- Create healthy indoor and outdoor environments for building occupants, workers and communities;
- Minimize adverse impacts that site development may have upon natural and built systems;
- Explore and act on opportunities to employ renewable energy technologies;
- Follow, to the maximum extent practicable, guidelines for the construction of green buildings, including the Division of Capital Asset Management Sustainable Design Program and the U.S. Green Building Council's LEED Rating System;
- Integrate building commissioning into the study, design and operations of campus buildings; and
- Provide training to all building occupants on energy conserving practices relevant to their building's operation.

- Paper Cube and Biomass

  UMA is always investigating alternative fuels to burn in our heating plant. The University has offset some of its coal use with paper cubes. The cubes are purchased locally and used to fire our boilers to generate steam. The University started a year ago with a test burn and has since increased the use of paper cubes to 1,250 tons. The University expects to continue to increase the use of paper cubes to 5,000 tons in FY06. UMA just completed a test burn and analysis in conjunction with the Massachusetts Department of Environmental Protection to assure the paper cubes are compliant with Massachusetts air standards.

Waste Reduction and Recycling

UMA operates a highly successful solid waste program. The University recycles more than 50% of its solid waste and realizes more than $250,000.00 in avoided landfill costs. The University also has a very active hazardous and universal waste management program, which also recycles much of its waste. However, these programs affect only the end of the life cycle, with no influence on the purchasing practices and limited influence on waste minimization.

Currently the University generated 3,379 tons of solid waste and recycles 4,016 tons of material for a total of 7,395 tons of material managed in FY04. This accounts for a cost of approximately $1,339,836.000 in solid waste and recycling in FY04. In addition to the solid waste and recycling, the University spent approximately $220,000.00 on hazardous waste disposal in FY04. The total on waste disposal and recycling is well over $1,500,000.00 for FY04.

Waste Reduction and Recycling

Agency Operations	Activities	Environmental Impacts
Office Management	▪ Computer Use ▪ Paper, Reports, Memorandums ▪ Forms, ▪ Space use	▪ Electrical waste ▪ Paper waste ▪ Energy and Water use ▪ Hazardous and Universal Waste
Teaching and Research	▪ Laboratory chemical use ▪ Teaching chemical use ▪ Art and design chemical use ▪ Space use, papers, forms,	▪ Electrical Waste ▪ Paper waste ▪ Energy and Water use ▪ Hazardous and Universal Waste
Maintenance and Facilities Operations	▪ Maintenance Chemicals ▪ Oil Storage and Waste oil ▪ Lighting maintenance ▪ Parking lot and road maintenance	▪ Electrical Waste ▪ Paper waste ▪ Energy and Water use ▪ Hazardous and Universal Waste

Current Initiatives:

- Hazardous Waste Management

  The University of Massachusetts has an established and comprehensive hazardous waste management program in place. The program is designed to educate the hazardous waste generators, capture hazardous wastes, properly label and store them, and dispose of the wastes in accordance with state and federal laws. UMA also captures and disposes of many wastes, which although not hazardous per regulation, are hazardous to human health or the environment.

  UMA has also begun work to identify areas in which we can accomplish waste minimization and pollution prevention. These areas include:
  - Removal of most PCB transformers and ballasts on campus and replacement with non-PCB materials and where possible dry transformers
  - Substitution of latex and less hazardous paints
  - Substitution of non-aerosol cleaners, and maintenance chemicals
  - Movement to micro-scale chemistry in teaching labs
  - Movement to non-hazardous chemistry in introductory chemistry labs
  - Removal of mercury thermometers and replacement with less hazardous thermometers

  UMA utilizes recycling whenever it is a viable alternative, and chooses incineration, aqueous treatment, chemical precipitation, or another form of complete destruction for other material. UMA only uses landfill as a last resort for items with no other viable or accepted form of more complete destruction, such as asbestos.

- Universal Waste Management

  The University of Massachusetts has an established and comprehensive universal waste management program. The program is designed to educate the universal waste generators, capture universal wastes, properly label and store them, and dispose of the wastes in accordance with state and federal laws. As part of the Energy Project, UMA has seen a large increase in Universal Waste Lamps from the change out of fluorescent

lamps to the low mercury fluorescent lamps. The University has a strict policy of recycling all lamps regardless of the amount of mercury. The University also recycles large volumes of batteries and ink cartridges for the campus community.

- Solid Waste and Recycling

  UMA's Office of Waste Management recycles 57% of the University's solid waste stream, saving well over $300,000.00 per year in avoided landfill costs, as well as revenues from the sale of some of the recycled streams. The University operates its own solid waste removal and processing programs. All solid waste is collected throughout campus by UMA employees and brought to an Intermediate Processing Facility (IPF). At the IPF the solid waste is sorted and disposed, recycled, or composted on site.

