Lake Alice Watershed Management Plan

Prepared for

University of Florida

August 2024

Prepared by

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Section 1.0 Introduction

The University of Florida (UF) is a paragon of educational excellence in the State of Florida and recognized nationally as a preeminent public university. This reputation is based not only on academic and research achievements but also on the campus experience, which encompasses both the facilities and natural setting. The University of Florida Campus has developed over more than 100 years with the original two buildings in 1906 expanding to over 900 buildings today. This growth has mirrored and fueled Gainesville's urbanization.

With this expansion has come impacts to the natural environment both on and off campus, including changes in land use and increased stormwater runoff. This development has been accompanied by a significant increase in impervious surfaces on campus including roofs, roads, parking lots, sidewalks, and waterbodies, which now make up approximately 46% of the Lake Alice Watershed (Chen-Moore & Associates, 2023). Impervious surfaces, such as sidewalks, parking lots, buildings, etc., do not allow for infiltration and instead convert most or all rainfall to runoff. These impervious surfaces in conjunction with the topography that makes for a scenic campus create challenges for managing stormwater.

Lake Alice, the largest waterbody on campus, functions as the primary permitted stormwater feature, receiving, attenuating, and providing a degree of water quality treatment for stormwater generated from more than 1,000 acres of campus and adjacent portions of the City of Gainesville. The streams that flow across campus and feed Lake Alice serve as the primary conveyances receiving stormwater from overland flow and stormwater infrastructure. This stormwater has impacted campus waterbodies through erosion, sedimentation, and water quality impairment. Additionally, the lack of holistic stormwater and watershed management across the built areas of campus has resulted in new infrastructure (buildings, parking lots, sidewalks, athletic fields, etc.) having impacts on existing infrastructure (buildings, roads, stormwater pipes, etc.). While these impacts are clearly observable in developed areas of campus, most stormwater infrastructure exists underground or hidden from view in Conservation Areas.

1.1 The University of Florida's Lake Alice

Lake Alice is the primary natural feature on Main Campus with the importance of this feature recognized in the Campus Framework Plan (University of Florida, 2019) as a:

> *"…campus organizer, unique natural resource, and compelling symbol of identity…"*

The Plan recommends that campus be centered around Lake Alice and states that the,

> *"Restoration and Expansion of these systems would, not only improve drainage conditions but, help organize and unite the 'blue' and 'green' campus corridors."*

The importance of Lake Alice and the creeks that feed it are also identified and highlighted in the Campus Master Plan, Strategic Development Plan, Campus Trails Master Plan, the Landscape Master Plan, the Conservation Area Land Management Plan, as well as other System Plans and Master Plan elements. In fact, the importance of Lake Alice and the natural areas is a common theme that links most campus planning documents. In addition to the acknowledged value of these systems, Lake Alice and the creeks that feed it comprise the primary stormwater conveyance, treatment, and recharge system for more than half of the Main Campus.

The purpose of this project is to develop a watershed management plan (WMP) for the Lake Alice Watershed that acknowledges the importance of this natural feature, presents a vision for the watershed, and makes recommendations for short-term and long-term management decisions for the lake and watershed.

Specific goals of this project included:

- Developing a comprehensive vision for the Lake Alice Watershed based on stakeholder input.
- Preparing comprehensive recommendations for watershed management including stormwater management, permitting, planning, design, operation and maintenance, and funding.
- **Attachment A** summarizes the historical and current development of campus, campus planning, stormwater and environmental permitting, and literature on the lake and watershed.
- **Attachment B** presents the available data and trends and relationships between parameters.
- **Attachment C** describes the facilitation process to solicit, receive, and incorporate feedback from the Project Team, Steering Committee, and Stakeholders.
- **Attachment D** explains the updates and refinements to the stormwater model for the UF Main Campus originally developed in 2017 by Jones Edmunds.
- **Attachment E** summarizes the vegetation data collected for the Conservation Areas in the Lake Alice Watershed, to document current vegetative conditions and cover by invasive species.
- **Attachment F** discusses use of the updated stormwater model to identify and prioritize three erosion and three flooding locations for conceptual project development with concepts presented.
- **Attachment G** provides recommendations for the operation and maintenance of the stormwater system.

1.2 Campus Setting

The University of Florida Main Campus is located in Gainesville, Florida within Alachua County in the north-central portion of the state. Main Campus is divided between four watersheds: Lake Alice, Hogtown Creek, Tumblin Creek/Alachua Sink, and Internally-Drained Basins (Figure 1). The Hogtown and Tumblin Creek Watersheds drain large portions of Gainesville with only a small portion of their area on Main Campus. Each of these watersheds is primarily a closed basin, meaning that rain that falls, and the runoff generated, flows to the lowest point in the basin and infiltrates or is otherwise directed to groundwater. The primary destinations for runoff in these watersheds include:

- Lake Alice Watershed – Lake Alice and drainage wells
- Internally-Drained Basins – Karst sinkholes and features
- Hogtown Creek Watershed – Sugarfoot Prairie and Haile Sink
- Tumblin Creek Watershed – Bivens Arm Lake, Paynes Prairie, and Alachua Sink

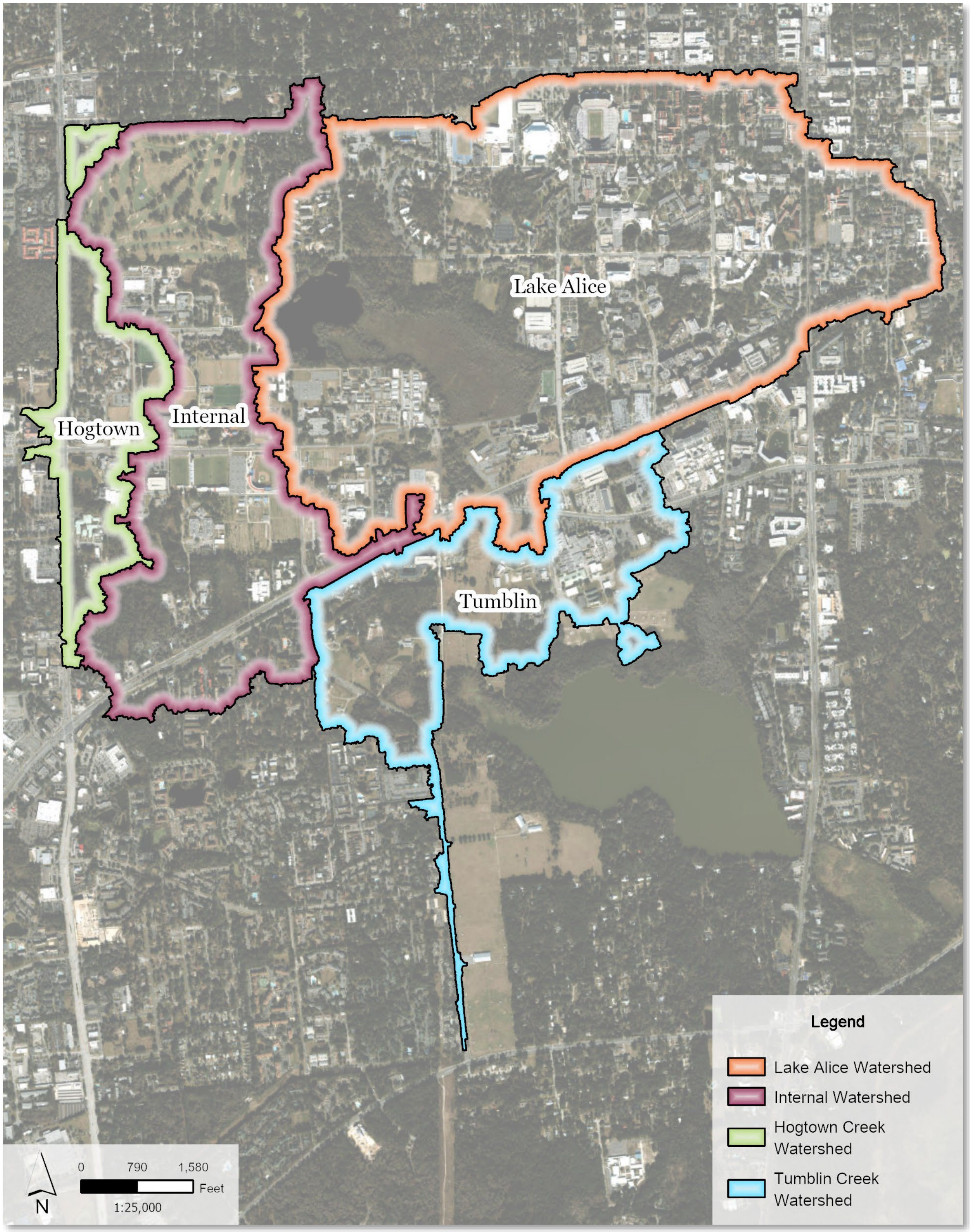

Figure 1. University of Florida Campus and Main Campus Watersheds

Of the four watersheds that comprise Main Campus, the Lake Alice Watershed covers approximately 1,005 acres and most of the older portions of the Main Campus. The Lake Alice Watershed is primarily made up of University-owned property (868 acres). The watershed has nearly 100 feet of topographic change from the highest portions of the watershed near University Avenue and West 13th Street to Lake Alice (Figure 2). The University's control of most of the watershed means that there are unique opportunities for the University's actions to affect the overall watershed and for the University to implement best practices in watershed management that can serve as a model to other universities and municipalities in Florida and across the country.

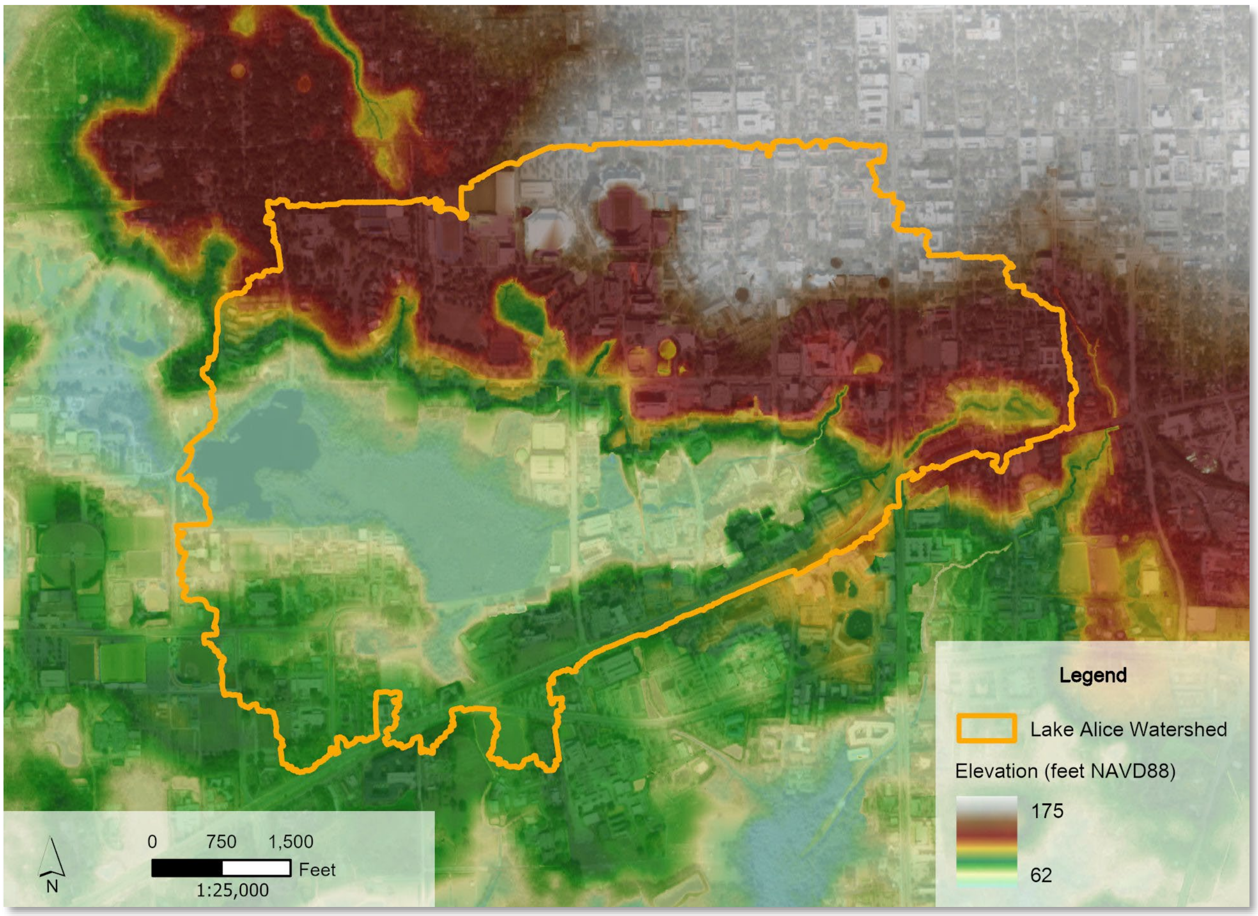

Figure 2. Lake Alice Watershed Elevations

1.2.1 Geologic Setting

The University and much of Gainesville are situated within a unique geological area characterized by "stream-to-sink" or closed watersheds. In North Central Florida, stream-to-sink watersheds are characterized by a clay layer perforated by sinkholes that connect the surface to the underlying, high-transmissivity, limestone Upper Floridan Aquifer (UFA). Runoff generated in the watershed flows downhill until it reaches one of these sinkholes where it can relatively rapidly infiltrate to the UFA without flowing to a downstream surface waterbody. The UFA underlies most of Florida, as well as parts of Georgia and

South Carolina, and is the primary water supply across much of its extent. In much of Gainesville and further west, the UFA is particularly vulnerable to contamination because of discontinuous confinement which allows for rapid vertical movement of water from the surface into the aquifer (Figure 3).

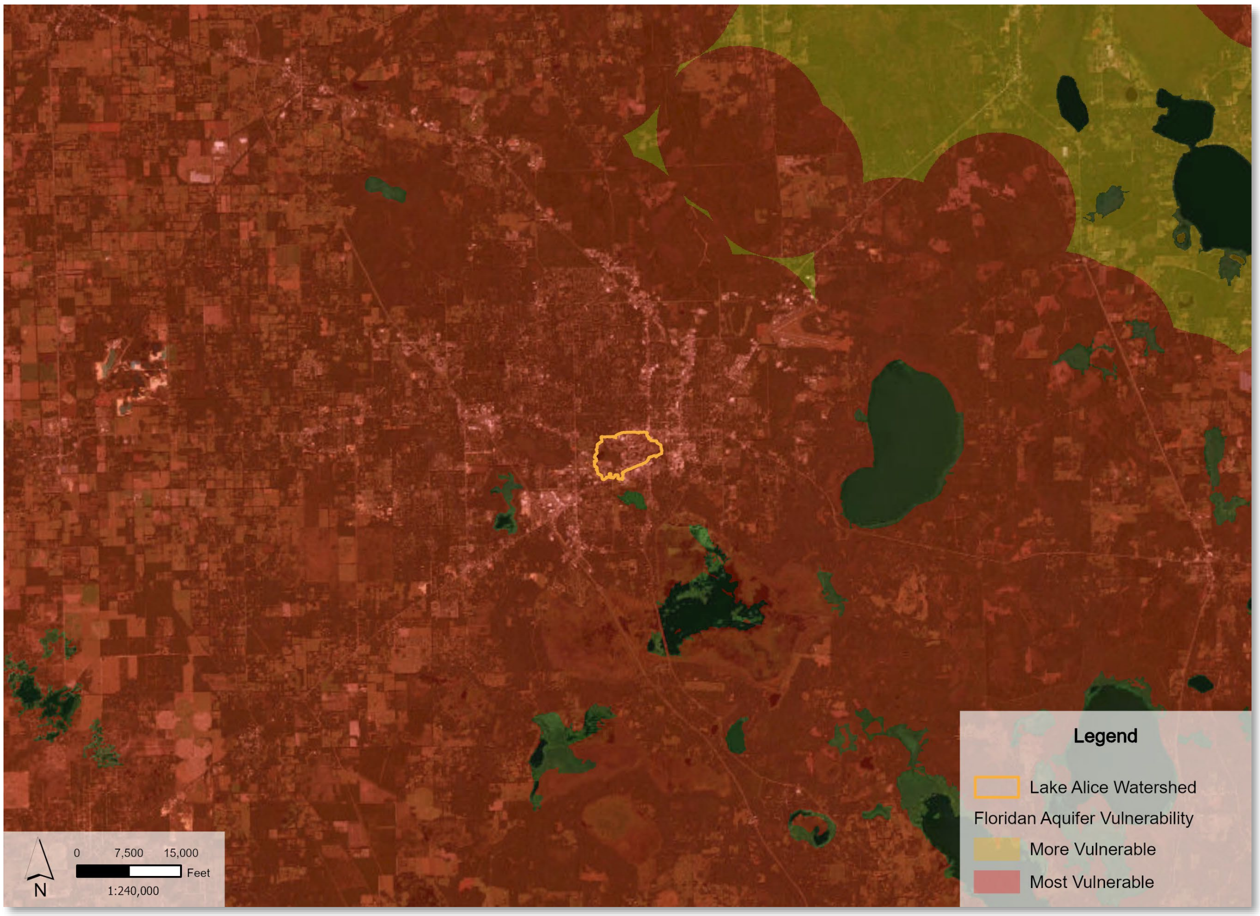

Figure 3. Upper Floridan Aquifer Vulnerability

The Lake Alice Watershed has multiple sinkholes dispersed across Main Campus and two drainage wells located on the edge of Lake Alice that provide infiltration to the UFA. The drainage wells were installed in 1959 to control lake levels and reduce flooding after many of the natural sinkholes in the watershed were filled and/or disconnected from surface waterbodies resulting in flooding around Lake Alice.

