REDEFINING STORMWATER AS RAINWATER

University of Illinois Urbana-Champaign

Rainwater Management Program

Farnsworth GROUP

INTRODUCTIONS

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Engineer

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Farnsworth GROUP

Aqua Vitae

GREEN METRO PLANNING, LLC

LIN ENGINEERING, LTD.
Consulting Engineers

ILLINOIS GREEN FUND
STUDENT SUSTAINABILITY COMMITTEE

ACKNOWLEDGEMENTS

CLIENT

University of Illinois Urbana-Champaign
Facilities & Services

FUNDING PROVIDED BY

INDIGENOUS LANDS AND PEOPLE

"We would like to begin today by recognizing and acknowledging that we are on the lands of the Peoria, Kaskaskia, Piankashaw, Wea, Miami, Mascoutin, Odawa, Sauk, Mesquaki, Kickapoo, Potawatomi, Ojibwe, and Chickasaw Nations. These lands were the traditional territory of these Native Nations prior to their forced removal; these lands continue to carry the stories of these Nations and their struggles for survival and identity."

PRESENTATION Outline

- Goals and Approach
- Gathering Data
- Understanding Existing Conditions
- Analyzing Proposed Conditions
- Compiling Plan
- Conclusions

Goals and Approach

GOALS of Rainwater Management Program

- Redefine stormwater as rainwater, an asset
- Enforce protection of waterways by utilizing green infrastructure
- Recommend green infrastructure facilities to address flooding and ponding issues on campus
- Address funding and marketing options for rainwater facilities
- Deliver a plan to inspire, educate and nurture an ecologically diverse campus

PROGRAM Approach

1 GATHERING DATA

- Review previous studies, plans, historical documents, campus utility GIS layers
- Survey storm sewer info
- As-Built information
- Site visits
- Open house virtual meetings for public input

2 UNDERSTANDING EXISTING CONDITIONS

- Delineate campus into drainage areas and determine major flow paths
- Identify all existing detention facilities
- Model existing conditions in PCSWMM

3 ANALYZING PROPOSED CONDITIONS

- Analysis criteria
- Methodology for recommending green infrastructure
- Modeling techniques

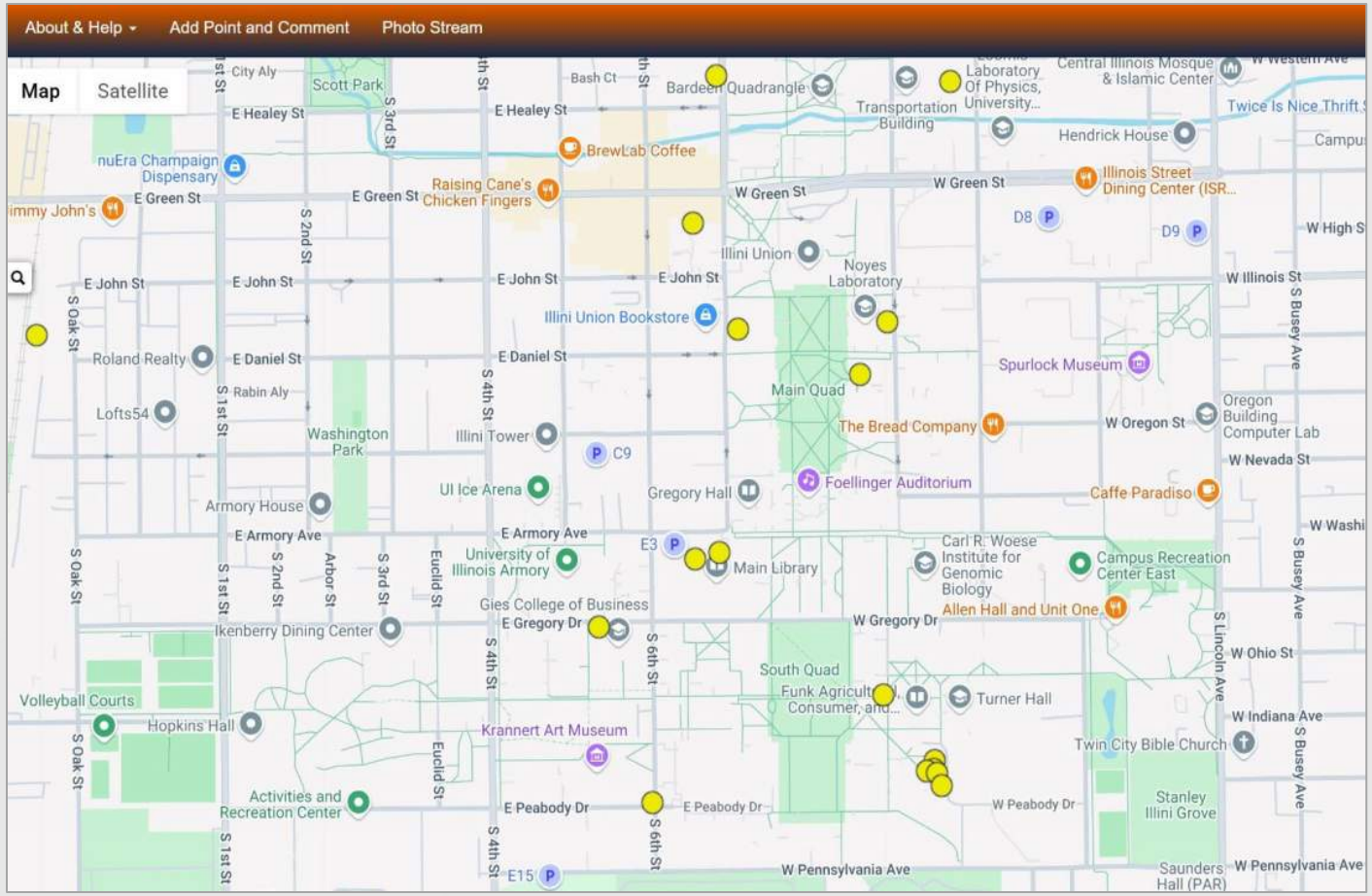
4 COMPILING PLAN

- Visual representation of proposed recommendations
- Updates to Rainwater Standards
- Addresses funding mechanisms

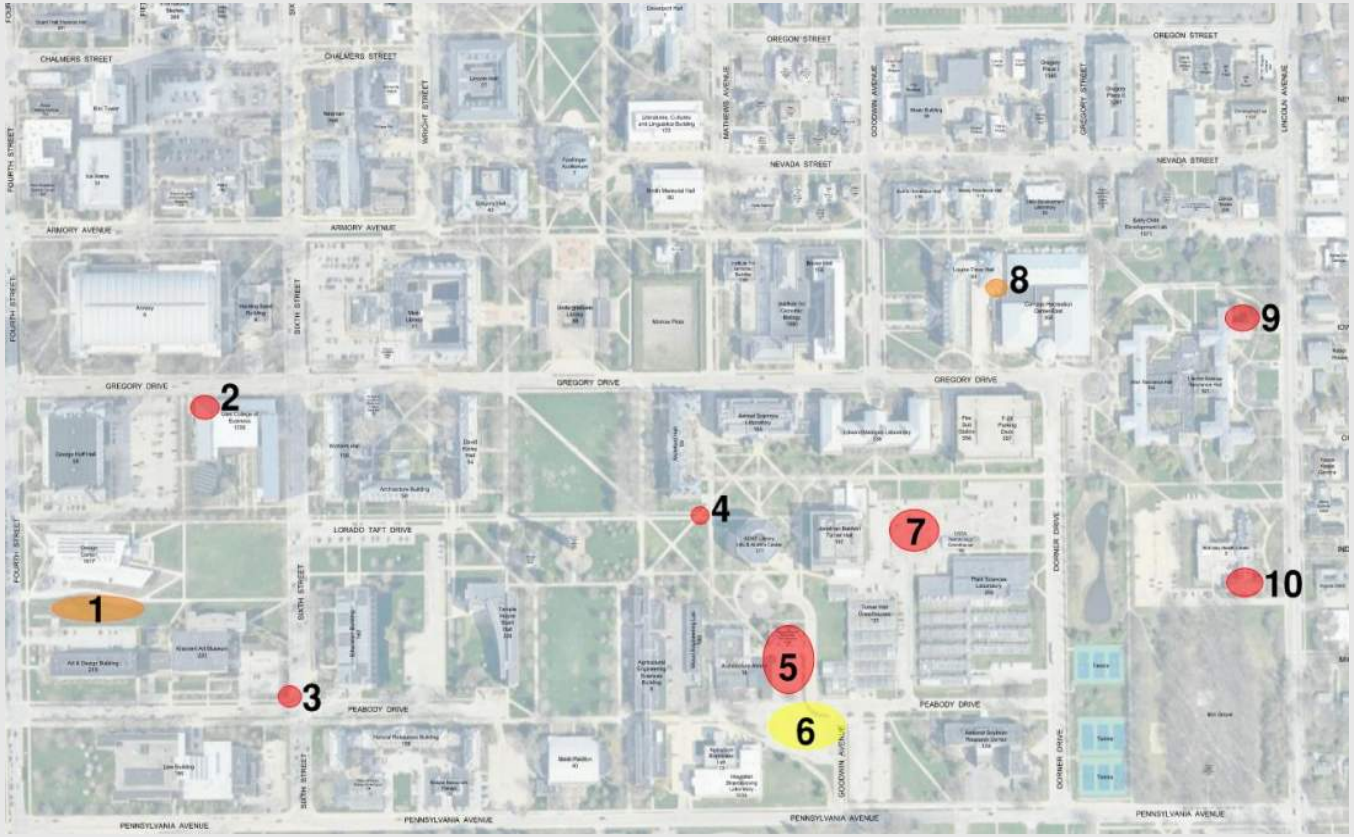
Gathering Data

GATHERING DATA

1. Review previous studies, plans, historical documents, campus utility GIS layers
2. Survey storm sewer information
3. As-built information
4. Site visits
5. Open house virtual meetings for public input