  The University also recycles the following materials:
  - Ballasts, Books, Batteries, and Toner
  - Mixed containers, paper, and cardboard
  - Scrap Metal, CRTs, and Electronics
  - Fly Ash and Concrete
  - Magnetic Media
  - Tires
  - Waste Oil
  - Animal Bedding, Wood Chips, Food Waste and Plant Waste are all composted on site

Mercury and Persistent Bioaccumulative Toxins (PBTs) Reduction

UMA operates a significant number of teaching and research laboratories, as well as health care and nursing facilities which utilize various mercury thermometers, manometers, mercury compounds, and other mercury containing devices, as well as other PBTs. The University is aware of the hazards associated with mercury and is taking action to encourage mercury reduction. The University is taking action to identify and reduce the number of unnecessary mercury containing equipment and mercuric compounds. The University is also developing methods to identify and track other sources of mercury on campus.

UMA has taken great strides in ridding the campus of polychlorinated biphenyls. The University has a handful of PCB transformers on campus, which are tracked and inspected on a regular basis. The University is also replacing light fixtures and ballasts as part of the energy performance project. As a result the University will remove any remaining PCB ballasts.

The University must identify potential sources of PBTs and continue to replace them when possible. PBTs may continue to be used in small quantities in research, under controlled conditions. However, all other sources should be eliminated and replaced wherever feasible.

Mercury and PBT Reduction

Agency Operations	Activities	Environmental Impacts
Building Operations	▪ Heating and Cooling ▪ Lighting Maintenance	▪ PCB Transformers ▪ PCB Ballasts ▪ Mercury Vapor Lights ▪ Mercury Containing Equipment
Teaching and Research	▪ Teaching chemical use ▪ Laboratory chemical use	▪ PBT Research ▪ Mercury Containing Equipment ▪ Mercury ▪ Mercury Compounds and Reagents
Maintenance and Facilities Operations	▪ Heating and Cooling ▪ Building Maintenance ▪ Lighting maintenance ▪ Water Use	▪ PCB Transformers ▪ PCB Ballasts ▪ Mercury Vapor Lights ▪ Mercury Containing Equipment

Current Initiatives:

- Thermometer Exchange Program

  UMA, through a grant issued by the Executive Office of Environmental Affairs, has begun a thermometer exchange program. The University has already identified more than 1500 mercury thermometers which will be turned in or exchanged for mercury free thermometers. The mercury which is collected will be sent for recycling.

  The thermometer exchange program has multiple goals:
  - Identify teaching and research areas which utilize mercury containing equipment
  - Exchange mercury free thermometers for existing thermometers where feasible
  - Develop better storage and handling procedures for mercury thermometers which are not exchanged
  - Develop a purchasing protocol to assure mercury thermometers are not purchased when there is a suitable alternative

  Once the University has completed the thermometer exchange program, we will review the feasibility of pursuing other mercury containing equipment and mercuric compounds found in thermostats, switches, measuring equipment, and other equipment located throughout the University. Laboratories also use mercury, mercury reagents and mercury compounds. The University will also review the feasibility of introducing non-mercury reagents, and reducing the amount of chemistry performed with mercuric compounds.

- PCB Reduction

  UMA has identified and replaced the vast majority of its PCB filled transformers. Several of these transformers are currently stored in a campus storage facility awaiting shipment this spring. The University is in the process of completing a survey to ensure that all University owned PCB transformers have been removed, or will be removed this spring. The University is making an effort to replace these transformers with dry transformers to reduce the amount of oil filled transformers on campus.

The University is also removing lights and light fixtures as part of the energy performance project. The ballasts removed from these fixtures are sorted by type and recycled. Once this project is complete the University will be free of PCB ballasts.

- Fluorescent Light Retrofit

  The University is retrofitting light fixtures with low mercury lamps as part of the energy performance project. The University currently manages all fluorescent lamps as Universal Waste, which ensures that the release of any mercury would be minimized. The University also intends to continue to manage all fluorescent lamps as Universal Waste, and to continue to recycle all lamps. The elimination of higher levels of mercury will protect the campus from accidental breakage, and improper disposal should it ever happen.

Sustainable Design and Construction

The University is beginning an important phase of capital improvement through renovation and new building construction. Many of these buildings will be used to house research and teaching spaces which utilize large amounts of energy in their daily operation. It is very important that the University utilize appropriate design strategies to alleviate some of the energy strains common to these buildings. UMA has developed a sustainable building design policy and program which will be used to aid in the design and construction of these new buildings, as well as to renovate the existing structures. Sustainable design responsibilities fall to the Facilities and Campus Planning department.

