Attachment F – Lake Alice Watershed – Stormwater Project Prioritization and Concepts

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Section 1.0 Introduction

Lake Alice is the primary natural feature on the University of Florida (UF) Main Campus. Beyond its recognized aesthetic, educational, and cultural value, Lake Alice and its feeder creeks also serve as the primary stormwater conveyance, treatment, and recharge system for approximately half of the Main Campus (Table 1). The Lake Alice Watershed, along with other basins on the UF Main Campus, are shown in Figure 1. The Lake Alice Watershed and Internal Basins are primarily contained on Main Campus, while the Hogtown and Tumblin Watersheds extend off of campus.

This report discusses stormwater issues identified within the Lake Alice Watershed based on modeling, geographic information system (GIS) data review and analysis, and field visits as a part of this project. Also presented are stormwater prioritization criteria that were developed and considered by the Project Team and Steering Committee. These criteria can be used to prioritize how stormwater projects are implemented on campus. Finally, this report presents conceptual alternatives for three projects to reduce flooding and three projects to resolve erosion. Each conceptual alternative includes an opinion of probable cost for planning purposes.

Table 1. Watershed Areas

Watershed	Area (acres)
Lake Alice	1,005
Internally-Drained	490
Tumblin Creek	273
Hogtown Creek	148

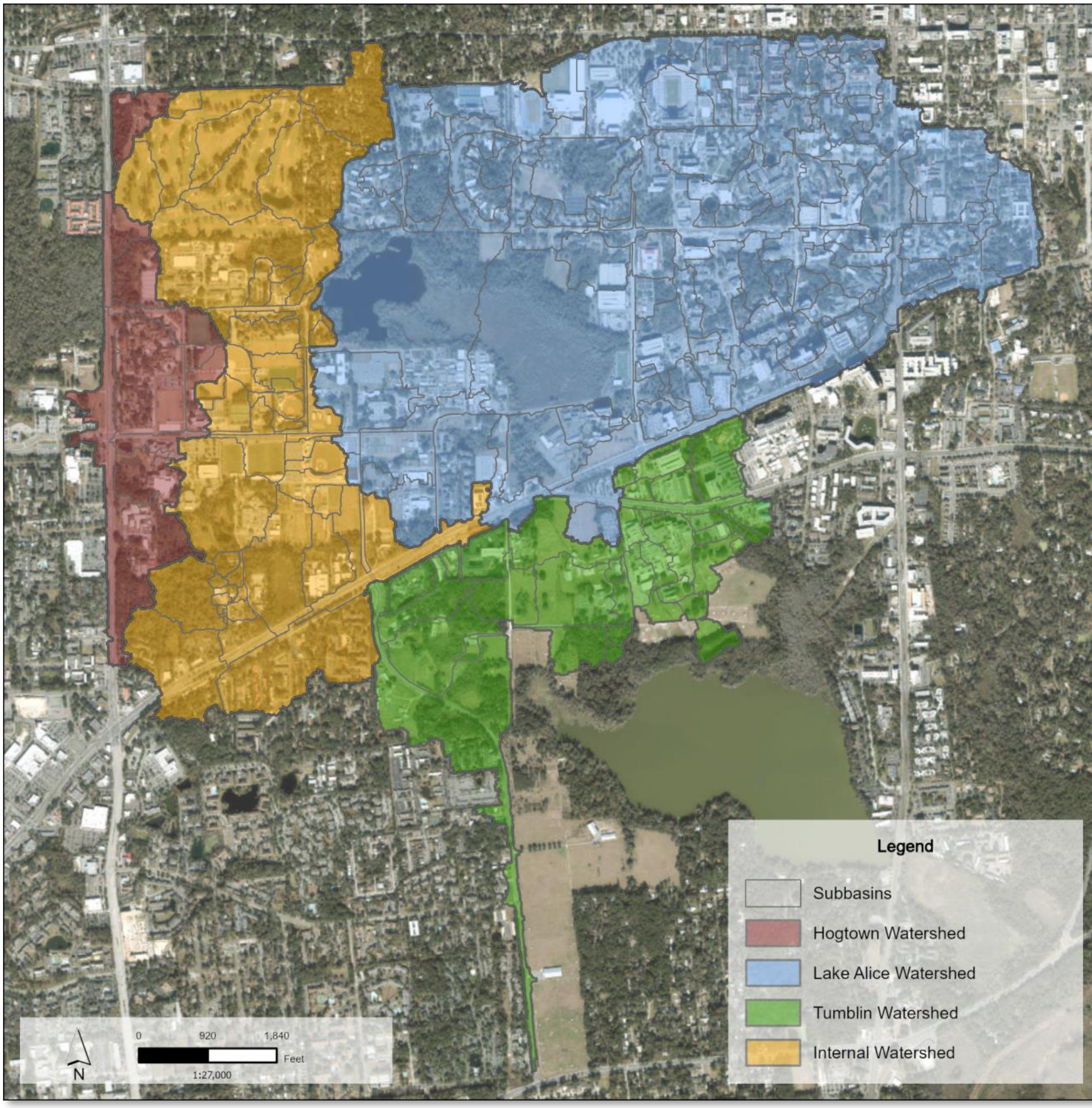

Figure 1. University of Florida Main Campus Modeled Watershed Areas

Section 2.0 Stormwater Project Prioritization

The University has a variety of stormwater challenges that include erosion, flooding, water quality, trash, and sedimentation. These problems occur in various locations across campus and were evaluated at a high-level as part of developing the Lake Alice Watershed Management Plan. To make recommendations for addressing these areas, prioritization criteria were developed and are proposed to guide scheduling of projects in a way that is logical and methodical. These criteria were discussed internally by the Project Team and deliberated with the Steering Committee who provided recommendations on prioritization. These conversations illustrated that many of the criteria are complimentary and a project that would rank well for one criterion would frequently rank well for others, simplifying the ranking process. This ranking process is not intended to supersede implementing stormwater improvements as a part of each new construction or renovation projects.

In addition to the criteria that were developed, there were two considerations that were defined as non-negotiable and not ranked. These included life-safety and damage to non-stormwater infrastructure. Areas that currently have these issues will receive priority to increase campus safety and avoid damage to infrastructure.

2.1 Prioritization Criteria

Criteria for ranking were developed at a high-enough level that projects could be compared qualitatively without collection of new data or development of detailed project concepts. As previously stated, life safety and damage to non-stormwater infrastructure were considered non-negotiable and not ranked. Projects having either of these attributes were placed in a single, critical projects category. The criteria to rank projects, excluding the non-negotiable characteristics were:

- Damage reduction (energy, erosion, peak flow rates, and flooding)
- Environmental benefit (water quality and wildlife habitat)
- Watershed location (upstream to downstream)
- Public perception (visibility of project, speed of implementation, and permanence of improvements)
- Implementation difficulty (utility conflicts, permitting feasibility, and property ownership)
- Cost and cost-effectiveness (cost-benefit ratio and total cost to implement)

Based on the feedback of the Project Team and Steering Committee the ranks for the criteria were sorted into three tiers. These were from most important to least important (out of 100 points):

1. Environmental benefit (25%) and damage reduction (23%)
2. Cost and cost-effectiveness (18%) and implementation difficulty (16%)
3. Public perception (9%) and watershed location (9%)

Section 3.0 Project Identification

The updated stormwater model was used to identify locations in the Lake Alice Watershed that exhibited conditions that could result in flooding, erosion, or sedimentation. The model for the watershed was not developed at a scale that would allow for all localized flooding to be identified. As such, there are locations with localized flooding that were not shown by the model. Many of these localized flooding locations are small and might best be identified by Grounds and Facilities staff that address sandbag requests, stormwater issues, and landscape maintenance.

Areas that were identified in the model and/or the GIS data included the following cases with possible consequences shown in []:

- Areas with mapped flooding [flooding].
- Velocities greater than 2.5 feet per second (fps) in natural channels [erosion].
- Velocities greater than 15 fps in pipes [erosion/infrastructure damage].
- Velocities lower than 1 fps in natural channels [sedimentation].
- Pipe networks with decreasing sizes in the downstream direction [flooding].

3.1 Flooding Locations

Based on the mapped 100-year floodplains, locations with standing water were identified and are shown in Table 2. The following issues are important when considering this list of locations.

- The ICPR model is developed assuming all pipes are flowing full, functioning as intended, are in good repair, and are maintained.
- Mapped floodplains are 100-year, 24-hour floodplains and some level of nuisance flooding in parking lots is not unexpected or particularly problematic for a rainfall event with this return interval.
- Surveyed finished floor elevations (FFEs) for all structures were not available for comparison to the mapped floodplain elevations. Some structural flooding may occur that could not be identified with available information
- ICPR subbasins are developed at a scale that does not capture all localized flooding.