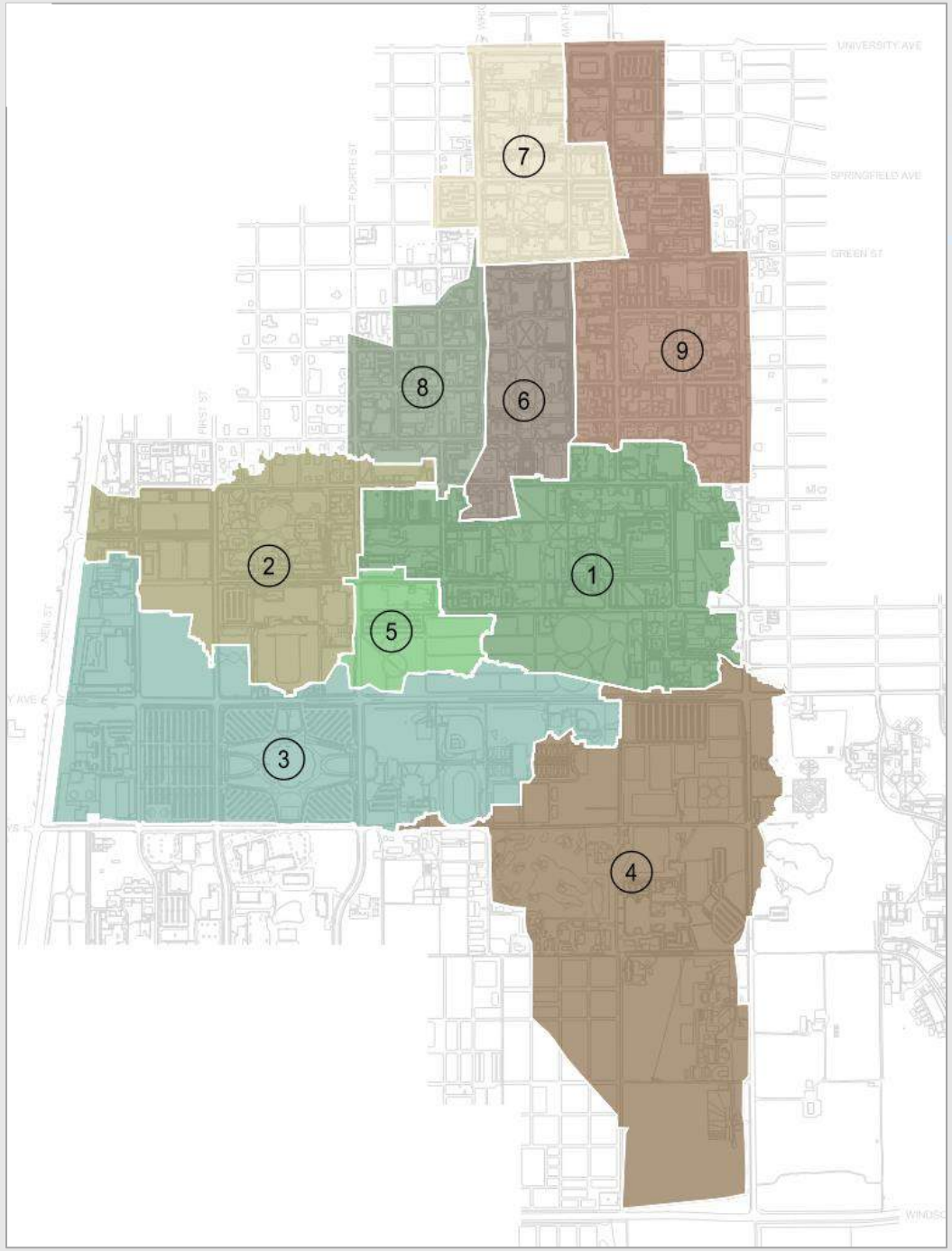


GATHERING DATA



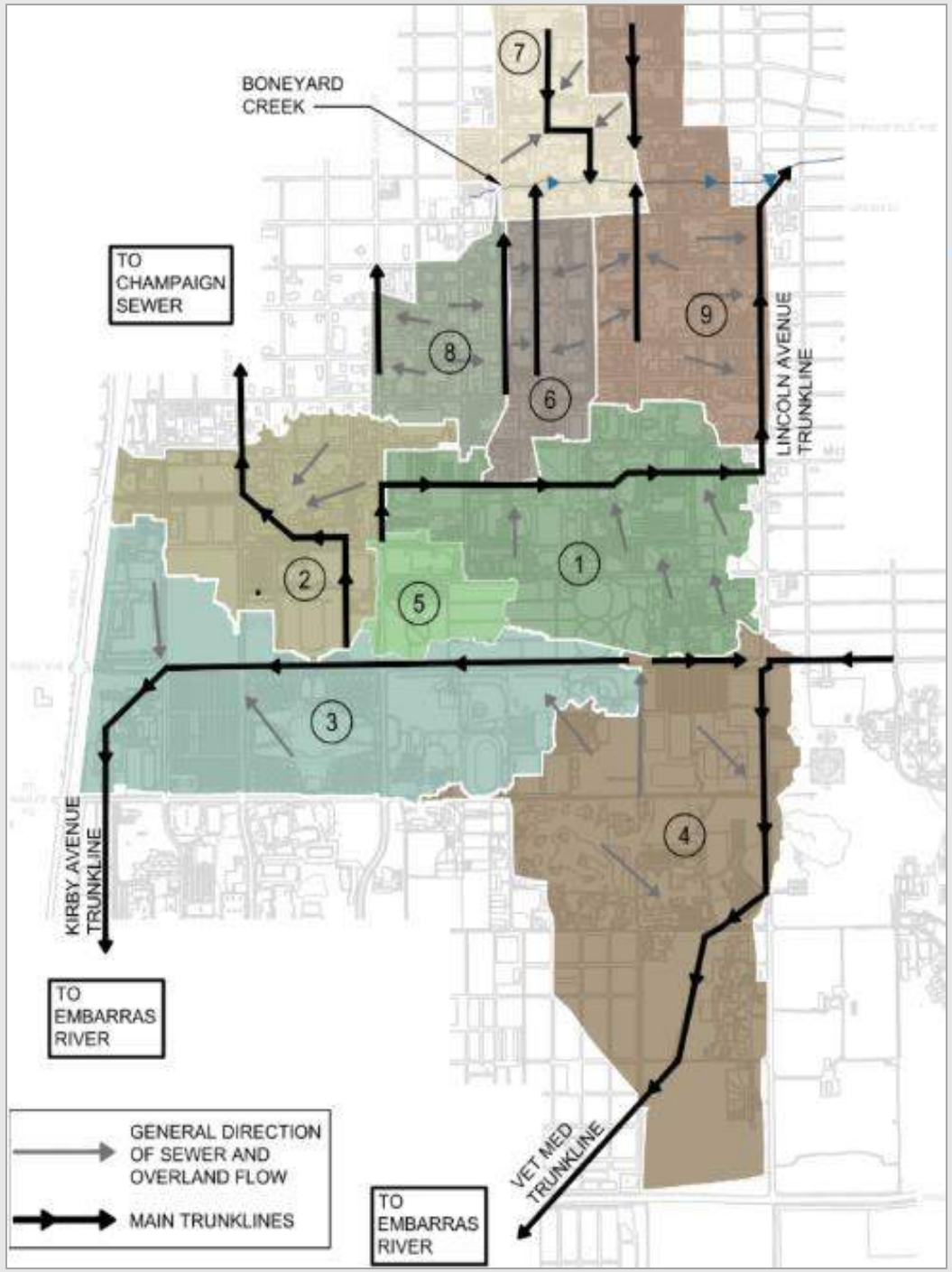
Area 1	
Comment #	**Comment**
1	At times there was occasionally flooding in subbasement of Siebel Center for Design, but it hasn't been as big of an issue as it was years ago.
2	The basement of the Gies College of Business floods from rainwater flowing down the slope of the dock. Years ago, the mulch was removed and replaced with rock so mulch was not also entering the building.
3	New road work (summer 2024) has created ponding at the northwest side of this intersection.
4	Sidewalk flooding
5	Studio 2 of the Art Annex Building experiences significant flooding in east basement with occasionally flooding in west basement. Someone mentioned that their basement office floods every time it rains. They have tried a few things but nothing has worked. Water comes to south side of the building from the parking lot and then goes towards building and around to ADA access on the east side of the building. The entrance floods and sometimes freezes if it is cold enough. Heavy rainfall comes through on north side as well. The grading of the parking lot is inconsistent and needs redone. There are several manholes on the west side of the building that are higher than walkway. There has been discussion about demolishing the building because the maintenance is a lot of time and money, but there is push back on saving an old building.
6	This parking lot is usually a problem, but hasn't been recently along with the area south of Turner Hall between the greenhouses. This has been fixed.
7	Water in the basement of the Turner Hall greenhouses and flooding of the F-28 parking lot. Lots of potholes and uneven surfaces at this location.
8	Freer hall has a history of flooding in the basement. A cement rise (a step up before going downstairs) was built to prevent water from going into the basement. There hasn't been issues in the area recently. If issues begin to arise, the university could consider connecting 2 manholes that are 15 apart in this location so water can overflow into the other structure. However, the pavement in this area was just installed as part of the recent construction at Freer Hall, so there is hesitation to tear it up again.
9	On the north side of LAR, there is sunken ground with a retaining wall on one side that ponds during torrential downpours. There is crushed tile near the street.
10	Water gets into the south side of the McKinely Health Center. Believes that runoff comes primarily from Orchard Downs, but an inlet on the east side is blocked and can't take any more water, so it backflows and blows debris holders 3 ft in air.

Understanding Existing Conditions



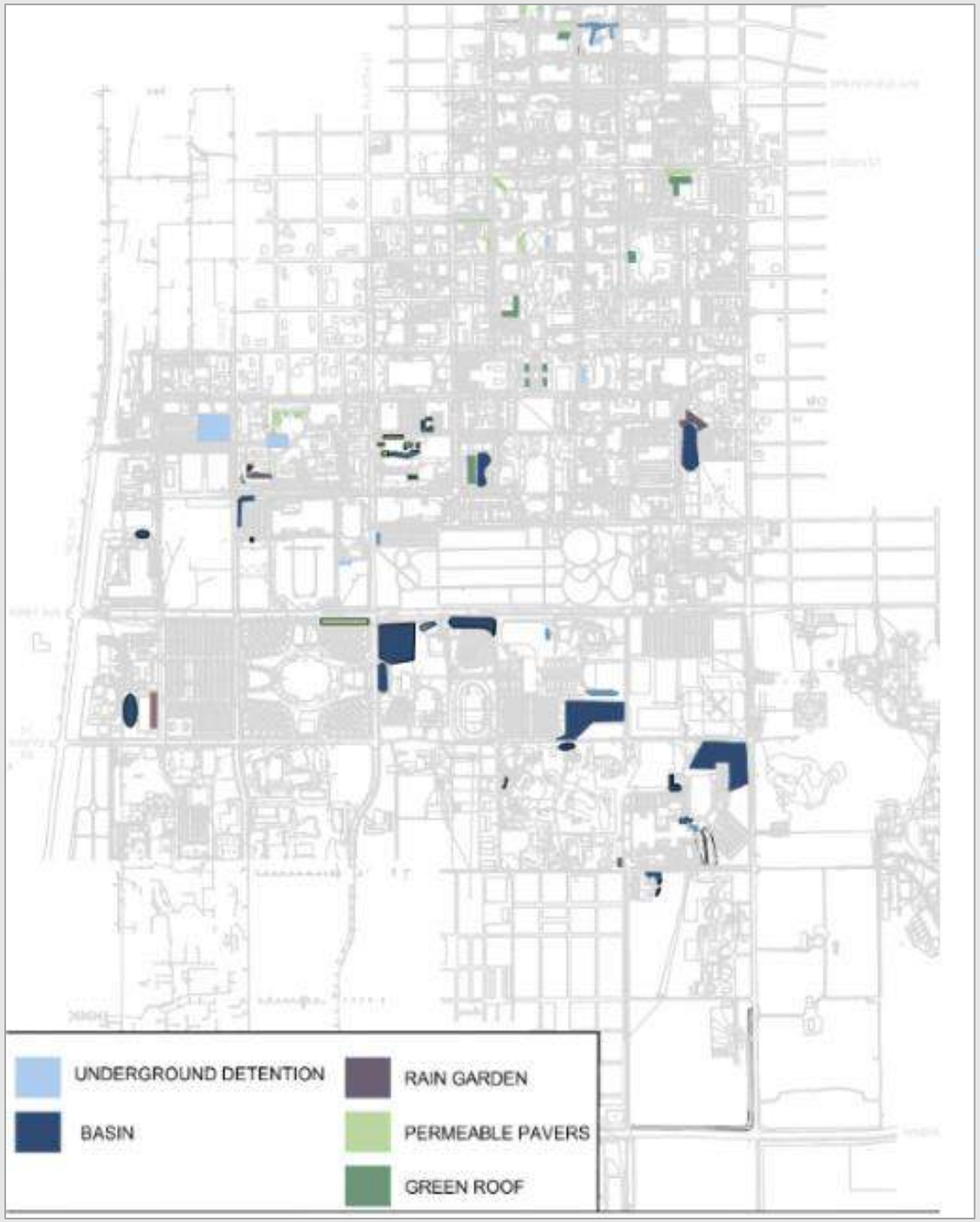
UNDERSTANDING EXISTING CONDITIONS

1. Delineate campus into drainage areas
2. Determine major flow paths
3. Identify existing detention facilities
4. Model existing conditions in PCSWMM