UMA considers this environmental impact reduction process a win-win situation as the University will recognize significant cost savings in operations, with a relatively quick return on investment. UMA must ensure that the program proceeds in a comprehensive and systematic fashion.

Sustainable Design and Construction

Agency Operations	Activities	Environmental Impacts
Building Operations and Renovation	▪ Maintenance ▪ Renovation	▪ Energy Use and Emissions ▪ Water Use ▪ Waste and Materials use ▪ Indoor Environmental Quality
New Construction	▪ Building Design ▪ Construction ▪ Operation	▪ Site Location and Impacts ▪ Waster Use ▪ Energy Use and Emissions ▪ Waste and Materials use

Current Initiatives:

- Sustainable Design

  The University developed a commitment to Green Building design through our Green Building Design Policy and New Building Council. The University developed a policy which was included in the Climate Change and Energy Efficiency section. The intent of the policy is to ensure that the University will commit to a resource and energy conservation program based on continual improvement in the design and construction of new buildings and major renovations.

Water Conservation

UMA has designed its first water conservation effort in replacing the consumption of fresh water for steam generation with the consumption of grey water from the adjacent waste water treatment facility. The University currently used 59,935,800 gallons of water in FY04 for a cost of $2,367,933.00. UMA recognizes that this is a significant impact.

Water is used in all of the University's operations, from offices, laboratories, and facilities maintenance, to housing and food services. Its universal application makes it a large impact, but also identifies it as a significant target for sustainability efforts.

Water Conservation

Agency Operations	Activities	Environmental Impacts
Building Operations and Renovation	▪ Housing ▪ Maintenance ▪ Food Services ▪ Office Management	▪ Water Use ▪ Wastewater ▪ Water Quality ▪ Wetlands
Teaching and Research	▪ Laboratory Operations ▪ Maintenance ▪ Office Management	▪ Water Use ▪ Wastewater ▪ Water Quality ▪ Wetlands
Maintenance and Facilities Operations	▪ Heating and Cooling ▪ Building Maintenance ▪ Fleet Maintenance ▪ Grounds Management	▪ Water Use ▪ Wastewater ▪ Water Quality ▪ Wetlands

Current Initiatives:

- Grey Water

  The University has agreed with the Town of Amherst, MA to utilize grey water from the adjacent waste water treatment plant. The grey water will be used in the steam generation process. The grey water will also be used in irrigation of grounds and athletic fields. The use of grey water will significantly reduce the amount of potable water currently used in these processes.

- Low Flow Fixtures

  The University is utilizing low flow fixtures, such as faucets, toilets, and showers, in new construction and in large renovation projects. The university hopes to see a significant reduction in water used, as well as associated costs.

- Meters

  In order to better evaluate water usage and progress, the University has begun to meter every building with more than 28,000 square feet. Buildings which are smaller than 28,000 square feet are placed into a cluster, which is also monitored for water usage. The University will track water use and react accordingly.

Environmental Compliance

Environmental compliance has been important to the University since the regulations were first enacted in the 1970's. The University realized a renewed interest in compliance assurance in the 1990's when the Environmental Protection Agency identified Higher Education as a compliance enforcement target. The University works hard to assure compliance through education, assistance and enforcement of local, state and federal regulations. The responsibility for these programs falls to the Environmental Health and Safety Office, but the day to day compliance activities are shared by all.

The University has also adopted the implementation of an Environmental Management System, which helps to assure environmental compliance and promote environmental performance. Through this management effort we have identified several areas, which we would like to improve.

Environmental Compliance

Agency Operations	Activities	Environmental Impacts
Building Operations	▪ Housing ▪ Maintenance ▪ Food Services ▪ Office Management	▪ Chemical Use and Disposal ▪ Oil Storage ▪ Emissions ▪ Wetlands
Teaching and Research	▪ Laboratory Operations ▪ Maintenance ▪ Office Management	▪ Chemical Use and Disposal ▪ Emissions ▪ Chemical Purchasing and Storage ▪ Hazardous Materials Shipping
Maintenance and Facilities Operations	▪ Heating and Cooling ▪ Building Maintenance ▪ Fleet Maintenance ▪ Grounds Management	▪ Chemical Use and Disposal ▪ Oil and Fuel Use and Storage ▪ Emissions ▪ Stormwater Pollution

Current Initiatives:

- Multi-media review

  The Environmental Health and Safety Office is designing and implementing a third party multi-media inspection. The inspection will be used to review our current Title V permit, and our air programs. We will use the inspection to review the permit, program, training, recordkeeping, and emission sources. Once a comprehensive review has been performed the University will work to ensure that any identified issues have been corrected and recommendations for improvement have been incorporated into the program.