Table 2. Mapped Floodplain Areas

Basin	Location	Flooding Type			
		Structure	Parking	Road	Sidewalk
LA1330	USDA Building	X			
LA1480	Food Toxicology Lab		X		
LA1530	Mowry Road			X	X
LA1550	Mowry Road			X	X
LA1640	Generation Facility	X			
LA1640	Mowry Road			X	
LA1740	Nursing/Pharmacy	X			
LA1740	Traffic Circle			X	

Basin	Location	Flooding Type			
		Structure	Parking	Road	Sidewalk
LA1750	Museum Road			X	
LA1780	Driveway			X	
LA1830	Newell Drive			X	
LA1880	Garage 5	X		X	
LA1890	East Panhellenic Drive			X	
LA1900	SW 9th Avenue			X	
LA1930	SW 11th Street			X	
LA1990	Museum Road			X	
LA2015	Museum Road			X	
LA2040	Museum Road			X	
LA2050	Norman Parking Lot		X		
LA2104	Stadium Road			X	
LA2280	Hough Hall		X	X	
LA2330	Ben Hill Griffin Stadium				X
LA2340	Library West		X		
LA2450	Nursing/Pharmacy				X
LA2530	Generation Facility		X	X	
UF1040	Surge Area		X	X	
UF1050	Archer Road			X	X
UF1100	Housing Specialty Shop	X	X		
UF1140	Waste Pole Barn	X			
UF1430	Hull Road			X	X
UF1530	Substation		X		
UF1870	Elmore Hall	X			
UF1910	Facilities Multiple	X	X		
UF1930	Grounds Nursery	X			
UF2380	Seashole Pressly Stadium	X	X		
UF2430	Museum Road			X	
UF2440	Baughman Support	X	X		
UF2440	Museum Road			X	
UFT1050	Ritchy Road		X		
UFT1370	Near Shealy Drive		X	X	
UFT2520	SW 16th Avenue			X	
UFT2550	SW 16th Avenue			X	
UFT2850	Vet Medicine Energy Plant	X			

The identified flooding locations included 12 structures, 13 parking areas, 25 road areas, and 6 sidewalks. These locations should receive further review and be discussed with Facilities and Grounds. Based on review and feedback, areas where flooding is confirmed should be considered for additional study to determine the extent of flooding, depth of flooding, flooding during smaller storms, and whether any drainage improvements should be developed to reduce or eliminate flooding in these areas. All mapped 100-year, 24-hour floodplains are shown in Figure 2.

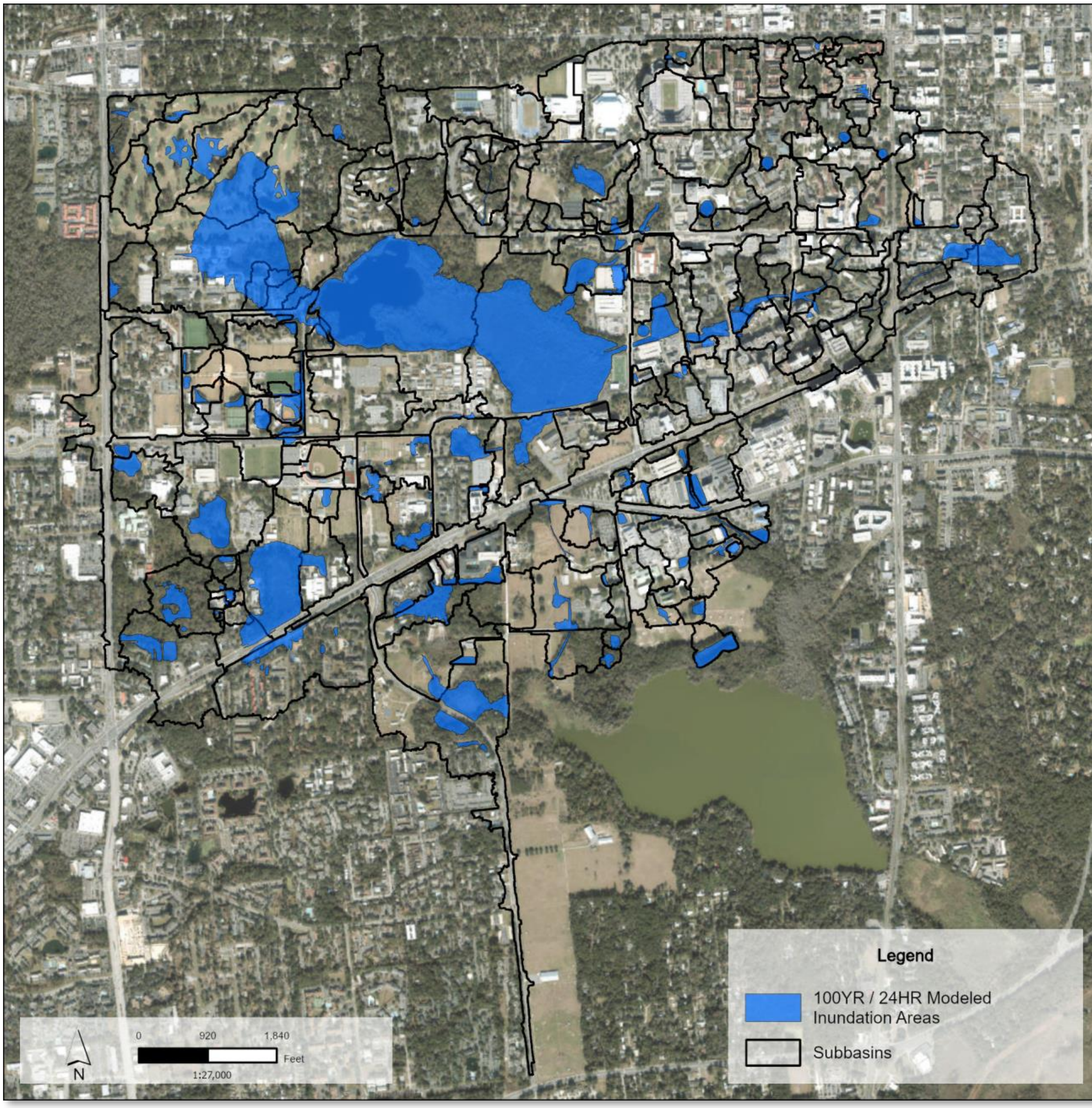

Figure 2. Mapped Floodplains for the 100-Year, 24-Hour Rainfall Event

3.2 Channel Erosion Locations

Areas with erosion concerns were evaluated based on the ICPR modeling results. Peak flow rates were examined for each of the modeled design storms (1-day: mean annual, 10-year, 25-year, 50-year, 100-year; 3-day: 100-year; 7-day: 100-year). Peak flow rates were compared to the maximum allowable velocities for channels described in the master stormwater permits for campus (Causseaux & Ellington, Inc., 2000; Causseaux, Hewett & Walpole, Inc., 2010; CH2M Hill, 1987) and shown in Table 3. The following assumptions were made in evaluating velocities for individual channels:

- The channel material for evaluation was considered to be firm loam with a maximum allowable velocity of 2.5 fps (this is considered to be a reasonable approximation of allowable velocities as many of the highest flow rates occur in conjunction with high stages that will encounter channel lining types with lower allowable velocities).
- Portions of these channels that may be lined (concrete or fabriform) were not considered (channel lining is not complete on any channels on campus so risk still exists at upstream edges, downstream edges, and natural slopes above the channel lining).
- Only channels that were explicitly included in the model were evaluated.

Table 3. Maximum Allowable Channel Velocities for Various Linings

Channel Lining	Allowable Velocity (fps)
Silt or Fine Sand	1.5
Sandy Loam	1.7
Silt Loam	2.0
Firm Loam	2.5
Stiff Clay	3.7
Hardpans	6.0
Sod	4.0
Lapped Sod	5.5
Geotextile Grid	4 - 8[a]
Concrete	10[b]

Reference: University of Florida (1972)
[a] Varies with grid type
[b] Higher velocities allowable with appropriate energy dissipation

Based on the assumptions above, a total of 26 channel reaches (20 in the Lake Alice Watershed) had velocities exceeding 2.5 fps for the 100-year, 24-hour storm and 22 reaches (20 in the Lake Alice Watershed) exceeded allowable velocities during the mean annual storm. All storms and maximum velocities are shown in Table 4. Within the Lake Alice Watershed most of Jennings Creek, Diamond Creek, Lake Alice Creek, Reitz Ravine, Hume Creek, and the creek through Lake Alice Gardens have velocities exceeding 2.5 fps. Modeling results in these areas should be examined more closely with projects considered to reduce flow rates, stabilize these channels, and protect associated infrastructure.