1.3 Project and Facilitation Process Overview

This project relied on a robust facilitation effort to solicit, compile, and report feedback. This process is summarized below. A comprehensive discussion of the facilitation schedule, strategies, and tools used to solicit and organize feedback, as well as the feedback received from this process, is presented in Attachment C.

1.3.1 Project Contributors

This project benefited from the contributions of knowledge, expertise, and time of numerous individuals. This included the Project Team, the Steering Committee, and other stakeholders. These contributions were used to guide the process and prioritize various objectives and outcomes for the WMP. To all of those who shared their time and expertise, thank you.

1.3.1.1 Project Team

The Project Team for the Lake Alice WMP included members of the University administration from Business Affairs including Planning, Design, and Construction; Facilities Services; Office of Sustainability; and Business Affairs and Technical Services (BATS). Table 1 shows the Project Team members, their role, and their affiliation.

Table 1. Project Team Membership

Name	Role	Representation
Linda Dixon	Project Manager	Planning, Design, and Construction
Rachel Mandell	Member	Planning, Design, and Construction
Mark Helms	Member	Facilities Services
Chuck Kammin	Member	Facilities Services
Matt Williams	Member	Office of Sustainability
Kaylee August	Member	Office of Sustainability
Angelique Hennon	Member	BATS - Space & GIS Management

1.3.1.2 Steering Committee

A Steering Committee was assembled for this project from University faculty, administrators, students, and other stakeholders (Table 2). The role of the Steering Committee was to provide their technical and scientific input on problems in the watershed and feedback on management recommendations. The Steering Committee also helped identify and reach out to stakeholders.

Table 2. Steering Committee Membership

Name	Department
Eban Bean	UF Agricultural and Biological Engineering
Mark Brenner	UF Geological Sciences
Chuck Cichra*	UF Fisheries and Aquatic Sciences
Mark Clark	UF Soil, Water, and Ecosystem Sciences
Matt Cohen	UF Forest Resources and Conservation
Dave Conser	City of Gainesville Urban Forestry
Lillian Crawford	UF Landscape Architecture - Student
Marty Dempsey	UF Recreational Sports
Stefan Gerber	UF Soil, Water, and Ecosystem Sciences
Stacie Greco	Alachua County Environmental Protection Department
John Guerra	UF Environmental Health and Safety
Mark Hostetler	UF Wildlife Ecology and Conservation
Jared Howard	UF Facilities Services - Wastewater
Mark Hoyer	Florida LAKEWATCH
Alan Ivory	UF Wildlife Ecology and Conservation - Student
Yi Luo	UF Landscape Architecture

Name	Department
Jeanna Mastrodicasa	UF IFAS
Nia Morales	UF Wildlife Ecology and Conservation
Mark Newman	UF Engineering School of Sustainable Infrastructure & Environment
Steve Noll	UF History
AJ Reisinger	UF Soil, Water, and Ecosystem Sciences
John Sansalone	UF Engineering School of Sustainable Infrastructure & Environment
Tom Schlick	UF Facilities Services - Grounds
Bill Smith	UF University Athletic Association
Taylor Stein	UF Forest Resources and Conservation
Amanda Subalusky	UF Biology
Kim Tanzer	Former Professor UF Architecture & UVA Professor Emerita
Matt Whiles	UF Soil, Water, and Ecosystem Sciences
Missy Williams	UF Planning, Design & Construction

*Retired December 2023/Withdrew

1.3.1.3 Stakeholders

The University of Florida is a major landmark and important community connector in Gainesville. Campus is also the home, classroom, research facility, alma mater, and medical center for hundreds of thousands of students, Gainesville residents, visitors, and alumni. Because of the visibility of Lake Alice and the conservation areas, stakeholders for this project are considered to be any person on campus, in the community, or member of the broader "Gator Nation" that has an interest in the management and future vision for the watershed. To maximize participation, both in-person and virtual engagements were used.

1.4 Lake Alice Regulations and Uses

Lake Alice, the creeks, and Conservation Areas on campus are not managed or operated by a single department. Therefore, the responsibilities associated with maintaining the watershed lie with different groups depending on the nature of the need. Departments that have a role in the management of stormwater or the Lake Alice Watershed on campus are shown in Table 3.

Table 3. Departments with Responsibilities for Lake Alice

Name	Role
Facilities Services – Grounds	Landscaping; Vegetative maintenance; Dredging
Facilities Services – Utilities	Stormwater infrastructure; Wastewater treatment facility; Reclaimed and irrigation, Stormwater permitting
Facilities Services – Finance	Solid waste management & recycling
Planning, Design, and Construction	New infrastructure in the watershed; New building construction and renovations; Long-range planning; Conservation Area Land Management planning
Environmental Health & Safety	Allowed uses around the lake and watershed; Bat houses; Hazardous waste and site management
Institute for Food and Agricultural Sciences (IFAS)	Greenhouses and research plots adjacent to lake
Student Life – Recreational Sports	Irrigation and fertilization of sports fields
University Athletic Association	Irrigation and fertilization of sports fields
University Police Department	Public safety

1.4.1 Conservation Areas Restrictions and Allowable Uses

The University of Florida has established policies for the Lake Alice Watershed and other waterbodies on the Main Campus to acknowledge the importance of these areas for wildlife, stormwater conveyance and management, and natural area conservation.

1.4.1.1 Conservation Area Restrictions

The following activities are prohibited in the Conservation Areas on Main Campus, including Lake Alice:

- Hunting, camping, and fishing,
- Swimming and wading,
- Feeding alligators,
- Boating,
- Harassing wildlife,
- Damaging or removing vegetation,
- Littering, and
- Accessing closed areas.

Prohibitions on fishing are at least partially related to Florida Statute 790.25(h), which allows for carrying a firearm when engaged in fishing, camping, or hunting. Exceptions to the above restrictions may be allowed for official performance of duties with an approved exemption from EHS.

1.4.1.2 Allowable Uses

Permitted uses of the Conservation Areas, including around Lake Alice and its tributary creeks, include:

- Passive recreational uses from dawn to dusk,
- Pets if leashed and cleaned up after, and
- Research projects or studies with an approved exemption from EHS.

1.4.2 Teaching and Research

In addition to recreation in the Lake Alice Watershed, the Conservation Areas on campus provide a valuable outdoor classroom for experiential and hands-on learning for a diversity of classes across departments. Classes that have used the watershed for educational purposes are shown in Table 4, although this list is not exhaustive. These areas are also used for a wide variety of research activities.

Table 4. Courses that Use the Watershed for Teaching

Course Name	Course Number
Introductory Botany	BOT2010
Practical Plant Taxonomy	BOT2710
Local Flora	BOT3151C
Individual Studies	BOT4905
Ecosystems of Florida	BOT5695
Vascular Plant Taxonomy	BOT5725
Entering Research in Biology	BOT6905
Environmental Planning and Design	EES4932/EES5307
Invertebrate Field Biology	ENY3163/ENY5164
Spider Biology	ENY4905/ZOO4926
Introduction to Fishery Science	FAS4305C
Fish and Limnology	FAS6932
Dendrology	FNR3131C
Natural Resources Sampling	FNR3140C
Forest Conservation and People	FOR3004
Forest Ecology	FOR3153C
Foundations in Natural Resources and Conservation	FOR3200C
Tree Biology	FOR3342C
Urban Forestry	FOR4090C
Forest Health Management	FOR4624C
Sustainable Ecotourism	FOR4664
Take a Hike	FOR4934
Physiology of Forest Trees	FOR6340
Horticultural Plant Morphology and Identification	HOS5117C
Environmental Plant Identification and Use	ORH3513C
Advanced Plant Identification	ORH4932/HOS6932
Plant Ecology	PCB3601

Section 2.0 Lake Alice Watershed Vision

On the UF Campus, Lake Alice and the creeks, ponds, and wetlands that flow to it are unique environmental resources that serve as a campus and community touchstone, while providing critical stormwater attenuation, transport, and treatment. Gainesville's plentiful rainfall supports these iconic campus landscapes including the majestic moss-draped live oaks, the cascading creeks with their ponds and waterfalls, Lake Alice, and the wildlife that lives there. The same rainfall that nourishes these ecosystems flows across the natural and built environment becoming stormwater that can convey pollutants, cause flooding, and damage property. Management of stormwater is critical to protect life, landscapes, ecosystems, and infrastructure. Proactive stormwater management mitigates risks, improves resilience, and enhances the natural and built environments that support healthy ecosystems and provide meaningful user experiences on campus. The direct and indirect benefits provided to the University by the natural systems in the Lake Alice Watershed are collectively referred to as ecosystem services.

Development and implementation of the Lake Alice WMP will allow UF to manage the lake and its drainage features, and to respect this multifaceted role, while enhancing these ecosystem services. The WMP will guide the University as it seeks to integrate the natural resources of the lake and watershed with those of the built environment to create a healthy and balanced urban ecology. The plan:

- Clarifies watershed terms and definitions,
- Establishes benchmarks, thresholds, and metrics,
- Recommends collaborative strategies to improve stormwater conveyance, enhance water quality, and increase habitat and recreational value,
- Defines management roles, responsibilities, and approval processes, and
- Identifies funding sources and mechanisms.

As the University and Lake Alice continue to evolve, the WMP will adapt to achieve long-term incremental progress towards a healthy and well-balanced lake and watershed.

The overall vision is expounded by four vision themes that describe aspirational goals and focus for the plan strategies.

2.1 Environmental Conditions and Stormwater Management

Sustainable campus stormwater management promotes a healthy natural environment while protecting University property.

Lake Alice is the heart of campus and symbolizes the University's dedication to environmental stewardship. The lake and watershed are inextricably linked to successful stormwater conveyance and treatment on campus and provide vital ecosystem services. Incorporation of green stormwater infrastructure, low impact development, and best management practices will reduce flooding, erosion, and sedimentation that impact the University's assets and the natural environment. A visible, successful, and celebrated stormwater system will further the University's educational mission by telling the stormwater story while showcasing a commitment to innovation and excellence.

2.2 Recreation, Access and Accessibility, and Education

Increasing linkages to Conservation Areas on campus offers connections to nature, improves well-being, enhances recreation, and promotes education.

Lake Alice and the Conservation Areas provide a unique network of natural spaces integrated within the built environment of campus. This proximity offers consistent connection to nature and recreational opportunities that further the University's academic mission and enhance well-being. Increasing accessibility, passive recreation, and intentional programming in and around these areas raises awareness and appreciation for the watershed and University while promoting natural discovery.

2.3 Conservation and Biodiversity

Protecting the natural areas on campus promotes biodiversity and enhances habitat.

The extensive natural areas on campus are an integral part of the University and community experience. The protection and enhancement of these areas is essential to foster biodiversity, protect wildlife habitats, and expand connectivity. These ecologically diverse communities provide a living laboratory for outdoor learning and best management practices for urban stream ecology and wildlife movements.

2.4 Organizational Accountability, Collaboration, and Responsiveness

Recurring funding and dedicated staff allow for proactive and collaborative stormwater management.

UF strives to have well-maintained buildings and a vibrant landscape that is functional and well-used. Extending this standard to all natural areas and stormwater features requires clear coordination, communication, and a responsive organizational framework. Stormwater management is a critical component of preserving and enhancing the campus experience and image. Successful management depends on assigned responsibility and funding that ensures necessary projects and upgrades can be made. Endorsement of an adaptive watershed management plan with dedicated, recurring funding acknowledges the ongoing nature of watershed stewardship.

Section 3.0 Lake Alice Permitting

Lake Alice has been the permitted stormwater management feature for the entire Lake Alice Watershed since the first campus stormwater permit in 1987. Since that time the interpretation of the rules and the status of Lake Alice as a waterbody have been discussed, evaluated, and contested. Varying interpretations and approaches have been taken that create complexity in the regulatory framework for the management of Lake Alice today. These interpretations and their implications are discussed in this section with reference to the regulatory decisions involving Lake Alice.

3.1 Lake Alice Paradox

When considering stormwater management and the role of Lake Alice on the UF campus, there is a paradox.

> **How can Lake Alice be both a stormwater treatment facility and a lake claimed as both a Water of the United States (WOTUS) and a Water of the State (WOTS) that is classified as impaired?**

These apparent contradictions and their implications create an untenable permitting quandary. Lake Alice has been the permitted stormwater facility for the portion of UF's campus that drains to the lake since 1987, with issuance of the first Master Permit for stormwater on campus. As a stormwater treatment facility, Lake Alice cannot be classified as impaired because it is a permitted waterbody that provides water quality and water quantity treatment for development on campus.

However, the Lake was previously designated as both a WOTUS, since 1979, and a WOTS, since at least 1998 (see Attachment G, Appendix A for the regulatory history of Lake Alice), meaning it is a natural waterbody that requires management to support its designated uses. Lake Alice is designated as a Class III waterbody with uses for "Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife". Unless more stringent standards are set, Class III waterbodies must comply with the criteria contained within 62-302.530 and 62-302.531 of the Florida Administrative Code (FAC). Based on the water quality standards that apply for Lake Alice, the lake is listed on the 303d verified list of impaired waterbodies for total phosphorus.

Factors that further complicate this assessment relate to the configuration of Lake Alice and the surrounding depressional basins on campus. These basins are closed, meaning that stormwater runoff is contained and infiltrates to groundwater rather than flowing overland to a surface waterbody. The open water portion of Lake Alice (WBID 2719A) and the surrounding Lake Alice Watershed (WBID 2719 – named Lake Alice Outlet) drain to the UFA through a combination of the drainage wells and karst features. Both WBIDs and other depressional basins on campus are described as being in the Orange Creek Basin, despite having no surface water connection to the basin. Additionally, the Lake Alice Watershed lies outside of any currently mapped springs priority focus areas (PFAs) or springsheds. The combination of these factors indicate that Lake Alice should not be included in the Orange Creek Basin but would be more accurately classified as being in one of the springs BMAP areas, either the Santa Fe, Rainbow Springs and Rainbow River, or Silver Springs. These conflicting designations illustrate the challenge of identifying the appropriate basin and relevant water quality targets for Lake Alice and the watershed.

3.1.1 Lake Alice's Future

The inherent contradictions that exist for Lake Alice's official designation necessitate a decision be made for how the lake will be managed. Either the University should fully commit to managing stormwater on campus in compliance with stormwater regulations to improve the health of the Lake, or the University should repeat their challenge to the WOTUS/WOTS designation, gain approval from the Florida Department of Environmental Protection (FDEP) and U.S. Environmental Protection Agency (USEPA), and successfully reclassify all or a portion of Lake Alice as a stormwater management system. UF should also consider the potential re-classification of Lake Alice as a Class III-Limited waterbody with designated uses of Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife. This classification appears to more accurately describe Lake Alice which does not allow fishing or on-water recreation and does have human-induced impacts that preclude attainment of a Class III designation.

Recent rule-making under the Clean Waterways Act, Senate Bill 7040, will modify the Environmental Resource Permit (ERP) Applicant's Handbook to require 80% removal of TN and TP in stormwater projects that discharge to a hydrologic unit code (HUC)-12 basin that includes an impaired waterbody in most cases. These requirements will become effective 18 months after the effective date, June 28, 2024, and will apply to projects permitted after December 28, 2025. These rules will require UF to either provide water quality improvement as part of projects within the Lake Alice Watershed, or to have an alternative WMP approved and achieve post-development loads less than or equal to pre-development loads. These new requirements will be challenging to achieve in many areas of campus, but striving to meet them will improve water quality and environmental conditions in a way that benefits the University in the future.

The recommendation of this project is that UF implement a comprehensive WMP that addresses stormwater and the environment as assets that enhance the campus experience and aesthetic. As a preeminent institution, the University can be a model for stormwater innovation and implement cutting-edge solutions that enhance water quality and natural spaces on campus in a way that highlights environmental stewardship and promotes research and learning. While this approach will involve numerous projects on campus and extensive capital expenditures, the long-term benefits of these actions will result in a sustainable stormwater solution on campus that reduces operations and maintenance (O&M) and stormwater-related repair costs, while improving campus for students, faculty, alumni, and the community at-large.

