UNIVERSITY OF CENTRAL FLORIDA

9.0 CONSERVATION

2020-30 CAMPUS MASTER PLAN UPDATE

CONTENTS

INTRODUCTION

NARRATIVE

This element outlines the University's goals and policies related to conservation of natural habitats and species, prevention of water and air pollution, and efficient use of energy.

RELATED ELEMENTS

See 2.0 FUTURE LAND USE & URBAN DESIGN for a chart of the acreages of Developed, Developable, and Undevelopable campus lands and the Future Land Use Map.

See 5.0 GENERAL INFRASTRUCTURE & UTILITIES for more information on Energy Infrastructure and Conservation, and Water Use and Conservation.

See 6.0 TRANSPORTATION for policies designed to discourage dependence on personal automobiles and to encourage alternative modes of transportation on campus.

STATUTE & REGULATION

9.0 CONSERVATION is an element that is required by Florida Statue 1013.30(3). The element must follow the guidelines stated in Florida Board of Governors (BOG) Regulations, Chapter 21.

BOG 21.208 states the purpose of the element as follows:

> "This element ensures the conservation, protection and wise use of all natural ecosystems and natural resources on the university campus and in the planning study area".

9.1 CONSERVATION OF NATURAL ECOSYSTEMS AND RESOURCES

NARRATIVE

The University is committed to preserving and enhancing its natural areas and the biological diversity they support. The UCF campus lies at the southern end of the Southeastern Coastal Plain, which was designated as a global "biodiversity hotspot" in 2015. Global concern over the loss of biodiversity and habitats due to human activities makes preservation of the campus's remaining natural assets an important goal. The campus contains eleven different types of native ecosystems, including important local examples of the longleaf pine ecosystem, which is considered critically endangered globally. These natural areas contribute importantly to conservation of regional biodiversity, including threatened and endangered species.

The Department of Landscape and Natural Resources (LNR) manages campus natural lands with mechanical vegetation control, prescribed fire (controlled burns), and invasive species removal, and maintains a network of trails, making these areas accessible for nature enjoyment and passive recreation. The University has received state-wide recognition for its land management program, which focuses on conservation management at the urban-wildland interface. The goals and policies for nature conservation presented in this element will enhance the diversity and abundance of native plants and animals living in campus natural lands, and will help establish UCF as a national leader in conservation management and environmental stewardship.

Appropriately using and conserving water resources, improving air quality, and preventing or minimizing pollution are key aspects of the University's commitment to conservation and sustainability. The University's National Discharge and Elimination System Permit, which LNR oversees, guides the University's efforts to protect its surface waters. Air quality is addressed through transportation initiatives, use of alternative fuels and renewables, and the University's Air Operating Permit.

GOALS, OBJECTIVES, & POLICIES

GOAL 1: Conserve the region's biodiversity and natural heritage by designating significant campus conservation areas, developing wildlife-friendly landscapes, and minimizing the impact of future development on vulnerable species and habitats.

OBJECTIVE 1.1: Review and designate the status of all environmentally sensitive lands on campus, based on state and regionally determined criteria.

POLICY 1.1.1: The University shall maintain in a natural state all areas identified as "Conservation" in this Plan. New areas may be designated as conservation in the future based on documented conservation values, such as the presence of imperiled or vulnerable species or natural communities, or other features of state, regional, or local significance. Consistent with the Future Land Use Element, except for minimal structures and improvements necessary to ensure

safe access and essential support functions, there shall be no construction in conservation areas except pursuant to an amendment to this Plan adopted in accordance with all applicable state and local requirements.

POLICY 1.1.2: The University shall apply the designation of "Conservation Easement" to natural lands that are set aside in perpetuity pursuant to a recorded conservation easement. This designation allows only low-impact uses such as hiking, bird watching, nature study, or other low-impact uses consistent with the easement requirements. Other conservation lands that are not part of a designated Conservation Easement shall be identified and protected based on goals, policies, and objectives outlined in this element.

OBJECTIVE 1.2: Conserve, protect, and appropriately manage native vegetative communities and wildlife habitat as a system of interconnected wetlands and upland preserves.

POLICY 1.2.1: The University shall continue to protect and conserve imperiled and vulnerable plant and animal species, including threatened and endangered species, and species of special concern, as required by the Endangered Species Act of 1973, as amended, Ch. 68A-27, F.A.C. Rules Relating to Endangered or Threatened Species, and federal and state management policies relating to the protection of these species.

POLICY 1.2.2: The University shall coordinate with the Florida Fish and Wildlife Conservation Commission (FWC) to maintain and manage populations of the Gopher Tortoise, *Gopherus polyphemus*, on campus, due to the tortoise's key role as an indicator of upland habitat quality. Upland preservation areas may serve as gopher tortoise relocation sites until the carrying capacity has been reached for that specific parcel as defined and permitted by the FWC.

POLICY 1.2.3: The University shall coordinate with appropriate state and regional environmental agencies, such as the St. Johns River Water Management District (SJRWMD), Florida Fish and Wildlife Conservation Commission (FWC), and Florida Forest Service (FFS), to manage designated Conservation Areas appropriately.

POLICY 1.2.4: The University shall develop information systems and plans that support conservation management. These shall include, but not be limited to:

A Geographic Information System (GIS) database that includes digital overlays depicting the location of vegetative communities, conservation areas, or the locations of threatened and endangered species, and species of special concern, as well as rare or imperiled plant communities (e.g., ranked as G1-G3 or S1-S3 by the Florida Natural Areas Inventory).

Land management plans that include management and restoration techniques, monitoring and evaluation of species and habitat quality, and detailed methods for the removal and control of invasive, exotic plants in campus natural lands.

POLICY 1.2.5: The University shall monitor and attempt to remove all non-native invasive plants listed as Category 1 invasive species by the "2019 Florida Exotic Pest Plant Council (FLEPPC) Invasive Species List" from campus. Category 2 invasive species may be used in limited landscape applications where there is minimal chance of their spread into adjacent natural lands. LNR will periodically survey campus lands for the presence of such species and will properly remove and dispose of these exotic species as defined in UCF's Weed Management Plan.

POLICY 1.2.6: The University shall maintain established buffers, termed Riparian Habitat Protection Zones (RHPZ), consisting of uplands that are within 50-feet landward of all campus wetlands, in accordance with Riparian Wildlife Habitat Standards set forth in Chapter 40C-41.063 of the Florida Administrative Code.

POLICY 1.2.7: The University will use prescribed burns to manage upland vegetation and habitat in campus natural areas, whether those areas are designated as conservation, or are designated for other future use but are currently in a natural state. Prescribed fires will be conducted periodically as conditions allow to provide suitable habitat condition for plant and animal species adapted to fire-dependent native habitats (e.g. sandhill, upland pine, pine flatwoods), and to mitigate the potential for catastrophic wildfire. The University will follow accepted ecological guidelines for prescribed fire and comply with all applicable regulatory guidelines. LNR will be responsible for conducting prescribed burns, and will coordinate with University administration and appropriate internal departments (Facilities Planning and Construction, Landscape and Natural Resources, Facilities Operations, Environmental Health and Safety, University Police) and external agencies (Florida Department of Agriculture and Consumer Services, Florida Forest Service, Orange County Fire Department). Courtesy communications about planned burns will be shared with neighboring residential communities and traffic signs located near burn areas will be used to notify the campus community and visitors of burn activities.

OBJECTIVE 1.3: Restrict activities that may threaten the survival of imperiled or vulnerable species or habitats.

POLICY 1.3.1: The University shall avoid or minimize biological and hydrological impacts to designated conservation areas. Any proposed development adjacent to conservation areas shall be designed and implemented to minimize potential impact on the area. Landscape treatments of any such development shall preserve significant existing vegetation and plan for a gradual transition from developed to undeveloped areas.