Table 4. Channels with Modeled Velocities Exceeding 2.5 fps

Channel	2.33yr24hr	10yr24hr	25yr24hr	50yr24hr	100yr24hr	100yr72hr	100yr168hr
RLA1735B	***2.98***	***3.18***	***3.24***	***3.23***	***3.20***	1.19	0.92
RLA1755A	***3.96***	***4.06***	***4.12***	***4.19***	***4.28***	***3.46***	***3.14***
RLA1760A	***3.06***	***3.54***	***3.95***	***4.15***	***4.28***	2.26	2.01
RLA1770A	***2.90***	***3.26***	***3.63***	***3.82***	***3.92***	2.44	2.19
RLA1780A	***4.08***	***4.05***	***4.04***	***4.04***	***4.02***	***2.59***	2.22
RLA1800A	***2.65***	***3.41***	***4.01***	***4.37***	***4.64***	0.85	0.58
RLA1835A	***3.96***	***4.04***	***4.07***	***4.11***	***4.12***	***3.66***	***3.55***
RLA1850A	***3.36***	***3.43***	***3.46***	***3.48***	***3.50***	***3.32***	***3.29***
RLA1870A	***4.54***	***4.78***	***4.88***	***4.88***	***4.88***	***4.03***	***3.81***

Channel	2.33yr24hr	10yr24hr	25yr24hr	50yr24hr	100yr24hr	100yr72hr	100yr168hr
RLA1885A	***3.43***	***3.67***	***3.86***	***3.98***	***4.17***	***2.91***	***2.55***
RLA1980A	***3.28***	***3.30***	***3.04***	***3.04***	***3.26***	***2.52***	2.35
RLA2456A	***7.36***	***7.74***	***8.02***	***8.18***	***8.31***	***5.79***	***5.27***
RLA2460A	***5.86***	***6.30***	***6.63***	***6.78***	***6.92***	***4.41***	***3.96***
RLA2465A	***5.56***	***5.86***	***6.11***	***6.27***	***6.41***	***4.08***	***3.62***
RLA2470A	***4.13***	***4.17***	***4.23***	***4.18***	***4.29***	***3.49***	***3.14***
RLA2475A	***3.70***	***3.85***	***3.98***	***4.22***	***4.41***	***3.58***	***3.38***
RLA2477A	***4.63***	***4.98***	***5.22***	***5.38***	***5.51***	***4.11***	***3.87***
RLA2670A	***2.59***	***2.92***	***3.17***	***3.24***	***3.36***	2.03	1.84
RLA2680A	***4.02***	***4.30***	***4.75***	***4.96***	***5.21***	***3.40***	***3.11***
RLA2690A	***4.29***	***5.03***	***5.02***	***5.06***	***5.14***	***3.77***	***3.47***
RUF1940A	1.77	1.72	1.70	2.20	***2.59***	1.77	1.39
RUF2425A	1.93	2.09	2.21	2.43	***2.82***	2.16	2.06
RUFT1005A	1.83	2.04	2.47	***2.78***	***3.05***	1.70	1.55
RUFT2570A	***2.58***	***2.83***	***2.93***	***2.93***	***2.89***	2.47	2.25
RUFT2830A	***3.74***	***4.25***	***4.67***	***4.86***	***4.95***	***2.97***	***2.62***
RUFT2840A	2.16	2.48	***2.77***	***2.84***	***2.85***	1.67	1.47

The channels having maximum modeled velocities exceeding 2.5 fps are shown in Figure 3. The pictured channels are the links within the model, the actual channel in many cases is only a portion of the length shown. Channels outside of the subbasins shown were not modeled.

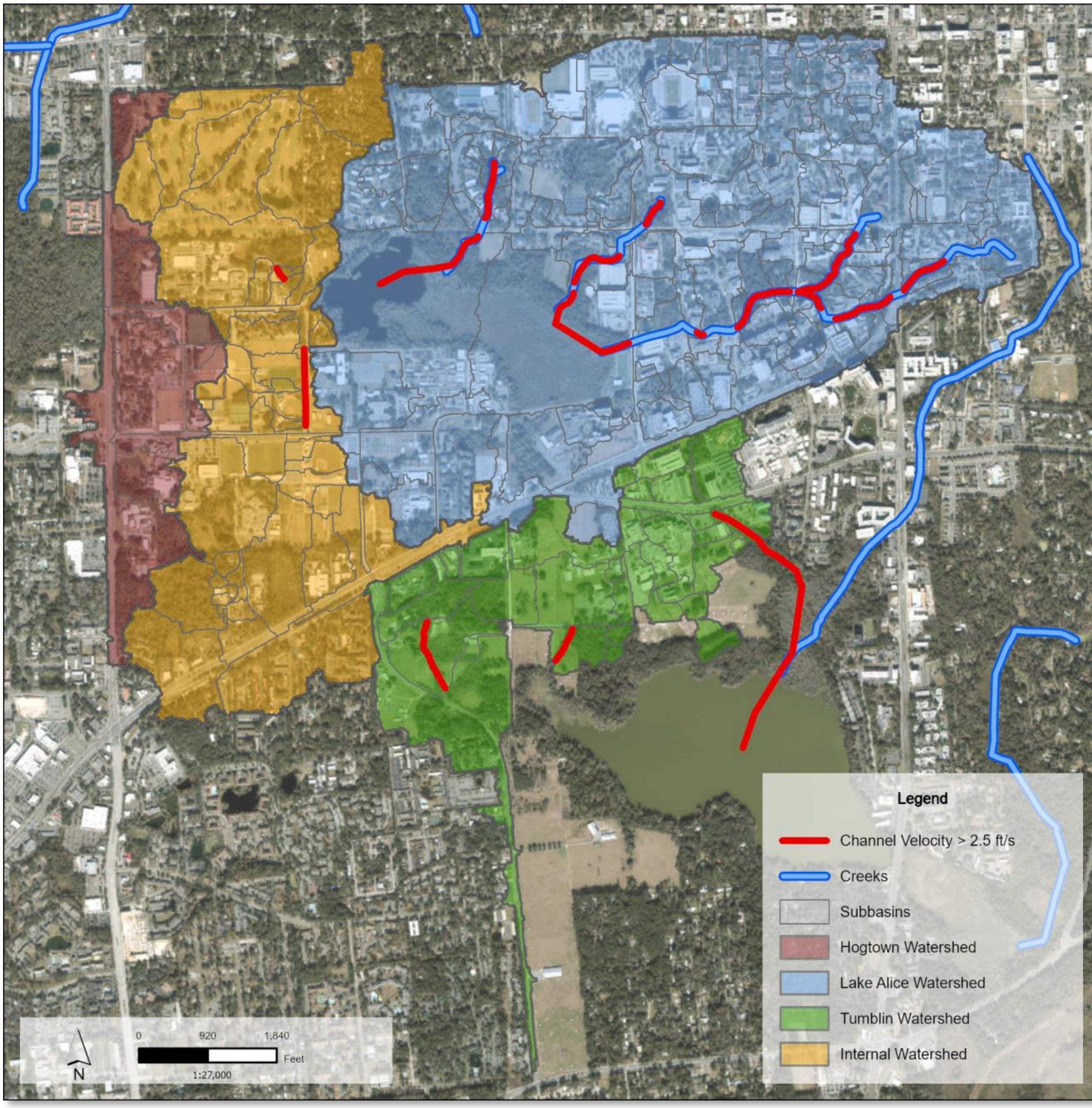

Figure 3. Channels with Modeled Velocities Exceeding 2.5 fps

3.3 Excessive Pipe Velocity Locations

Pipe velocities greater than 15 fps are considered excessive based on guidance from the Florida Department of Transportation (FDOT) (Florida Department of Transportation, 2024). Maximum pipe velocities were extracted from the ICPR model and compared to this design guidance. The following assumptions are made in ICPR or were applied when evaluating these pipes:

- Pipes are flowing full.

- Pipes are maintained with no blockages or obstructions.
- Only pipes that were explicitly included in the model were considered.

A total of 24 pipes (21 within the Lake Alice Watershed) exceed a velocity of 15 fps, with 3 pipes (all within the Lake Alice Watershed) exceeding this velocity during the mean annual storm. These pipes should receive further evaluation with flow data collected and visual inspection to verify integrity and condition. Based on the results of the recommended data collection, alternatives should be considered to reduce velocities, including opportunities to increase upstream storage, upsize pipes, decrease pipe slopes, and reduce energy in water discharged to these pipes. Pipes that exceeded the 15 fps criterion for one or more storms are shown in Table 5. An additional three pipes in the mean annual storm had velocities between 14-15 fps and five had velocities between 13-14 fps. Given the assumptions made in the model (full pipe flow) and in modeling (pipes are in good condition and maintained) these pipes should also be considered for evaluation.