MAJOR DRAINAGEWAYS OF CAMPUS

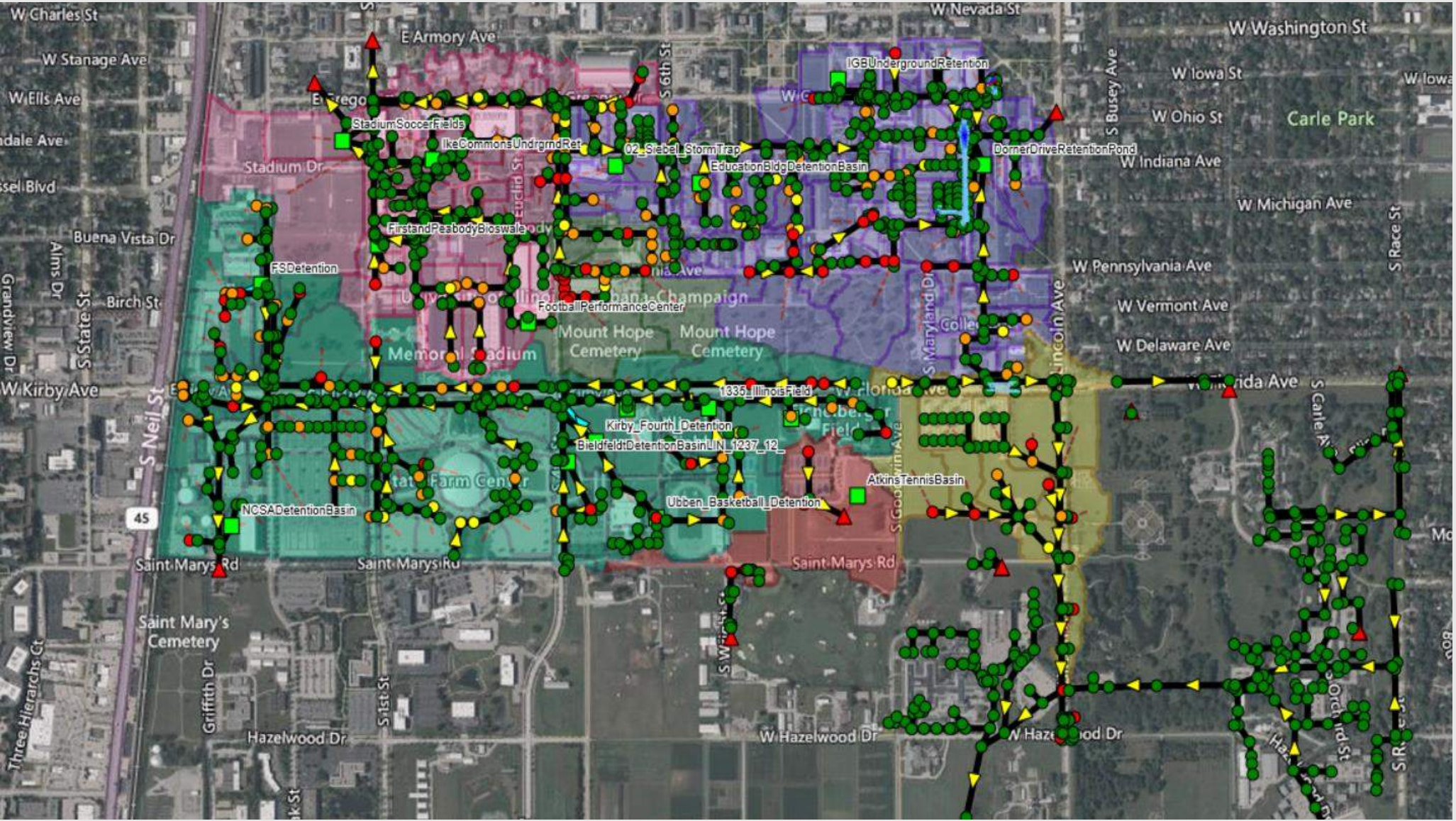
1. Delineate campus into drainage areas
2. Determine major flow paths
3. Identify existing detention facilities
4. Model existing conditions in PCSWMM



EXISTING RAINWATER MANAGEMENT FACILITIES

1. Delineate campus into drainage areas
2. Determine major flow paths
3. Identify existing detention facilities
4. Model existing conditions in PCSWMM

EXISTING CONDITIONS MODEL IN PC-SWMM



UNDERSTANDING EXISTING CONDITIONS: Rainfall

- Bulletin 75 precipitation amounts
- Huff 1st Quartile Distribution
- Critical duration analysis
- 100-year, 1 hour duration storm = 3.49 in

Analyzing Proposed Conditions

ANALYZE PROPOSED CONDITIONS

1. Analyze criteria
2. Methodology for recommending green infrastructure
3. Modeling techniques
4. Green infrastructure examples


GREEN ROOF


GREEN STREET

ANALYZE PROPOSED CONDITIONS

Criteria: Limit runoff to 0.18 cfs/acre of area by implementing green infrastructure


RAIN GARDEN


WETLAND


PERMEABLE PAVEMENT

MODEL PROPOSED CONDITIONS: Green Infrastructure

Low Impact Development Controls

- Infiltration Basin
- Permeable Pavement
- Rain Garden
- Cistern
- Vegetated Swale

Storage Nodes

- Underground Storage
- Abandoned Steam Tunnel Storage
- Wet and Dry Detention Basins
- Wetlands
- Tree Boxes