POLICY 1.3.2: The University shall avoid or minimize any encroachment into designated Riparian Habitat Protection Zones (RHPZ), which are defined in Policy 1.2.6, above. If a review of the environmental and economic costs of a proposed development demonstrates that encroaching into the buffer is the only viable option, then the University shall pursue all reasonable efforts to minimize and mitigate any environmental impacts to the area. A permit shall be obtained from the SJRWMD if proposed

	improvements are within the RHPZ of a wetland conservation easement. POLICY 1.3.3: During the initial planning phase of any physical changes to campus natural areas, the University shall perform an environmental assessment and census of animal and plant species in the affected area. Plants or animals identified in the Florida Fish and Wildlife Conservation Commission most recent edition of "Florida's Endangered and Threatened Species List," or otherwise afforded protection by the host communities and state and federal agencies, or ranked as G1-G3 (critically imperiled globally, imperiled globally, or vulnerable globally) or S1-S3 (same, but assessed at state scale) shall be noted. Protection or mitigation plans for any such species shall be formulated and will include options for saving or relocating them or setting aside other protected areas to mitigate for the lost habitat.
OBJECTIVE 1.4: Enhance natural habitats and species in both developed and undeveloped areas of campus.	POLICY 1.4.1: The University shall encourage conservation within its landscaped areas by designing landscapes that provide habitat for birds, pollinators, and other native species. Landscape design and development will follow the Campus Landscape Master Plan and Design Standards adopted in 2016, and will use the principles of the Sustainable Campus and Landscape Approach outlined in the plan to develop wildlife-friendly and conservation-oriented landscapes. POLICY 1.4.2: The University shall support a healthy tree canopy throughout campus, and shall maintain its designation as a Tree Campus USA fulfilling its annual commitments to the requirements of that program. POLICY 1.4.3: The University shall support and enhance the diversity and abundance of pollinator species on campus, and shall maintain its designation as a Bee Campus USA by fulfilling its annual commitments to the requirements of that program.
Objective 1.5: Foster and encourage use of campus landscapes and natural areas as an outdoor "living laboratory" for hands-on experiential learning in conservation and land management.	Policy 1.5.1: LNR and the Arboretum will work together, and will partner with other entities both within and outside the University to develop courses, internships, and other student training opportunities that build on our programs in conservation and natural resource management. POLICY1.5.2: The University will document and track the use of campus as an outdoor living laboratory through site use permits issued by LNR.
GOAL 2: Protect regional water and air quality and human and environmental health by preventing or minimizing pollution and properly disposing of hazardous wastes.	
OBJECTIVE 2.1: Conserve, appropriately manage, and protect the	POLICY 2.1.1: The University shall strive to prevent harmful pollutants from entering its municipal separate storm sewer system (MS4) by following requirements set forth in its National Pollutant Discharge Elimination System (NPDES) permit as required by the

quantity and quality of regional water sources.

Florida Department of Environmental Protection (FDEP). LNR shall be responsible for updating the NPDES permit and coordinating NPDES activities.

POLICY 2.1.2: The University shall use reclaimed water, sourced from the Iron Bridge Water Pollution Control Facility in Seminole County for landscape irrigation, where applicable.

POLICY 2.1.3: The University shall continue to monitor and test raw well water, destined for potable use, on a daily and monthly basis per DEP requirements, and shall monitor campus surface water for compliance with existing surface water quality standards as specified in the University's NPDES permit.

POLICY 2.1.4: The University shall continue to implement a comprehensive water conservation program, to include:

- Using reclaimed water for an expanded campus irrigation system and chilled water system make-up water;
- Using automated timers and other irrigation flow-monitoring mechanisms;
- Planting Florida-Friendly® and drought-resistant landscapes for new building construction and landscape renovations;
- Using low-flush fixtures in new building construction; and
- Implementing the water conservation plan submitted by the University to the SJRWMD, which is a basis for issuing the University's consumptive use permit.

POLICY 2.1.5: The University shall not undertake activities on campus that would contaminate groundwater sources or designated recharge areas unless provisions have been made to prevent such contamination or otherwise provide mitigation for such activities so as to maintain established water quantity and quality standards.

POLICY 2.1.6: The University shall continue to maintain and update the University Spill Prevention Control and Countermeasures Plan. The University shall inspect and maintain all petroleum storage tanks to prevent oil discharges from occurring and to prepare the University to respond in a safe and effective manner to mitigate the impacts of discharge to navigable waterways.

OBJECTIVE 2.2: Maintain or improve existing air quality on campus.

POLICY 2.2.1: The University shall continue to participate in and consider those programs that will maintain or improve existing air quality on campus lands.

POLICY 2.2.2: The University shall minimize emissions of air pollutants by minimizing the storage and use of volatile and hazardous materials in campus buildings, as established by the Department of Environmental Health and Safety.

POLICY 2.2.3: The University shall determine the potential impacts on air quality before construction of parking garages. Parking structures shall be designed to facilitate rapid ingress and egress of vehicles to minimize idling time, and to maximize air-flow throughout to eliminate pockets of stagnation where pollutants can congregate.

POLICY 2.2.4: The University shall continue to comply with its Air Operating Permit 0950015-009-AO. The University shall monitor and maintain records, provide compliance testing, and maintain stationary combustion equipment and pollution controls to ensure emissions are within permitted parameters. The University shall meet federal and state air quality regulations prior to construction of stationary combustion equipment.

OBJECTIVE 2.3: To maximize on-campus reclamation of hazardous materials and consumer products.

POLICY 2.3.1: All University buildings shall be designed with facilities to accommodate collection, storage, and disposal of recycled materials.

POLICY 2.3.2: The University shall provide on-campus facilities for the collection and storage of hazardous materials used in University operations as required by federal, state, and local regulations.

POLICY 2.3.3: The University shall implement academic programs that promote awareness of environmental impacts of resource recycling.

POLICY 2.3.4: The University shall continue to enforce hazardous materials handling and storage procedures per the recommendations of the Department of Environmental Health and Safety.

POLICY 2.3.5: The University shall use only licensed and permitted hazardous waste transportation and disposal companies.

9.2 CONSERVATION OF ENERGY

NARRATIVE

Energy in its many forms impacts nearly every aspect of university life, as it powers the heating and cooling of buildings, water distribution, lighting, computers, and UCF's world-changing research experiments.

UCF's enormous appetite for energy warrants serious consideration, given the associated environmental and financial impacts. As energy costs and demands continue to grow, achieving energy sustainability has become increasingly important to the University's mission.

Appropriate policies and procedures that govern how we use our environmental resources and facilities will enable UCF to achieve the improvements necessary to establish itself as a national leader in energy research, education, and stewardship.

Although this plan focuses on the energy use attributed to buildings and associated systems, the energy and environmental impacts of transportation are equally important. Currently, these two major energy consumers (buildings and vehicles) are largely decoupled, but this will not always be the case. As electric vehicles continue to become more common, the interplay between building and vehicle energy will increase, particularly as UCF builds out its smart-grid infrastructure.

As stated in UCF Policy 3-111.1 Energy Sustainability, "The University is committed to energy sustainability and ensuring a productive environment for all members of the University community. Requirements involving energy conservation are to be followed by all University members, including students, staff, faculty, visiting scholars, and campus visitors."

Collectively, we owe it to future generations to preserve and protect our finite natural resources, as we are all stewards of this Earth. The energy section of this element describes the state of UCF's energy portfolio and our goals and policies for energy infrastructure, energy conservation, renewable energy generation, and energy storage.

GOALS, OBJECTIVES, & POLICIES

Energy Efficiency

GOAL 1: Reduce campus energy use through innovative technologies to achieve Carbon Neutrality by 2050.

Objective 1.1: Reduce energy use by campus infrastructure, buildings, and systems energy to meet or exceed peer building benchmark Energy Utilization Index (EUI) and Energy Cost Index (ECI) performance metrics.