3.1.2 Effects of Climate Variability on Campus Stormwater

Stormwater on the UF Main Campus is impacted by factors within and outside of the control of the University. Within the University's control are permitting, building, and stormwater management; but outside of the University's control are extreme events and climate variability. One challenge identified by stakeholders during this project was managing high-intensity, short-duration storm events that impact construction sites and overwhelm stormwater infrastructure. With climate variability the frequency and intensity of these events is expected to change. The scientific consensus is that Florida is expected to experience increasing rainfall totals associated with changes in weather patterns and climate. Given the longevity of the University, the critical healthcare facilities, and the iconic buildings and space on campus, planning and managing for future conditions is imperative to protect students, staff, patients, and infrastructure.

This study considered two future rainfall scenarios for the Lake Alice Watershed and two alternative intervention strategies for an approximately 50-year horizon. The two rainfall scenarios considered applied change factors based on the Intergovernmental Panel on Climate Change's (IPCC's) Representative Concentration Pathways (RCPs) of 4.5 and 8.5. These two scenarios predict changes assuming that forcing is stabilized by 2050 (RCP4.5) or not stabilized in the 21st century (RCP8.5). The change factors for Gainesville for these two scenarios are 1.35 and 1.47 for RCP4.5 and RCP8.5, respectively. These change factors both indicate expected increases in rainfall volumes for the modeled storm events.

The two intervention scenarios considered for this study were based on the actions of the University. The first of these assumed that the stormwater management approach in the Lake Alice Watershed was not changed. In this condition the lake continues to be used as the primary stormwater treatment system with minimal upstream attenuation. The second scenario considered wide-spread adoption of low impact development (LID), green stormwater infrastructure (GSI), and regional stormwater treatment. These changes were made in the model by making the following adjustments:

- Directly-connected impervious area reduced from 90% to 75% (simulates the addition of LID/GSI).
- Increased time of concentration by 50% (addition of LID/GSI and regional stormwater treatment).
- Removed flat parking lots with greater than 2 feet to seasonal high groundwater table and added a storage depth of 4.4 inches (addition of pervious parking).

Anticipated changes in the impervious area within the Lake Alice Watershed were based on projected future development locations provided by PDC. This included approximately 62 acres of estimated impervious area within the Lake Alice Watershed and 86 acres within the model domain. Of this area, approximately 24 acres are located on land that is not currently impervious within the Lake Alice Watershed (38 acres within the model domain). These scenarios were compared to the current condition 100-year, 24-hour rainfall event which had mapped floodplain extents of 273 acres for the model domain and 147 acres within the Lake Alice Watershed.

3.1.2.1 Climate Effects for the Status Quo

Without changes in the current approach to permitting it is anticipated that most or all new development in the Lake Alice Watershed will be status quo and rely on storage and treatment in Lake Alice. With the projected development and the estimated change factors for rainfall this is expected to result in increased flood stages across campus. The range of increases for individual subbasins within the Lake Alice Watershed was 0.03 to 9.01 feet for the RCP4.5 scenario and 0.04 to 9.68 feet for the RCP8.5 scenario without new stormwater infrastructure. For the RCP4.5 scenario the total model domain floodplain increased to 335 acres with 176 acres of floodplain within the Lake Alice Watershed. For the RCP8.5 scenario the floodplain increased further to 356 acres within the model domain and 185 acres within the watershed.

3.1.2.2 Climate Effects with Stormwater Interventions

The University has observed and understands the impacts of stormwater on campus. Additionally, regulatory requirements for managing stormwater are changing and expected to have impacts for the University's stormwater management moving forward. If the decision is made to invest more in stormwater management upstream of Lake Alice, through a combination of LID, GSI, and regional treatment projects, there is the potential to appreciably reduce floodplain levels in these subbasins. The effect of implementing LID and GSI across the model domain was simulated based on the previously described assumptions. The result of these changes was a reduction in floodplain levels when compared to the status quo (without intervention). For the RCP4.5 scenario with interventions, levels increased by 0.03 to 8.08 feet in the Lake Alice Watershed. The median decrease in levels within the Lake Alice Watershed compared to the status quo simulation was 0.15 feet with a maximum reduction of 4.5 feet. The RCP8.5 simulation with interventions had a range of increases from 0.03 to 9.31 feet within the Lake Alice Watershed. The median decrease in this simulation compared to the status quo scenario was 0.12 feet with a maximum reduction of 2.25 feet. Figure 4 and Figure 5 show the changes in floodplain levels for each subbasin, ranked based on the increase in the status quo (without interventions) scenario. For the RCP4.5 scenario with stormwater interventions the total model domain floodplain was 327 acres with 171 acres of floodplain within the Lake Alice Watershed. For the RCP8.5 scenario the floodplain was 348 acres within the model domain with 180 acres in the Lake Alice Watershed.

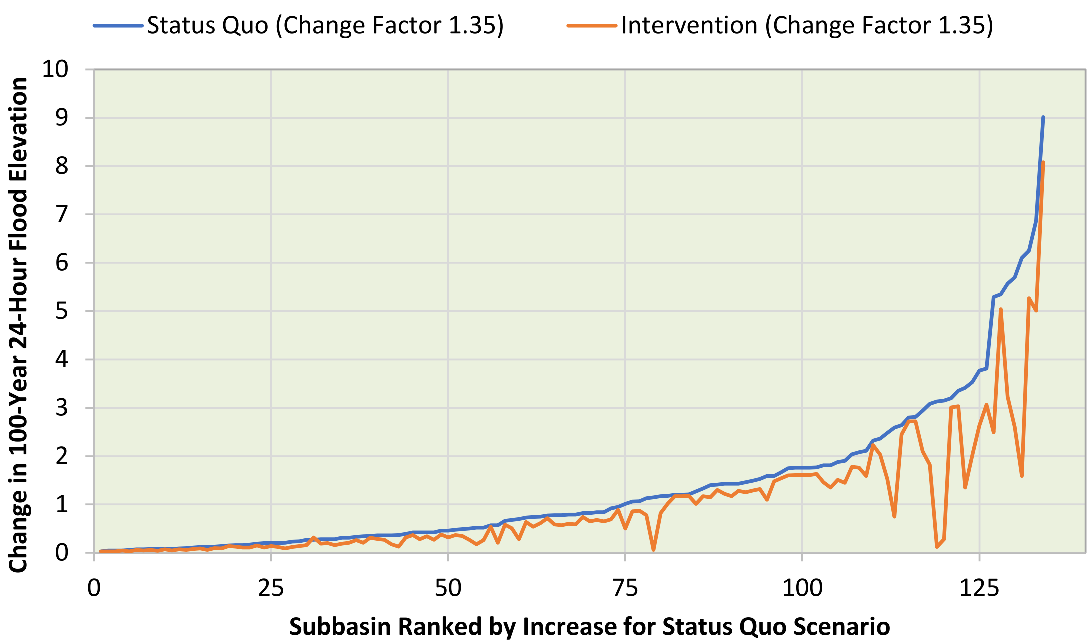

Figure 4. Change in 100-Year, 24-Hour Floodplain Elevation With and Without Stormwater Interventions (RCP4.5)

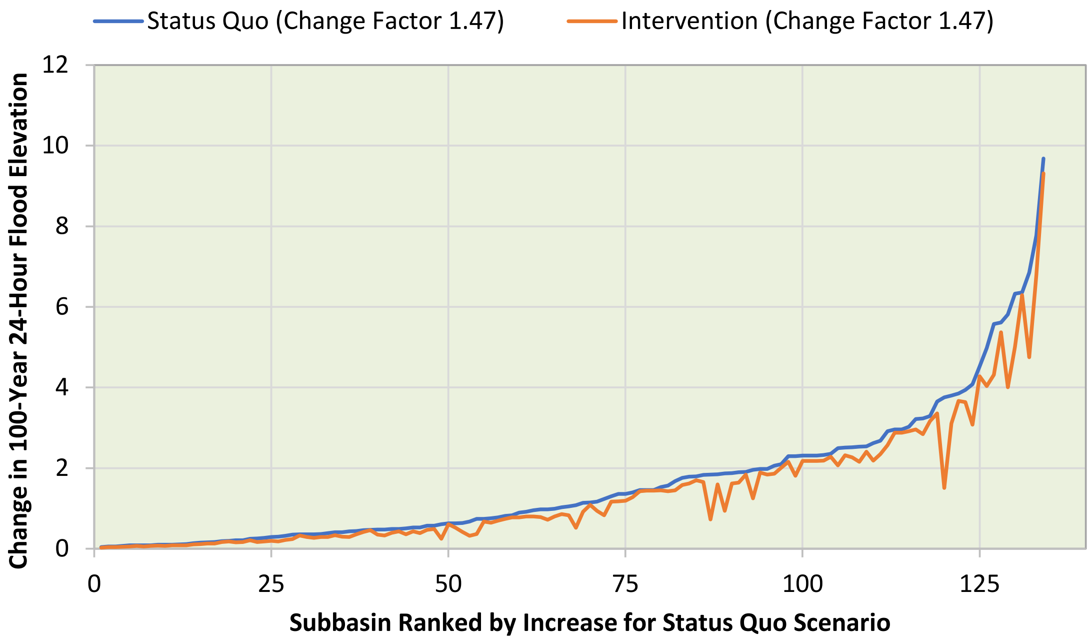

Figure 5. Change in 100-Year, 24-Hour Floodplain Elevation With and Without Stormwater Interventions (RCP8.5)

The floodplains for these future scenarios were mapped based on the modeled water surface elevation compared to the campus topography. The extents of these floodplains are shown in Figure 6 for the area around Lake Alice. The difference in floodplain extent is evident both around the lake and nearby areas with apparent flooding of Museum Road on the northwestern edge of the lake and flooding of Mowry Road along the southern edge of the lake. Areas east of Lake Alice are also observed to have flooding near the UF Cogeneration Plant.

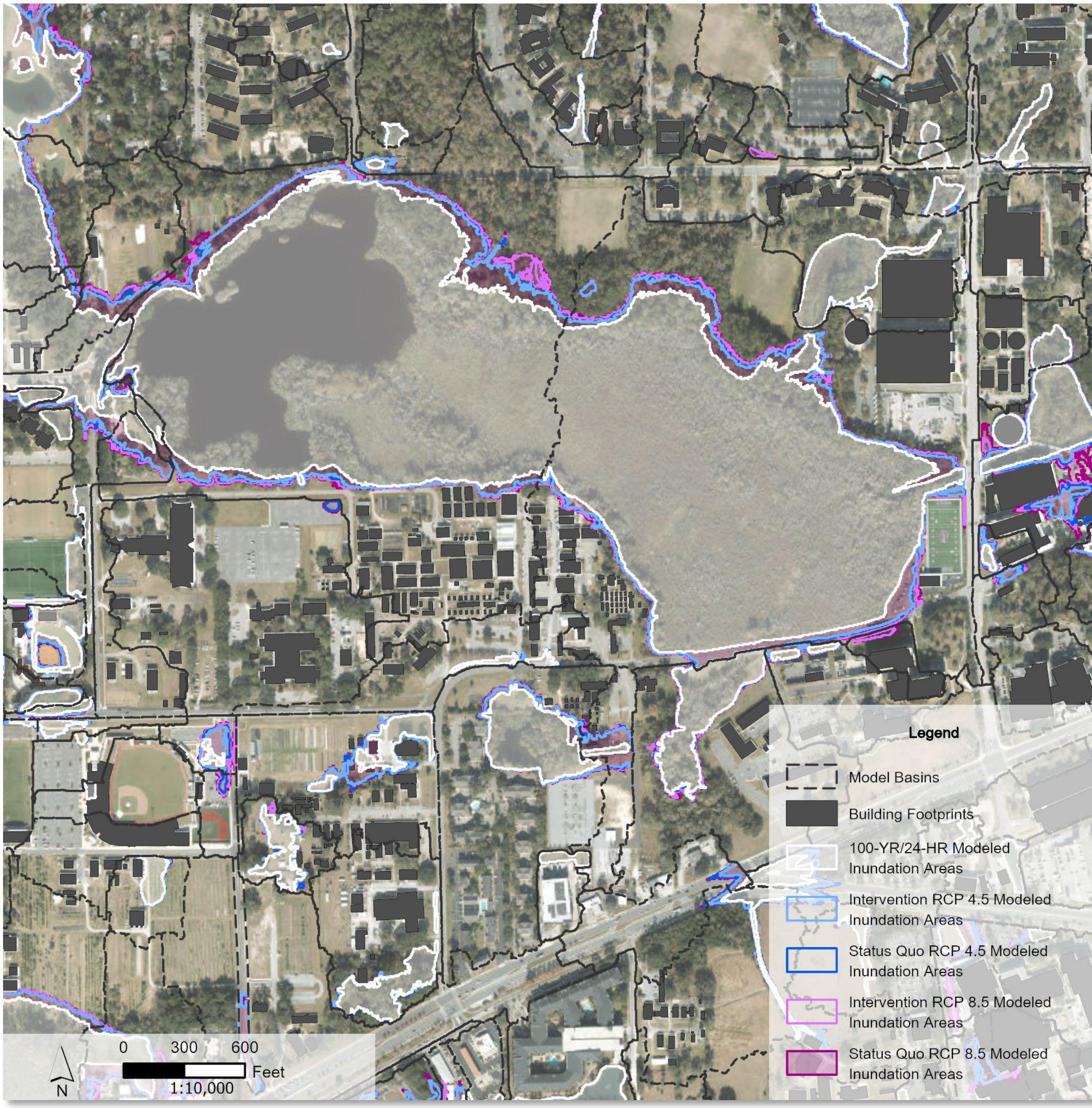

Figure 6. Estimated 100-Year, 24-Hour Floodplain Extents for Current Condition and Future Scenarios

Section 4.0 Watershed Recommendations

To ensure that stormwater does not impede growth and development as the University continues to evolve, it will be critical to manage stormwater in a holistic manner that maximizes the ecosystem services provided by the natural stormwater infrastructure on campus while reducing the impacts that reduce these same services. This WMP makes a series of recommendations to improve stormwater management through implementable actions that can be taken across the departments responsible for planning, design, construction, operations, and maintenance. Consolidation and funding of watershed management activities is also presented. These recommendations are described in the following sections.

4.1 Stormwater Project Recommendations

Proactive and effective stormwater management is imperative to allow the University to fulfill its educational and research missions. Without reliable and resilient stormwater management, there will be continued impacts to infrastructure, utilities, and personnel. These impacts result in capital costs to repair damage and correct deficiencies, increased operation and maintenance costs to keep marginal systems functional, and lost time for impacted staff and students.

Stormwater project recommendations are based on prioritization and ease of implementation. Projects are categorized as follows:

- Critical Projects: Required immediately to replace failing infrastructure.
- Near-Term Projects: Smaller or easier to implement projects with lower anticipated capital costs.
- Medium to Long-Term Projects: Larger projects that will be more expensive, are expected to take longer to implement and permit, or are likely to be phased.

4.1.1 Critical Projects

Projects identified as critical projects are needed to address failing infrastructure and life safety issues. All of the critical projects address extreme channel erosion. The University has successively completed similar repair projects in the past at Reitz Union Ravine, as shown in Figure 7, and at Diamond Creek. These projects were completed using a combination of new, hard infrastructure to provide energy dissipation and reduce erosion and vegetative restoration to stabilize slopes, reduce erosion, and improve habitat.

Figure 7. Reitz Ravine Before (2004) and After (2007) Repair and Stabilization

Critical projects were identified based on feedback from the Project Team and verified with site visits. This section discusses the problems at each location, proposes approaches to mitigate these problems, and recommends next steps. Identified critical projects were:

- Jennings Creek Headwall Failure and Channel Erosion
- Graham Woods and Keys Complex Erosion and Channel Stability
- McKnight Brain Institute Channel Erosion

4.1.1.1 Jennings Creek Headwall Replacement and Step-Pool Stabilization

Jennings Creek is one of the primary creeks on campus that conveys stormwater to Lake Alice. The creek begins at Yulee Pit, located just west of SW 13th Street, and flows through a 48" pipe under Museum Road, northwest of Beaty Towers. At the downstream end of the pipe under Museum Road, the headwall that supports the pipe has collapsed and created a separation in the last joint of the pipe (Figure 8). This collapse is due to the volume and velocity of stormwater moving through this pipe falling on an unprotected creek bed which caused the erosion of material that previously supported the headwall. During a site inspection by UF Facilities on July 5, 2023, the pipe was evaluated using a remotely-operated camera. At that time, it was determined that no additional pipe joints were separated. Upon inspection of the channel further downstream, a failed weir stretches across the creek. This feature appears to have historically backed water up, creating a pool that would have absorbed the energy coming through the Jennings Creek pipe. This weir appears to have failed due to water flanking around the end of the weir, which resulted in bank instability and the loss of trees along the channel edge. The loss of this pool allowed for upstream erosion of the material supporting the headwall and contributed to its collapse.