Subcatchment Modifications

- Green Roofs
- Native Vegetation

GREEN INFRASTRUCTURE: Examples

INFILTRATION BASIN

PERMEABLE PAVEMENT

GREEN INFRASTRUCTURE: Examples


RAIN GARDEN


CISTERN

VEGETATED SWALE

GREEN INFRASTRUCTURE: Examples


UNDERGROUND STORAGE


ABANDONED STEAM TUNNEL STORAGE

GREEN INFRASTRUCTURE: Examples


DETENTION BASIN


WETLAND

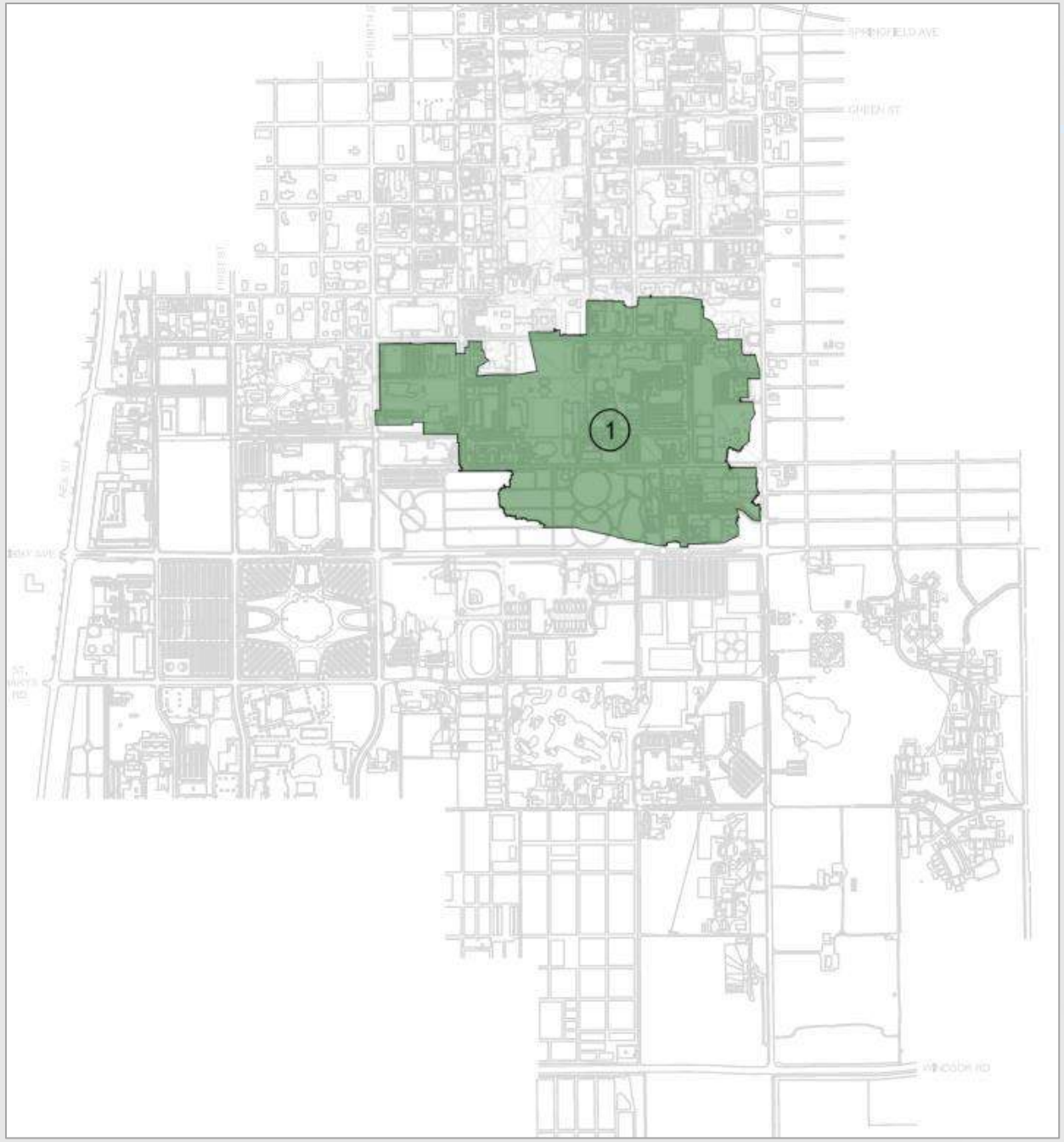

TREE BOX

GREEN INFRASTRUCTURE: Examples


GREEN ROOF

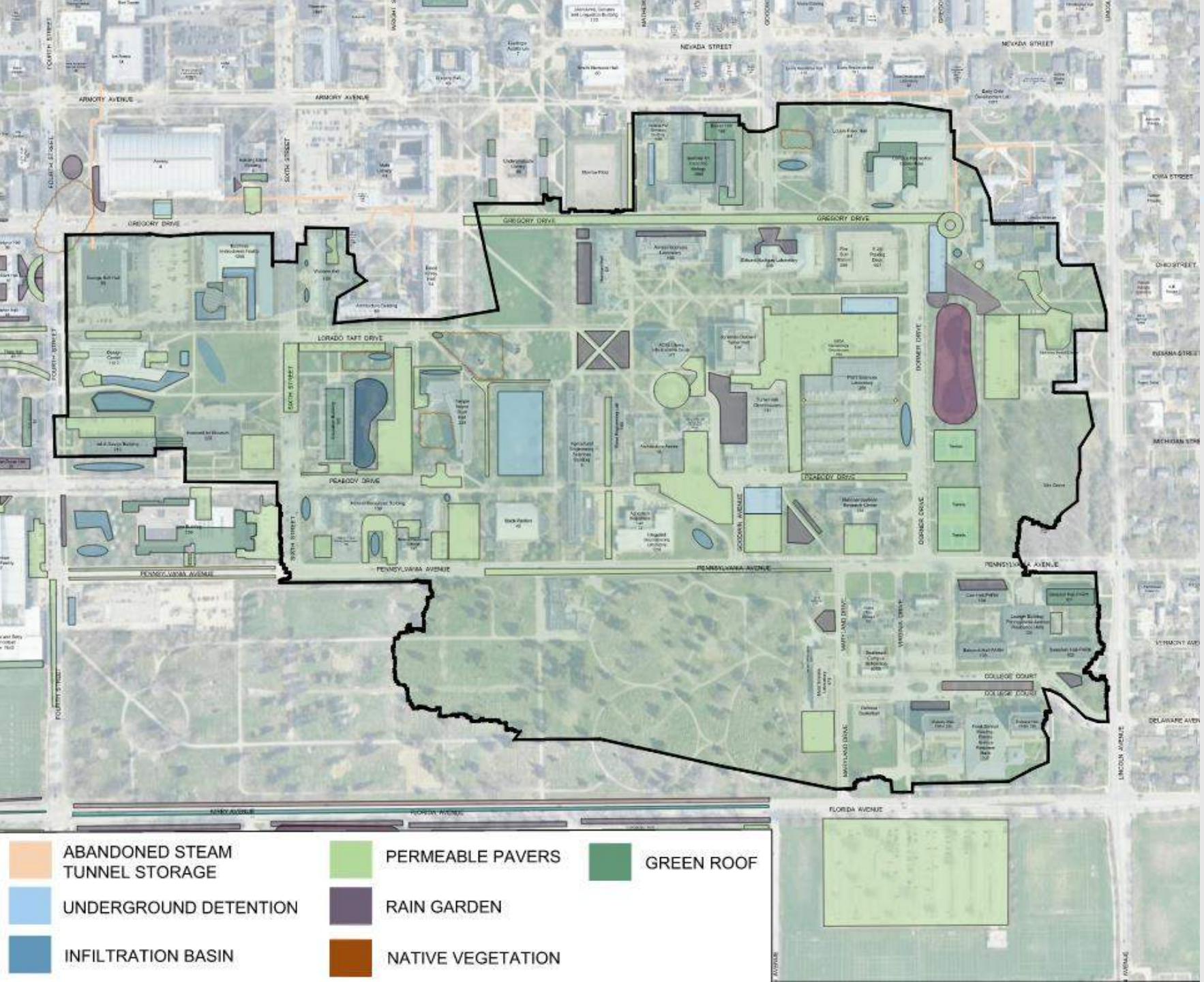

NATIVE VEGETATION

RESULTS AND RECOMMENDATIONS



AREA 1: South Quad District

PROPOSED GREEN INFRASTRUCTURE FACILITIES
TOTAL STORAGE: 1.5M CF



AREA 1: South Quad District

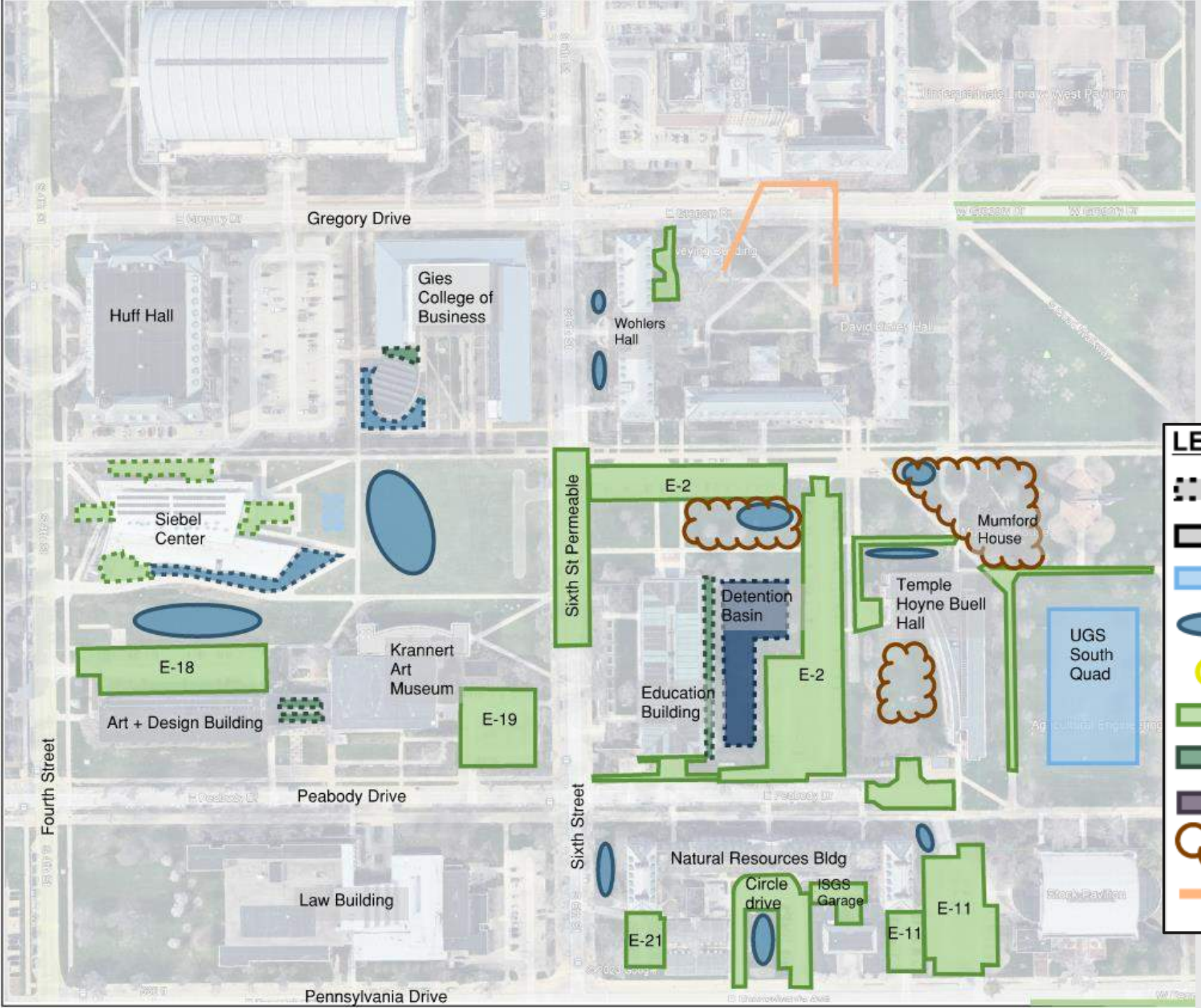
PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 1.5M CF

Total area: 157 acres
Existing release rate: 187 cfs
Proposed release rate: 26 cfs

AREA 1:
Western

RECOMMENDED IMPROVEMENTS

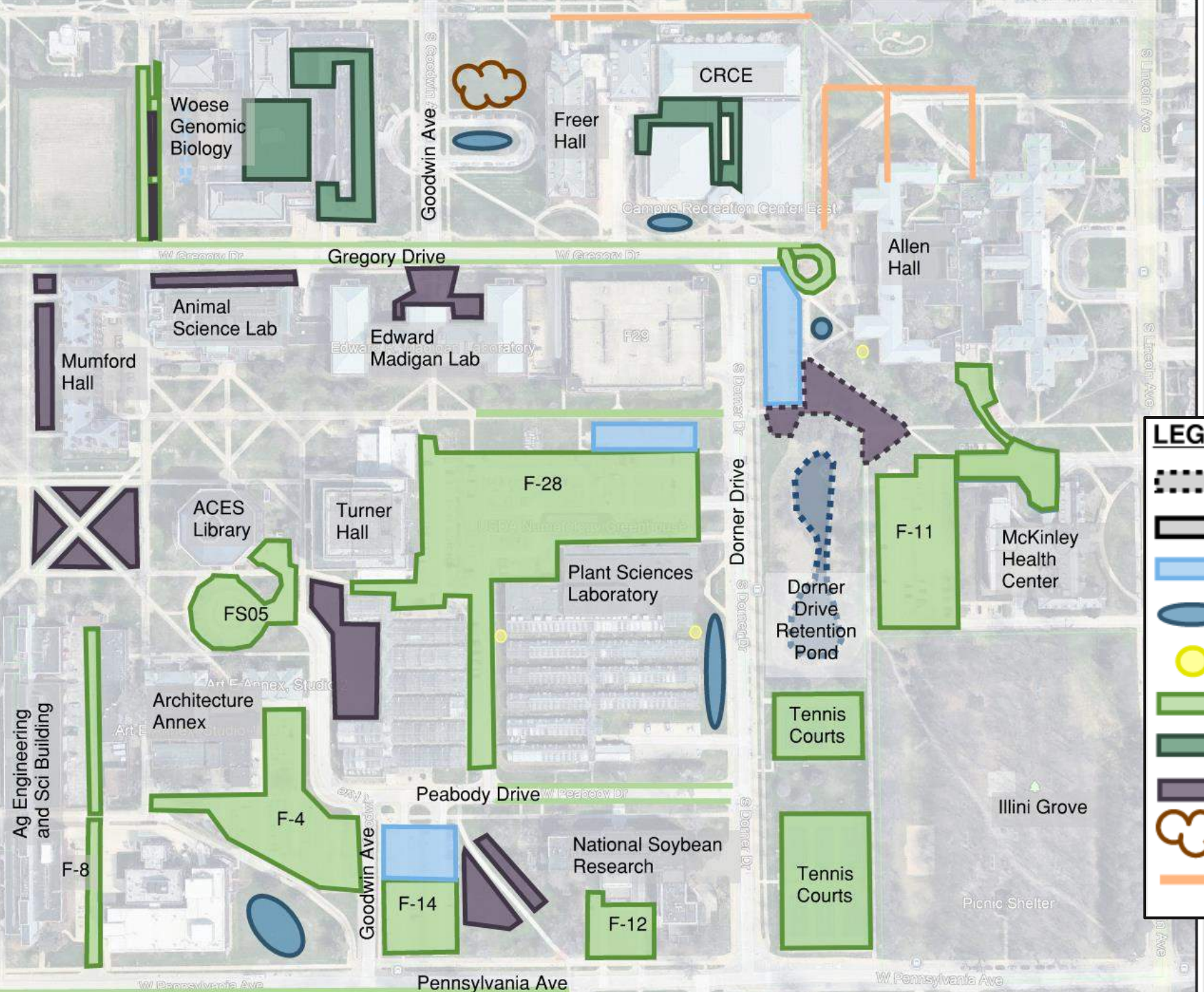


LEGEND

- EXISTING INFRASTRUCTURE
- PROPOSED INFRASTRUCTURE
- UNDERGROUND DETENTION
- INFILTRATION BASIN
- CISTERN
- PERMEABLE PAVEMENT
- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