- EMS and Compliance

  The University has recently adopted an EMS and its philosophies. The EMS was initiated in the Chemistry department and in the Fleet Services area of Physical Plant. The EMS has expanded to include the Utilities area, and is currently being used to track all of our Title V, and SPCC requirements. The EMS is also part of a greater effort in recognizing that environmental obligations do not end with compliance. The University is beginning to use the EMS to expand on its environmental performance efforts, and tracking this comprehensive approach to reducing our environmental impacts.

1.5 Agency Operational Costs

The table below illustrates specific volumes and expenses for the University in fiscal year 2004. The University spent $18,638,162.00 in Fiscal Year 2004 on fuel, energy, water, solid and hazardous waste, and recycling. UMA tracks this information in order to measure annual performance.

FY04 Operating Costs

Topic	FY04 Data	Unit	Cost
Electricity	113,452,075	KWh	$ 7,452,031.00
Natural Gas	466,195	Decatherms	$ 3,189,024.00
Fuel Oil #2	558,719	Gallons	$ 512,242.00
Coal	39,628	Tons	$ 3,167,699.00
Paper Cubes	200	Tons	$ 10,000.00
Gasoline	161,429	Gallons	$ 252,233.00
Diesel Fuel	41,549	Gallons	$ 65,998.00
Propane	60,854	Gallons	$ 60,255.00
Water Use	59,935,800	Gallons	$ 2,367,933.00
Solid Waste	3,379	Tons	$ 600,589.00
Hazardous Waste	57	Tons	$ 220,911.00
Recycling	4,016	Tons	$ 739,247.00
Cost Total			**$ 18,638,162.00**
Recycling Breakout			
Mixed Paper	604	Tons	
Mixed Cans & Bottles	125	Tons	
Lawn and Yard Waste	433	Tons	
Metals	300	Tons	
Batteries	10	Tons	
C&D Waste	177	Tons	
Food Waste	503	Tons	
White Goods	123	Tons	
Corrugated Cardboard	365	Tons	
Electronics	171	Tons	
Paint	4	Tons	
Tires	12	Tons	
Toner	6	Tons	
Fluorescent Lamps	16	Tons	
Clothing	4	Tons	
Fly Ash	400	Tons	
Animal Bed	763	Tons	

2.0 Long-term Goals

The University has developed long-term goals consistent with its identified major environmental impacts. These goals serve as a broad view of the direction in which UMA wants to head. They are the compass to keep us on course, not the specifics associated with short-term goals, which will define our daily activities. This section describes the six long-term goals UMA has established that seek to minimize the environmental impacts of our operations.

The University feels that education and procurement are an important part of each of these long-term goals. Education is important, and the University is in a unique position to influence students through our mission as a teaching and research university. Although the University did not identify Environmentally Preferable Purchasing as one of its impact areas, it recognizes that purchasing and procurement practices are an important part of all areas. Reviewing procurement practices may help identify ways to reduce impacts through management on the front end of each area, eliminating waste by avoiding purchases is the most cost efficient form of reduction.

The University is an organic institution which changes year to year. The task of this committee is to develop intuitive and accurate accounting systems to track efficiencies and impacts. The system must have a series of indexes which will allow UMA to track progress and failures. Another important aspect is financial costs and gains, which must be determined in order to compare our successes with their true costs. Economics is very important to this process and each success must only be deemed so after developing a cost benefit analysis.

2.1 Climate Change and Energy Efficiency

Vision Statement:

Reduce greenhouse gas emissions to 1990 levels by the year 2010 and to 10% below 1990 levels by year 2020. Develop a greenhouse gas inventory, tracking and reporting program.

Long-term Sustainable Solutions:

- Explore alternative fuel sources for building heating and cooling, such as renewable energy and biomass
- Explore use of electric and alternative fuel vehicles for campus fleet
- Encourage the purchase of hybrid vehicles for off-campus trips
- Increase the effectiveness of Rideshare and other programs, such as bicycles and telecommuting to reduce the commuter traffic on campus
- Conduct conference calls and electronic meetings to reduce inter-office travel
- Conduct energy audits and retrofits for high energy consumption buildings
- Install efficient lighting and appliances
- Utilize on-demand hot water and occupancy sensors
- Educate campus population on ways to reduce energy consumption
- Create procurement policies to encourage purchase of energy efficient appliances, vehicles, etc.

2.2 Waste Reduction and Recycling

Vision Statement:

Reduce the amount of solid waste produced per person by 25% by 2010. Develop a solid waste inventory tracking and reporting program and educational program for the campus.