Figure 8. Jennings Creek Headwall Separation

The proposed project in this area consists of a series of step-pools with a new headwall installed on the Jennings Creek pipe. The conceptual design performs two necessary functions. The headwall replacement is necessary to allow flow through the pipe without additional upstream failure that might affect the integrity of the pipe and Museum Road. Pairing this replacement with the step-pool design will allow for energy dissipation on the downstream end of this pipe, which will protect the headwall and downstream channel. Rather than the rock and concrete weir that existed downstream on Jennings Creek previously, this project proposes using sheetpile overflow structures installed perpendicular to the direction of flow and beyond the edge of channel to ensure that flows will not erode around or underneath the wall. The sheetpile will be topped with cemented stone to improve aesthetics in the installed system. The existing steep creek banks, depending on location, will be either laid back (slope decreased) or will have gabion baskets to retain the slope and to ensure bank stability. In both cases native planting will be used to increase habitat value, enhance slope stability, and improve aesthetics. The conceptual layout for this feature is shown in Figure 9. The figure includes the conceptual layout for the trails as shown in the Campus Trails Master Plan. The northern-most trail alignment may need to be revised to ensure the trail supports do not increase scour at the toe of the west creek bank.

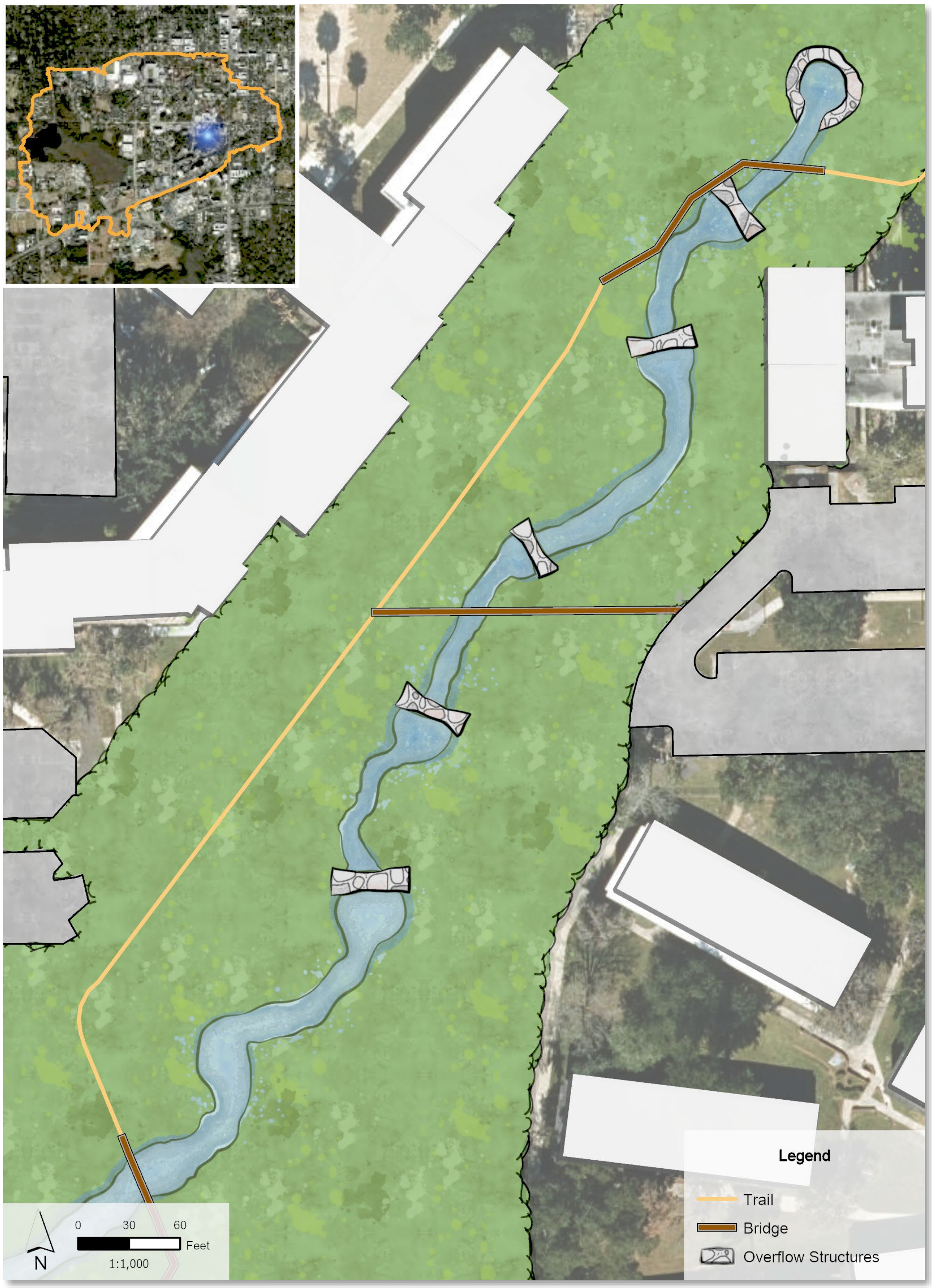

Figure 9. Jennings Creek Headwall and Step-Pool Improvements

4.1.1.2 Graham Woods Stabilization

Graham Woods is located south of Stadium Road with Tolbert Hall to the east and the Keys Complex to the west. This is a relatively steep-sided depressional feature with a creek that flows through the bottom of the depression south toward Graham and Hume Ponds and ultimately to Lake Alice. The top of the north bank is at 136 feet NAVD 88, while the toe of slope is approximately 105 ft NAVD 88 at the north end and 97 ft NAVD 88 at the far south end. The bottom of Graham woods is gently sloped with a braided stream channel. Stormwater and excess irrigation water enters this feature from development along the border of Graham Woods and to the north of Stadium Road. At least 15 pipes enter Graham Woods from the north across Stadium Road and from developed areas along both sides of the Conservation Area. Stormwater leaves Graham Woods through a 48-inch reinforced concrete pipe (RCP) at the south end of Graham Woods. The 48-inch pipe runs under the foundation of Graham Hall before discharging into Graham Pond. During large storm events, Graham Woods floods with a modeled 100-year floodplain elevation of 101.3 ft NAVD88.

The fifteen known pipes that enter Graham woods terminate upslope of the channel, and nearly all terminate outside of the jurisdictional wetland. This configuration has resulted in substantial erosion and bank instability on the perimeter of Graham Woods. At the northwest corner of Graham Woods, stormwater that bypasses inlets along Stadium Road is directed through a curb cut along the Keys Complex maintenance drive and into a vegetated area along Graham Woods. With the construction of the Heavener Football Complex and Student Health Care Center north of Stadium Road, additional stormwater was routed to this location which has resulted in an erosive channel forming along this surface drainage feature. Following initial channel formation, subsequent storms have contributed to additional erosion resulting in a vertical-walled channel approximately six feet deep that extended all the way back to the Keys Complex Drive (Figure 10). This feature exposed a communications conduit and was beginning to undermine the curb cut. Facilities Services used aggregate to form a temporary repair to reduce the potential for additional damage near the driveway.

The resulting channel continues into Graham Woods and has resulted in the loss of soil supporting large trees within the Conservation Area, causing their collapse. The termination of this erosive feature is a deep stormwater feature with a sand-cement riprap wall and two additional pipe outlets (Figure 11). At this location, the higher elevation pipe outlet is collapsing into the deep feature and there are apparent bank stability issues due to the near vertical sides of the stormwater feature. While temporary fencing has been installed to reduce access, the fence has been repeatedly damaged by people to allow access. Temporary repairs have been made in this area to resolve the erosion near Keys Complex Drive as of August 2024.

Figure 10. Keys Complex Erosion

Figure 11. Graham Woods Erosion and Pipe Outlets

The proposed project in this area includes constructing one or more grade control structures in the bottom channel. Concrete structures, such as baffled end walls and riprap aprons, will dissipate energy for stormwater inflows and provide erosion protection for the various stormwater pipes currently discharging into Graham Woods. To reduce erosion along the edges of Graham Woods, the side slopes will be recontoured and strategically hardened with gabion baskets, stormwater pipes will be extended with inverts lowered to enter the bottom of Graham Woods, and native vegetation will be installed to secure soils. Native plantings will also be used to restore habitat value and to improve aesthetics and recreational opportunities. To address upstream stormwater inflows, inlets along Stadium Road will be milled to capture flow more effectively, and a new stormwater inlet and pipe will be considered along the Keys Complex driveway to route flows into one of the existing stormwater inflow pipes rather than overland. Ideally the proposed project will also re-route the stormwater conveyance around Graham Hall rather than under it. The proposed concept for Graham Woods is shown in Figure 12.

Figure 12. Graham Woods Stabilization and Stormwater Basin

4.1.1.3 McKnight Brain Institute Erosion

The McKnight Brain Institute is located downstream of the confluence of Jennings and Diamond Creeks. In this location, the sidewalk was constructed into the wetland that buffered the creek channel. The earthen embankment next to the sidewalk was constructed with a steep slope and included utilities between the sidewalk and the creek. The creek has eroded the toe of slope due to sheer stress and changes in the flow characteristics of the system. This has resulted in flows being directed toward the edge of the sidewalk, which has exposed utility conduits (Figure 13). This erosion risks undermining the existing sidewalk, and if it migrates further, a road and loading dock may also be impacted.

Figure 13. Lake Alice Creek Along McKnight Brain Institute Sidewalk

Facilities Services proposed a repair for this location which included installation of earth-filled bags to stabilize the failing slope, protect the conduits, and allow for vegetation establishment over time. This concept, shown in Figure 14, was submitted to the SJRWMD along with a request for an exemption for shoreline stabilization. Unfortunately, the proposed project does not meet the requirements for the exemption.

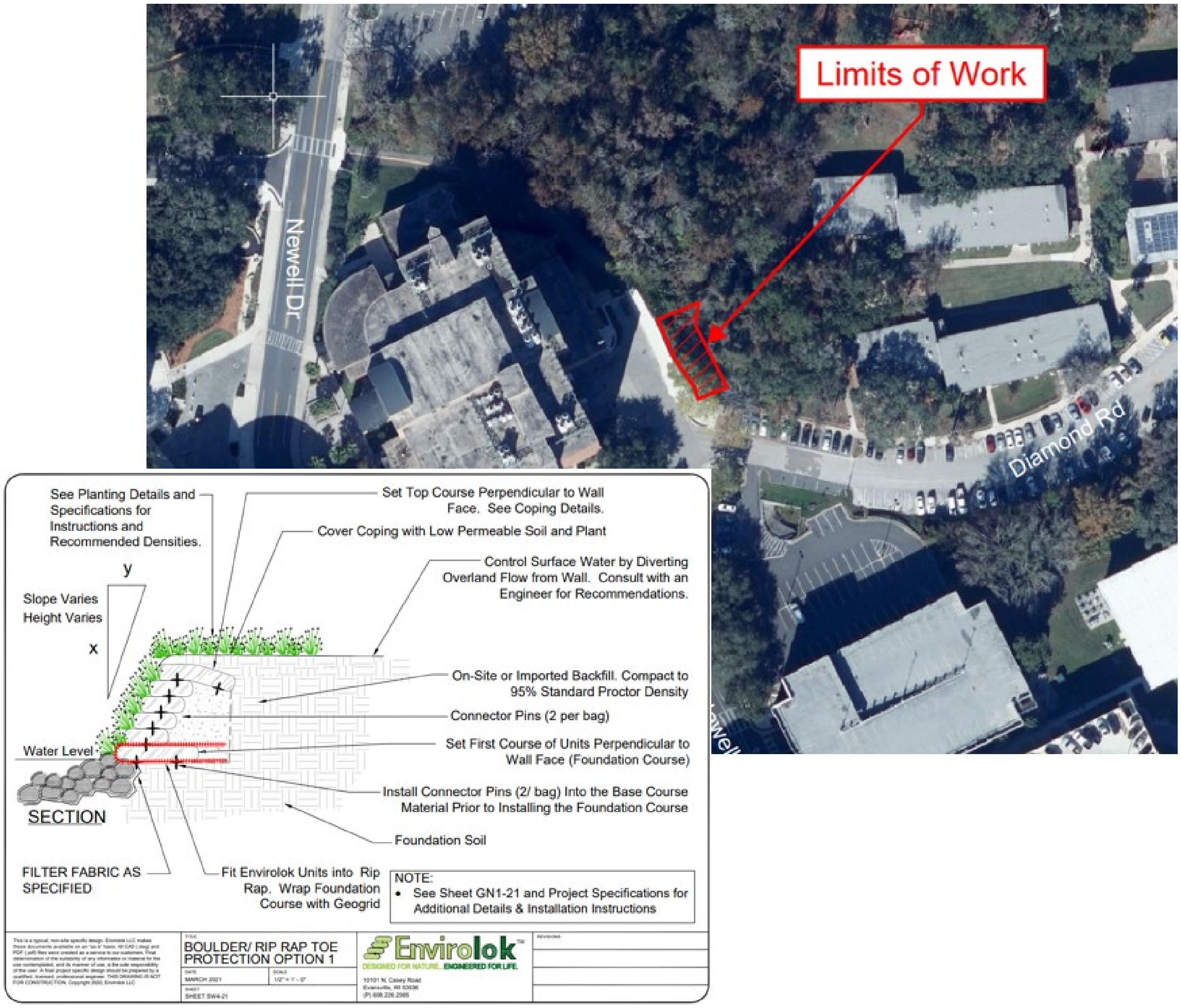

Figure 14. McKnight Brain Institute Proposed Stabilization (adapted from University of Florida, 2021)

It is recommended that this project have a design completed and that the University apply for a general permit (62-330.451 F.A.C.). In this location a repair that includes channel stabilization upstream may help re-direct flows away from the sidewalk. This may be accomplished with a sheetpile weir and limited excavation to remove accumulated sediments within the adjacent riparian area. This repair should be accompanied by slope stabilization, or hard armor, along the sidewalk to provide a long-term solution in this area.

4.1.2 Near-Term Projects

Projects identified as near-term projects are needed to address permitting/regulatory requirements, have been previously discussed and identified as opportunities, or are expected to be relatively low-cost. These recommendations include projects that are site-specific, but also stormwater management approaches that can be implemented more broadly throughout the watershed. The identified near-term projects include the following:

- Yulee Stormwater Park,
- Lake Alice South Stormwater Wetland,
- Site-Specific Stormwater Management,
- Dispersed Stormwater Management, and
- Sediment Traps at Lake Alice.

The near-term projects are described in detail below.

4.1.2.1 Yulee Stormwater Park

Yulee Pit is located north of Museum Road and west of SW 13th Street. This feature is a large depressional area that is the headwaters of Jennings Creek which begins on the south side of Museum Road. Based on historic aerials, this large depressional feature appears to have once been a seepage slope wetland that was dewatered by ditching through the wetland to Jennings Creek prior to the 1940s. Development has largely encircled this high-visibility site, which sits at one of the primary entrances to campus at Museum Road and SW 13th Street.

The recommended project at this location is a stormwater park that includes an open-water feature, fountain/aerator, littoral fringe, stabilized slopes, and human use features. Developing this feature will serve four primary purposes: increasing storage in the headwaters of Jennings Creek, dissipating energy associated with new multi-story development, improving water quality, and creating an inviting and accessible gateway to UF. This feature was conceptualized as a stormwater amphitheater with stabilized and landscaped slopes which would provide a functional outdoor space for recreation, relaxation, and outdoor learning. Trails would be developed to connect adjacent buildings efficiently and would include overlooks of the park-like setting. The concept developed for this location is shown in Figure 15.

Figure 15. Yulee Stormwater Park

4.1.2.2 Lake Alice South Stormwater Wetland

The Lake Alice South Conservation Area is located between Archer Road to the south and Mowry Road and Lake Alice to the north. This area receives both seepage and stormwater flow from Archer Road that drain to Lake Alice. Because of the urban interface along Archer Road, this site receives a large amount of trash that enters the Conservation Area and flows toward Lake Alice. As with many channels on campus, the higher elevation areas of this channel have been significantly eroded with sediment deposited in lower, flatter reaches of the stream. This has resulted in braiding and migration of the channel before it reaches a flat forested wetland and flows under Mowry Road and into Lake Alice.

The proposed project in this area includes installing a trash trap downstream of Archer Road and expanding the wetland to incorporate upland and grassed areas downstream of a former culvert and road crossing that has eroded and failed (Figure 16). A trash trap will help capture refuse that currently migrates to Lake Alice from Archer Road and will facilitate efficient collection and disposal of the accumulated material. Given that this trash is generated from Archer Road, discussions should be initiated with FDOT to install and maintain this system. Repair of the existing creek crossing and expansion of the wetland will provide the following benefits to the watershed and Lake Alice: improved water quality, increased stormwater attenuation, and the creation of a passive use wetland park as a recreational amenity in the southern portion of campus. The proposed layout for this location is shown in Figure 17.