AREA 1:
Eastern

RECOMMENDED IMPROVEMENTS



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- GREEN ROOF
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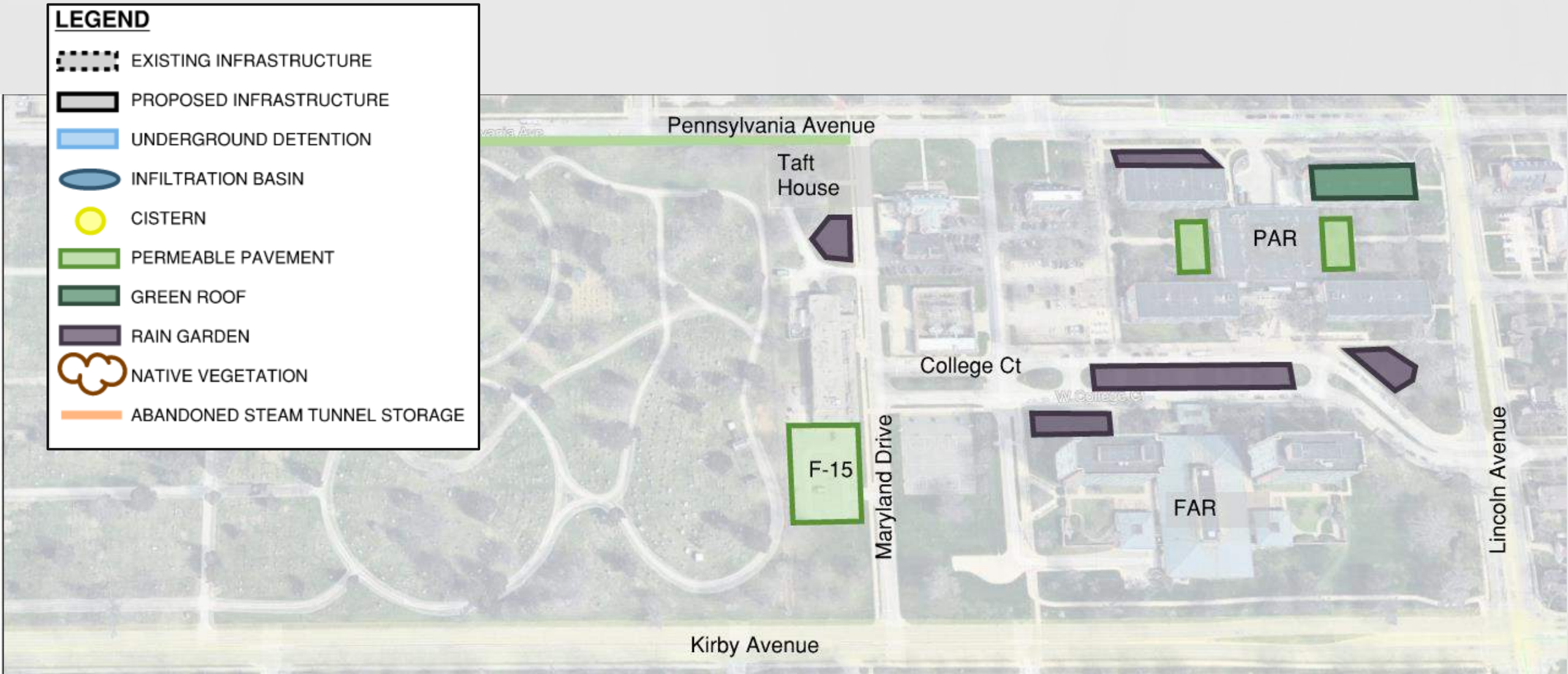
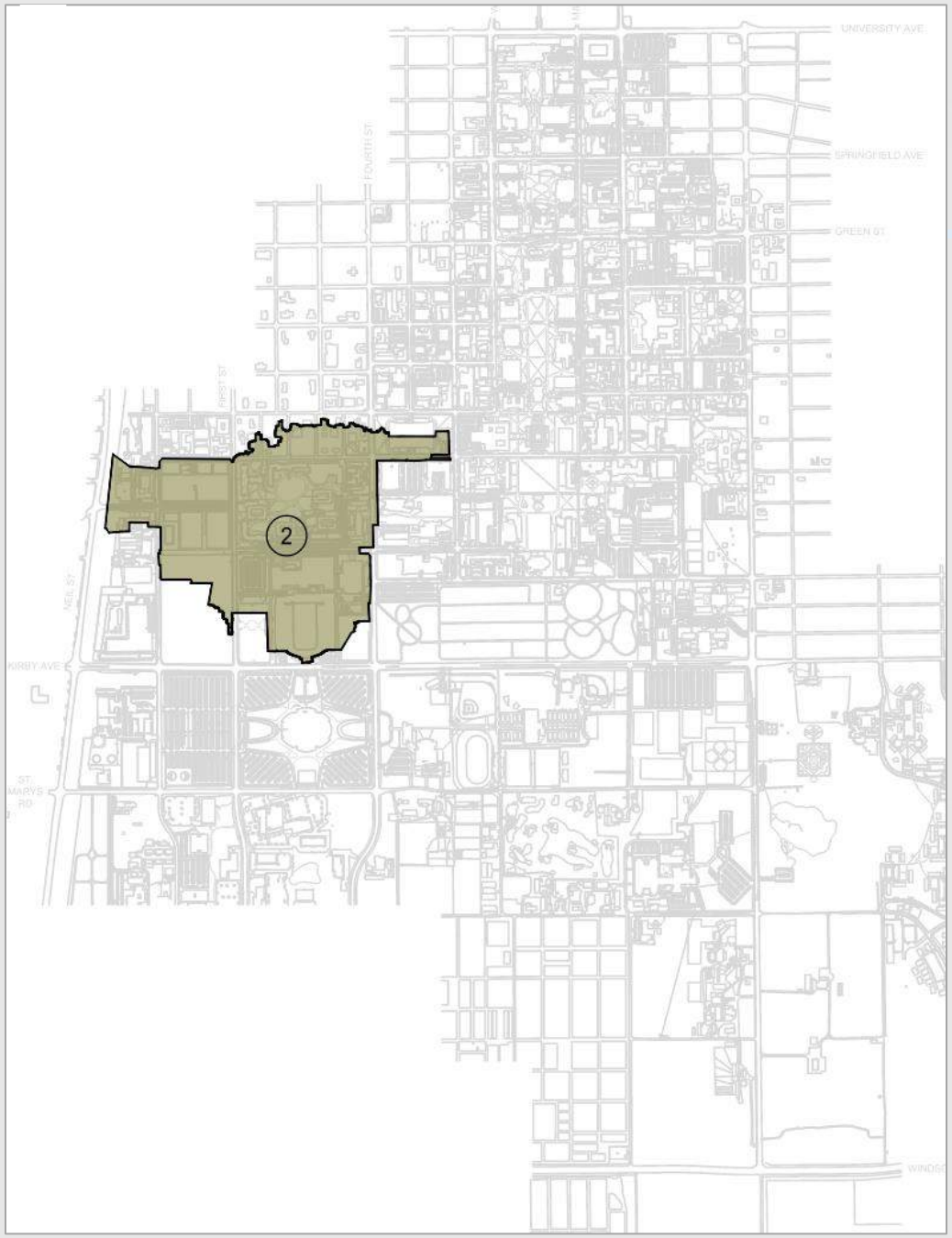
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

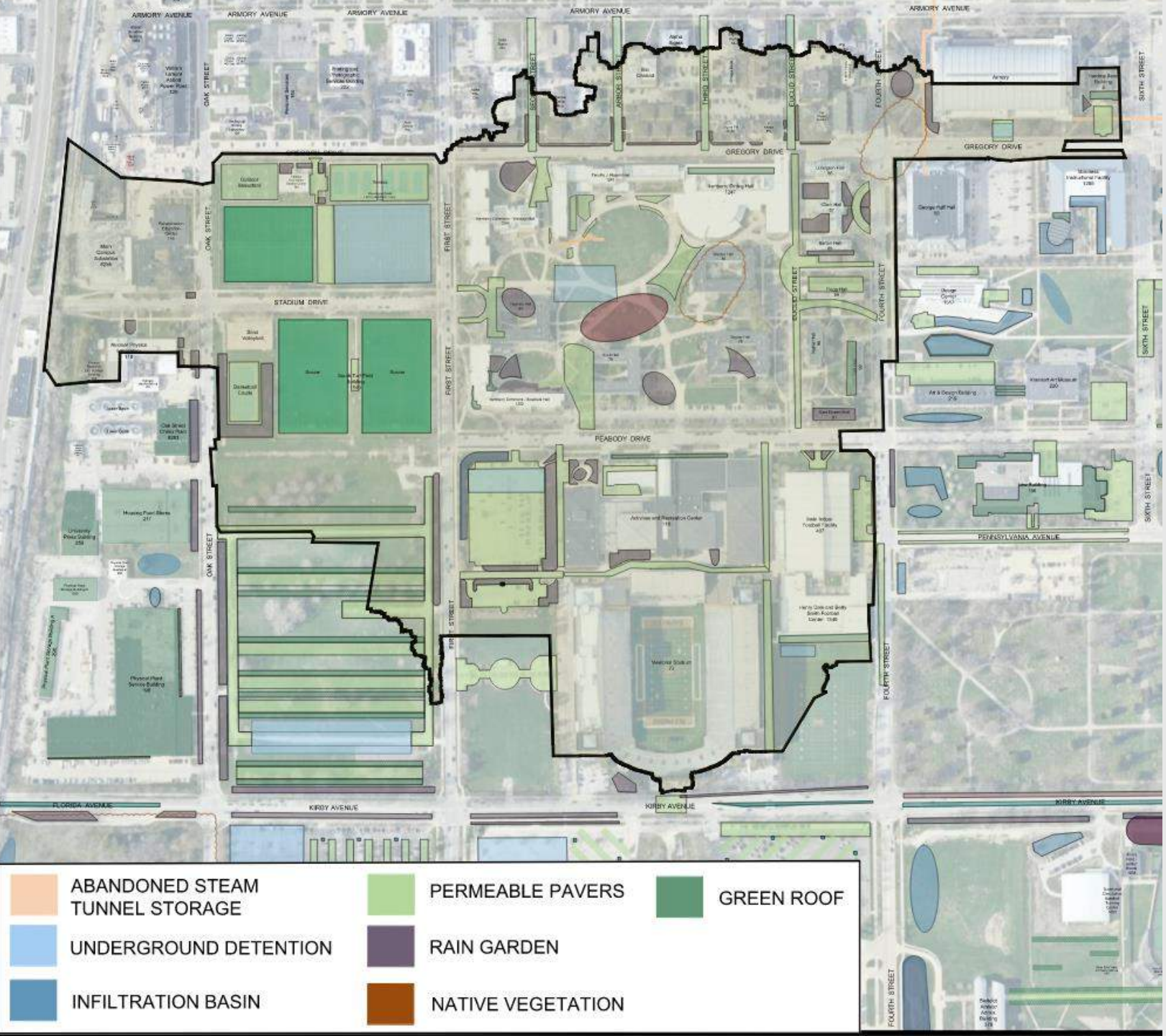
AREA 1: *Southern*





AREA 2: University Housing District

PROPOSED GREEN INFRASTRUCTURE FACILITIES
TOTAL STORAGE: 933,000 CF



AREA 2: University Housing District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