Policy 1.1.1: All UCF buildings shall be benchmarked to determine energy performance using the ASHRAE Building Energy Quotient database or other appropriate benchmark databases for prioritization of energy efficiency projects and retro-commissioning activities.

Policy 1.1.2: All Building Automation Systems (BAS) not adhering to ANSI/ASHRAE Standard 135 BACnet® requirements shall be replaced or modernized to comply, and allow for optimized sequencing of operations, smart-grid integration, enhanced diagnostics, and ongoing monitoring-based commissioning efforts.

Policy 1.1.3: All building lighting systems shall be upgraded to energy-efficient lighting technologies to reduce electrical power and HVAC cooling loads, reduce the maintenance burden of re-lamping efforts, and eliminate the use of mercury-containing bulbs.

Policy 1.1.4: All energy-intensive HVAC equipment shall be upgraded at end of life to meet or exceed the current UCF Design, Construction and Renovation Standards, to reduce energy expenditure and improve Indoor Air Quality (IAQ).

Policy 1.1.5: All campus site lighting (roadway, parking, sidewalks, signage, etc.) shall be upgraded to energy-efficient lighting technologies to improve site lighting characteristics, thus reducing energy expenditure and improving safety.

Policy 1.1.6: All building chilled water connections and associated tertiary pumps shall be modernized to meet both uniform specifications and the UCF Design, Construction and Renovation Standards to improve chilled water usage characteristics, reduce

pumping power, and improve the chilled water temperature differential (Delta T).

Policy 1.1.7: All UCF E&G buildings shall be re-commissioned in adherence to the latest version of ANSI/ASHRAE Standard 202 and ASHRAE Guideline 0.2 within a three-year cycle to maintain building system performance, document performance degradation due to entropy, and prioritize system modernization projects.

Policy 1.1.8: The University shall reduce HVAC loads by raising or lowering the temperature in all non-essential, unoccupied spaces after-hours. The University shall also work with UCF IT to implement computer shutdown protocols for all UCF-owned non-server, non-critical computers and peripheral hardware.

Policy 1.1.9: All energy efficiency building practices shall be guided by ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1 and the latest version of LEED.

Objective 1.2: Transition electrical power sources from public-utility sourced power to onsite renewable energy and other onsite generation technologies, reducing greenhouse gas emissions and improving economic stabilization of electrical utility rates.

Policy 1.2.1: A utility-scale ground mount photovoltaic (PV) array shall be planned to achieve the Climate Action Plan milestone target of producing 15% of the campus's electrical power from renewable resources.

Policy 1.2.2: A rooftop PV prioritization plan shall be developed and implemented to install PV on select building roofs.

Policy 1.2.3: All new construction projects shall be designed and built to be solar-ready. Solar PV point of connections shall be located at the utility transformers instead of at the buildings, allowing for clear demarcation of PV electrical generation systems from building electrical systems.

Policy 1.2.4: A parking garage PV prioritization sequence shall be developed and implemented for superstructure support of PV panels over the top deck of parking garages, as costs become favorable.

Policy 1.2.5: A parking deck PV prioritization sequence shall be developed and implemented for covered parking structural arrays to support PV panels over the surface parking lots, as costs become favorable.

Policy 1.2.6: Pressure-reducing valves used in the distribution of reclaimed water delivered to UCF from the City of Orlando / Seminole County Iron Bridge Wastewater Treatment Facility shall be assessed and replaced with pressure-reducing turbines for power generation, when economically viable.

Objective 1.3: Utilize the infrastructure, buildings, and systems as "living labs" for academic

Policy 1.3.1: UCF shall continue to develop partnerships between its operations and academic units to enhance the quality of real-world academic applications and foster greater research potential in the areas of utilities, sustainability, and the built environment.

collaboration and research, in cooperation with Facilities and Safety, for hands-on experiential learning.

Policy 1.3.2: Utilities and Energy Services (UES) shall continue to work with University Space Administration and the Registrar's Office to optimize space use and planning, reducing energy use associated with under-utilized and unoccupied spaces. Development of an energy-centric space usage policy could result in a significant reduction in campus energy consumption.

Policy 1.3.3: UCF shall continue to pursue human-led energy conservation policies as outlined in the Collective Impact and Climate Action Plans, such as "Kill-a-watt" competitions and "Green Office" certifications.

Microgrids

NARRATIVE

UCF must shift its paradigm with regards to utility master planning and develop an on-campus microgrid: a small-scale power grid with defined electrical boundaries that can operate independently or collaboratively with both the public utility provider and other microgrids.

A microgrid would allow the University to reduce energy costs; improve infrastructure resiliency through grid-strengthening projects; and offer portfolio flexibility with campus energy mixes, deploying both smart and microgrid applications. By using advanced controls and communications to synchronize generation assets to the existing power distribution system, the microgrid allows any excess generated power to be delivered back to its electrical grid. During an emergency situation, UCF's microgrid could disconnect from the local utility power and continue operating as an "island." The maximum continuous demand to be served by the proposed microgrid will depend on how much generation and local battery storage capacity is connected.

Additionally, a priority load-shedding scheme would be implemented to avoid overloading the system.

Potential sources of power for the microgrid include some combination of cogeneration/CHP, solar, or other renewable technologies. Many microgrids incorporate energy storage as well as energy generation, to compensate for the differences between energy production and demand.

Long-term, an assessment of financial focus, operational flexibility, and future outlook is recommended to better position the University for uninterrupted electric and thermal generation under microgrid considerations. This will be essential to protect environmentally-sensitive research, minimize technical risk events, and achieve campus sustainability targets.

GOALS, OBJECTIVES, & POLICIES	
GOAL 1: To transition the campus to a microgrid to synchronize generation assets to the existing medium voltage power distribution system.	
Objective 1.1. Transition the UCF electrical transmission and distribution systems to a Smart Grid model capable of islanding the UCF Main Campus in a "microgrid" configuration for economic benefit, inclement weather, or other conditions that warrant separation from the public electrical utility grid.	POLICY 1.1.1 UCF shall evaluate microgrids that incorporate energy storage, as well as energy generation, to compensate for the differences between energy production and demand. Policy 1.1.2: The University shall analyze the costs and determine whether to continue leasing the on-campus electrical distribution assets from the local utility provider, or buy them outright. Ownership of the assets would allow UCF to upgrade the grid infrastructure as needed to incorporate a distributed generation portfolio of PV and realize cost savings. Policy 1.1.3: UCF shall create a model demonstrating the impact that each new, renewable energy project in development would have on the electrical grid, to ensure grid resiliency and reliability. Policy 1.1.4: UCF shall consider energy storage technology to achieve greater grid resiliency and reliability. This technology would allow the University to maintain operations in the event of momentary electrical utility interruptions, and consider grid-level energy storage for circuits powering research buildings. Policy 1.1.5: UCF shall integrate a microgrid-controller interface with the campus's Building Automation Systems, as distributed renewable energy generation is deployed and scale warrants. The interface would allow for dynamic demand response modes, at both the campus and building levels, to reduce peak demand on the electrical utility grid and prevent back feeding.

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9.1 CONSERVATION OF NATURAL ECOSYSTEMS AND RESOURCES

DATA & ANALYSIS

A. Nature Conservation

Overview

The UCF campus contains significant natural resource areas, many of which are protected from future development. Areas of interest include the Arboretum, preserved upland areas, wetland conservation easements and other wetlands, Lakes Lee and Claire, and campus stormwater ponds. Natural areas not only provide substantial habitat for diverse and abundant plant and wildlife populations, but also offer attractive campus assets for connection with nature and recreational opportunities. The preservation of both the quantity and quality of these resources is vital to the continued ecological function of these resources as well as the quality and character of the UCF campus.