Figure 16. Washed-Out Dirt Road in Lake Alice South Conservation Area

Figure 17. Lake Alice South Stormwater Wetland

4.1.2.3 Site-Specific Stormwater Management

The 2010 Master ERP is currently being renewed with a new Stormwater Master Plan Conceptual Permit expected to be issued in 2024. This new permit is expected to modify the way that individual projects for new construction or redevelopment are permitted on campus. As previously described, the current permitting process relies on Lake Alice being permitted as the wet detention pond for all development within the watershed, with the lake providing water quality treatment and storage. The new permit will continue to have Lake Alice permitted as the stormwater pond, but because of the documented impairments, the lake will require water quality treatment on-site for each new project constructed in the watershed. This requirement will necessitate that any new project or redevelopment first apply for either an individual permit, or if it qualifies, a general permit. Treatment will be required for the first 1 inch of runoff over the entire site area or for either 1.25 or 2.5 inches of runoff from the impervious area, depending on the treatment system, whichever is greater.

4.1.2.4 Dispersed Stormwater Management

The University of Florida is a highly-developed campus that includes buildings and infrastructure constructed over more than 100 years. The high intensity of development on campus creates opportunities for implementing large stormwater projects which are limited to either natural areas, un-built areas of campus, or within the footprint of structures that are to be demolished. Despite the lack of opportunities for developing large projects there are numerous opportunities to install smaller, low impact development (LID)/green stormwater infrastructure (GSI) projects on campus. These features offer the opportunity to implement dispersed stormwater management to provide treatment, reduce runoff volumes, and reduce peak flows. The University had a LID manual developed in 2010 (Causseaux, Hewett & Walpole, Inc., 2010) which offers recommendations on a wide variety of LID opportunities and discusses the implementation of these features on campus. Additional recommendations for incorporating LID in the planning and review process are provided in Section 4.3.2.

Available forms of LID/GSI that would be optimal for developed areas of campus include bioretention, rain gardens, vegetated swales, curb cuts with recessed median storage, and permeable pavement. The Southwest Recreation Center has a rain garden, as shown in Figure 18. Many of these practices can be incorporated in the existing landscape through minor changes to grade, slopes, and small structural modifications. As an example, the surface parking lot at the O'Connell Center currently includes vegetated swales and curb cuts. However, the structures that convey this water into the stormwater network are at or near grade, meaning that minimal water is stored in these features before discharge. By modifying these structures to increase the grate elevation and incorporating a lower elevation orifice, these features could provide storage while still draining back to the bottom of the swale within 48-72 hours. There are opportunities for vegetated landscaped beds that are often bordered by brick curbs or seat-walls in many locations on campus. These areas could be redesigned with lower grades and curb cuts or orifices to allow water to infiltrate into the ground or drain into the stormwater network in a more controlled fashion during storm events.

Figure 18. UF Southwest Recreation Center Rain Garden (The Nature Conservancy, n.d.)

4.1.2.5 Sediment Sumps

To reduce sediment and associated nutrients from entering Lake Alice it is recommended that maintainable sediment sumps be constructed near the terminus of at least Lake Alice Creek and Fraternity Creek. These new sumps would be used to capture sediments and would provide an easily maintainable feature for removing sediment and the associated nutrient loads before it reaches Lake Alice. Hume Pond effectively functions as a sediment sump for Hume Creek and the Graham Ponds provide this function for the creek through Graham Woods. However, maintenance of both of these features is visually impactful and challenging due to side slopes and soft sediments. For this reason, construction of dedicated sediment sumps for each of these creeks may be desirable to ease maintenance. Potential implementation locations are shown in Figure 19.

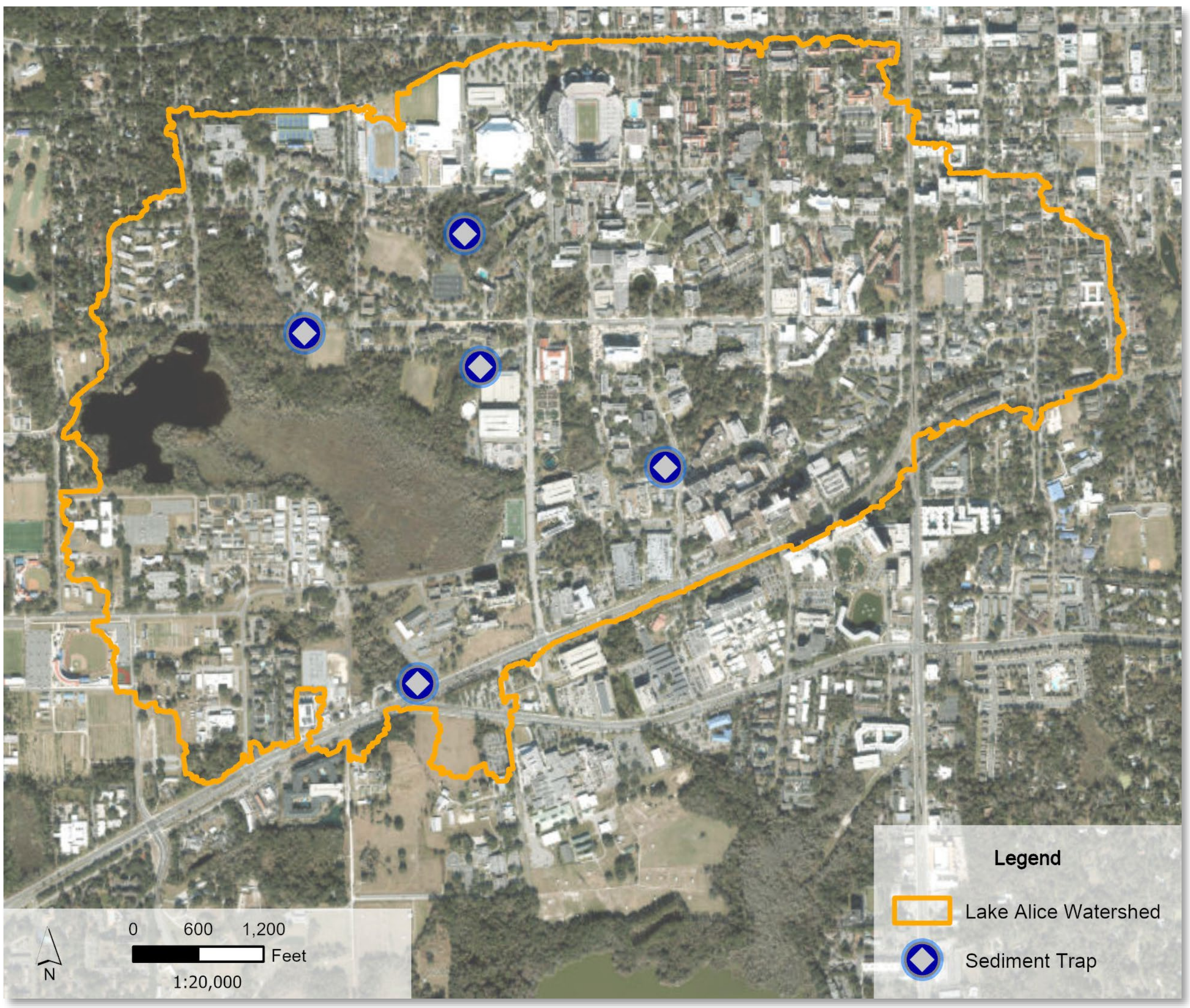

Figure 19. Potential Creek Sediment Sump Locations

4.1.2.6 Regional Stormwater Treatment

A significant portion of the University of Florida campus, particularly the health science area and northeast section, is already highly developed. These areas, collectively termed the "Red Box" in the Campus Framework Plan, are targeted for additional infill development. Given their current state of intense development, opportunities for implementing stormwater management projects during redevelopment and infill are limited. To address stormwater needs in these highly developed zones and other similar areas, the plan recommends that the University establish regional stormwater management projects for each of the primary drainage basins on campus. This strategic approach ensures effective stormwater management as development and redevelopment activities continue. This approach would provide credit basins that could be used to meet the needs of future development without on-site, project-specific treatment. This approach is frequently used in highly developed areas like the City of Gainesville (e.g. 5th Avenue Stormwater Park and Depot Park Stormwater Park). For each of the drainages, a larger project would be developed lower in the watershed with credits derived based on the amount of water captured and the treatment implemented. Potential locations for implementing these projects are shown in Figure 20.

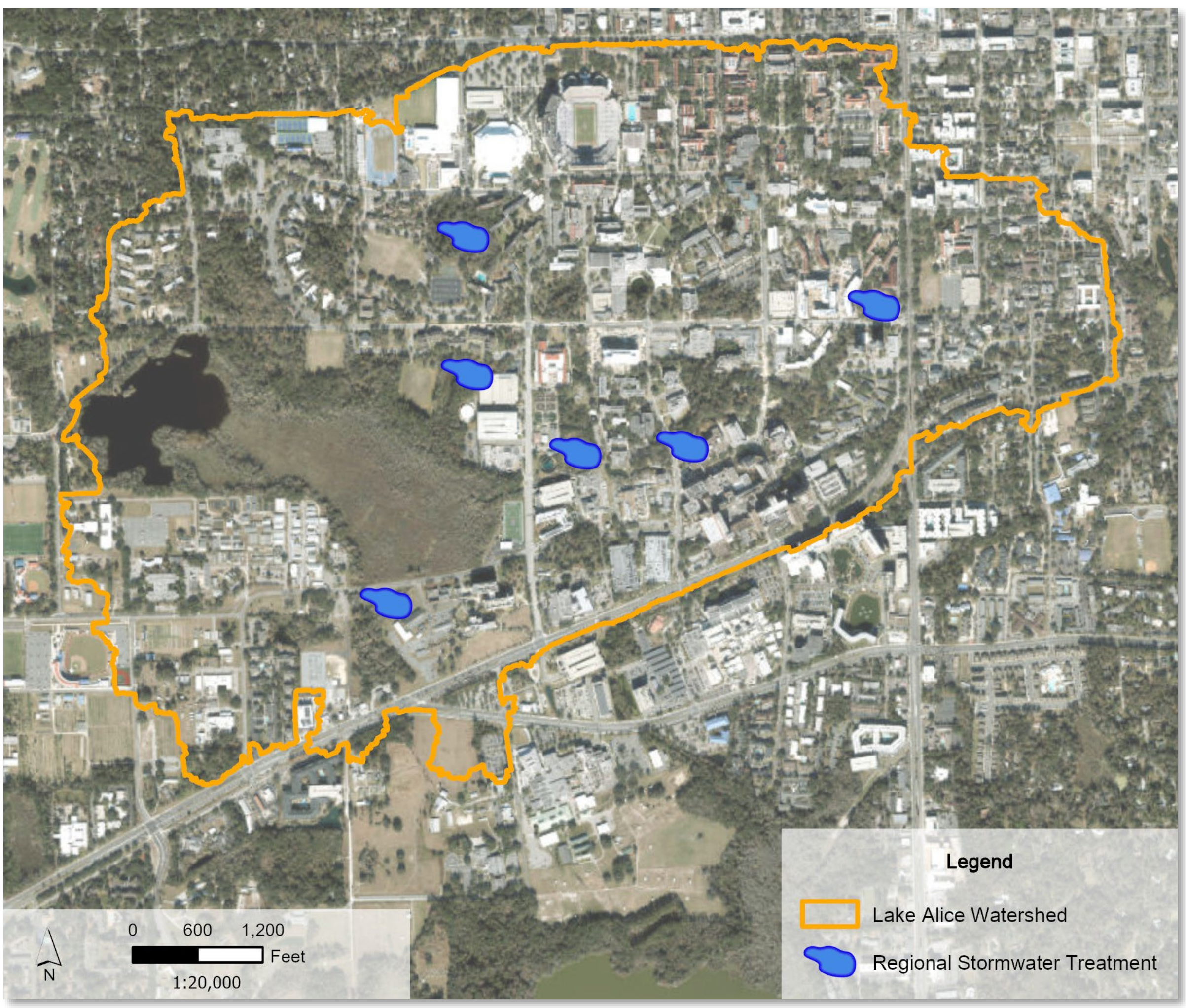

Figure 20. Potential Regional Stormwater Project Locations

The recommended projects in these areas could include a combination of wet detention, bio-retention, swales, stormwater wetlands, and dry retention. These treatment methods could be combined in series or implemented individually depending on location, site conditions, and project goals.

4.1.3 Medium and Long-Term Projects

The level of development on campus means that there is a need for larger, comprehensive solutions that require committed capital funding over years. These projects aim to stabilize channels and provide stormwater treatment on a scale that will protect infrastructure moving forward while improving water quality in receiving waterbodies including Lake Alice and the Upper Floridan Aquifer. The scope and scale of these projects, like that of many buildings on campus, are grand. These projects will underscore the University's commitment to a vision of campus that preserves its natural areas for generations of students to come. The proposed medium and long-term projects include the following:

- Complete Creek Stabilization,
- Lake Alice Dredging, and
- Campus Mitigation Bank.

The medium and long-term projects are described in detail below.

4.1.3.1 Complete Creek Stabilization

All the steep gradient creeks on campus have been impacted by increased stormwater flows that have caused erosion, sediment transport, and elevated phosphorus concentrations associated with scouring of the phosphorus-rich Hawthorn Formation. This recommendation extends the step-pool stabilization concept proposed for Jennings Creek, Diamond Creek and Graham Woods across campus to all impacted creek systems. These projects should be implemented with construction beginning at the upstream extent of each creek and progressing in a downstream direction. These projects should be designed with a consistent aesthetic in materials and stabilization methods.

These are considered medium- to long-term projects based on the expectation that they would be phased based on available funding. Where possible, it is recommended that these projects be developed for complete segments of creeks in a single phase to reduce repetitive and overlapping impacts in Conservation Areas and to allow for installation of user access features in association with the stabilization projects. Creeks where this approach is recommended include Jennings Creek downstream to the junction with Diamond Creek, Diamond Creek downstream to the junction with Jennings Creek, Lake Alice Creek from the junction of Diamond and Jennings Creeks to Center Drive, Hume Creek to Hume Pond, the creek in Graham Woods, and Fraternity Creek to Museum Road. These creek segments are shown in Figure 21.

For the segments of the creeks with lower gradients that continue downstream from the identified steep creek segments, including Lake Alice Creek from Center Drive to Lake Alice, Hume Pond to Lake Alice, and Fraternity Creek from Museum Road to Lake Alice it is recommended that banks be re-contoured and stabilized using native plantings. In areas of these creeks that are adjacent to infrastructure, it may be necessary to examine grey infrastructure such as gabions or sheetpile to avoid impacts to the built environment. It is recommended that these projects be completed after upstream creek stabilization to reduce potential erosion and sedimentation.

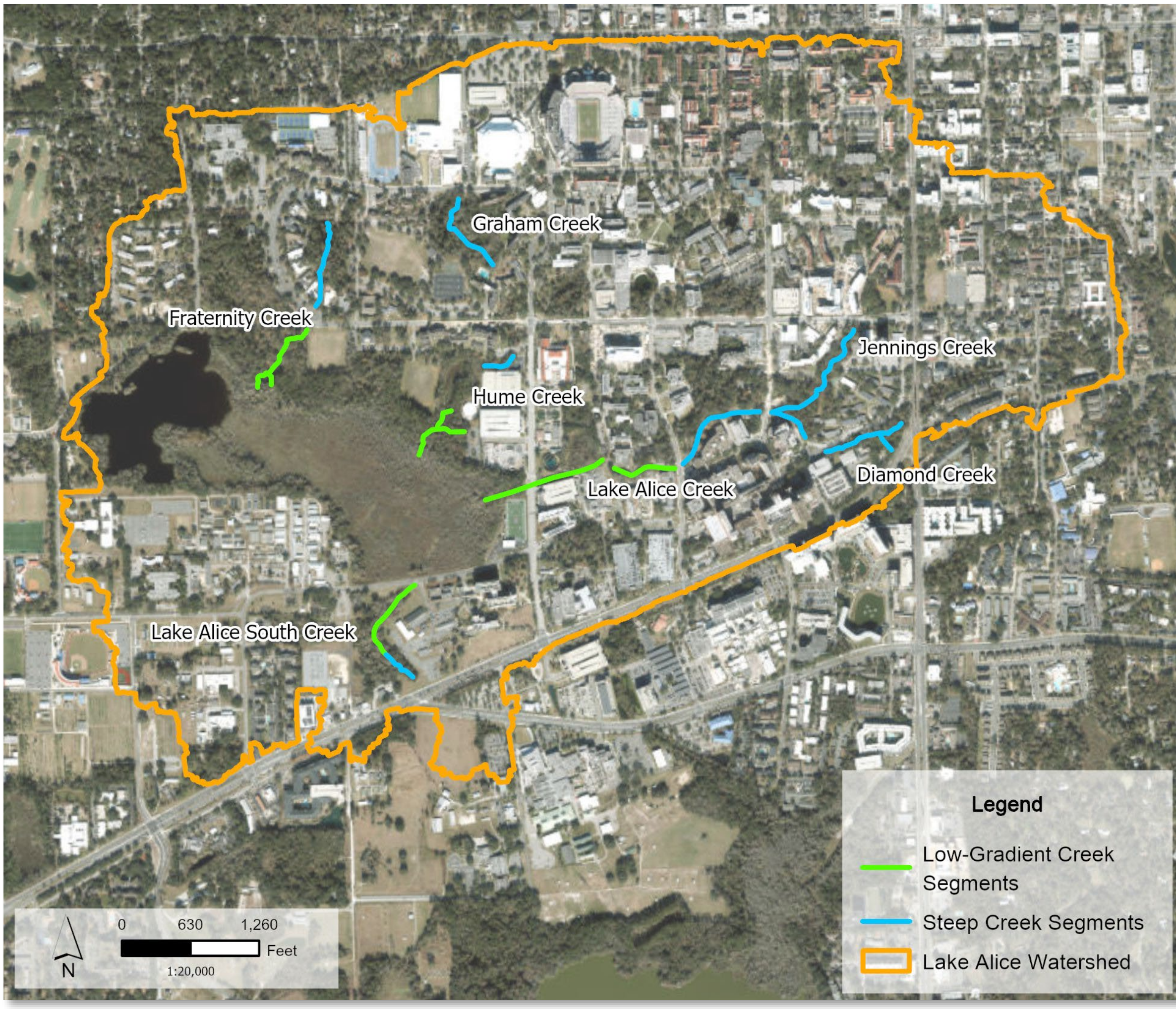

Figure 21. Creek Segments Recommended for Improvement

4.1.3.2 Lake Alice Dredging

Increases in stormwater flows in channels and across steep slopes on campus have resulted in substantial erosion. This eroded material has been deposited in downstream waterways including low-gradient sections of creeks and in Lake Alice. When not removed, this sediment results in a loss of storage in creeks and the lakes and an increase in channel elevations that can cause channels to jump their banks and carve new channels resulting in additional erosion. For any material that is not removed upstream, the ultimate destination for this material is the lake.