Table 5. Pipes with Modeled Velocities Exceeding 15 fps

Pipe	2.33yr24hr	10yr24hr	25yr24hr	50yr24hr	100yr24hr	100yr72hr	100yr168hr
RLA1560C	***16.25***	***16.25***	***16.25***	***16.25***	***16.25***	***16.25***	***16.25***
RLA1580A	12.92	14.55	***15.74***	***18.88***	***18.60***	8.67	7.71
RLA1920A	9.66	11.49	***15.19***	***18.38***	***20.92***	9.62	8.65
RLA1965A	10.24	14.24	***16.37***	***16.58***	***15.94***	8.41	7.57
RLA1990B	14.20	***16.75***	***17.00***	***17.12***	***19.81***	11.36	10.46
RLA2020A	13.34	12.44	13.21	14.16	***15.02***	10.47	9.27
RLA2090A	***15.81***	***17.48***	***17.65***	***17.92***	***17.65***	9.44	8.44
RLA2110A	13.06	13.90	14.57	***15.00***	***16.46***	10.90	9.80
RLA2120A	11.92	13.12	14.86	***15.76***	***16.75***	9.84	8.85
RLA2160A	12.24	13.72	***15.02***	***16.74***	***18.18***	8.76	7.86
RLA2200A	9.57	10.72	11.97	14.07	***17.24***	6.16	6.47
RLA2210A	13.21	***16.07***	***15.96***	***16.03***	***16.02***	8.37	3.93
RLA2250A	10.62	11.96	13.94	***15.18***	***15.31***	3.76	3.10
RLA2405A	13.83	***19.01***	***20.07***	***20.49***	***21.05***	10.16	8.61
RLA2430A	14.43	***17.00***	***19.24***	***21.69***	***22.81***	9.79	8.76
RLA2455A	11.08	12.38	14.26	***15.56***	***16.82***	8.00	7.20
RLA2630A	7.92	8.86	9.68	11.38	***16.58***	6.00	5.40
RLA2640A	14.28	***15.24***	***15.43***	***15.54***	***15.69***	9.22	8.26
RLA2660A	8.69	10.32	13.50	***15.84***	***16.14***	5.19	4.67
RLA2695A	13.43	***16.95***	***16.99***	***16.99***	***17.00***	4.94	4.15
RLA2700A	***15.89***	***16.01***	***16.16***	***16.27***	***16.38***	13.29	11.87
RUF1140A	6.00	***28.04***	***26.71***	***26.75***	***27.12***	9.51	3.10
RUF2440A	10.64	10.64	10.64	13.69	***16.47***	10.64	10.64
RUFT1055A	9.27	13.46	14.72	***15.00***	***15.49***	5.16	4.58

The pipes having maximum modeled velocities exceeding 15 fps are shown in Figure 4. This figure shows the actual pipe network and the modeled pipe network. Field verification of these features will require identifying the modeled pipe.

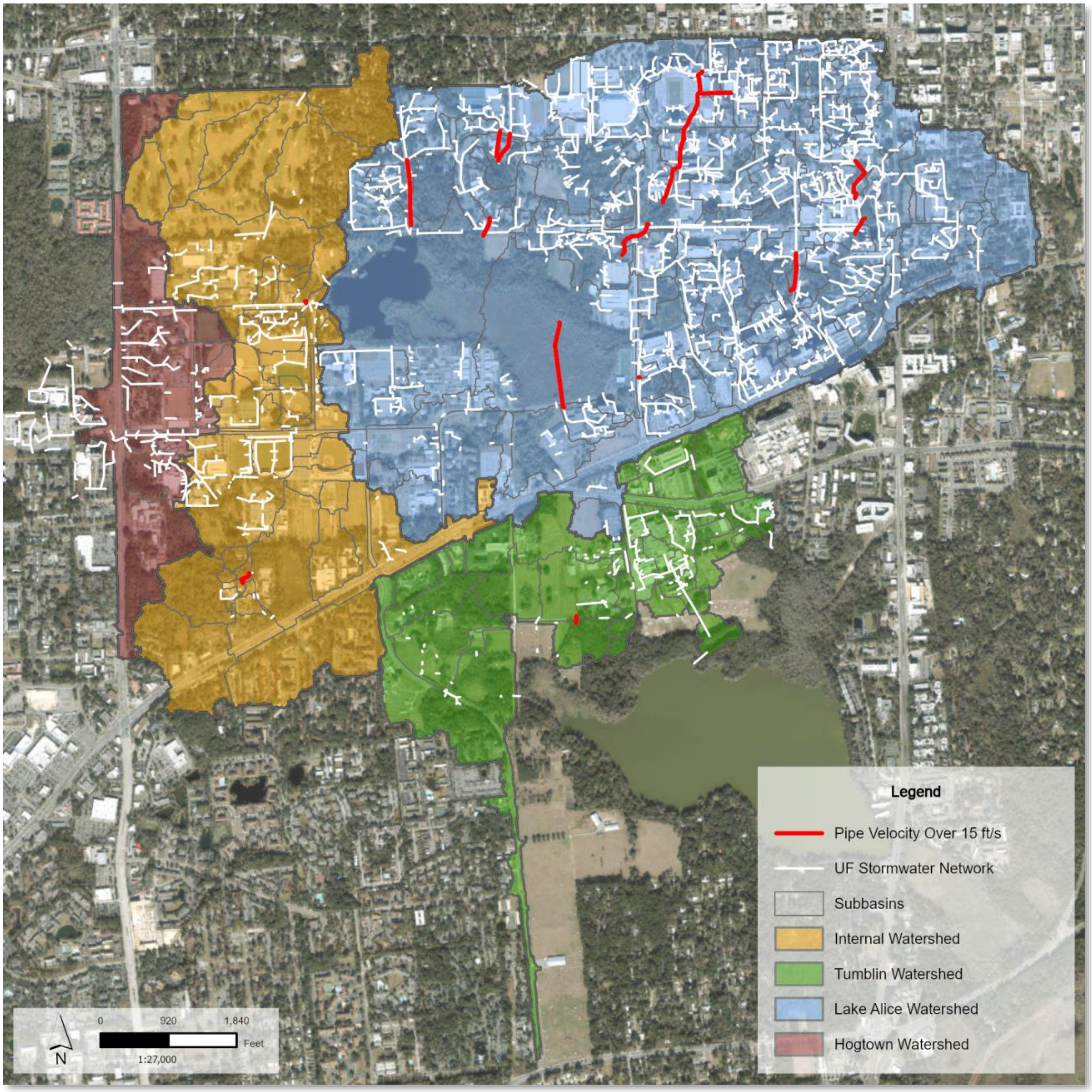

Figure 4. Pipes with Modeled Velocities Exceeding 15 fps

3.4 Sedimentation Locations

Erosion that occurs upstream in the Lake Alice Watershed mobilizes sediments that are deposited in downstream areas of channels with lower slopes, channels with wider cross-sections, near other features that reduce local velocities (bridges, pipes, structures), or Lake Alice. While nearly all channels on campus have slopes that exceed the minimum FDOT recommendation of 0.0005 feet of drop per foot of length there are a number of channels that have maximum modeled velocities of less than 1 fps. At these velocities sediments are expected to settle and accumulate. There were seven channels (4 within the Lake Alice Watershed) that had maximum modeled velocities less than 1 fps. The four channels within the Lake Alice Watershed with these lower velocities are located in the flatter portion of the watershed near the lake. The locations of these channels are shown in Figure 5. The pictured channels are the links within the model, the actual channel in the field is typically only a portion of the length shown. These areas should be regularly evaluated to determine the need for maintenance, including dredging, to ensure adequate conveyance exists for properly directing stormwater flows. The identified channels correspond well with feedback received from Facilities and Grounds and locations where dredging has occurred or is ongoing. Additional locations with known sedimentation issues include Lake Alice Gardens and Hume Pond.