Figure 2.0-1 Current Land Utilization Table shows that UCF has 665.5 acres of natural land, uplands, bodies of water, and wetland habitats on the Main Campus. Of these, 217.2 acres are preserved in perpetual Conservation Easements to the St. Johns River Water Management District.[1]

The remainder of UCF's natural areas, including uplands, wetlands, and wetland buffers, are set aside for long-term preservation, but are not held under a Conservation Easement.

The location of various conservation lands on campus are shown in Figure 9.0-4 Conservation Lands Map.

Invasive Species

LNR maintains a Weed Management Plan that identifies nuisance plant species in the natural lands. All plants list by the 2019 Florida Exotic Pest Plant Council List of Invasive Plant Species are monitored, mapped, and chemically treated yearly. Most of these invasive, exotics are stable or decreasing in coverage due to proactive management, and with support of grant awards from the Florida Fish and Wildlife Conservation Commission.

Threatened and Endangered Plants and Animals

All listed threatened and endangered plant and animal species that are observed during annual compliance monitoring and general field observations are documented, mapped, and reported annually.

Figure 9.0-5 Map of Threatened and Endangered (T&E) Plants and Animals shows documented locations of T&E plants and animals.

Monitoring

Vegetation monitoring is completed twice a year, in June and December, for compliance monitoring required for environmental permits with the SJRWMD. A total of thirty-nine (39) vegetation plots

[1] For conservation easements in favor of the St. Johns River Water Management District, see UCF Ownership and Encumbrance Report 2019, items gg. and tt.

are located in the natural areas, and data collected is also used for habitat evaluation and restoration research.

Gopher Tortoises

Gopher Tortoises and their burrows are surveyed and monitored periodically by LNR.

Figure 9.0-6 Map of Gopher Tortoise Burrows shows locations of gopher tortoise burrows evaluated during surveys of selected natural areas.

B. Surface Water Quality

The University of Central Florida's water features include twelve (12) constructed stormwater ponds, two natural lakes, and several other natural wetland and stream systems. These water bodies are monitored regularly by LNR and pond management contractors. Periodic measurements of pond and lake systems have included dissolved oxygen, temperature, acidity (pH), conductivity, and turbidity. Routine water samples were collected from ponds from 2012-2014 and analyzed for dissolved nitrogen and phosphorus (Table 9.0-1). The University currently samples Lake Claire and Lake Lee monthly as part of the Florida LAKEWATCH program.

Figure 9.0-1: Average Water Quality Data for UCF Water Bodies

Water samples were taken at pond outlets. Values represent averages of values from a variable number of sample dates, ranging from 20 to 29 sampling events, taking place over a two-year period from 2012-2014.

Surface water body	pH	Cond. (µs)	D.O. (mg/L)	NH4 (mg/L)	NOx (mg/L)	Total N (mg/L)	DRP (mg/L)	Total P (mg/L)
1D Pond	7.56	236	7.71	0.072	0.004	0.489	0.012	0.019
2HEX Pond	7.23	186	8.38	0.132	0.052	0.601	0.011	0.015
2H Pond	7.17	211	9.41	0.133	0.087	0.675	0.011	0.017
3A Pond	8.05	223	9.09	0.081	0.091	0.619	0.011	0.031
4L Pond	7.10	228	7.37	0.112	0.265	0.495	0.011	0.027
4M Pond	7.49	159	7.45	0.058	0.013	0.425	0.012	0.015
4R Pond	7.30	160	8.70	0.077	0.003	0.449	0.012	0.012
Bonneville Creek	6.99	129	7.15	0.125	0.077	0.580	0.012	0.020
4B2 Pond	6.97	176	5.27	0.128	0.074	0.598	0.017	0.026
Lake Claire	7.37	145	7.76	0.049	0.003	0.457	0.012	0.009
Lake Lee	7.29	118	7.62	0.054	0.010	0.392	0.012	0.010
PGH Pond	7.47	220	8.17	0.056	0.005	0.658	0.014	0.024
W5 Stream	6.90	149	6.09	0.075	0.034	0.474	0.021	0.019
W9 Stream inlet	6.62	328	4.30	0.129	0.633	0.672	0.024	0.025
W9 Stream outlet	6.82	144	6.27	0.067	0.009	0.509	0.024	0.011

C. Hazardous Materials and Spill Prevention

Underground and Above-ground Tanks

The University has a number of above-ground storage tanks associated with diesel generators, lubricant oil, motor vehicle oils, and used oils. All of these tanks are double-walled and range in size

from 25 gallons to 5,200 gallons. The University remediated and closed several old underground storage tanks in the 1990s. The current fuel island was installed in 1995 at the Facilities Management Compound. This underground tank has a capacity of 17,500 gallons and is FDEP-compliant.

The University continues to maintain and update its Spill Prevention Control and Countermeasures Plan. The University inspects and maintains all petroleum storage tanks to prevent oil discharges from occurring. The Department of Environmental Health and Safety (EHS) provides training to prepare University personnel to respond in a safe and effective manner to mitigate the impacts of discharge to navigable waterways.

Hazardous Materials and Waste

By virtue of its academic and research activities, the University uses hazardous materials. All such materials are carefully monitored and regulated such that there is no indication of any prior or current toxic waste problems on the campus property.

Environmental Management within EHS is responsible for ensuring the University's compliance with local, state, and federal environmental laws and regulations. Areas covered include hazardous materials storage, hazardous waste management, environmental assessments, site remediation, the investigation and cleanup of contaminated media on state-owned property, storage tanks, environmental health, and regulatory monitoring to track changes to environmental regulations as they relate to environmental compliance.

EHS is responsible for the safe and legal disposal of all hazardous chemicals and wastes generated by the University. Various campus departments, particularly those involved in engineering, science, or health-related research, generate hazardous waste. EHS contracts with licensed and permitted contractors for final disposal of these wastes, after they are collected, profiled, and safely characterized.

Hazardous material inventory is maintained by laboratory managers and shop managers. The EHS Chemical Safety and Security Coordinator oversees the inventory training, auditing, and outside agency reporting.

Air Quality

EHS provides monitoring, recordkeeping, and compliance testing in accordance with Air Operating Permit 0950015-009-AO. The University maintains stationary combustion equipment and pollution controls to ensure emissions are within permitted parameters. The University obtains construction permits for new, stationary combustion equipment.