Long-term Sustainable Solutions:

- Increase visibility of recycling on campus
- Increase recycling programs on campus
- Reduce use of paper products and packaging on campus
- Educate campus populations on ways to reduce solid waste production
- Create procurement policies to encourage reduction in solid waste
- Educate campus population to reduce inventory to eliminate unnecessary waste from unused product
- Encourage contractors to adopt similar practices and ensure materials brought in are brought out by the contractor
- Develop the ChEMS inventory system to track purchasing and use of chemicals in teaching and research laboratories to promote waste minimization
- Encourage electronic forms, memorandums, and teaching materials

2.3 Mercury and Persistent Bioaccumulative Toxins Reduction

Vision Statement:

Eliminate all the unnecessary use of mercury on campus by 2010. Eliminate all the unnecessary use of PCBs on campus by 2010. Develop a PBT inventory tracking and reporting program, and educational program for the campus.

Long-term Sustainable Solutions:

- Exchange all unnecessary mercury thermometers for non-mercury replacements
- Replace all PCB transformers with non-PCB replacements, dry transformers wherever it is feasible
- Replace all PCB ballasts with non-PCB ballasts
- Replace all mercury containing equipment with non-mercury alternatives wherever it is feasible on campus
- Research and replace mercury, mercury compounds and mercury reagents with less toxic substances wherever feasible
- Encourage micro-scale chemistry where mercury is necessary to reduce the amount of material on campus
- Educate campus to hazards of PBTs and develop a tracking program which allows EHS to identify locations of use and storage

2.4 Sustainable Design and Construction

Vision Statement:

All new construction and large renovation projects will be subject to an integrated sustainable design approach that focuses on: site location and impacts, water consumption, energy consumption, indoor environmental quality, and waste and materials. Develop a sustainable design inventory tracking and reporting program, and use new spaces as educational opportunities for the campus.

Long-term Sustainable Solutions:

- Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity
- Use resources efficiently by designing buildings that minimize energy and water use and maximize use of natural daylight, exceeding code minimums where appropriate and feasible
- Use environmentally preferable products, including (but not limited to) those without toxic ingredients and those which contain recycled content
- Create healthy indoor and outdoor environments for building occupants, workers and communities
- Minimize adverse impacts that site development may have upon natural and built systems
- Explore and act on opportunities to employ renewable energy technologies
- Follow guidelines for the construction of green buildings, such as the DCAM Sustainable Design Program and the LEED Rating System
- Provide training to all building occupants on energy conserving practices relevant to their building's operation

2.5 Water Conservation

Vision Statement:

Reduce water consumption on campus by 20%, per person, by 2010, based upon 2004 baseline levels. Develop a water consumption inventory tracking and reporting program, and educational program for the campus.

Long-term Sustainable Solutions:

- Use grey water for all feasible activities, such as grounds and the heat generation plant
- Install waterless urinals wherever feasible
- Install high efficiency appliances
- Install low flow and metered faucets and showers wherever feasible
- Utilize native plants, which may be better suited to these climates and drought tolerant
- Identify leaks and other inefficiencies in the system and correct them when appropriate
- Set periodic reduction goals and track savings

2.6 Environmental Compliance

Vision Statement:

Complete the installation of the Environmental Management System and its culture by 2010. Develop an environmental compliance inventory tracking and reporting program, and educational program for the campus.

Long-term Sustainable Solutions:

- Continuously monitor environmental compliance
- Educate all areas on campus which affect compliance to ensure compliance becomes part of the core values
- Develop a comprehensive management system which encourages decision makers to account for every action and its impacts
- Develop compliant programs which fit with University goals and activities
- Continuously review environmental regulations and update University programs as appropriate
- Develop procurement policies to encourage smarter compliance with environmental regulations, such as double walled oil storage tanks, reduced chemical purchases, oil in less than 55 gallon drums, etc.

3.0 Short-term Goals

This section identifies a list of short term action steps that the University will take to move forward towards a more sustainable campus. These short-term goals are designed to allow the University to identify tracking and measurement metrics to better evaluate our current position and to establish baseline measures. The University is also concerned that it continue to include operations costs, return on investment, and cost benefit analyses in their efforts to reduce environmental impacts. The UMA Short-term Action Steps were developed by the University Sustainability Team. The Team identified energy, water and waste issues as impact areas in which we may have the greatest return on our investments in the shortest amount of time. These areas will also be easily monitored through easily measurable and tracked results.

3.1 Comprehensive Management

The first and most important short-term action is to develop a management tool, which allows the University to track and measure environmental impacts and costs. As the University continues to grow, the measurement must be weighed against an input, such as users to develop performance indicators. A user would be defined as a full-time employee or student of the University. In using proper performance indicators the University can develop more telling and accurate numbers.