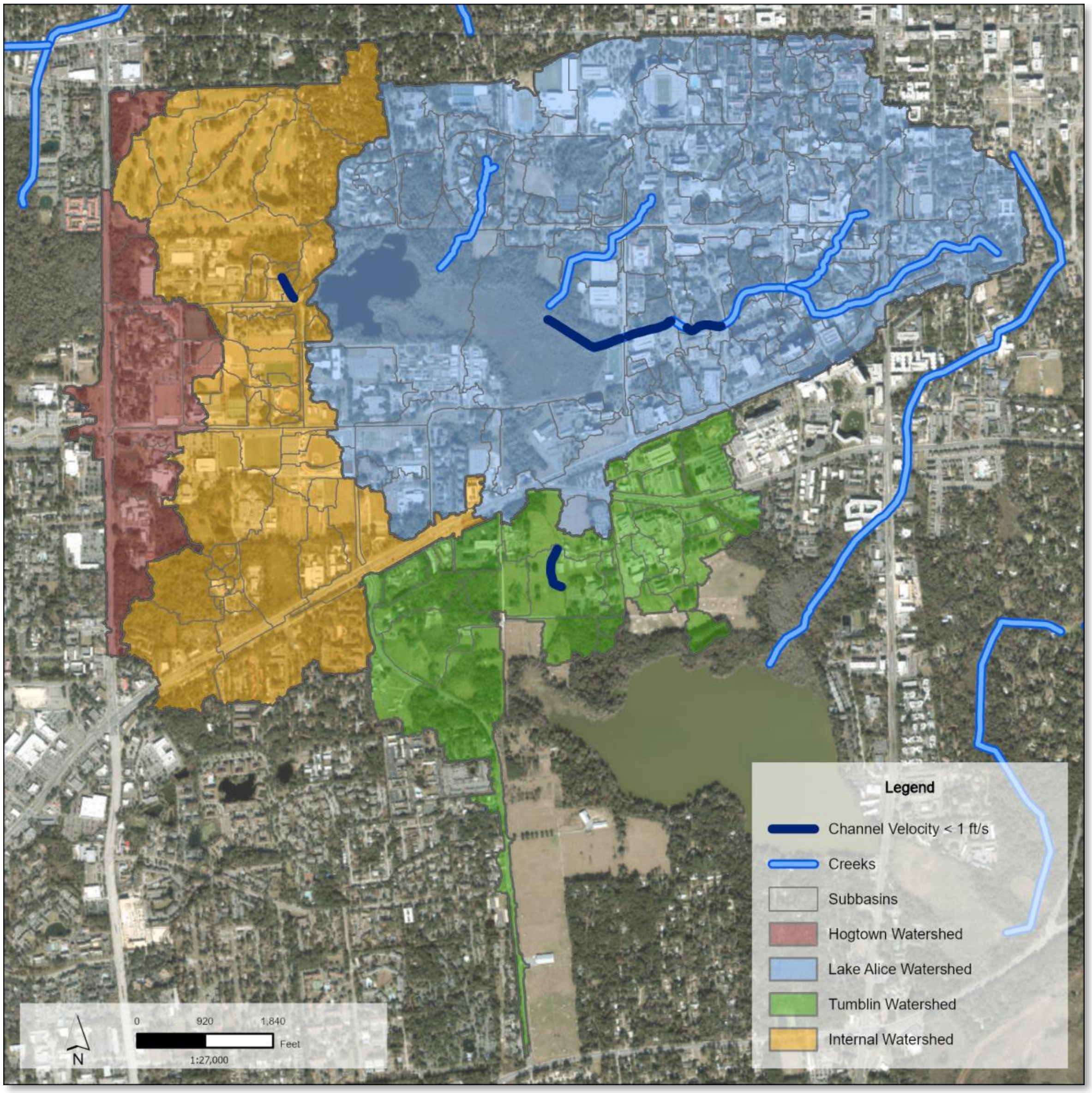

Figure 5. Channels with Modeled Velocities Below 1 fps

3.5 Other Stormwater Issue Locations

In addition to the cases discussed above there are a variety of other types of potential stormwater impacts that were identified. These were evaluated based on model data, direct observations, and GIS data. These include recovery of Lake Alice water levels and pipe network sizes.

3.5.1 Field-Observed Stormwater Issues

As a part of this project, site visits were completed to examine stormwater infrastructure. During a site visit to Lake Alice in early-2024 it was noted that Lake Alice was approximately level with the weirs on the front of the R-2 Well which are approximately 2.65 feet higher than the invert elevation of the weirs on the R-1 Well. On closer inspection of the wet well for the R-1 Well it was noted that there was little observable flow and floating plants were present within the structure. After notifying Facilities, the wet well was drained and the well screen was cleared (February 15, 2024) which caused substantial increases in observable flows. This occurrence highlights the importance of operation and maintenance for the R-1 Well to control levels on Lake Alice, provide stormwater treatment and storage capacity, and protect campus infrastructure from flooding.

3.5.2 Undersized Pipes

The University's stormwater system has developed over decades to meet the current needs of campus development. In this situation there is the potential for downstream stormwater infrastructure capacity to be undersized compared to new upstream stormwater infrastructure capacity that can result in localized flooding and sedimentation within the pipe network. The stormwater network for campus was visually assessed in GIS for pipe sizes in the downstream section with areas where pipes decreased in size flagged. Two primary cases occur on campus, pipes with no information on diameter (517 pipes) and pipes that decrease in size in the downstream direction. Based on a visual assessment there were 20 locations identified within the model where identified pipes decreased in diameter in the downstream direction (Figure 6). Each of these locations should be individually assessed to determine if recorded dimensions are accurate and match field dimensions. If recorded dimensions are correct, areas should be modeled to determine whether there is a need to replace pipes to avoid conveyance problems.

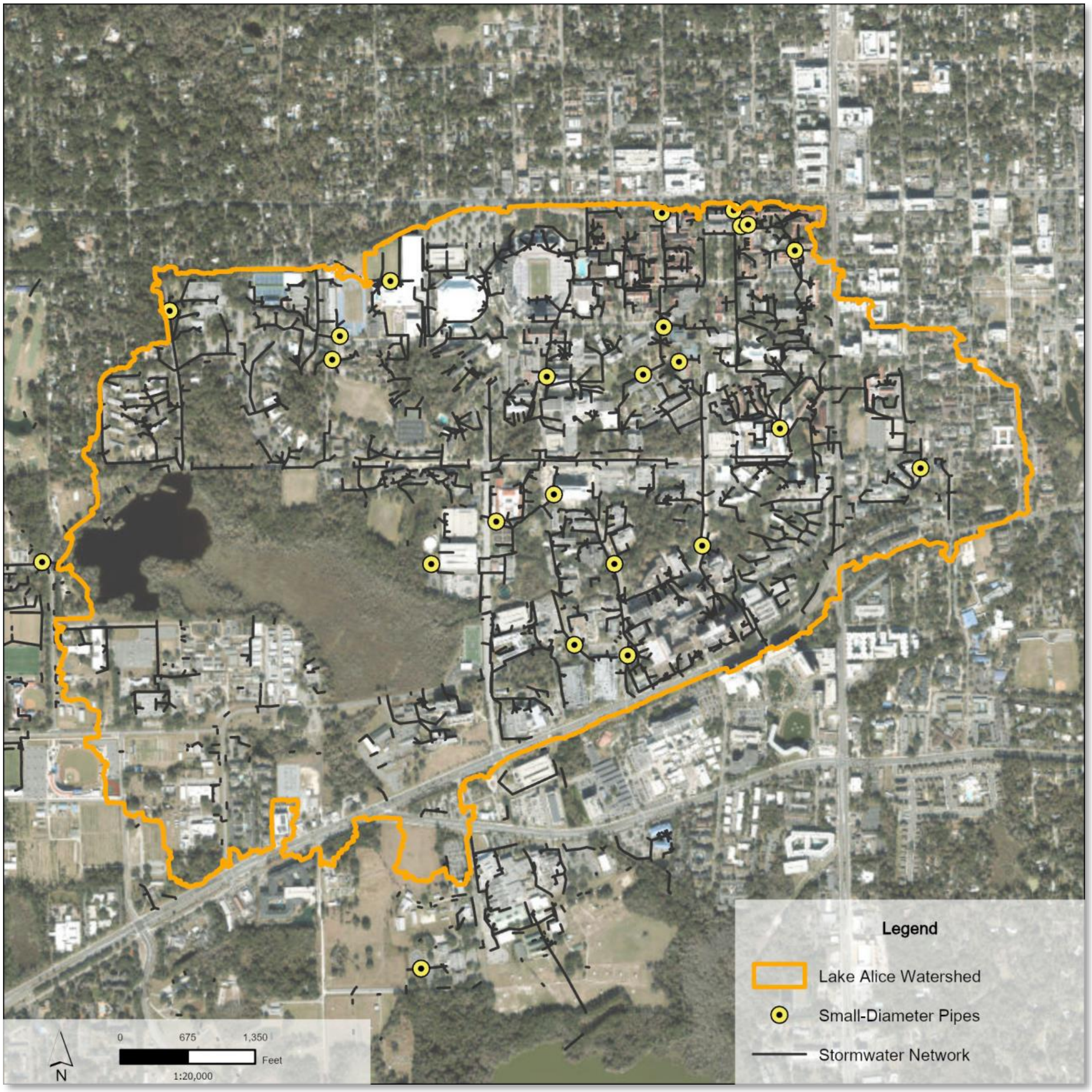

Figure 6. Pipes with Decreasing Diameter in the Downstream Direction

Section 4.0 Conceptual Projects

Based on the stormwater issues described above three flooding and three erosion concern areas were selected for development of conceptual projects and opinions of probable cost. These locations were selected for the following reasons: life safety issues, risk to non-stormwater infrastructure, environmental benefits, and damage reduction. The presented projects cover a range of implementation costs based on the extent of work required to rectify the identified problems. Opinions of probable cost were prepared based on the following assumptions and limitations, as such they should be treated as planning level only and actual costs could be lower or higher based on site-specifics and a final project design:

- No site-specific data were collected.
- Project specific modeling was not developed for these projects.
- Utility conflicts were not considered in these concepts.
- Layouts were based on GIS data without project-specific survey.
- Local geology could be impactful for designs but was not considered.