9.2 CONSERVATION OF ENERGY

DATA & ANALYSIS

D. Energy Efficiency

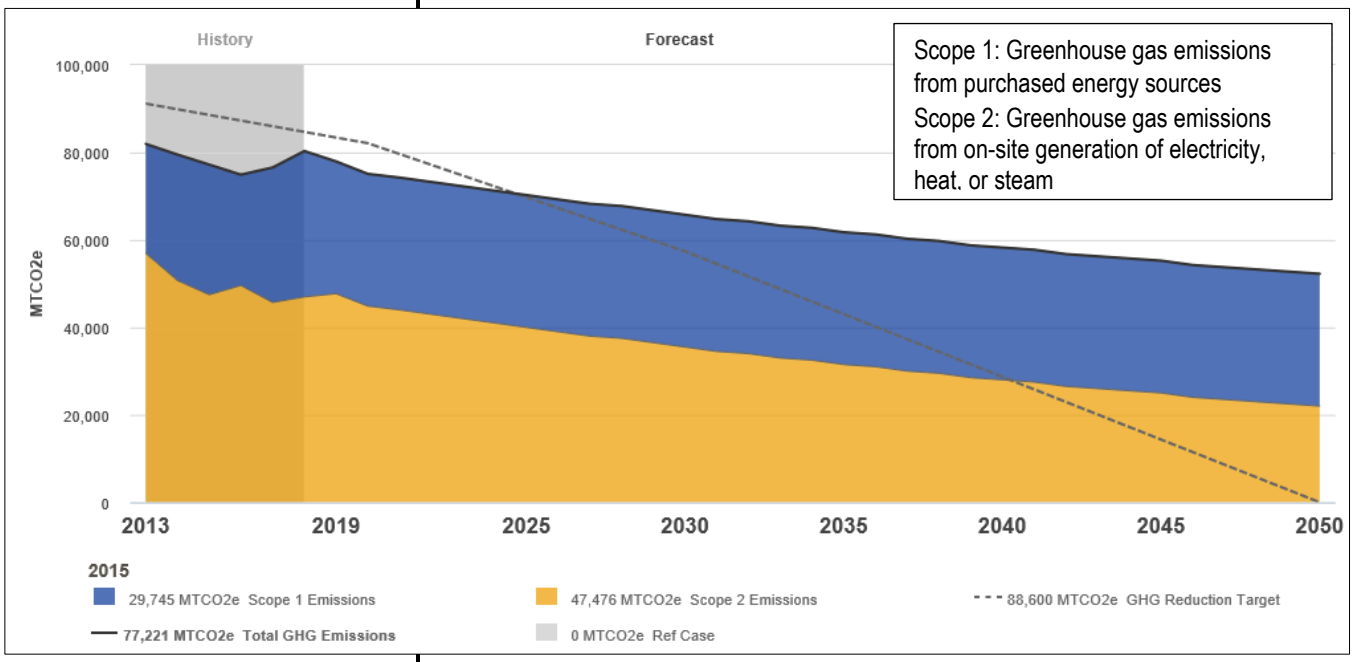
Background

UCF is fully committed to an energy conservation and sustainability program based on universal participation and continual improvement. All UCF buildings and facilities are operated with the health, welfare, and safety of all students, faculty, and staff in mind, and in support of instruction and research. Regardless of their sources of funding, buildings will be operated in the most energy-efficient manner possible. Individual and departmental awareness and accountability are essential to the overall success of this initiative. As per University Policy 3-111.1, Energy Sustainability, requirements involving energy conservation are to be followed by all members of the University community.

Current Energy Use

University energy data can be viewed on the Open Energy Information System.

Figure 9.0-2 **Forecast of Campus Emissions From Campus Energy Use**



Energy Efficiency Projects

The University is responsible for coordinating numerous energy initiatives related to green buildings and energy efficiency. This includes capital energy improvement projects, renovations, and equipment replacement; and updates to University policies relating to energy, sustainability, and the built environment. UCF also developed a campus-wide system to track and report its energy utilization, which assists operations staff in optimizing building performance throughout the campus building portfolio; enhancing the University's advantage in energy and environment; and developing internal and external

partnerships to creatively implement a broad range of expanded demand-side management initiatives.

The University prioritizes energy efficiency projects in Education and General (E&G) buildings based on the total Operations & Maintenance (O&M) costs normalized per square foot of conditioned space. O&M costs are comprised of all utility costs, as well as costs associated with service and repair work orders. While this method tends to prioritize the smaller, energy-intensive laboratory buildings, those buildings often are prime candidates for energy efficiency projects.

Based on this prioritization schedule, the University benchmarks and conducts ASHRAE Level 1 energy audits.[2] In buildings that are not performing optimally, the condition of the energy-using systems[3] contributing to the utility use is assessed. If the systems are still within an acceptable range of life cycle but are underperforming, those buildings are identified as candidates for retro-commissioning (or re-commissioning if they've been commissioned previously). If it is determined that an energy-using system should be upgraded, replaced, or modernized, a Level 2 energy audit[4] is conducted to determine initial budget figures and a scope of work for the design and implementation of Facility Improvement Measures (FIMs).

Commissioning Process of New Construction

As described in the ASHRAE Commissioning Standards and Guidelines: Standard 202, the Commissioning (Cx) approach is a quality-focused process to achieve the Owner's Project Requirements, starting at project inception and continuing throughout the life of the facility. Commissioning is not an additional layer of construction or project management, but rather a strategy to reduce the cost of delivering construction projects and increase value to owners, occupants, and users. It focuses on the integration and interdependency of facility systems, since a performance deficiency in one system can result in less-than-optimal performance by other systems. Upon completion, commissioning is intended to reduce the life-cycle cost of the facility as well as the project capital cost through the warranty period.[5] Per University Policy 3-111.1, Energy Sustainability, all projects conducted at UCF that impact utility use or the indoor environment shall be commissioned.

Retro-commissioning Process of Existing

The Retro-commissioning (RCx) approach allows for a repeatable, standardized approach to optimizing building system performance.[6] RCx involves verification that the Building Automation System (BAS)

[2] Level 1 audits use platforms like the ASHRAE Building Energy Quotient Portal, EPA Energy Star Portfolio Manager, or Department of Energy Asset Scoring Tool to determine the benchmark score of each building and triage the performance of that building against peer building indices to determine if each building is a candidate for energy efficiency projects or is performing "as it should be."

[3] Energy-using systems such as HVAC, lighting, building automation (BAS), laboratory ventilation or heating hot water.

[4] In compliance with the current version of ANSI/ACCA/ASHRAE Standard 211.

[5] Definitions derived from ASHRAE Commissioning Standards and Guidelines, Standard 202.

[6] ASHRAE Commissioning Standards and Guidelines, Standard 202 and Guideline 0.2 are utilized for the overall retro-commissioning (RCx) process.

Building Automation System

is functioning as designed, such as checking if sensors are calibrated and actuators/relays are verified. Devices that are not performing properly are recalibrated, repaired, or replaced, and trend logs and system alarm notifications are updated accordingly.

A re-Testing, Adjusting and Balancing (reTAB) is then conducted to restore proper airflow and water flow characteristics to the HVAC and/or laboratory ventilation systems. Once fully functional, the system's sequence of operations is tested and optimized to confirm that the programming is functioning as intended, and opportunities for optimization are recorded. Software changes are then developed and simulated, and the optimized sequence of operations is downloaded into the BAS controllers and re-verified. The BAS points are mapped into the UCF Fault Detection and Diagnostics monitoring-based commissioning platform. This system monitors system performance, and if it receives any data that indicates performance degradation or event occurrences that are outside of pre-defined tolerances, UES is notified for investigation.