Sustainability should be moved forward at UMA through an effort which includes a high level centralized support system. Currently there is no entity which exists on campus to review the environmental impacts created in the normal business operations of the institution. The Environmental Health and Safety Office acts as a central entity to review, record, and track environmental compliance and many departments, such as Physical Plant and Facilities Planning, act independently to manage internal performance programs, such as the IPF waste reduction and recycling, the energy reduction program, and efforts to build "green buildings". However, the lack of a central entity makes a comprehensive review of these efforts difficult at best, which in turn makes sustaining these efforts and determining success of these efforts difficult. It is the Team's recommendation that UMA create an Environmental Council that is responsible for coordinating the campus sustainability efforts.

Education is the third and equally important function of the comprehensive management program. As we work to connect the uncoordinated departmental efforts, it is imperative that we educate the University to include environmental impact into their decision models. Many decisions at the University have a ripple effect, creating issues in other areas away from the sources of the decision. Departments on campus must be aware of the effects their decisions have, and must feel the responsibility to take these effects into account. Education of personnel in sustainable efforts must also become a priority on campus. Many easily attainable goals are a direct result of people taking small actions on their own, such as turning appliances off when not in use. Sustainability will not be achieved unless it becomes a part of the campus culture.

3.2 Short-term Action Steps

Climate Change and Energy Efficiency

- Continue to implement the Energy Performance Project
- Reduce facility energy consumption through facility energy conservation projects with a short return on investment
- Continue to investigate alternative fuels, such as the paper cubes, and renewable energy
- Identify funding sources for alternative fuels, renewable energy, and other energy conservation projects
- Identify behavioral practices and educate personnel on these practices to reduce energy consumption
- Develop a tracking program to record identified energy consumption points to ensure proper management and tracking

Waste Reduction and Recycling

- Continue with current waste reduction and recycling efforts
- Increase level of some recyclable collection, such as batteries, bottles and paper
- Develop educational items to promote buying less, stocking less, and considering true costs of purchases, to include cost of disposal
- Identify behavioral practices and educate personnel on these practices to reduce solid waste production
- Implement a chemical tracking and purchasing system to reduce redundant chemical orders and ensure proper tracking and management

- Develop a tracking program to record solid and hazardous waste areas, the amount generated per person, and other identified points to ensure proper management and tracking

Mercury and Persistent Bioaccumulative Toxins Reduction

- Institute the Thermometer Exchange Program
- Survey the University community to identify areas in which mercury and other PBTs are being used
- Develop a tracking program to record these areas, their uses, the amounts and materials, and other identified points to ensure proper management and tracking
- Educate personnel about alternatives to PBTs and micro-scale processes, to reduce the quantity of PBTs purchased, stored and used at the University

Sustainable Design and Construction

- Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity
- Use resources efficiently by designing buildings that minimize energy and water use and maximize use of natural daylight, exceeding code minimums where appropriate and feasible
- Use environmentally preferable products, including (but not limited to) those without toxic ingredients and those which contain recycled content
- Create healthy indoor and outdoor environments for building occupants, workers and communities
- Minimize adverse impacts that site development may have upon natural and built systems
- Explore and act on opportunities to employ renewable energy technologies
- Follow guidelines for the construction of green buildings, such as the DCAM Sustainable Design Program and the LEED Rating System
- Provide training to all building occupants on energy conserving practices relevant to their building's operation

Water Conservation

- Eliminate unnecessary water use
- Identify and repair areas which contribute to major water loss, such as underground pipes
- Include water conserving measures in all new building projects and large renovations, such as toilets, showers, faucets
- Introduce water conserving lawn and landscape techniques and technologies
- Utilize grey water from adjacent wastewater treatment plant for all appropriate applications, such as steam generation and grounds
- Develop a tracking program to record these areas, the water usage, and other identified points to ensure proper management and tracking

Environmental Compliance

- Finish implementation of the Environmental Management System
- Complete a multi-media audit of campus compliance by December 2005
- Complete update of permits, programs, plans, and reports by August 2006
- Develop comprehensive system for assuring continued compliance with environmental regulations
- Educate campus personnel on appropriate environmental compliance points, compliance should become part of the campus culture
- Develop the EMS tracking program to record all compliance points and associated data, and to ensure reporting is performed

4.0 Formalized Management System

Developing a sustainability work plan is important, but it is also important to develop an ongoing process through which sustainability efforts are promoted to the University despite individual levels of commitment. The team responsible for the continuous improvement of environmental performance must include high level decision makers. It is the University's opinion that an Environmental Council should be created. The working committees of the council will be headed by members of the current sustainability team, each heading the area of which they have the most expertise. The Council itself will consist of the Directors of Housing, Physical Plant, Facilities and Campus Planning, Office of Information Technology, Athletics, Auxiliary Services, Extension Services, and the Dean of the College of Natural Resources and the Environment. The Council will be headed by the Associate Vice Chancellor of Facilities and Campus Service, who will also be assuming the title of Sustainability Coordinator.