4.1 Conceptual Flooding Projects

Three conceptual flooding projects were identified that spanned a range of project types including recharge well structure improvements, stormwater infrastructure, and increasing storage and trash removal. Each of these projects is presented in the following sections with presentation of the concept and the estimated cost. These projects were developed at a conceptual level of detail and are intended for general planning and budgeting purposes.

4.1.1 Lake Alice Recharge Well Structure Improvements

The Lake Alice recharge wells (R-1 and R-2) are two of the most critical pieces of stormwater infrastructure on campus. As such, the proper function of these structures is critical to avoid flooding around the lake. The importance of this feature is highlighted in the 2008 UIC Permit Renewal, "If R-1 would fail for any reason that would plug the well and stop drainage capacity…lake levels would rise and likely flood Museum Road." (Sheldon, 2008). The first flooding project recommended is to improve the R-1 Well intake to improve maintainability and reduce clogging of the interior well screen. This is expected to improve conveyance to the well, reduce clogging, and increase stormwater storage in the lake.

This project recommends installing a new well screen on the intake to the R-1 wet well structure (outer grate) and installing stop gate channels. As currently configured the outer screen on the front of the wet well has a larger grate size (approximately 2"x5") than the interior screen on the well intake (approximately 1"x4"), because of this configuration the outer screen can pass pieces of debris large enough to clog the interior screen. Emptying this structure and clearing the interior grate is difficult as currently configured. The recommended improvement for this structure is to replace the wet well grates and to install a stop-gate channel that allows for manual installation of a stop gate for easier dewatering of the structure. The estimated costs for this conceptual project are shown in Table 6.

Table 6. Lake Alice Recharge Well R-1 Structure Modifications Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**			
University of Florida	Scott Knight			
Project Title:	**Checked By:**			
Lake Alice R-1 Well Structure Improvements				
WSI Project Number:	**Date:**			
UFL-2	6/6/2024			
AACE 18R-97 Estimate Classification	**Design Progress:**			
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate			
DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Grate for existing drainage structure	SF	54	$ 400	$ 21,600
Stop Gates (4'x4.5', WxL)	EA	3	$ 7,000	$ 21,000
Subtotal				$ 42,600
ESCALATION	YR	3%		$ 1,278
Subtotal				$ 43,878
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 4,260
Subtotal				$ 48,138
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 48,138
BONDING		3%		$ 1,278
Subtotal				$ 49,416
CONTINGENCY - WORK IN FLOWING WATER		30%		$ 12,780
Subtotal				$ 62,196
ENGINEERING		12%		$ 5,112
Subtotal				$ 67,308
OPINION OF PROBABLE COST (ROUNDED)				**$ 70,000**
OPINION OF PROBABLE COST RANGE		**$ 50,000**	**to**	**$ 80,000**

4.1.2 Physics and Multi Use Trail Flooding

Recent construction near the Physics Building has resulted in localized erosion and flooding due to stormwater flows bypassing stormwater infrastructure. While repairs have been implemented, flooding in this area has continued and caused additional damage. Given the visibility of this area and the potential damage to non-stormwater infrastructure a conceptual alternative was developed for this location to manage stormwater and provide treatment. Existing issues in this area include significant elevation changes, overland flows, a Solid Waste Management Unit (SWMU), and insufficient stormwater conveyance. The proposed alternative for this location is construction of a stormwater feature north of the Physics Building to capture a portion of the stormwater flow and to provide some attenuation to reduce peak flows in the stormwater pipes in the area. It is also proposed to re-grade some areas and install additional drop structures to capture stormwater runoff that currently bypasses stormwater infrastructure and moves overland causing damage. The conceptual layout is shown in Figure 7. Costs for this concept were estimated based on the presented layout and are provided in Table 7.

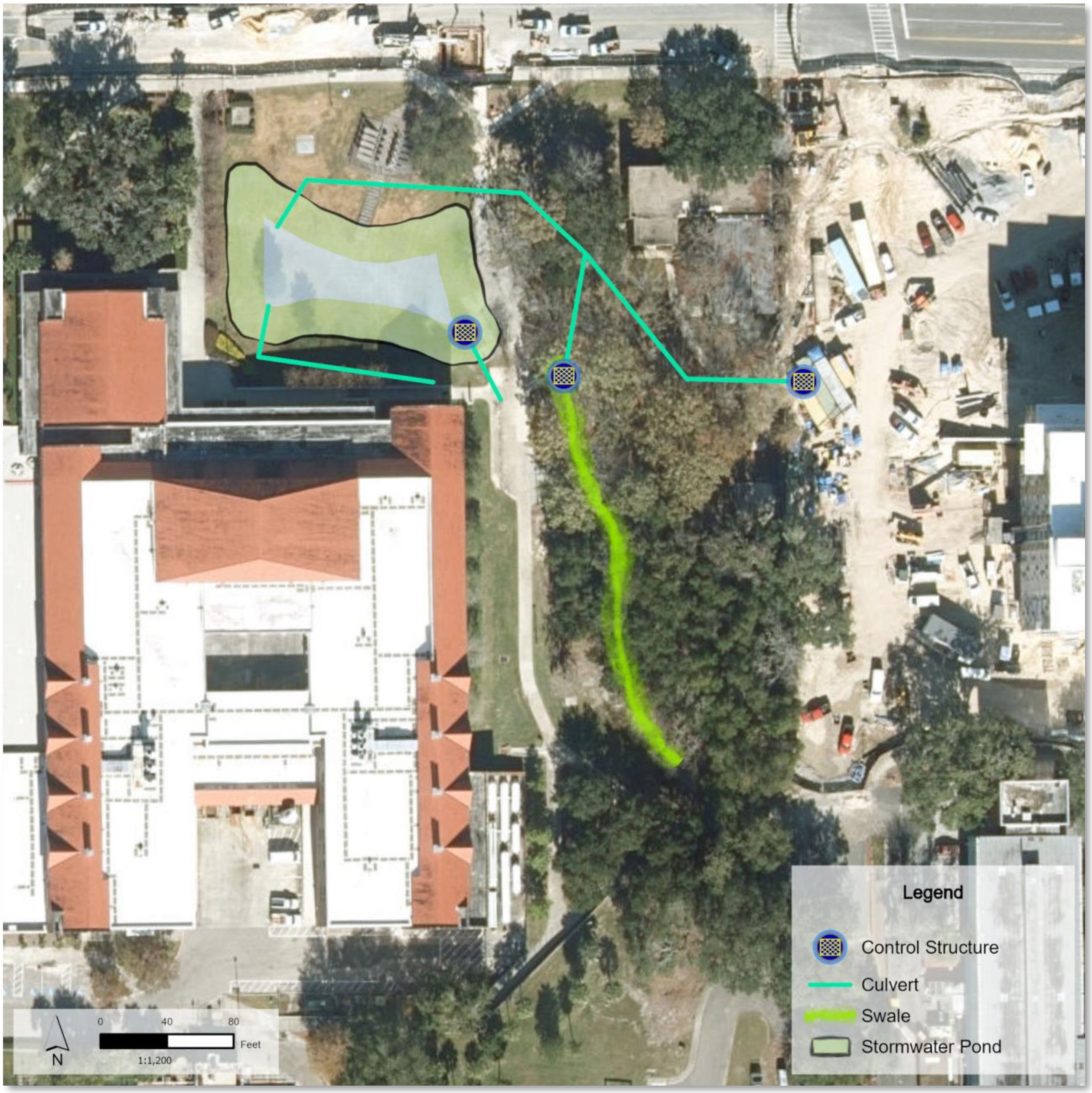

Figure 7. Stormwater Improvements Concept at the Physics Building

Table 7. Physics Stormwater Improvements Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**
University of Florida	Scott Knight
Project Title:	**Checked By:**
Physics Stormwater Pond	
WSI Project Number:	**Date:**
UFL-2	6/7/2024
AACE 18R-97 Estimate Classification	**Design Progress:**
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Clearing and grubbing, selective with trees to rer	AC	0.25	$ 5,000	$ 1,250
Regular Excavation	CY	2400	$ 15	$ 36,000
Channel Excavation	CY	120	$ 60	$ 7,200
Type D Inlet	EA	3	$ 12,000	$ 36,000
Manhole	EA	3	$ 10,000	$ 30,000
Wetland Planting	EA	1500	$ 2	$ 3,000
Sod	SY	350	$ 6	$ 2,100
Sidewalk Repair	SY	30	$ 80	$ 2,400
Reinforced Concrete Pipe - 24 inches	LF	260	$ 200	$ 52,000
Reinforced Concrete Pipe - 15 inches	LF	220	$ 200	$ 44,000
Reinforced Concrete Pipe - 12 inches	LF	140	$ 200	$ 28,000
Concrete Curb Repair	LF	20	$ 100	$ 2,000
Asphalt Repair	SY	20	$ 90	$ 1,800
Subtotal				$ 245,750
ESCALATION	YR	3%		$ 7,373
Subtotal				$ 253,123
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 24,575
Subtotal				$ 277,698
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 277,698
BONDING		3%		$ 7,373
Subtotal				$ 285,070
CONTINGENCY - WORK IN FLOWING WATER		10%		$ 24,575
Subtotal				$ 309,645
ENGINEERING		12%		$ 29,490
Subtotal				$ 339,135
OPINION OF PROBABLE COST (ROUNDED)				**$ 340,000**
OPINION OF PROBABLE COST RANGE		**$ 250,000**	**to**	**$ 400,000**