Lighting Technology Upgrades

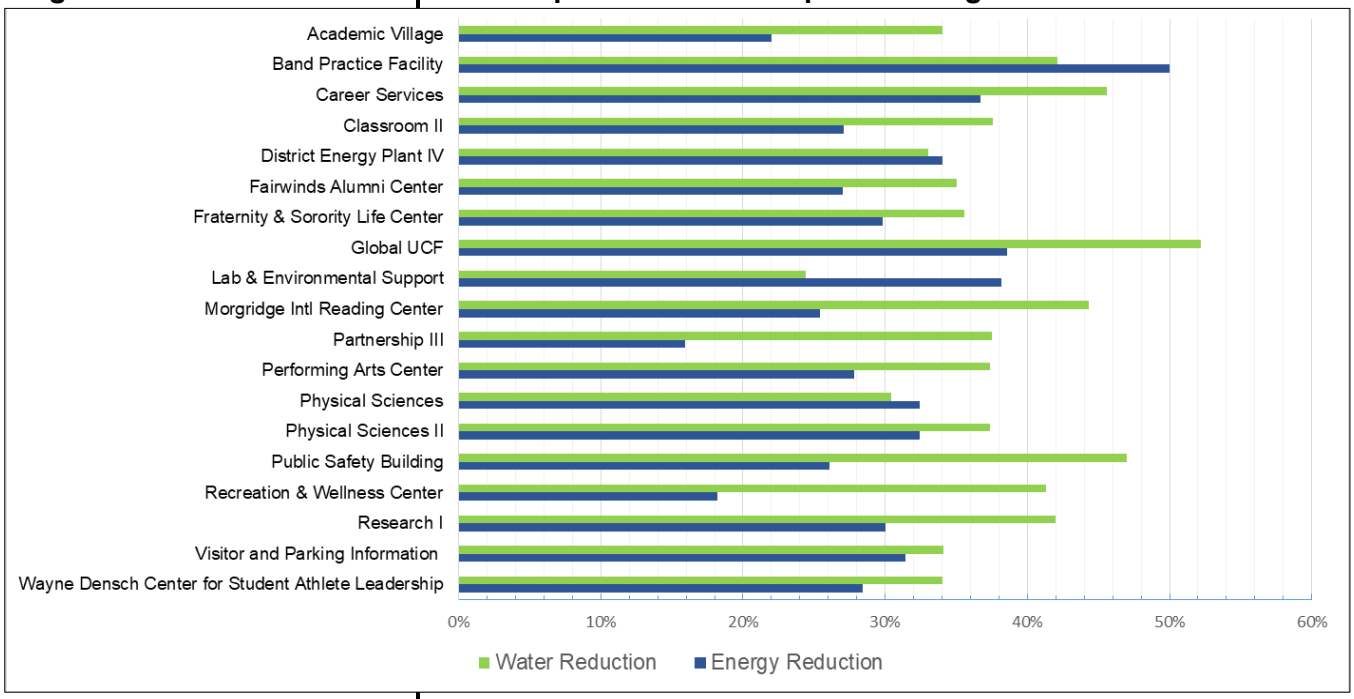
Lighting upgrade projects play a large part in energy conservation strategies at UCF. The University will continue to evaluate building and site lighting systems for the possibility of upgrading to more efficient fixtures with uniform lighting levels, color (temperature), and Color Rendering Index (CRI). At the time of this plan's development, LED technology is state-of-the-art and thus is the basis of technology reviewed and approved for upgrade and modernization projects.

In even further commitment to environmental stewardship, UCF has committed to complying with the International Dark Sky Association certification for exterior lighting fixtures.

Green Building Standards

Since 2007, UCF has pursued Leadership in Energy and Environmental Design (LEED) certification for all new construction, major renovations, and most recently, for existing buildings adhering to the latest LEED rating system. High-performance buildings play an integral part in supporting UCF's learning environment. Through LEED's high-efficiency standards, UCF LEED buildings are consuming approximately 30% less energy (based on ASHRAE 90.1 2010) and 40% less water than similar non-LEED buildings

Figure 9.0-3 **LEED Impact on Main Campus Building Use**



Distributed Generation – Photovoltaic (PV)

Rooftop photovoltaic (PV) systems are anticipated to become a larger source of electrical energy at UCF campuses between 2020 and 2030. The rollout of PV installations will be based on energy generation potential, structural engineering reviews, and digital grid lab simulation.

Floating Photovoltaic (FPV) systems represent an emerging market for PV systems sited directly on bodies of water. Possible benefits of FPV include efficiency gains due to lower cell temperatures; reduced balance of system costs associated with land costs and control of vegetation; improved water quality; reduced evaporation rates; and avoidance of land-energy conflicts. The Florida Solar Energy Center (FSEC) was awarded a contract by the U.S. Department of Energy to assess the performance of FPV systems relative to their land-based counterparts. This work will provide UCF with the data necessary to determine the incremental benefits of FPV on campus water bodies, preserving land for conservation or future development.

Alternative Fuel Vehicles

Alternative Fuel Vehicles (AFVs), as defined by the Energy Policy Act of 1992 (EPACT), include any dedicated, flexible-fuel, or dual-fuel vehicle designed to operate on at least one alternative fuel. Alternative fuel vehicles come in a variety of vehicle models, such as sedans, pickup trucks, sport utility vehicles, vans, shuttle buses, medium-duty vehicles (such as delivery trucks), heavy-duty buses, and heavy-duty trucks. As vehicles are purchased, the University is required to purchase new vehicles fleet, at least 75% being AFV. When replacing existing fleet vehicles or adding to the fleet, the University shall seek out alternative fuel, flex fuel or hybrid-fueled vehicles.

E. Microgrids

Energy Storage and Smart Grid Projects

UCF is well-positioned to become one of the most electrically-efficient, reliable, and resilient institutions in the country, while also bringing significant economic benefit and reduction of carbon emissions. Most importantly, these improvements can be interactively integrated with the teaching and research mission of the University, resulting in a world-class showcase of advanced energy technology.

This opportunity presents at a time when several developments have converged to offer all institutions improvements in various energy system attributes, including an unsubsidized cost of energy from PV systems that is competitive with traditional fossil-fueled generation; reduced electric energy storage costs in batteries; and dramatic improvements in the efficiency of major electric loads.

The campus grid is effectively that of a small city, with a large number of commuting workers, full-time residents, and significant electric and critical loads. There are many benefits of operating as a microgrid.

Facility characteristics:

- UCF currently operates a 5.5MWe Combined Heat and Power plant (CHP) powered by natural gas in baseload mode while using the waste heat to power an absorption chiller.
- The campus is served at primary voltage through six 12.47kV feeders from two different substations.
- The campus was developed on a “greenfield” basis, without having to accommodate any existing structures, streets, or underground utilities.
- While significant vacant land remains for future growth, the campus has been developed in a very space-efficient way, utilizing a concentric configuration for the highest possible structural density without feeling crowded. This translates to lower energy losses in distribution of electric and thermal energy.
- Due to the looped design of the campus 12.47kV feeders, all major buildings have at least one alternate feed which is currently available through manual switching, but could easily be converted to automated reconfiguration.
- Vacant, uncommitted, and unreserved land is still available on campus for 14-18MW of PV arrays and associated battery storage.
- Many buildings have advanced energy automation controls, with a campus-wide retrofit now underway.
- Continuous advancement and deployment of electric vehicles will present a vehicle-to-grid energy storage element, warranting further studies and modeling to determine how those rolling batteries could additionally serve the needs of a UCF microgrid.

Staffing characteristics:

- A commitment by Facilities to self-perform work, with the use of consultants and contractors reserved for peak personnel demands or specialty needs.
- A strong link between Facilities staff and engineering faculty, including joint participation in externally-funded R&D projects and integration of senior design projects which benefit and improve campus energy systems.
- A commitment by the Office of Research and the College of Engineering to grow the academic programs in energy both generally, and specifically in smart grid, renewable energy, electric transportation, and cyber-physical security.

User/occupant characteristics:

- A strong and nearly-universal commitment to sustainability.
- A highly-educated group with nearly-universal familiarity with technology and interconnected devices and systems.
- A permanent population (faculty and staff) which is under direction of the President and Board of Trustees, and a transient population (students) which is effectively constrained by the application process, code of conduct, and peer expectations.

Beyond Planning for Load Growth – The Traditional Microgrid

UCF has always planned well for the growing electrical demands of its building program, and certainly provided reliability within the requirements of all codes and user expectations. In the short term, however, the combination of economic forces and our greater reliance on electric energy has given rise to the use of microgrids that operate in parallel with the electric utility, but contain embedded distributed generation units to be capable of separating all or part of the loads in times of stress or for economic advantage. This is a conventional reactionary microgrid, which is likely to be justified for UCF in the immediate future. Analysis by UES and studies by the College of Engineering would provide the basis for recommendations to the Administration.

Beyond Reaction – The Advanced Microgrid

For modest capital expense, UCF is well-positioned to expand its control of the microgrid so that it can anticipate changes in circuit parameters, economic conditions, and external electrical disturbances. Because implementation is largely accomplished by digital means, through monitoring, communications, and control, the only significant capital expense is the incremental cost of high-speed switches over the slower, motor-operated switchgear in today's designs.