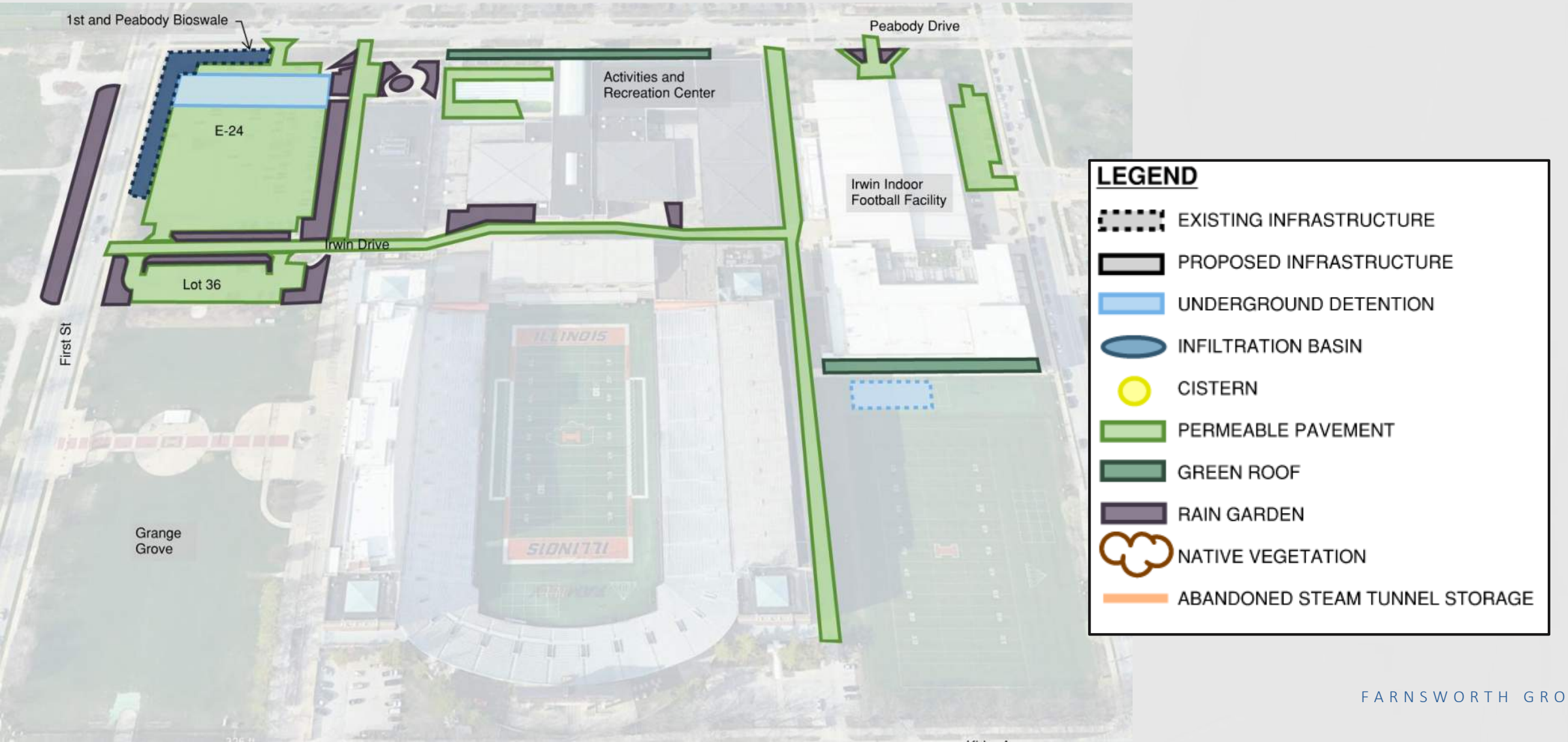
TOTAL STORAGE: 933,000 CF

Total area: 111 acres
Existing release rate: 223 cfs
Proposed release rate: 15 cfs