The most recent bathymetric data available for Lake Alice is from a LakeWatch data collection effort in 2000 (LakeWatch, 2000). These data, when compared to bathymetric data shown in a 1975 study of the lake (Mitsch, 1975), show a decrease in depth in the northern portion of the open water section of Lake Alice by 2-4 feet. This decrease in depth is in the vicinity of the inflow from a large stormwater pipe near Harmonic Woods and Village Drive. In addition to the discharge of mineral sediments into the lake, there is a history of eutrophication and expansion of floating aquatic plants on the lake. As these plants senesce seasonally or die due to herbicide treatment, they sink, adding organic sediments to the lake bottom and imposing an oxygen demand on the water column. This material settles creating a flocculant layer that provides nutrient recycling and enrichment. In the case of Lake Alice both the organic and mineral sediments have the potential for contamination due to the extensive history of campus and the historical use of chemicals, pesticides, and treated materials, as well as direct discharge of wastewater to the lake, untreated and treated, for decades. Particularly in the context of wastewater discharges, phosphorus was contributed at high concentrations to the lake for a long period of time. It is expected that this legacy phosphorus is at least partially to blame for current algal blooms observed during dry periods.

The primary way to manage sediments in lakes is using suction dredges to remove the material with dewatering conducted in geo-tubes. A separate method that can be used to inactivate nutrients without removal is application of materials that bind to the phosphorus, effectively controlling the release of these nutrients back to the water column. This study does not recommend dredging of the lake, but includes the following recommendations regarding studying lake sediments:

- Collect bathymetric data to better understand the current depths in the lake and the potential need for sediment management.
- Collect cores across the lake to understand the chemical makeup of sediments that might be removed and parameters that might require special handling. Based on a core collected and analyzed in August 2023 by LakeWatch and the Geological Sciences Department, no specific chemicals of concern were identified, although additional analysis was recommended.
- Developing an estimate of accumulated sediment depth across the lake based on collected cores.
- Evaluate permitting approach and feasibility including a pre-application meeting with the SJRWMD.
- Develop an estimated cost for dredging based on sediment quality and required disposal.

After completing these analyses, the goals and objectives of dredging should be considered, and a decision should be made about moving forward. This study does not recommend that dredging proceed until the above data are collected and dredging costs are fully evaluated.

4.1.3.3 Campus Mitigation Bank

The Lake Alice Watershed includes approximately 123 acres of wetlands and the Main Campus includes approximately 196 acres of wetlands based on the wetland delineation of campus completed by WSP in 2023 for renewal of the stormwater permit (WSP, Inc., 2023). Given the acreage of wetlands on campus and the potential need for work in and around these areas associated with stormwater management and future development, it is the recommendation of this study that as the University begins to develop large stormwater projects (e.g. Yulee Stormwater Park and Lake Alice South Stormwater Wetland) that include wetland components or enhancements, that a wetland mitigation bank be developed.

Campus lies within the service boundary of the Mill Creek Mitigation Bank. This provides the University with three potential options for mitigating wetland impacts on campus. First, if available, UF could purchase credits from the Mill Creek Mitigation Bank. This is a financial transaction where the University would pay the mitigation bank for needed credits and have no further responsibility for mitigation. Second, for projects with wetland impacts the University could provide project-related improvements, enhancement, or creation of wetlands that compensate for the proposed impacts. Finally, the University could develop a mitigation bank for Main Campus. This option has the benefit of potentially lower costs over the long-term and would provide additional benefits and habitat that is of higher value than small project-specific mitigation efforts that provide limited benefits and may require more challenging maintenance. This approach may also allow for mitigation credits to be developed as part of Conservation Area maintenance, including the removal of invasive vegetation, re-vegetation, and stream stabilization.

A wetland mitigation bank for the University can be permitted as part of a proposed project with credits usable only by the University. This would include calculation of wetland impacts for the project and estimates of the post-project wetland credits based on the Uniform Mitigation Assessment Method (UMAM). The credits developed for the mitigation bank project would then be requested as part of the ERP to be reserved for additional projects by the University on Main Campus.

Development of mitigation credit requires an ongoing commitment to the maintenance of mitigation features in perpetuity. Given the University's current commitment to Conservation Areas on campus this is not expected to pose a major challenge. Typically, a minimum of five years of post-project annual monitoring is completed with sign-off from the regulatory agencies if the mitigation success criteria are met. Ongoing maintenance typically includes monitoring and reporting, vegetative maintenance to promote minimal coverage by invasive vegetation, and if necessary, replanting. It might also be necessary and in the University's interest to install signs or monuments indicating the specific location of the mitigation area and allowable maintenance to avoid confusion or damage to these mitigation areas. The implications of these requirements should be considered in the context of establishing a mitigation bank or mitigation projects.

4.2 Water Quality Source Control Recommendations

The Lake Alice Watershed has a history of nutrient enrichment from the application of wastewater to Lake Alice until its redirection to the R-2 well in 1995. Since that time, primary sources of nutrients in the watershed have been from reclaimed water application on campus, erosion of the phosphorus-rich Hawthorn Formation in the creeks, and fertilizer application and runoff. This section discusses each of these sources and provides recommendations for controls. Given a lack of continuous data collection on campus, the Waters of the University of Florida report (Wells et al., 2006) provides the best available information on nutrient sources and quantities. This report presented data collected in 2003-4 for 15 locations across the watershed. Three of these locations (Hume Creek, Medicinal Garden – Up, and Medicinal Gardens – Down) were observed to have significantly elevated concentrations of nitrogen with several separate stations showing elevated concentrations of phosphorus (Pony Field, Golf Course Pond, Golf View Creek, 7th Fairway, and Shop Storm Pond). Further evaluation indicated that fertilizer application on athletic fields within the respective drainages likely caused the elevated nitrogen levels. Each of the potential sources and possible controls is discussed in additional detail in the following sections.

4.2.1 Fertilizer Application and Irrigation

There are a variety of fertilized spaces on campus. Based on focus groups held with both UAA and Rec Sports, fertilizer is currently applied to all grass sports fields. Potentially exacerbating this application is that fertilizer is applied to fields that are under-drained and that are also irrigated. The UAA is charged with maintaining fields associated with the sports that are organized through the University including: football, baseball, softball, soccer, track, and lacrosse. Based on conversations with the UAA, fertilizer is applied to maintain turf condition. Soil testing is performed as part of this effort. UAA indicated that all fields use soil moisture sensors and that the fertilizer applied is the slow-release variety with some addition of foliar fertilizer. Some fields have also been amended with *Comand™* compost to reduce the need for fertilizer and water. Records are kept of fertilizer application and were requested but not provided by UAA for inclusion in this report. Soccer, Lacrosse and softball fields are irrigated with reclaimed water and the remaining fields have separate wells managed by UAA.

Within the Lake Alice Watershed Rec Sports maintains Lake Alice Field, Flavet Field, and Hume Field. These fields are all fertilized between April and October using three different fertilizers depending on the month. Two of the three fertilizers are controlled release. All four fields have the potential to direct water toward the lake or toward stormwater features that direct the water toward the lake. Hume Field is not irrigated, but the remaining fields are irrigated with reclaimed water. Soil moisture sensors and rainfall shut-offs are used on irrigated fields. Soil testing is conducted by IFAS 2-3 times per year. Nitrogen in reclaimed irrigation is not considered in the nutrient budget for the fields.

The following recommendations are made regarding fertilizer application on campus:

- Both UAA and Rec Sports should collaborate with IFAS with the specific goal of reducing fertilizer use to the maximum extent possible on all their managed fields.
- All fields that use reclaimed water should account for nutrients in the applied water when considering fertilizer needs.
- Irrigation scheduling post-fertilization should be optimized to reduce infiltration past the root zone and to eliminate runoff.
- All under-drained fields should have samples collected in their drainage system to evaluate the nutrient content of runoff.

4.2.2 Reclaimed Irrigation

Reclaimed irrigation is used extensively on campus to meet the irrigation demands of landscaped areas and the previously described athletic fields. The use of reclaimed is beneficial from the standpoint of reducing the use of potable water for irrigation but has the potential to increase nutrient loads if not properly managed and could violate the University's wastewater disposal permit. Reclaimed water is not permitted to enter any surface waters including creeks or Lake Alice without an NPDES permit for discharge, and the University does not have an NPDES permit for discharge to Lake Alice, except for lake level control below an elevation of 69.5 feet (assumed to be NGVD29, but unspecified). Data were not collected on all reclaimed users on campus. The following recommendations will help reduce concerns with reclaimed irrigation.

- All sprayheads should be carefully aligned to irrigate vegetation and avoid watering hard surfaces.
- All irrigation systems should employ rainfall sensors that immediately discontinue irrigation after a threshold of 0.125" of rainfall is detected.
- Soil moisture sensors should be installed for all irrigated areas over one acre with irrigation discontinued as soon as the soil reaches field capacity.
- No more than ¾" of irrigation should be applied per irrigation day and irrigation should occur no more than twice per week.
- Regular inspections of reclaimed irrigation infrastructure should be completed to identify leaks or line breaks.

- Reclaimed water observed in creeks or the stormwater system should be traced back to its origin with repairs or modifications made to eliminate runoff of reclaimed water.
- All under-drained fields should have sensors installed in the under-drain system to stop irrigation as soon as water is sensed.

4.2.3 Erosion in Creeks

Increased flow rates in the stormwater system have resulted in erosion in many of the creek channels on campus. Much of the University is underlain by the Hawthorn Formation, a phosphorus rich clay unit. Erosion of surficial soils in many of the creeks has exposed and scoured this formation, resulting in mobilization of phosphorus into downstream waterbodies. Erosion and recommended improvements to reduce erosion are discussed in previous report sections that address erosion in creek channels. These recommendations are not repeated here, but measures to reduce erosion in the watershed should reduce this source of phosphorus loading to Lake Alice.

4.2.4 Street and Parking Lot Sweeping

Street-sweeping is completed at parking lots and roads across campus on varying frequencies. The removal of accumulated sediment and organic material reduces the runoff of pollutants including metals and nutrients that might enter waterbodies and/or stormwater features on campus. Water quality credit may be available to the University for street-sweeping that can count toward possible future goals for Lake Alice. Additionally, street-sweeping should be reported as part of the MS4 permit. It is recommended that the location and mass or volume of material removed by street-sweeping be recorded in the asset management system to allow for quantification of benefits for the MS4 program and any future pollutant load reduction goals for Lake Alice.

4.3 Design and Review Recommendations

Given the size of campus and the University's ownership of almost all the property on the Main Campus, stormwater management and permitting are different than for other local areas. These differences mean that there is less oversight by permitting agencies and increased responsibility for the University to oversee stormwater management and impacts of their actions on other University assets.

Complicating stormwater management on campus is the design process, which considers stormwater differently depending on project location. For projects within the Lake Alice Watershed, Lake Alice is considered the stormwater treatment system, with the creeks that feed the lake acting as principal stormwater conveyances. Historically, projects in this basin have listed the lake as the stormwater management system with a requirement to report annually on the additional impervious area added to each subbasin of the lake. The same general approach has been applied within the depressional basins on campus that remain wholly on University property. For depressional basins that include areas not owned by the University, or that flow to urban creeks (Hogtown or Tumblin), projects are required to apply for individual permits from the SJRWMD and comply with stormwater permitting requirements under Chapter 62-330 FAC. This approach is being modified as part of the current permit renewal process, which will require a separate stormwater permit for each new project constructed on University property.

The current stormwater approach has been developed based on Lake Alice's designation as a stormwater feature that functions as a wet detention pond serving the entire watershed. Because the lake acts as the stormwater management feature, the creeks in concert with pipes and constructed channels act as stormwater conduits that route flows from developed areas to the lake. Since the University owns nearly all property, the ability for the creeks and associated stormwater pipes/channels to convey increased flows without causing or exacerbating issues in the stormwater system are not considered. This means that additional runoff volume, higher energy flows, and/or higher peak flow rates are not required to show adequate capacity within the conveyance system. This has resulted in substantial damage within the conveyance system, including erosion in the creeks, damaged stormwater infrastructure, and downstream flooding.

The following recommendations would increase accountability and oversight of stormwater and reduce the potential for new or worsening impacts. The following sections include recommendations focused on the design and review process, operations and maintenance, funding stormwater, and stormwater management during construction.

4.3.1 Stormwater Modeling Recommendations

The University of Florida contracted with Jones Edmunds to develop a campus-wide stormwater ICPR model in 2017 (Jones Edmunds & Associates, Inc., 2018). This model was subsequently partially updated by Chen-Moore as part of the Stormwater Master Plan permitting process and separately by WSP for several small stormwater projects near Lake Alice. For the purposes of this project and to support permitting moving forward, the original 2017 ICPR model was updated to use curve numbers instead of the Green-Ampt method for runoff and infiltration, a requirement from SJRWMD permitting. The model was also refined in several areas to reduce subbasin size and increase the resolution to evaluate additional structures and localized flooding. The stormwater model layout developed for this study is shown in Figure 22.