4.1.3 Lake Alice South

Lake Alice South is located south of Mowry Road and receives runoff from Archer Road and seepage from higher elevation areas near Archer Road. This area contributes significant flows to Lake Alice during storm events. This area has the potential to provide regional stormwater storage and treatment and reduce peak flows to Lake Alice. The concept proposed for this location includes a stormwater treatment wetland with an expanded footprint, a sediment trap, a trash trap, and control structures. This wetland design proposes to establish an upstream forested wetland and a downstream emergent marsh with a maintainable sediment basin and trash trap. This project will result in wetland impacts that will require mitigation. Given the proposed expanded footprint of this project and the improvements being made, this project may produce excess wetland mitigation credits that could be used to offset wetland impacts in other areas of campus. The project concept is shown in Figure 8. The estimated costs for this conceptual project are shown in Table 8.

Figure 8. Lake Alice South Stormwater Wetland Concept

Table 8. Lake Alice South Stormwater Wetland Concept Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**
University of Florida	Amy Goodden
Project Title:	**Checked By:**
Lake Alice South Wetland	Scott Knight
WSI Project Number:	**Date:**
UFL-2	6/4/2024
AACE 18R-97 Estimate Classification	**Design Progress:**
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Clearing and grubbing, selective with trees to r	AC	6.89	$ 18,000	$ 123,967
Floating Trash Trap and debris boom	EA	1.00	$ 220,000	$ 220,000
Channel Excavation	CY	500	$ 60	$ 30,000
Sediment Trap Excavation	CY	2200	$ 15	$ 33,000
Reinforced Concrete Pipe - 36 inches	LF	60	$ 350	$ 21,000
Wetland Cell #1 @ 72 - Excavation	CY	2000	$ 15	$ 30,000
Embankment	CY	3400	$ 30	$ 102,000
Wetland Cell #2 @ 70 - Excavation	CY	3400	$ 15	$ 51,000
Embankment	CY	5600	$ 30	$ 168,000
Control Structure	EA	2	$ 4,000	$ 8,000
Overflow Structure	EA	2	$ 20,000	$ 40,000
Wetland Planting	AC	5	$ 7,500	$ 37,500
Sod	SY	75	$ 6	$ 450
Concrete Curb Repair	LF	20	$ 100	$ 2,000
Asphalt Repair	SY	100	$ 90	$ 9,000
Subtotal				$ 875,917
ESCALATION	YR	3%		$ 26,278
Subtotal				$ 902,194
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 87,592
Subtotal				$ 989,786
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 989,786
BONDING		3%		$ 26,278
Subtotal				$ 1,016,064
CONTINGENCY - WORK IN FLOWING WATER		30%		$ 262,775
Subtotal				$ 1,278,839
ENGINEERING		12%		$ 105,110
Subtotal				$ 1,383,949
OPINION OF PROBABLE COST (ROUNDED)				**$ 1,400,000**
OPINION OF PROBABLE COST RANGE		**$ 1,000,000**	**to**	**$ 1,700,000**

4.2 Conceptual Erosion Projects

All three of the erosion projects that were selected for development of conceptual alternatives were chosen based on the non-negotiable issues of life safety and damage to non-stormwater infrastructure. The problems that exist in these areas are indicative of issues that occur in other locations on campus. Each of these projects is discussed in additional detail in the following sections with a sketch of the concept for each and an opinion of probable cost.

4.2.1 Graham Woods

Graham Woods has been impacted by stormwater inputs from adjacent impervious areas that have increased flows into the Conservation Area and that have caused substantial erosion. These stormwater inputs have resulted in erosion that risks impacting sidewalks, electrical infrastructure, and a service drive adjacent to the Keys Complex. Within the woods, erosion has contributed to fall risks and the loss of trees. This concept proposes complete stabilization of the banks that surround Graham Woods, re-direction of stormwater from the top of slope to the bottom of the enhanced wetland, and construction of a new outlet structure that will stage water up during rainfall events to provide storage and treatment. The plan also proposes to remove invasive vegetation and establish desirable trees and groundcover. The proposed concept is shown in Figure 9 with the opinion of probable cost in Table 9.

Figure 9. Graham Woods Stabilization and Treatment Concept

Table 9. Graham Woods Project Concept Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**
University of Florida	Amy Goodden
Project Title:	**Checked By:**
Graham Woods Stabilization	Scott Knight
WSI Project Number:	**Date:**
UFL-2	6/4/2024
AACE 18R-97 Estimate Classification	**Design Progress:**
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Clearing and grubbing, selective with trees to r	AC	4	$ 18,000	$ 72,000
Gabion, 7 ft tall (5 ft retaining height)	SY	6500	$ 500	$ 3,250,000
Sheetpile, 5 ft tall (15 ft panel)	SF	1125	$ 100	$ 112,500
Precast Concrete Pile Cap	LF	75	$ 20	$ 1,500
Grouted Riprap Spillway	SF	8000	$ 15	$ 120,000
Riprap Bank and Shore	TN	900	$ 200	$ 180,000
Reinforced Concrete Pipe - 36 inches	LF	150	$ 350	$ 52,500
Reinforced Concrete Pipe - 30 inches	LF	300	$ 350	$ 105,000
Reinforced Concrete Pipe - 24 inches	LF	450	$ 200	$ 90,000
Reinforced Concrete Pipe - 18 inches	LF	600	$ 200	$ 120,000
Reinforced Concrete Pipe - 15 inches	LF	150	$ 200	$ 30,000
Reinforced Concrete Pipe - 12 inches	LF	600	$ 200	$ 120,000
U type Endwall with Baffle 15 to 30 inch	EA	12	$ 7,000	$ 84,000
U Type Endwall 30 to 72 inch	EA	3	$ 14,000	$ 42,000
Headwall for 48" RCP	EA	1	$ 25,000	$ 25,000
Embankment Fill	CY	10000	$ 25	$ 250,000
Regular Excavation	CY	6000	$ 15	$ 90,000
Planting	AC	7	$ 20,000	$ 140,000
Removal of Existing Concrete	SY	150	$ 50	$ 7,500
Subtotal				$ 4,892,000
ESCALATION	YR	3%		$ 146,760
Subtotal				$ 5,038,760
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 489,200
Subtotal				$ 5,527,960
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 5,527,960
BONDING		3%		$ 146,760
Subtotal				$ 5,674,720
CONTINGENCY - WORK IN FLOWING WATER		30%		$ 1,467,600
Subtotal				$ 7,142,320
ENGINEERING		12%		$ 587,040
Subtotal				$ 7,729,360
OPINION OF PROBABLE COST (ROUNDED)				**$ 7,700,000**
OPINION OF PROBABLE COST RANGE		**$ 5,700,000**	**to**	**$ 9,300,000**

4.2.2 Jennings Creek

Water flows into Jennings Creek from Yulee Pit and stormwater collectors along and under Museum Road. Immediately south of Museum Road water enters Jennings Creek through a 48” RCP pipe. Water exiting this pipe has caused erosion and the failure of the headwall supporting this pipe. This has resulted in the separation of the headwall and last segment of pipe from the stormwater pipe. The failure of this headwall has also allowed additional erosion of the creek bank adjacent to Museum Road. This causes risk to infrastructure including the road and has resulted in very steep creek banks that pose a safety risk.

The proposed project for Jennings Creek includes the construction of a step-pool system that will include sheetpile oriented perpendicular to flow in the creek with directed downstream overflows to protect the bed of the channel and support a plunge pool at the outlet of the current stormwater pipe to reduce energy and erosion. Also included in the design are gabions for bank stabilization and pipe modifications to reduce erosion from current stormwater pipes that flow to the creek. The proposed concept is shown in Figure 10 with the opinion of probable cost shown in Table 10.