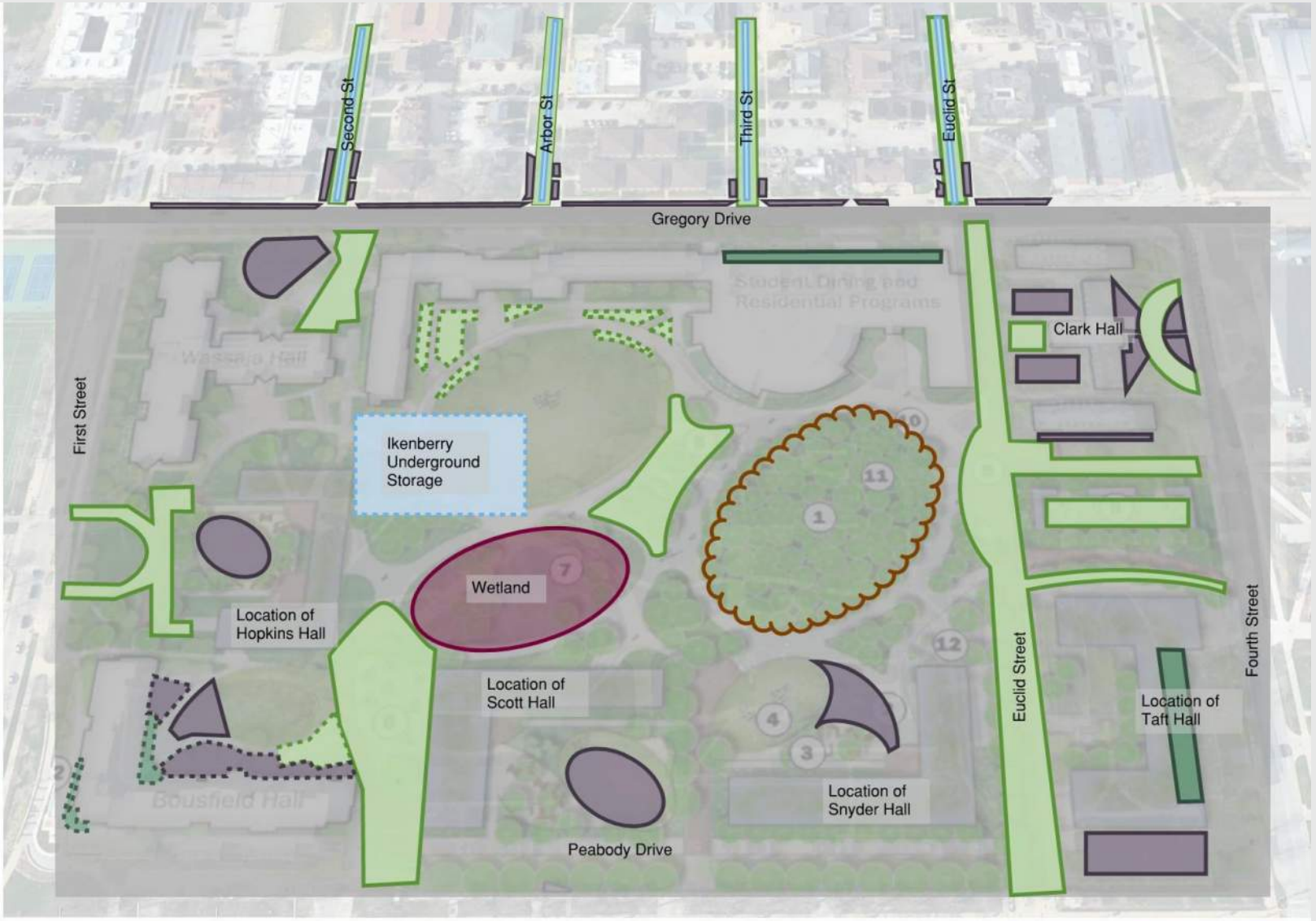
AREA 2: *Eastern*

RECOMMENDED IMPROVEMENTS

AREA 2: *Southern*



AREA 2: *Northern*



LEGEND

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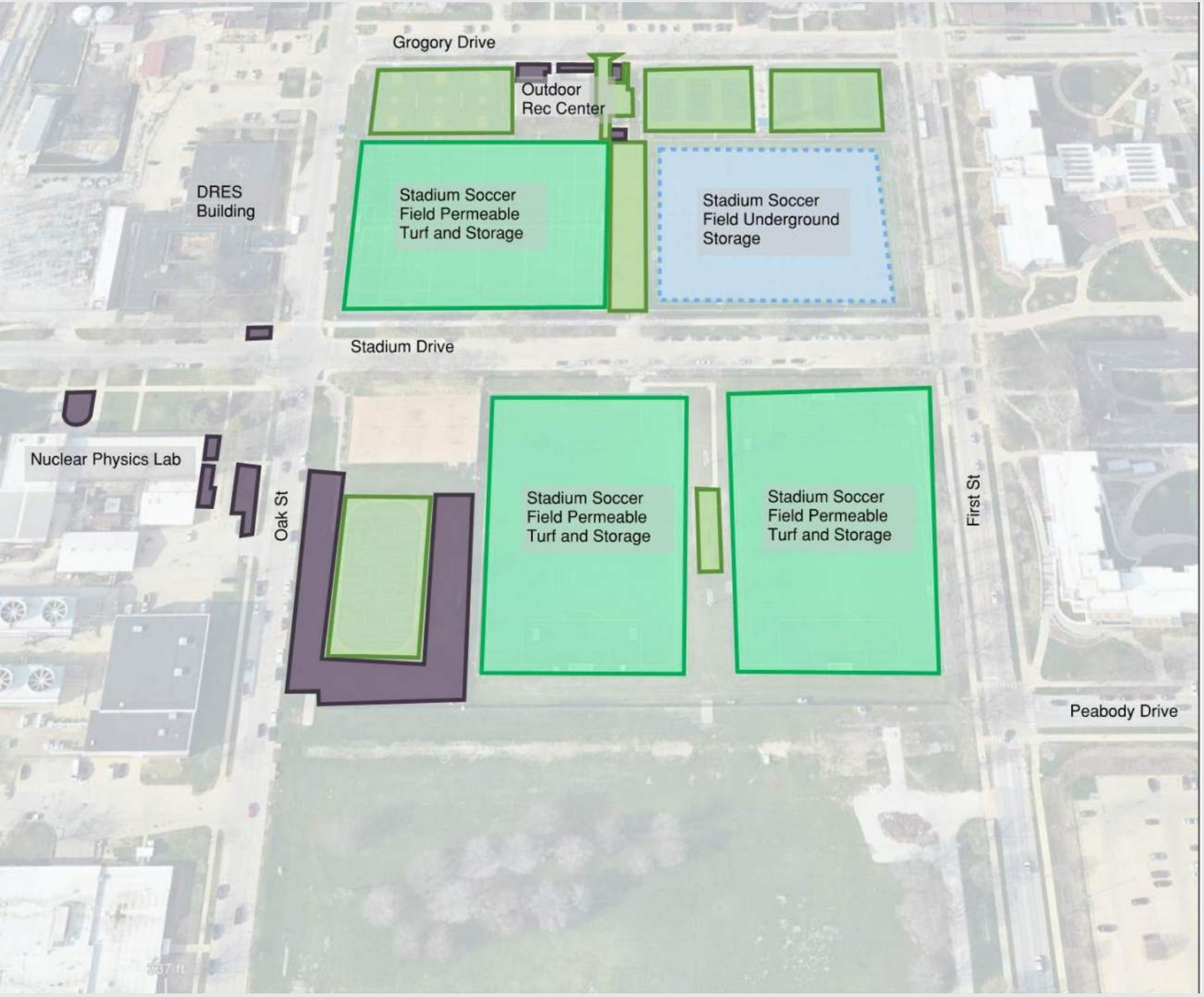
- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE



AREA 2:
Western

RECOMMENDED
IMPROVEMENTS

LEGEND

- EXISTING INFRASTRUCTURE
- PROPOSED INFRASTRUCTURE
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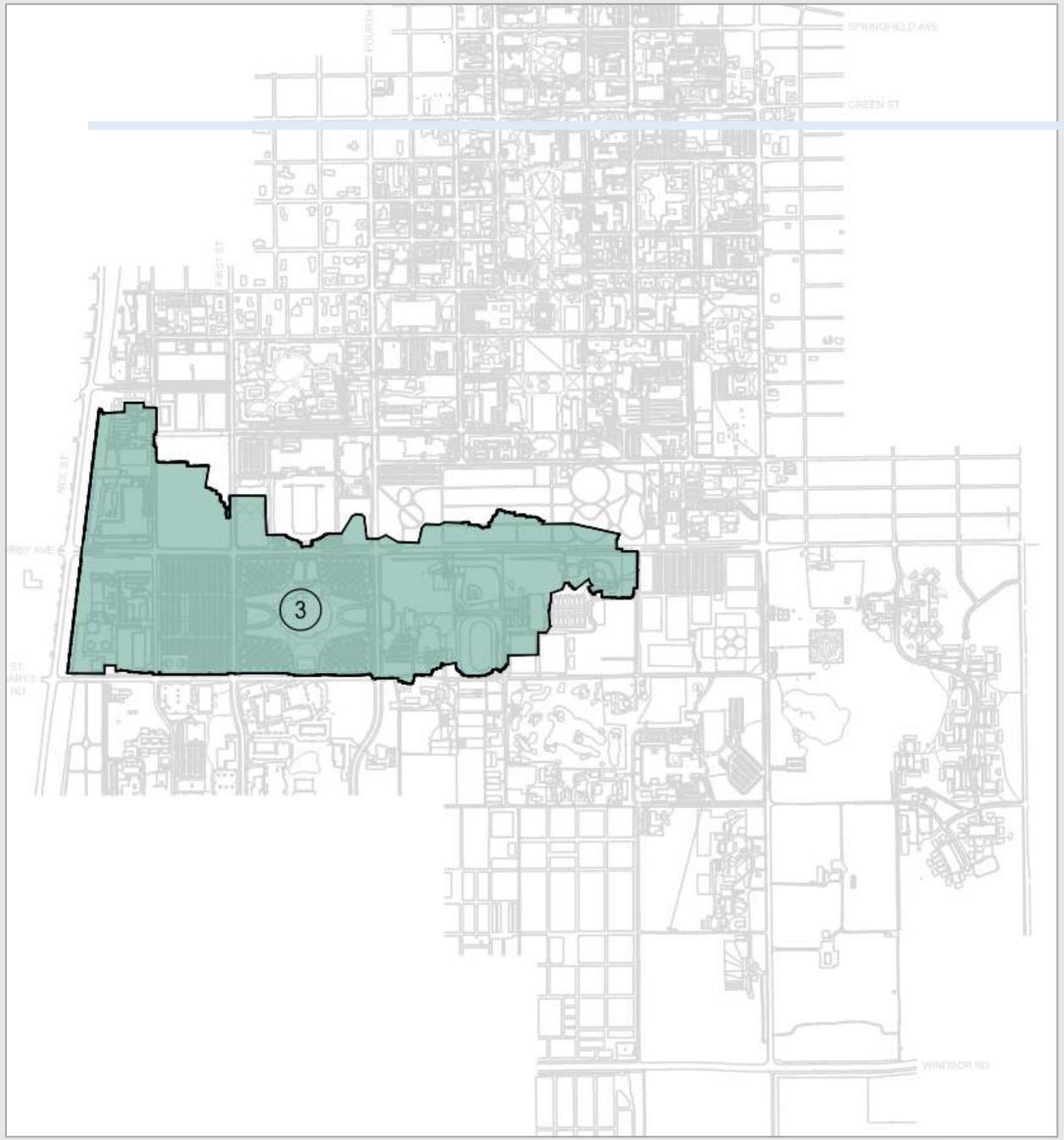
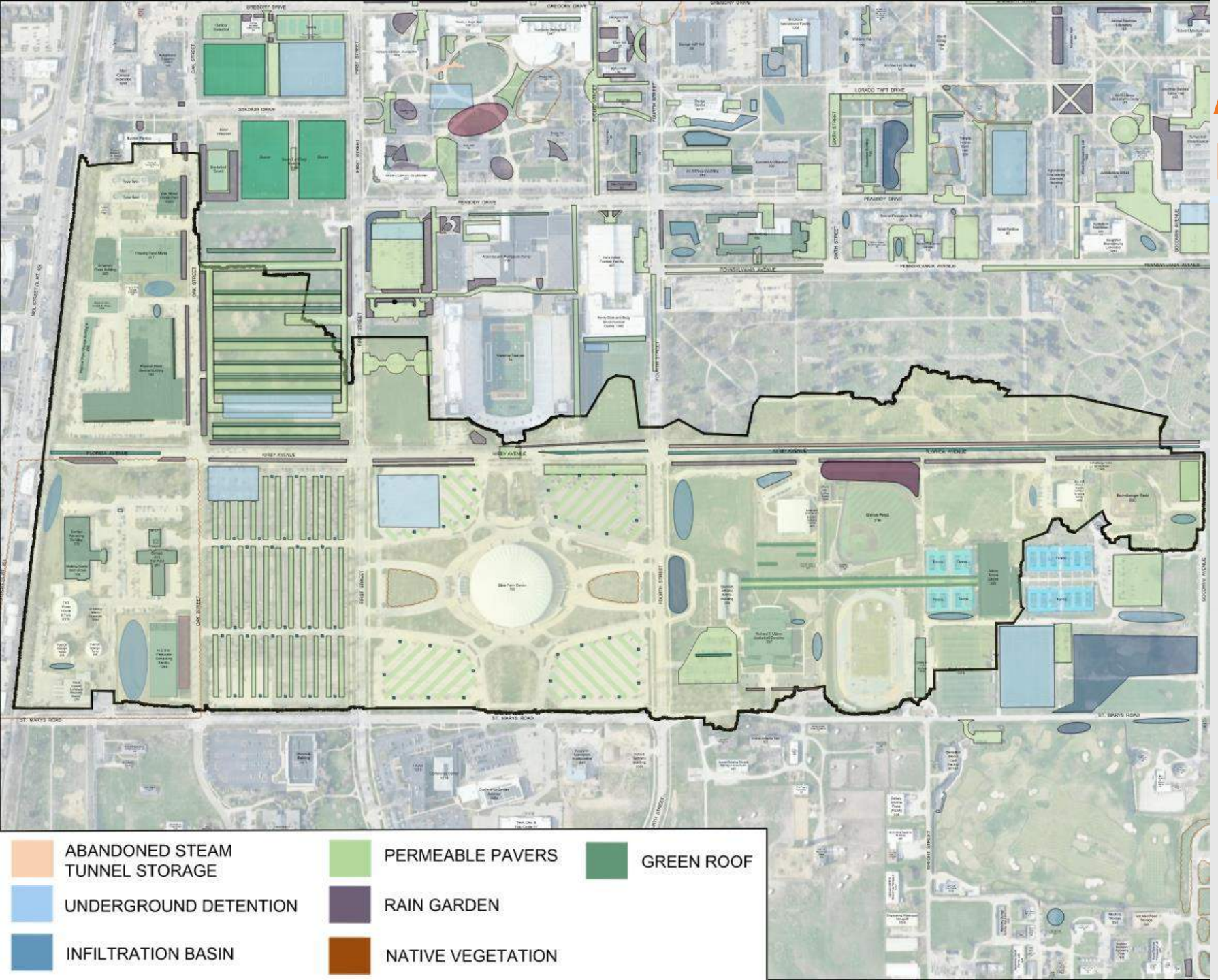
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE