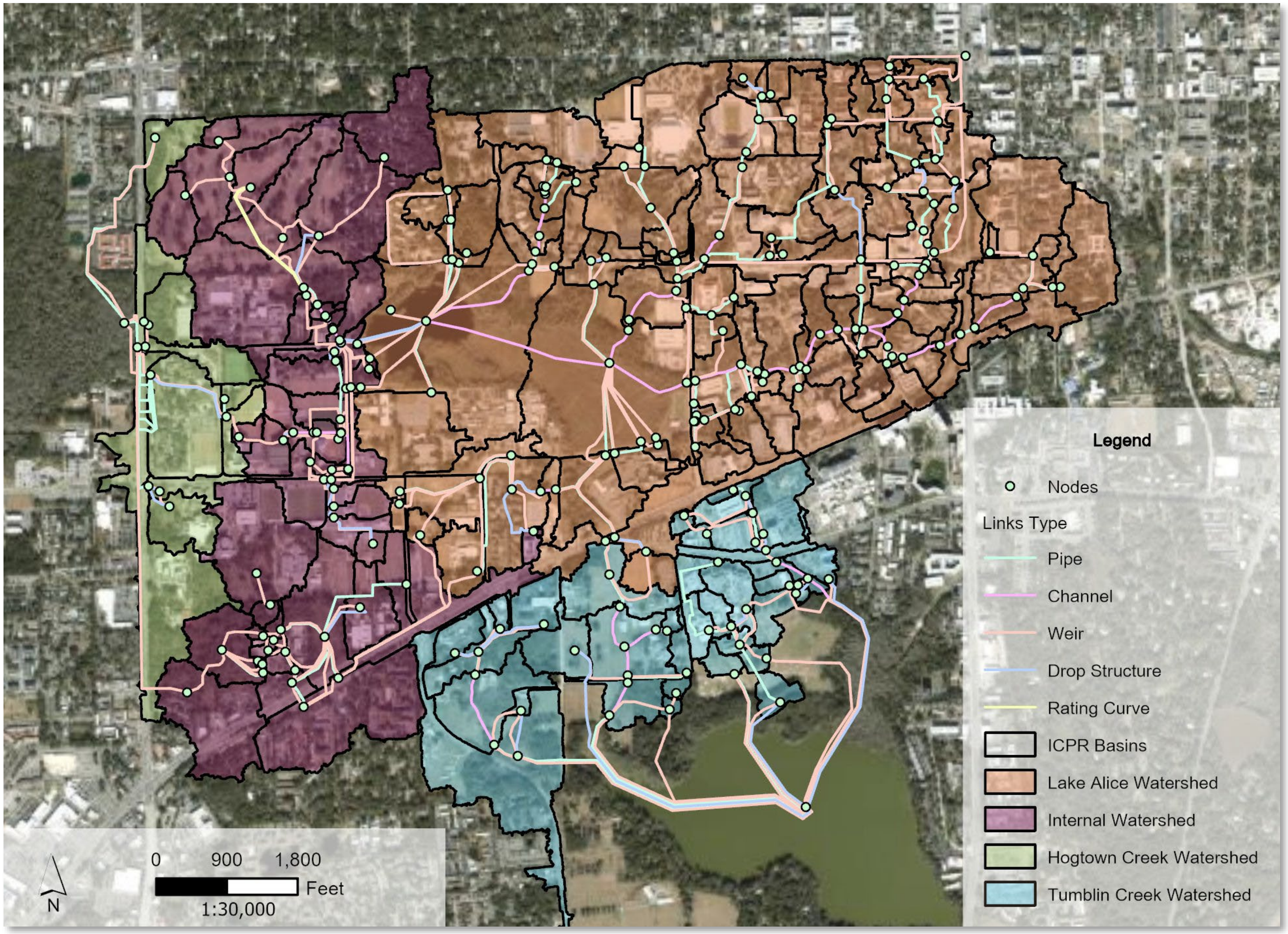

Figure 22. University of Florida Stormwater Model Layout

To evaluate future projects and their impacts on the existing stormwater system it is recommended that all new or redevelopment projects be incorporated in the stormwater model to examine the downstream impacts of projects and the need for improvements in the stormwater system. The following updates to the model should be made for each new or redevelopment project:

- Refining subbasin boundaries to provide adequate detail for the project,
- Incorporating survey information for new stormwater features,
- Verifying that hydrologic parameters reflect current conditions, and
- Following refinement of the existing conditions model, development of a proposed condition model that reflects the proposed changes.

Following model updates and refinement, the following comparisons should be made:

- Comparing pre-project flood elevations to post-project elevations,
- Comparing flow rates between the pre- and post-conditions model, and
- Ensuring no downstream flooding occurs in the stormwater system.

Stormwater modeling is a useful tool but will not capture all design deficiencies. Specifically, localized drainage may cause or exacerbate flooding within a single basin, or for an adjacent structure. Recommendations for the design and review process are discussed in the next section to capture these issues.

4.3.2 Design and Review Process

To reduce impacts to the existing stormwater infrastructure and Conservation Areas on campus, it is recommended that the design review process include additional evaluation for stormwater infrastructure and downstream stormwater capacity using a tool similar to the Campus Master Plan Checklist (CMPC). It is further recommended that additional information be required from design firms to allow for the evaluation of stormwater associated with new or redevelopment projects. These recommendations are specifically tied to other recommendations in this report. The following are recommended additions that should be included within the Evaluation Criteria of the CMPC:

- The most recent Campus Stormwater Model has been updated to include the proposed development. The model results demonstrate that the project does not increase flows downstream of the project, or that increased flows can be accommodated in downstream infrastructure without adverse impacts.
- Energy dissipation has been included as part of the stormwater system design for the construction and no increase in energy is being added to the stormwater system or creeks.
- The proposed stormwater management system provides required water quality treatment or adequate credit is available in a downstream regional basin and has been accounted for in the ledger for the regional basin.
- The site grading plan has been reviewed and provides positive drainage to the stormwater collection system and does not send overland flow offsite unless accommodation has been made and demonstrated to capture stormwater flows downgradient.

- The most recent Campus Stormwater Model, updated to include the project, has been run for the following design storms, 2.33-yr 24-hr, 5-yr 24-hr, 10-yr 24-hr, 25-yr 24-hr, 100-yr 24-hr, 100-yr 120-hr; and the proposed finished floor elevation for any buildings is at least 1 foot above the modeled floodplain elevation. Additionally, flows for all of these storms are conveyed in a way that does not cause adverse impacts to any adjacent buildings.

4.3.3 Third-Party Review

The University of Florida currently reviews designs and manages construction projects through the Planning, Design, and Construction group within Business Affairs. It is the recommendation of this plan that third-party review be added for stormwater design and modeling to increase oversight for stormwater design and ensure that recommended stormwater modeling is completed accurately in a way that satisfies the recommendations of this report. This is a commonly contracted component of city, county, and municipality review because of the specialized expertise and software required to complete the evaluation. This is often structured as a time and materials, not-to-exceed annual contract with work performed on an as-needed basis. This approach benefits the University by separating design development, a collaborative process between PDC and the design firm, and stormwater review, a potentially adversarial process. Verifying that design plans are appropriately modeled and do not contribute to flooding impacts of adjacent buildings and structures is critical to protect University assets.

4.3.4 Sustainable Infrastructure Planning

At least four rating systems have been used on campus: the Leadership in Energy and Environmental Design (LEED), the Sustainable Sites Initiative (SITES), the Green Building Initiative’s Green Globes system, and Florida Green Building Coalition (FGBC) rating systems. These rating systems provide credits for implementing features or equipment that offer measurable benefits.

With the University’s ongoing growth and development on campus that includes all types of civil infrastructure (buildings, roads, parking lots, outdoor spaces, sporting arenas, etc.) the current rating systems are not generally applicable for all construction types or planning processes. It is the recommendation of this report that the University evaluate potential benefits that might come from implementation of a more comprehensive and holistic planning framework and certification process. One possible option is the Envision© framework originally created by the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), and the American Council of Engineering Companies (ACEC). This education and research nonprofit is now led by the Institute for Sustainable Infrastructure (ISI).

Key features of the Envision Sustainability Framework and Rating System include:

- The rating system is based on 64 sustainability and resilience indicators.
- Organized around five credit categories: quality of life, leadership, resource allocation, natural world, and climate and resilience.
- May be used as a collaboration tool to strengthen planning.
- Holistic and continuous review of organizational readiness around capital projects.
- Flexible format allows for modification to maximize applicability.

4.3.5 Student, Faculty, and Community Outreach for Projects in Conservation Areas

This project is focused on management of water resources and stormwater within the Lake Alice Watershed. Most of the individual projects proposed in this report are expected to be implemented largely or wholly within Conservation Areas. This is expected given the alignment of the Conservation Areas on campus with creeks, sinks, seeps, and lakes. Projects implemented to protect Conservation Areas while conveying stormwater in a way that does not cause downstream impacts will have temporary impacts to the areas where these projects are constructed. These impacts are expected to include removal of vegetation and trees to install structures, earth-moving to create storage and modify slopes, and placement of materials to retain soils and stabilize channels and slopes. Removal of exotic vegetation and re-planting are also expected to be included as a part of these projects, as well as passive recreational features in some areas.

Given the active community on campus it is recommended that all projects that will involve construction and vegetation removal in Conservation Areas be clearly communicated in advance to applicable Committees, student groups, and the broader campus community. While impacts in some of these areas will initially draw criticism, it is expected that if the project is presented in an open way that this resistance can be reduced. Messaging and design in these areas should include the following at a minimum:

- A description of the proposed project and its purpose.
- A timeline for the project.
- Anticipated impacts and how impacts were avoided and minimized.
- Concept drawings showing the restoration or enhancement.

4.3.6 Operation and Maintenance Recommendations

The University currently performs O&M for all of campus and for all utility systems including electric, steam, water, wastewater, stormwater, building repair, and landscaping. This is similar or greater in scope than many municipalities and/or utilities. Specifically for stormwater, which does not receive direct funding for O&M, this process is generally reactive rather than proactive, often resulting in additional damage to University infrastructure before repairs are initiated. As recommended in the following section, specific funding of stormwater is recommended to ensure that systems can be proactively maintained or improved to reduce impacts to campus infrastructure. Specific inspection and O&M recommendations for the Lake Alice Watershed are provided in Attachment G. Included here are other recommendations that do not specifically relate to O&M of the stormwater system, or that are being highlighted.

4.3.6.1 Lake Alice Recharge Wells

The most critical pieces of stormwater infrastructure on campus are the two recharge wells on Lake Alice (R-1 and R-2). These wells were constructed in 1959 and provide most of the drainage from Lake Alice. Detailed recommendations for well inspection and maintenance are provided as part of Attachment G, but several specific recommendations are provided here to emphasize their importance:

- The last documented well inspection for both of these recharge wells was in 1986 (Sheldon, 2008). At that time some issues were noted with both wells. It is recommended that inspections be completed immediately for both wells to ensure that no conditions may cause failure. These wells would be un-permittable today and timely replacement would be expected to be infeasible. In the 2008 report, alternative locations for discharging this water were explored, but options were limited and would be expected to carry extremely high capital costs and potentially be un-permittable.

- Lake Alice was observed to have higher water levels than expected in February 2024. This was brought to the attention of Facilities who dewatered and cleaned the intake screen to the R-1 well. This significantly increased flows post-cleaning. Draining this structure was challenging and is undesirable at the potentially frequent basis required. It is recommended that a recirculating pump be installed in the wet well to circulate flows and scour the screen automatically. It is also recommended that the inflow bar grates on the front of this structure, which appear to have been in place since at least 2008, be redesigned to have an opening dimension that is the same or smaller than the well intake. The opposite is currently true, which allows for material to pass through the larger screen and collect on the harder to access wet well screen. The screen from the lake should also be designed to allow for regular cleaning and debris removal.
- Following the cleaning in February 2024, cleaning of the well screen was included in the asset management system for Facilities, AssetWorks AiM Facilities Management Software, with a six-month cleaning interval. Other components of recharge well inspection and maintenance should also be included in the asset management system to ensure ongoing inspection and maintenance.
- Flow meters should be re-installed on both recharge wells and tied to the Supervisory Control and Data Acquisition (SCADA) system to track flows and provide notification of any change in flow conditions. This would allow for development of a flow rating curve for both wells and rapid response maintenance or repair as needed.

4.3.6.2 Stormwater Asset Inventory and Record-Keeping

Planning the proper operation and maintenance of stormwater assets requires a detailed asset inventory. It is recommended that UF continue to update the campus asset inventory as a part of all new projects with additional data collection based on staff availability. Assets should be recorded geographically in GIS with relevant attributes recorded (dimensions, invert elevations, material, condition, installation date, etc.). Attachment G makes specific recommendations for inspections and assessment. Maintenance, inspections, and repair should be tracked within the University's asset management system. All elevations should be converted to the same vertical datum, or have the datum reported as part of the record.

GIS should also record the locations of any flowage easements through private property, ERP permit boundaries, including permits issued to private landowners that discharge to the University's MS4. Permit conditions that require maintenance or operation should be recorded in GIS as well as in the asset management system.

4.3.6.3 Gainesville Clean Water Partnership

In 2001, Alachua County, the City of Gainesville and the Florida Department of Transportation formed a partnership to implement the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Separate Stormwater Systems (MS4) program in the Gainesville Urbanized Area. The University is operating a MS4 in Gainesville but is not currently in the partnership. Joining the partnership should be considered and could offer the University the following benefits:

- Clear communications with the operators of the adjoining MS4.

- Cost effective public education and outreach campaigns.
- Streamlined reports to satisfy the MS4 permit requirements including:
    - Stormwater pollution prevention efforts
    - Response to spills and complaints
    - Illicit discharge detection and elimination inspection reports

4.3.6.4 Landscape Maintenance

As part of this plan, data were collected on the vegetation composition by community for each of the Conservation Areas within the Lake Alice Watershed. Currently the CALM Plan is being updated to provide recommendations on the management of these areas and this document defers to that plan for management of these areas. This study did identify several specific vegetation management issues that are described below:

- Many of the Conservation Areas have edges that have grown an abundance of shrub-sized, often invasive vegetation because of increased light availability adjacent to the built environment. This decreases sight lines into these areas which reduces safety and enjoyment of their natural beauty. It is recommended that the LVL Committee consider a maintenance and planting aesthetic for the edges of each Conservation Area that can be conveyed to Grounds and the student body to reduce conflict and improve these areas. This should include recommended treatment and replanting approaches and be developed to not require separate approval by the LVL Committee for each individual maintenance and planting effort.
- Lake Alice is one of the most beloved and iconic locations on campus. The Campus Trails Master Plan identified recommended improvements on the northwest side of Lake Alice along Museum Road in the vicinity of the bat houses that included additional trails, boardwalks, and a viewing platform. Before this project is designed and built there is an opportunity to increase the vistas along this section of Lake Alice through vegetation management. Because of increases in the levels in Lake Alice over the past five years, and lack of clear direction for Grounds, there has been growth of shrubs and trees along this edge of Lake Alice. It is recommended that the northwest fringe of the lake between Village Drive and the Baughman Center be managed for human use with the remainder of the lake edge kept in a more natural condition. This will encourage use in a smaller area that can be appropriately managed with trash receptacles and possibly restrooms. It is recommended that this edge have lower brush and trees in poor condition removed and long-lived, hydrologically-appropriate trees and native emergent plants installed within the littoral zone (e.g. blue-flag iris, pickerelweed, and fireflag). This will ease maintenance for Grounds by providing clear direction and allowing less impactful and safer access to this edge of the lake.

4.3.6.5 Litter Management

Solid waste management on campus presents challenges due to the large population, as well as litter contributions from the City, weather, and wildlife. Focus group meetings identified wildlife scavenging from trash cans as a major cause of the litter observed in the Conservation Areas. Without collection, this litter enters waterways on campus and is conveyed to Lake Alice. The following recommendations to reduce litter are based on site visits and observing the placement of trash receptacles and dumpsters on campus.

Source control is the cheapest and most effective alternative for managing solid waste. For this reason, it is recommended that dumpsters and trash receptacles be located outside of the floodplains, further from Conservation Areas, and away from stormwater conveyances. A campus-wide evaluation of trash receptacles should also be completed to determine if the current placement of bins is consistent with the need. The problem of litter in natural areas is particularly evident along Fraternity Row. Garbage exceeding the capacity of receptacles and dumpsters is thrown in the woods or left in the stormwater channels, where it eventually washes into Fraternity Creek. To reduce the impact of wildlife on litter it is recommended that all receptacles and dumpsters on campus be outfitted with tamper-proof closures. Additionally, an educational campaign using photos of litter in Conservation Areas and Lake Alice should be launched to educate students and faculty on the impacts of not properly discarding of their refuse. This educational effort should be paired with both friendly competitions for clean houses in the Greek areas, and monetary fines for dumpsters that are left open. The focus group meetings also identified that at one point the University employed two people whose job on campus was to collect litter. It is recommended that the University consider adding at least one staff person whose primary responsibility is collection of litter on campus. This will result in cleaner grounds and improve the campus aesthetic for students, staff, and visitors.

4.3.6.6 Permit Tracking

Several permits that have been issued for projects on campus include requirements for signage and/or ongoing maintenance. It is expected that new permits will have similar specific conditions for maintenance and possibly mitigation. Tracking these permit conditions can be challenging depending on who applies for and receives the permit and whether specific permit conditions are communicated to departments that will be responsible for ongoing perpetual maintenance. Given the important role of Grounds in landscape and natural area maintenance on campus it is recommended that coordination occur during permitting to ensure permit conditions are reasonable and do not place an undue burden for maintenance.

It is recommended for current and future permits that include maintenance, monitoring, and/or signage that these permit conditions be entered into the asset management system used by Facilities immediately upon permit receipt. Entry in the asset management system allows for assigning identifiers to assets, scheduling inspections and maintenance on a defined frequency, and entering work orders. By entering specific permit conditions, responsibilities can be assigned with frequencies, reminders, and approved maintenance techniques.

For all projects on campus involving mitigation, it is further recommended that signs be installed identifying the mitigation area in a way that is easily interpreted by Grounds staff responsible for management. Invasives management is a common permit requirement for mitigation activities. Grounds should evaluate all permitted mitigation areas semi-annually to determine the need for invasives management. Where necessary, control should be paired with re-planting to expand desirable communities while reducing invasives coverage.

4.3.6.7 Stormwater System Renewal and Replacement Fund

The stormwater system on campus has been designed, constructed, and modified during the University's more than century-long history. While many stormwater components have been replaced and modified there are critical pieces of infrastructure, particularly in the older or more-developed areas of campus that are potentially in need of repair or replacement. It is recommended that the University establish a stormwater system renewal and replacement (R&R) fund to budget and save for occasional but potentially expensive stormwater system projects. This fund would be used to address issues within the existing stormwater network not associated with new construction. Projects would be prioritized based on inspections and the criticality and condition of the infrastructure. Establishment of a fund would reduce the need for diverting funds from other types of projects and allow for a better understanding of the ongoing cost of operating the stormwater system on Main Campus.