UMA will use this mix of working committees and the Environmental Council to ensure environmental performance is considered as part of the business decisions made during day to day operations, planning, and introduction of new programs. UMA will use the existing EMS and its structure to capture and record data, develop comparisons and assessments, perform educational and training efforts, and in making decisions. The EMS model is one of a Plan, Do Check, Act, and is iterative in nature promoting continuous improvement. UMA sees this as complimenting the sustainability efforts and will work within this framework.

Environmental Council

UMA is in the process of developing a formal environmental performance review process to compliment our existing Environmental Management System efforts. It is our recommendation that the University develop a Council on the Environment (UMACE). The UMACE will meet every two months and is expected to carefully ascertain impacts and evaluate programs that could lead to new or revised environmental policies as well as operational strategies that have the potential to:

- Enhance University compliance with applicable environmental laws, regulations, rules, policies and procedures.
- Assess and reduce environmental impacts of campus in a manner which incorporates sound business practices.

- Promote the campus as a leader in environmental performance.
- Coordinate environmental efforts and programs, and develop reporting, tracking and management mechanisms to ensure proper performance.
- Promote environmental education for the campus community

The Environmental Council will review recommendations submitted by the associated working committees. The Environmental Council will make environmental performance recommendations based upon sound business decisions. This is a high level decision making committee

Environmental Management System

The University of Massachusetts is committed to environmental excellence in our teaching, in our research, in our partnership with the community, and in the management of our own organization. Consistent with this commitment to environmental excellence, the University, in partnership with the US Environmental Protection Agency, is serving as a demonstration site for a pilot Environmental Management System. The pilot EMS provides a methodology to systematically assess and enhance environmental performance. The EMS is embodied in a set of environmental principles that collectively reflect the University's commitment to "STRIVE for Environmental Excellence". These principles are identified in Appendix D.

UMA has already committed to the EMS and feels that it is the perfect tool in which to house our sustainability efforts. The EMS Coordinator will be responsible for tracking and reporting, as well as developing management tools to aid in the measurement of progress. Although the EMS has been used, to date, to ensure compliance, this is the next logical step in the continuous improvement cycle to move from environmental compliance to environmental performance.

5.0 Tracking and Reporting

UMA Tracking and Reporting

UMA is in a unique position in that it already employs an EMS, and a powerful web-based EMS software called Enviance. Through this software UMA has one powerful, flexible environmental health and safety (EHS) software application. The Enviance System gives UMA all the fully integrated environmental management information system (EMIS) tools necessary to completely close the loop on EHS environmental management activities. Enviance consolidates and manages EHS data across all departments, and across all collection, storage, reporting, and data analysis activities. The Enviance System is designed to map EHS data to needs, business processes, monitoring technology and environmental management requirements.

The system allows UMA to build environmental components on site, which will notify users of data collection requirements, allow users to enter data into appropriate sections, and allows administrators to manipulate the data to prepare reports. This tool is currently used to record monthly, quarterly and annual compliance data, and to prepare monthly quarterly and annual reports. However, the system has the ability to track environmental performance and sustainability points. This system allows UMA to comprehensively manage all environmental performance activities through a paperless system.

The Environmental Coordinator is responsible for administering the Enviance system at the University. The Environmental Coordinator will be responsible for building out environmental performance tracking modules in Enviance. The Environmental Coordinator will also be responsible for developing measurement tools, reporting, and analysis of progress. These reports, and analysis will be prepared on a quarterly basis and presented to the Environmental Council. The Enviance software will also be used in the preparation of the annual reports which will be submitted to the Executive Office of Environmental Affairs.

Measurement and Continuous Improvement

UMA will conduct its own review process on a routine basis. UMA will take this opportunity to step back and consider how well the sustainability program is working. Key questions UMA will consider are:

1. How effectively are we performing against our goals and targets?
2. If our performance is not meeting expectation:
    - What is the problem e.g., resources, training, failed to revise plans when change occurred, etc.?
    - What steps would prevent this problem in the future?
3. Is our management system effective?
    - Are we catching mistakes before they become big problems?
    - Are we adapting to change effectively?
4. What are upcoming changes that may affect what we need to manage, such as new environmental regulations, changes in our operations, budgets, etc., that may affect how we manage environmental issues?
5. What can we do to ensure continuous improvement?