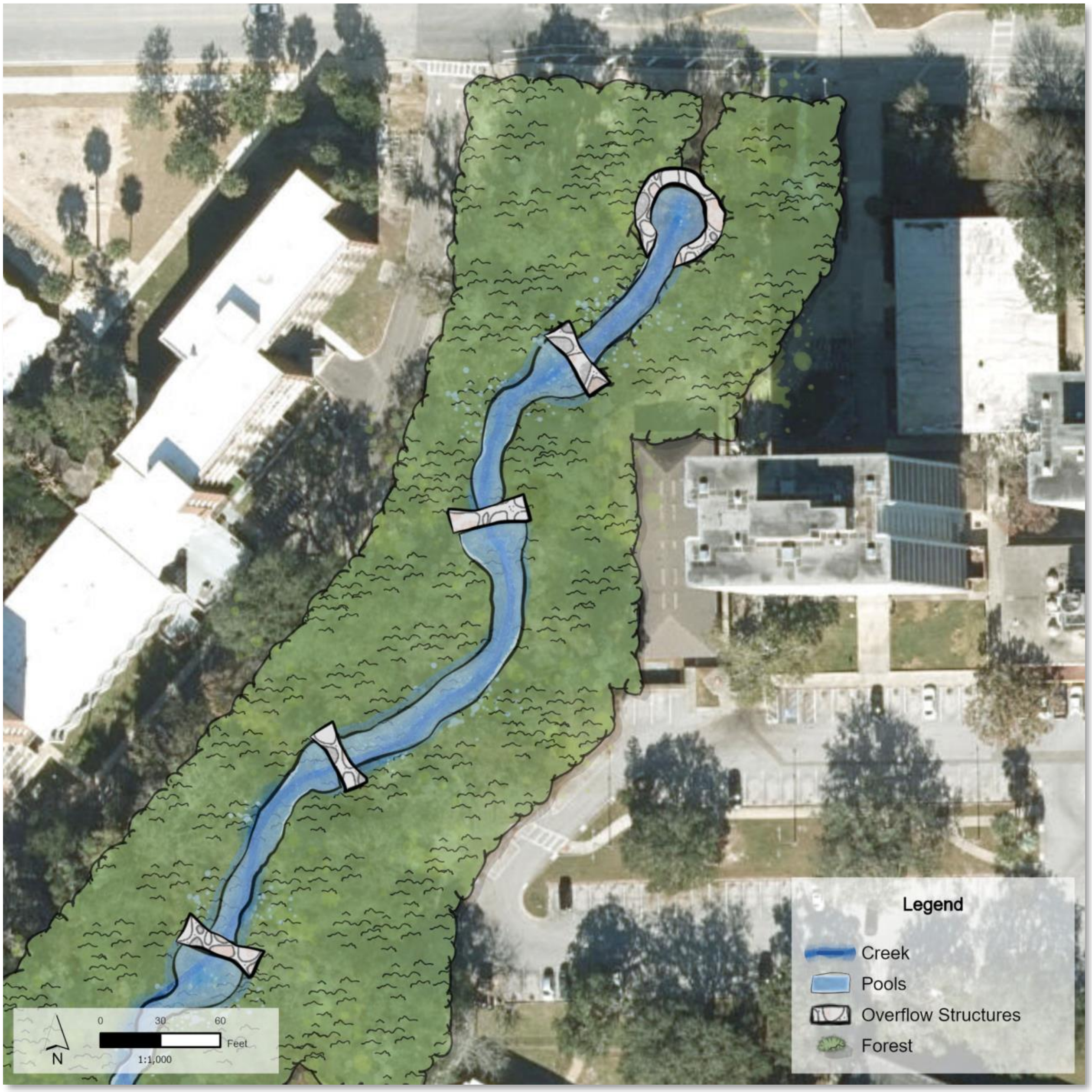

Figure 10. Jennings Creek Step-Pool Stabilization Concept

Table 10. Jennings Creek Project Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**			
University of Florida	Amy Goodden			
Project Title:	**Checked By:**			
Jennings Creek Stabilization	Scott Knight			
WSI Project Number:	**Date:**			
UFL-2	6/5/2024			
AACE 18R-97 Estimate Classification	**Design Progress:**			
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate			
DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Gabion, 14 ft tall (12 ft retaining height)	SY	1200	$ 750	$ 900,000
Sheetpile Grade Control, 5 ft tall (15 ft panel)	SF	7500	$ 100	$ 750,000
Precast Concrete Pile Cap	LF	500	$ 20	$ 10,000
Grouted Riprap Spillway	SF	2250	$ 15	$ 33,750
Riprap Bank and Shore	TN	1080	$ 200	$ 216,000
Reinforced Concrete Pipe - 36 inches	LF	25	$ 350	$ 8,750
Reinforced Concrete Pipe - 18 inches	LF	70	$ 200	$ 14,000
Reinforced Concrete Pipe - 15 inches	LF	45	$ 200	$ 9,000
Reinforced Concrete Pipe - 12 inches	LF	90	$ 300	$ 27,000
U type Endwall with Baffle 15 to 30 inch	EA	6	$ 7,000	$ 42,000
U Type Endwall 30 to 72 inch	EA	1	$ 14,000	$ 14,000
Headwall for 48" RCP	EA	1	$ 25,000	$ 25,000
Tree Planting	EA	100	$ 500	$ 50,000
Understory Planting	EA	10000	$ 1	$ 10,000
Subtotal				$ 2,109,500
ESCALATION	YR	3%		$ 63,285
Subtotal				$ 2,172,785
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 210,950
Subtotal				$ 2,383,735
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 2,383,735
BONDING		3%		$ 63,285
Subtotal				$ 2,447,020
CONTINGENCY - WORK IN FLOWING WATER		30%		$ 632,850
Subtotal				$ 3,079,870
ENGINEERING		12%		$ 253,140
Subtotal				$ 3,333,010
OPINION OF PROBABLE COST (ROUNDED)				**$ 3,300,000**
OPINION OF PROBABLE COST RANGE		**$ 2,500,000**	**to**	**$ 4,000,000**

4.2.3 McKnight Brain Institute Sidewalk

Along the sidewalk north of the McKnight Brain Institute, erosion along Lake Alice Creek has resulted in conduits being exposed and the potential for the sidewalk and adjacent parking area to be undermined. This erosion appears to be due to the sidewalk being constructed too close to the creek edge, routing of stormwater flows into the creek upstream of the sidewalk, and the natural migration of the channel. The proposed project in this area includes channel excavation, bank stabilization, and redirection of a pipe upstream of the project area. This project will have wetland impacts due to work within the creek but may qualify for an exemption [62-330.051(9)(b) or (c)] or for a general permit [62-330.451(2)(c), 62-330.453(1), or 62-330.474(1)]. The opinion of probable cost is provided in Table 11.

Table 11. McKnight Brain Institute Project Opinion of Probable Cost

Engineer's Opinion of Probable Construction Cost

Client:	**Estimated By:**
University of Florida	Amy Goodden
Project Title:	**Checked By:**
McKnight Brain Institute Sidewalk Repair	Scott Knight
WSI Project Number:	**Date:**
UFL-2	6/4/2024
AACE 18R-97 Estimate Classification	**Design Progress:**
ROM - 2% to 5% Engineering Completed	Preliminary Construction Estimate

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Clearing and grubbing, selective with trees to remai	AC	0.02	$ 18,000	$ 289
Channel excavation	CY	30	$ 60	$ 1,800
Flex MSE Vegetated Geobag	SF	1500	$ 50	$ 75,000
Reinforced Concrete Pipe - 36 inches	LF	60	$ 350	$ 21,000
Embankment Fill	CY	130	$ 25	$ 3,250
Sod	SY	75	$ 6	$ 450
Concrete Curb Repair	LF	20	$ 100	$ 2,000
Asphalt Repair	SY	100	$ 90	$ 9,000
Assume General Permit 62-330.451 (2)(c)				
Subtotal				$ 112,789
ESCALATION	YR	3%		$ 3,384
Subtotal				$ 116,173
MOBILIZATION AND GENERAL CONDITIONS		10%		$ 11,279
Subtotal				$ 127,452
OVERHEAD AND PROFIT		0%		$ -
Subtotal				$ 127,452
BONDING		3%		$ 3,384
Subtotal				$ 130,836
CONTINGENCY - WORK IN FLOWING WATER		30%		$ 33,837
Subtotal				$ 164,672
ENGINEERING		12%		$ 13,535
Subtotal				$ 178,207
OPINION OF PROBABLE COST (ROUNDED)				**$ 180,000**
OPINION OF PROBABLE COST RANGE		**$ 130,000**	**to**	**$ 210,000**

Section 5.0 References

Causseaux & Ellington, Inc. (2000). *University of Florida Stormwater Management Master Plan and Permit Application* (BR-160; p. 489).

Causseaux, Hewett & Walpole, Inc. (2010). *University of Florida Stormwater Management Master Plan and Permit Application* (10–0054; p. 82).

CH2M Hill. (1987). *Permit Application Report and Stormwater Management Master Plan* (BR-161).

Florida Department of Transportation. (2024). *FDOT Drainage Manual* (625-040–002; p. 162). FDOT.

Sheldon, H. A. (2008). *Engineering Report—2008 UIC Permit Renewal for the University of Florida's WWTP* (p. 55).