Features of the advanced microgrid include distributed cooperative control, high-speed fault detection with parallel reconfiguration, anticipatory microgrid reconfiguration for economics and/or resiliency, complete or partial islanding from the utility provider, flexible market transactions, management of storage, and system inertia support from inverter-coupled storage. A powerful feature of an advanced microgrid structure is that economic preferences and

operating requirements, yet to be defined, can be seamlessly introduced in the future. Of critical importance is the requirement that the system provides overall cyber physical security, yet allows for highly interactive features, including both central-market and peer-to-peer transactions, constrained global optimization of the energy resources and distributed cooperative control for area optimization of real and reactive power output. UCF can achieve this grid security using location-based communication protocols, distributed state estimation, and resilient control algorithms.

UCF is well prepared to face the unique challenge of advanced R&D coupled with practical application in both daily operations and retrofit scenarios. There will be several areas of theoretical development required. Industrial process optimization for such a wide range of parameters is particularly challenging, and the requirement for uniform functionality of both retrofit and future installations demands a very structured approach. While the relationships of these functions require significant explanation, a summary of the highlights of innovation includes:

- Development and integration of Local and Wide-Area control of real power for enhanced grid stability; especially important for distributed generation coupled through high reactance.
- Development and integration of Local and Wide-Area control of reactive power for improved voltage profiles and power factor; to be implanted by smart inverters.
- Development and integration of Distributed Cooperative Control options; especially important as more DG resources are dispersed on campus.
- Structured economic optimization of both real and reactive output Preferences, accommodating future possibilities of tariffed service rates, central market, bilateral and peer-to-peer transactions; especially important as the business models of utilities face rapid change.
- Development of a Parametric Analysis output mode, allowing interrogation of system responses to prospective changes in equipment investment or operating practices; especially important for evaluation and optimization of upgrades, storage, etc.
- Development of an Anticipation Mode, wherein knowledge of an upcoming outage risk (such as an approaching thunderstorm) or an upcoming demand shift (such as a football game) is automatically transformed to a system configuration response, like pre-loading emergency generation for critical labs or economic changes in demand management profiles.
- Development of a Resiliency Mode (aka “Storm Mode”) utilizing the inherent distributed cooperative control features to permit partial restoration of a small-area or regional “island” after destruction of transmission or distribution from a natural disaster.

- Development of cyber physical security integrating physical limits of the campus grid and using location-based communication protocols, distributed state estimation, and resilient control algorithms; especially important as DER becomes a dominant generation resource and communications remains web-connected.