The University will utilize industry standards and peer groups, such as the Campus Consortium for Environmental Excellence, to develop suitable performance indicators. UMA will measure our performance against:

1. Historic performance at UMA
2. Performance of comparable higher education campuses
3. Performance of comparable organizations, businesses, and municipalities
4. Other identified and acceptable standards

Appendix A

Table 1: UMA Major Operations

▪ Teaching & Education	▪ Office Operations
▪ Research & Laboratory Management	▪ Pools
▪ Building Management	▪ Police Force & Security
▪ Construction & Renovation of Buildings	▪ Special Events
▪ Equipment & Vehicle Maintenance	▪ Storm Water Management
▪ Fiscal & Contract Management	▪ Solid Waste & Recycling
▪ Fleet Management	▪ Steam & Power Generation
▪ Historic Building Preservation	▪ Coal Storage & Transportation
▪ Human Resources	▪ Transportation
▪ Ice Skating Rink	▪ Snow & Ice Removal
▪ Athletics	▪ Parking Operations and Roads
▪ Landscaping & Grounds Management	▪ Cranberry Bog Research & Operations
▪ Natural Resources and Facility Planning	▪ Apple Orchard Research & Operations
▪ Park & Daycare Management	▪ Farm Operations, Education & Research
▪ Housing & Food Services	▪ Hotel Operations

Appendix B

Table 2: Associated Activities

▪ Building lighting, heating, cooling	▪ Landscape irrigation
▪ Catch Basin Cleaning	▪ Maintaining & cleaning vehicles & equipment
▪ Chemical Treatment in pools	▪ Managing leases & contracts
▪ Coal offloading, storage and use	▪ Mowing, trimming, pruning, fertilizing
▪ Collection and disposal of recycling	▪ Operating vehicles and generators
▪ Collection and disposal of solid waste	▪ Paving & patching roads & walkways
▪ Construction, renovation, maintenance	▪ Purchasing office supplies, IT equipment
▪ Disposal of hazardous waste	▪ Revenue collections
▪ Distribution services	▪ Sanitation & custodial services
▪ Education & research	▪ Snowplowing, ice melt application
▪ Fire Detection and Suppression	▪ Steam and power production
▪ Food storage, preparation, purchase	▪ Street sweeping and disposal
▪ Hiring and Training Staff	▪ Wastewater management

Appendix C

Table 3: Potential Environmental Impacts

▪ Acid Rain	▪ Nitrogen oxides air pollution
▪ Air emissions	▪ Noise pollution
▪ Airborne Mercury	▪ Nutrient Loading
▪ Asbestos and lead based paint exposure	▪ Oil and fuel contamination
▪ Climate change	▪ Particulate air pollution
▪ Erosion	▪ Point source pollution
▪ Hazardous waste disposal	▪ Resource consumption and depletion
▪ Impacts on surface and ground water	▪ Soil and water contamination
▪ Indoor air quality	▪ Solid waste disposal
▪ Loss of biodiversity	▪ Sulfur oxides air pollution
▪ Loss of irreplaceable historic resources	▪ Toxic air pollution
▪ Loss of open space	▪ Water emissions
▪ Lost employee productivity and work-days	▪ Water use

Appendix D

UNIVERSITY OF MASSACHUSETTS AMHERST

Environmental Management System Pilot Program

Commitment to Strive for Environmental Excellence

Chemistry and Biochemistry and Molecular Biology Departments

The University of Massachusetts Amherst is committed to environmental excellence in our teaching, in our research, in our partnerships with the community, and in the management of our own organization. Consistent with this commitment to environmental excellence the University, in partnership with the U.S. Environmental Protection Agency, is serving as a demonstration site for a pilot Environmental Management System [EMS]. **The pilot EMS provides a methodology** to systematically assess and enhance our environmental performance. The EMS is embodied in a set of environmental principles that collectively reflect the University's commitment to "**STRIVE** for Environmental Excellence". These principles include:

Stewardship
…To empower employees and students, within the framework of the EMS, to identify significant environmental aspects of campus operations, set objectives and targets, and design and implement programs consistent with existing or attainable resources to minimize impacts on human health and the environment.

Train
…To provide appropriate training to all employees and students to ensure competence and awareness of our environmental programs and procedures, the significant environmental impacts of their work or activities, their roles and responsibilities in support of our EMS, and the potential consequences of departure from specified procedures.

Reduce, Reuse, Recycle
To employ processes, practices, materials or products that avoid or reduce pollution. This may include process changes, efficient use of resources, material substitutions and recycling.

Improve Continuously
…To enhance the EMS through systematic evaluations and management reviews with the goal of continuous improvement of environmental procedures and performance.

Verify Compliance
…To validate compliance with laws, regulations and other requirements and obligations. Where practical, strive for environmental performance that may exceed the goal of achieving regulatory compliance.

Educate the Public
…To share what is achieved through the EMS process with interested parties both within and outside the University.

John V. Lombardi
Chancellor

11-04-02
Date