4.3.7 Funding Recommendations

Stormwater is currently an unfunded utility on campus. This has often resulted in reactive rather than proactive management of stormwater and damage in the stormwater system. This delay in addressing deficiencies often results in increased repair costs or increased damage to the stormwater system or adjacent infrastructure. To avoid these issues and improve the stormwater system on campus, this report recommends developing funding strategies for both deferred and new capital costs and ongoing operation and maintenance. The following sections discuss potential funding mechanisms for the maintenance and improvement of the stormwater system on campus. The list of options presented here is not intended to be exhaustive, and as this plan is considered and implemented into policies, other options for funding should be considered.

4.3.7.1 Deferred Capital Costs

The stormwater system on campus has been developed on an ad hoc basis over more than 100 years. This has resulted in a disparate system that is not sufficient to handle the current stormwater flows. If the University had been required to permit the campus stormwater system like that of off-campus areas, there would be a network of stormwater ponds across campus, with Lake Alice receiving treated stormwater at lower peak flow rates. This would mean less erosion in creeks, less failed infrastructure, and reduced flooding. Permitting would also have included verifying that new development or redevelopment would not cause impacts offsite.

The stormwater treatment and infrastructure that was not built, because it was not required, is money that the University "saved", although these savings came at a cost. Costs borne by the University have included infrastructure damage, increased maintenance, and impacts to the natural spaces on campus. The cost of improving the stormwater system to make it functional for current flows and loads can be considered as deferred capital costs. All the critical, near-term, and medium-/long-term projects described in this report are deferred projects that are proposed to repair and stabilize creeks and improve water quality.

The estimated capital costs of implementing the projects described in this report are:

- Critical Projects: Capital – $6-15 million
- Near-Term Projects: Capital – $7+ million (total is dependent on the scope of LID)
- Medium – and Long-Term Projects: Capital – $10+ million (total is dependent on scope and final projects completed)

Recommendations for funding these deferred projects are:

- Requiring new construction or redevelopment to pay for all improvements necessary to convey stormwater from the project site to Lake Alice, or

- Implementing a charge on all new construction or redevelopment based on impervious area and structure envelope to fund projects throughout the watershed.
- Implementing a stormwater utility fee like fees charged for other utility services.

4.3.7.2 Stormwater System Capital Costs

The University will continue to grow and evolve to meet the needs of current and future students, faculty, research, and support. This will include increased stormwater management to protect people, infrastructure, and the natural environment. New stormwater infrastructure necessary to support new or redevelopment projects should be funded as part of the design and construction for the development. As previously described, it is expected that each of these new projects developed in the Lake Alice Watershed will require either a general or individual permit. The costs to implement these projects are expected to be highly-variable depending on the type of development, location on campus, utility conflicts, and available site area.

4.3.7.3 Operation and Maintenance Costs

Existing and new stormwater infrastructure on campus will require ongoing O&M. This project estimated annual costs of approximately $650,000 (2024$) to maintain stormwater infrastructure on campus. Some portion of these costs are currently being covered as part of Facilities and Grounds O&M. This estimate includes the following:

- Inspection of construction sites,
- Inspection of all stormwater infrastructure on campus every two years,
- Repair of stormwater infrastructure,
- Sediment removal from creeks, and
- Vegetative maintenance within Conservation Areas.

The recommended source of funding for ongoing O&M is a fee assessed for each impervious area on campus (e.g. buildings, sidewalks, parking lots, etc.) that is paid by the department or entity responsible for management.

4.3.7.4 Other Funding Sources

In addition to charges on new development and existing development there are other potential funding mechanisms for stormwater projects on campus. These sources could be targeted to managing the deferred capital costs on campus and include:

- Donations from individuals or organizations that are focused on nature and environmental projects. These projects are fundamentally different than most infrastructure projects on campus and might find interest from donors that would like to leave a legacy in the form of a creek, trail, landscape, garden, or bridge.
- Implementing a charge on nutrients discharged to campus creeks and Lake Alice. This would be implemented through robust source-tracing, water quality sampling, and flow measurements to identify the sources of nutrients reaching Lake Alice and the mass of nutrients contributed. Charges would be based on a cost per pound of nutrient and the measured load by source.

- There are multiple state and federal programs that are focused on improving water quality and stormwater management. The University may be eligible for funding from these sources to implement projects on campus to address deferred capital costs.

4.3.8 Construction Erosion and Sediment Control Recommendations

The University employs several staff trained and certified as FDEP Stormwater, Erosion, and Sedimentation Control Inspectors. This training teaches appropriate installation methods for sediment and erosion control measures and how to perform inspections of construction sites. While keeping all stormwater on a construction site is not possible under all circumstances, it is necessary to have sufficient erosion and sediment control as part of construction projects. On campus and in the Lake Alice Watershed specifically, maintenance of adequate stormwater controls is particularly challenging because of small project sites, proximity of adjacent structures, runoff coming into project sites from upgradient, and no requirement for on-site stormwater storage or treatment. Furthermore, many areas of campus have significant slopes that increase the velocity of stormwater runoff. In these cases, the contractor may have to install and maintain interim measures during different phases of the project.

To ensure that stormwater is appropriately managed, and that adequate erosion and sediment controls are developed as part of design and maintained throughout construction projects, the following recommendations are made:

- Require site-specific erosion control plans for all projects that account for stormwater coming onto the site from upgradient areas, adequately protect structures downhill, and reduce flows and erosion leaving the site to the extent possible. In many cases on campus stormwater cannot be maintained on-site. In these cases, design plans should define a flowpath that does not impact other infrastructure and ensure erosion and sediment control measures are adequate to improve the water quality of runoff before it leaves the construction site.
- Increase enforcement authority so that construction may be stopped and fines may be issued to contractors for failures of their stormwater controls.
- If preferred, the authority for evaluating construction site stormwater practices and violations could be contracted to a third-party which would reduce the internal conflict between delaying or fining contractors and the completion of construction projects.
- Include language in contract documents that requires clean-up of sediment or other materials generated from construction site runoff that enter the stormwater system.

As with litter management, source control is the most effective and cheapest way of managing construction site erosion. Removal of this material after it has entered the stormwater system causes expensive clean-up and/or damage to natural systems and is effectively an externalized cost of construction.

4.4 Data Collection Recommendations

This study included collection of available electronic data for the Lake Alice Watershed. While intensive data collection efforts have occurred in the watershed for decades, much of these data are not available electronically. Additionally, with only a few exceptions, data collection has been discontinuous. The recommendations in this section describe opportunities for improved data collection and data maintenance.

4.4.1 Survey and Geotechnical Data

As part of nearly all design and construction contracts, the University is collecting survey and geotechnical data for existing and as-built conditions. Although these data are typically project-specific, they are valuable for updating and maintaining an inventory of campus assets and features. Many surveyed features, including pipes, structures, utilities, appurtenances, and finished floor elevations, are not expected to change significantly. Developing and maintaining an internal survey database would prevent redundant data collection which could result in cost savings. Recently collected, signed and sealed data are desirable for new design projects, but a survey database could allow for conceptual projects to be developed without the need for new data collection in some cases.

As with survey data, geotechnical borings are collected for most structural features on campus. These data could be compiled in a geodatabase and/or database to provide an improved understanding of subsurface conditions across campus that could inform future design projects and reduce the need for new geotechnical data collection. For development of a database for survey and geotechnical data collection it is recommended that the University develop a standardized format for housing the data. This standard should be provided to contractors to ensure consistent collection that can be easily integrated in the University's database.

Currently, design projects on campus rely on the NGVD29 datum, although reference to the datum is often excluded in design and as-built plans. It is recommended that all survey data collected on campus be referenced to the NAVD88 datum which is the more recent and higher accuracy vertical datum. It is also recommended that design review include a check that the vertical datum used for survey is noted on all plans and as-builts as conflicts between datums could result in costly construction conflicts due to the difference in elevations between the datums on campus of approximately 0.8 feet.

4.4.2 Lake Alice Treatment Volume

Lake Alice is comprised of approximately 21 acres of open water and 60 acres of emergent marsh. At the time of the 1987 permit, the imperviousness on campus was 34.4% in the Lake Alice Watershed (CH2M Hill, 1987). Between the 1987 and 2010 permits, the impervious area increased to approximately 42% of the watershed.

The permitting strategy applied to Lake Alice in all the master permits issued for stormwater management have treated the lake as a wet detention pond. This requires capture, storage, and controlled release of one inch across the watershed, or 2.5 inches across the impervious area. At the time of the 1987 permit, one inch across the watershed provided the larger treatment volume, although this switched to the impervious area driving the required storage volume in the 2010 permit, after passing a threshold of 40% impervious. The estimated volume of the lake in 1987 was 270 acre-feet below a control elevation of 67.16 ft (NAVD88, 68 ft NGVD29). It was estimated that the lake had a treatment depth of approximately two feet while providing two feet of freeboard before exceeding the minimum overtopping elevation. This depth and the lake area was estimated to provide approximately 170 acre-feet of treatment volume, which was greater than the required detention volume of 79 acre-feet (CH2M Hill, 1987). This storage and treatment volume was slightly modified with an adjustment of 0.5 feet for the R-1 well in the 2000 report, which resulted in a decrease in the available treatment volume to 125 acre-feet. These values have been carried forward in subsequent permits in 2000, 2010, and in the 2024 stormwater report.

However, in 1996 as part of the UIC well permitting Barnes, Ferland and Associates (Barnes, Ferland and Associates, Inc., 1996) worked with CH2M Hill to change the working elevations of the recharge wells and to revise the Lake Level Operation Protocol. These changes were permitted through the wastewater permit and UIC, but do not appear to have been coordinated through the ERP. The 1996 lake level protocol relies on R-1 to receive most of the lake discharge, with R-2 operating only in high flow conditions, which are defined as flows over the 1-year, 24-hour storm event. The estimated capacity of R-1 was 3 MGD, resulting in a control elevation of 67 feet (datum not recorded) and a normal water level of 68 ft (datum not recorded, assumed as NGVD). The overflow elevation for R-2 was set at 69.5 ft (datum not recorded). The estimated storm response for the Lake, based on runoff volume is provided in Table 5.

Table 5. 1996 Lake Alice Level Operation Protocol

Event	1996 Estimated Runoff Volume (acre-feet)	Lake Alice Stage (assumed as ft NGVD)
Normal		68
1-year, 24 -hour	133	69.5
5-year, 24 -hour	256	70.8
10-year, 24 -hour	320	71.4
25-year, 24 -hour	399	72.2
100-year, 24 -hour	526	73

Based on the most recent bathymetry available (LakeWatch, 2000) the storage volume of Lake Alice and the emergent marsh was estimated to be approximately 270 acre-feet assuming that the emergent marsh was on average three feet deep. This estimate was made based on lake conditions as of December 2023. Following additional investigation in February 2024, it was determined that the R-1 well was not functioning as designed and the lake was effectively at the overflow weir elevation for the R-2 well, approximately 68.45 ft (NAVD88, 69.29 ft NGVD29). This is approximately 2.65 ft higher than the concrete weirs into the R-1 well structure (65.8 ft NAVD88, 66.64 ft NGVD29). UF Facilities blocked the inflow grate for R-1, drained the wet well, and cleaned the grate on the inflow of the R-1 well. Upon restoring flows, the R-1 well was observed to have substantially increased flows with a subsequent decrease in lake level. With improved drainage of the lake, it is expected that water levels in the emergent marsh and lake will decrease, resulting in a reduced storage volume.

To better understand the volume of Lake Alice and the current treatment volume it is recommended that the University collect updated bathymetric data for the lake, the weirs for the recharge wells, and associated structures in the vicinity of Lake Alice. These include the Baughman Center and support building, greenhouses, Museum Road, Mowry Road, and any other structures or roads located near the lake. This information can be used to inform development of an updated stage-storage relationship for the lake to ensure that infrastructure is protected. Furthermore, existing survey data for the recharge wells and structures are contradictory and do not match the 1987, 2000, 2010, or 2024 permit reports. Updating this information will allow for better decision-making regarding operations and will ensure that any new structures near Lake Alice are outside of the floodplain.

4.4.3 Hydrologic Data Collection

Multiple colleges at the University have experience collecting hydrologic data and have installed monitoring stations for research projects. This study recommends extensive collaboration between the University and these on-campus departments. Given University-ownership of a majority of the watershed and the similarities between campus and other urban areas, this watershed should be heavily studied as results would have applicability in other locations. These data would have an added benefit for the

University of demonstrating a commitment to data collection and research and the opportunity to identify potential cost savings. The following data collection efforts are recommended at a minimum:

- Continued water level data collection on Lake Alice (currently collected by Facilities – Wastewater).
- Water level stations on campus waterbodies including Liberty Pond, Gator Pond, Ocala Pond, karst feature in the Surge Area, and the karst feature between Facilities and golf course.
- Development of flow rating curves for each creek with annual verification and water level monitoring.
- Installation and maintenance of one or more weather stations on campus with rainfall and evapotranspiration.
- Collection of updated Lake Alice bathymetry at least once per decade.

4.4.4 Water Quality Data Collection

Water quality data collection will offer the University an improved understanding of concentrations of parameters of interest in the watershed. Of particular interest are nutrients, which could have an impact on Lake Alice and the creeks on campus, and other contaminants that may impact the streams or lakes on campus (e.g. metals, fertilizers, and pesticides). Data collection has occurred as a part of studies by various departments on campus, but the duration of collection and spatial extents have generally been limited, with few stations having very long periods-of-record. All electronically available data are presented in Attachment B.

It is recommended that as part of the hydrologic data collection described above that water quality stations be established across the Lake Alice Watershed. It is recommended that at a minimum two sampling stations be established in Lake Alice with additional stations at each of the primary creek inflows. Data collection should be completed monthly with samples collected in conjunction with flow measurements to allow for loading estimates to the lake. Details of a sampling plan should be developed in conjunction with one or more professors on campus. It is further recommended that the sampling frequency and analytes be adequate to begin to develop a total maximum daily load (TMDL) for the lake.

4.4.5 Other Data Collection

The expertise available on campus would allow for collection of a wide variety of additional data. The collection of these data could allow for extensive analyses that would provide insights that are applicable to campuses and urban areas more widely. Research efforts for Lake Alice, the watershed, and Main Campus could potentially be coordinated through the UF Water Institute, a collaborative and interdisciplinary collective of UF researchers. The following are examples of data that may be collected by departments and professors on campus, although this list is far from exhaustive:

- Biologic sampling (mammals, birds, fish, reptiles, amphibians, insects, vegetation, fungi, etc.),
- Human use and wellness,
- Stormwater system performance,
- Treatment for invasive, exotic species,
- Alternative land management approaches,

- Groundwater samples,
- Soils and sediment samples, and
- Ecotourism.

4.5 Total Maximum Daily Load (TMDL) Development

Lake Alice has been identified as an impaired waterbody by FDEP but has not had a TMDL developed for the lake. The TMDL process establishes the maximum amount of a pollutant that a surface water can receive while meeting the designated water quality classification. It is recommended that UF begin the data collection efforts necessary to establish a TMDL for Lake Alice. Establishing a TMDL for Lake Alice will allow for a better determination of acceptable loads which can then support allocation of loads based on sources. The steps for establishing a TMDL are summarized below:

- Evaluate whether the lake is meeting the relevant water quality standards.
- Establish and adopt a TMDL if the lake is found to be impaired as described in rule 62-304 F.A.C.
- Develop a basin management action plan (BMAP) with stakeholder input and begin implementation to work to achieve the TMDL.
- Re-evaluate progress.

4.6 Vegetation Management Recommendations

Vegetation management on campus is complex because of the wide variety of landscape and community types. This report considered two general vegetated landscape types: manicured and maintained within the urban setting and more natural within the Conservation Areas. Specific vegetative maintenance recommendations were not developed for the urban landscape types on campus except for the irrigation and fertilization recommendations described previously. Recommendations for Conservation Areas on campus were developed by community type. These recommendations are included in Attachment E and are not repeated here.

4.7 Plan Updates

Watershed management is an evolving process. Actions taken today reduce the needs of tomorrow. Continuing investment in stormwater reduces the impacts of flooding, erosion, and sedimentation on existing and new infrastructure, the campus community, and the natural environment. This work also helps make campus a more beautiful place for students, faculty, and visitors.

As a preeminent institution, the University of Florida is a complex and changing campus. Like planning for the future development and redevelopment of campus facilities, re-visiting the watershed management plan presented here provides opportunities for the University to know the projects needed today and tomorrow. This knowledge provides the ability to have projects ready to take advantage of funding opportunities as they arise.

The recommendations included in this document were developed based on available information and current conditions (permitting, regulatory, hydrologic, vegetative, etc.). As projects are completed and new issues arise it is important to update this plan based on the new, best available information. It is recommended that this plan be updated every five years to ensure that the continual process of stormwater management is captured and that new issues can be identified and addressed proactively. These updates should include quality assurance and quality control for the stormwater model to ensure that the model accurately reflects current conditions.

Section 5.0 References

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