9.0 CONSERVATION
MAPS

Figure 9.0-4
Conservation Lands Map

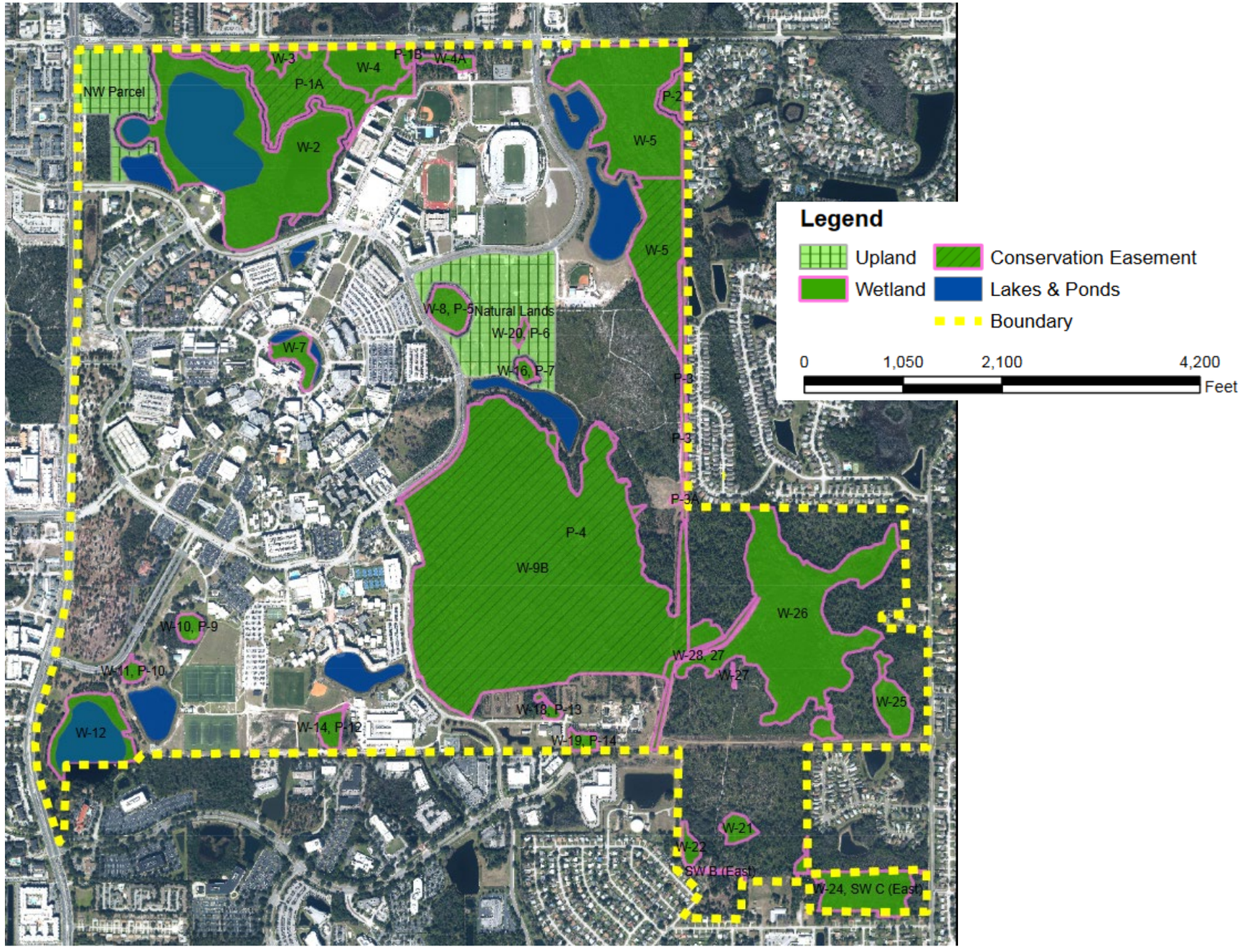
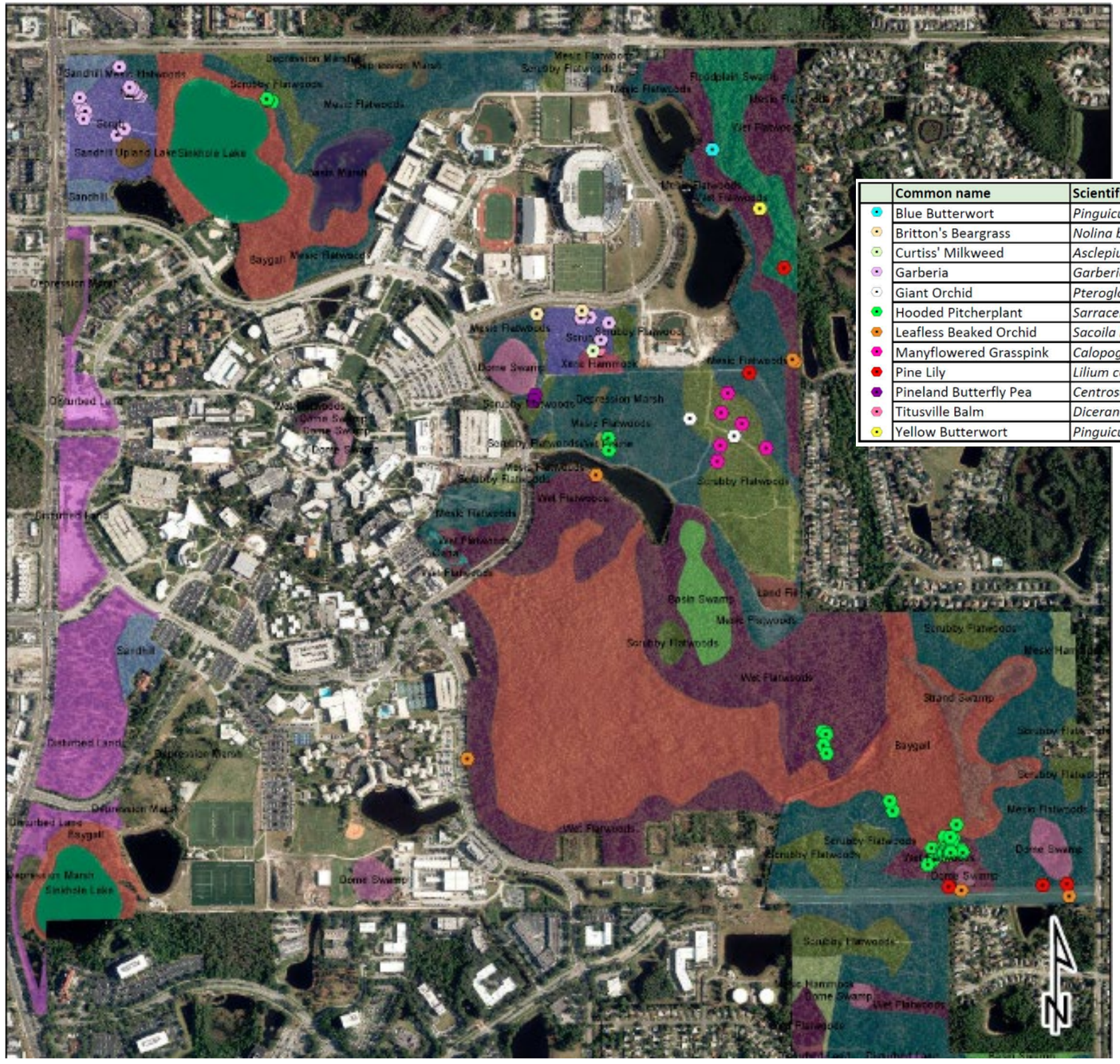
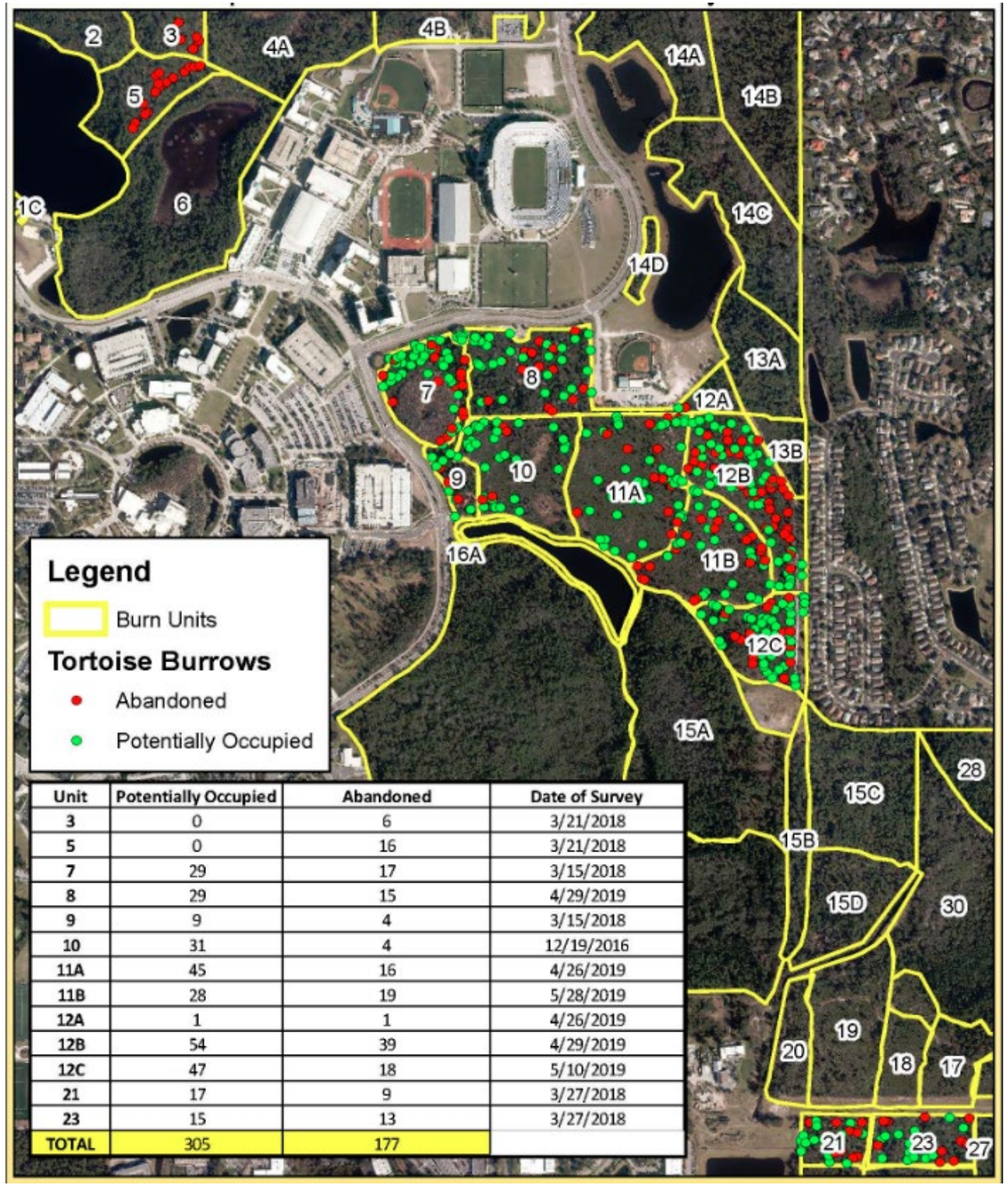


Figure 9.0-5 Map of Threatened and Endangered Plants and Animals



	Common name	Scientific Name	Consevation Status
	Blue Butterwort	*Pinguicula caerulea*	(FL) Threatened (US) none
	Britton's Beargrass	*Nolina brittoniana*	(FL) Endangered (US) Endangered
	Curtiss' Milkweed	*Asclepius curtisii*	(FL) Endangered (US) none
	Garberia	*Garberia heterophylla*	(FL) Threatened (US) none
	Giant Orchid	*Pteroglossaspis ecristata*	(FL) Threatened (US) none
	Hooded Pitcherplant	*Sarracenia minor*	(FL) Threatened (US) none
	Leafless Beaked Orchid	*Sacoila lanceolata*	(FL) Threatened (US) none
	Manyflowered Grasspink	*Calopogon multiflorus*	(FL) Threatened (US) none
	Pine Lily	*Lilium catesbaei*	(FL) Threatened (US) none
	Pineland Butterfly Pea	*Centrosema arenicola*	(FL) Endangered (US) none
	Titusville Balm	*Dicerandra thinicola*	(FL) Endangered (US) none
	Yellow Butterwort	*Pinguicula lutea*	(FL) Threatened (US) none

Figure 9.0-6 Map of Gopher Tortoise Burrows in Surveyed Units



Unit	Potentially Occupied	Abandoned	Date of Survey
3	0	6	3/21/2018
5	0	16	3/21/2018
7	29	17	3/15/2018
8	29	15	4/29/2019
9	9	4	3/15/2018
10	31	4	12/19/2016
11A	45	16	4/26/2019
11B	28	19	5/28/2019
12A	1	1	4/26/2019
12B	54	39	4/29/2019
12C	47	18	5/10/2019
21	17	9	3/27/2018
23	15	13	3/27/2018
TOTAL	305	177	