AREA 3: Athletic District

PROPOSED GREEN INFRASTRUCTURE FACILITIES
TOTAL STORAGE: 2.09M CF



AREA 3: Athletic District

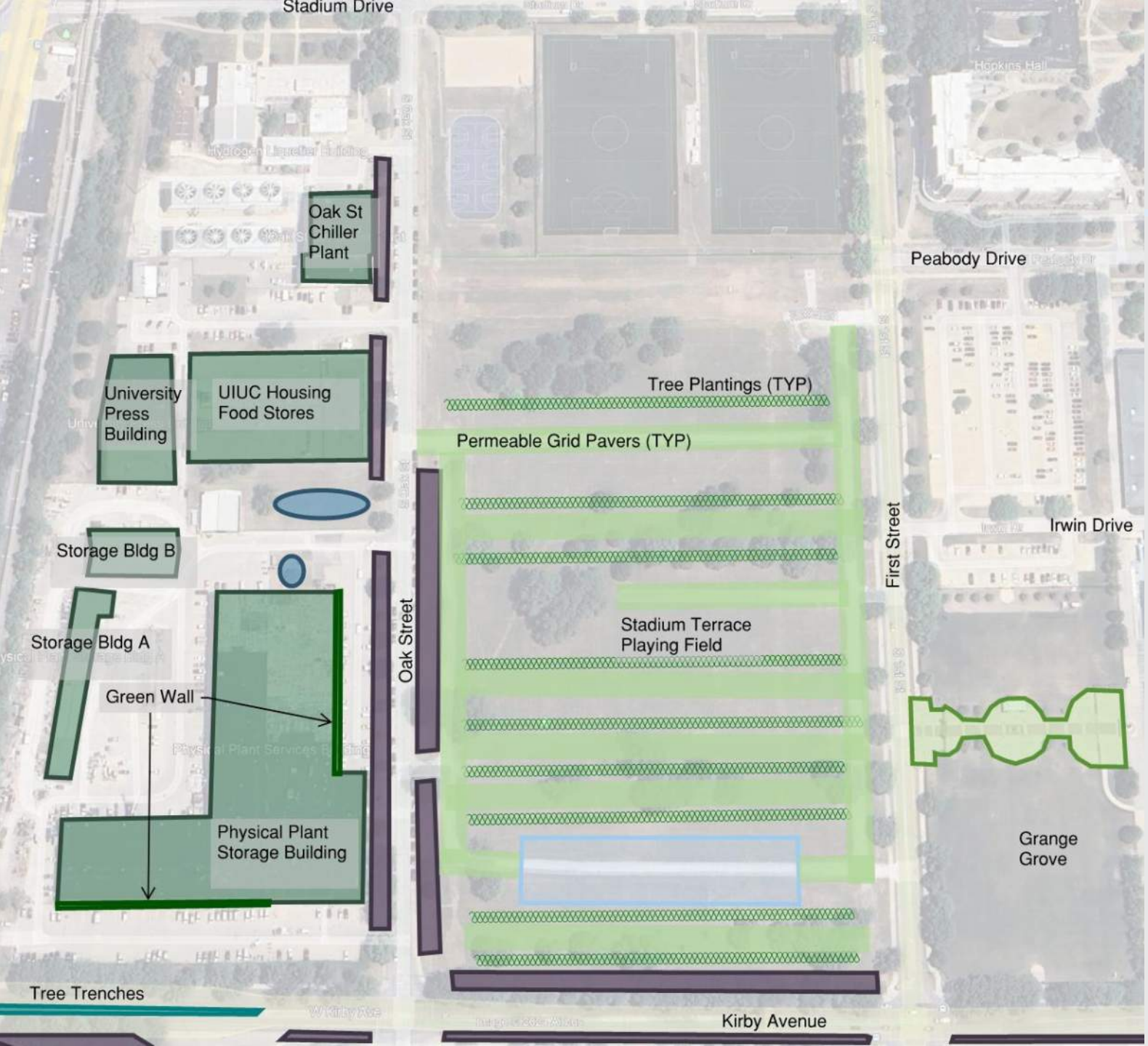
PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 2.09M CF

Total area: 208 acres
Existing release rate: 396 cfs
Proposed release rate: 33 cfs

AREA 3: *Northern*

RECOMMENDED IMPROVEMENTS



LEGEND

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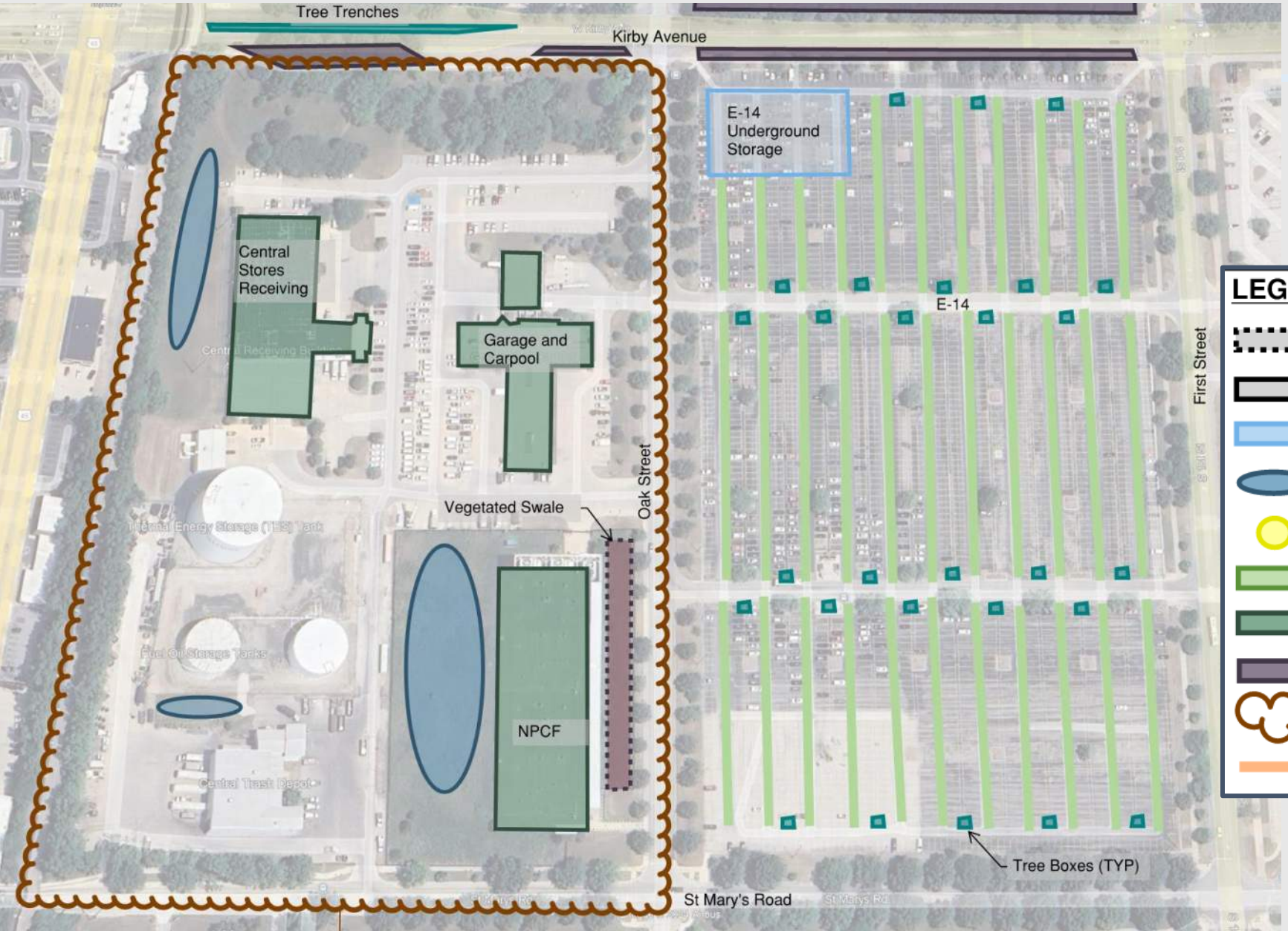
- CISTERN
- PERMEABLE PAVEMENT
- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

AREA 3: *Western*

RECOMMENDED IMPROVEMENTS



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- PROPOSED INFRASTRUCTURE
- UNDERGROUND DETENTION
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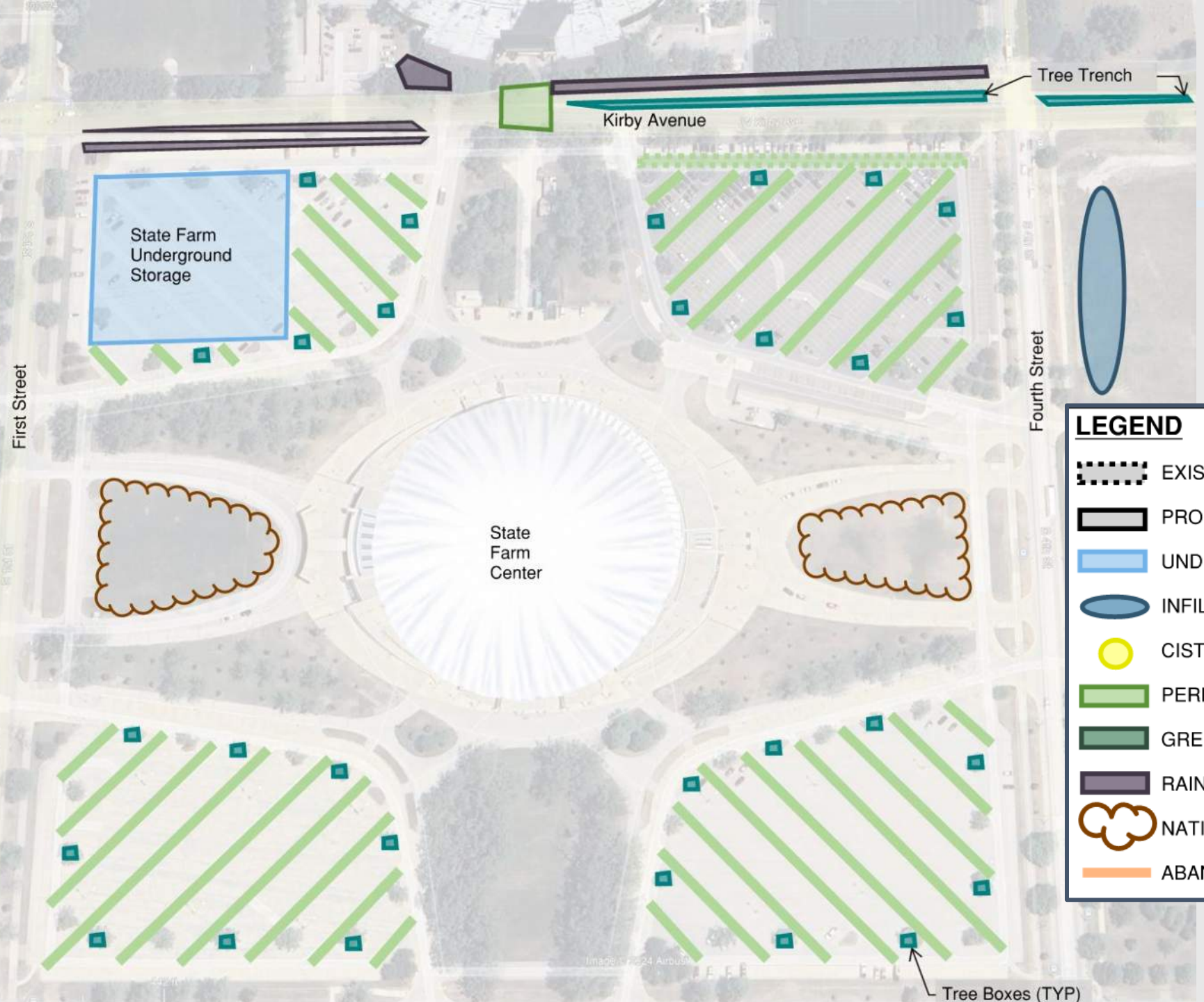
- PERMEABLE PAVEMENT
- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

AREA 3: *Central*

RECOMMENDED IMPROVEMENTS



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- INFILTRATION BASIN
- CISTERN
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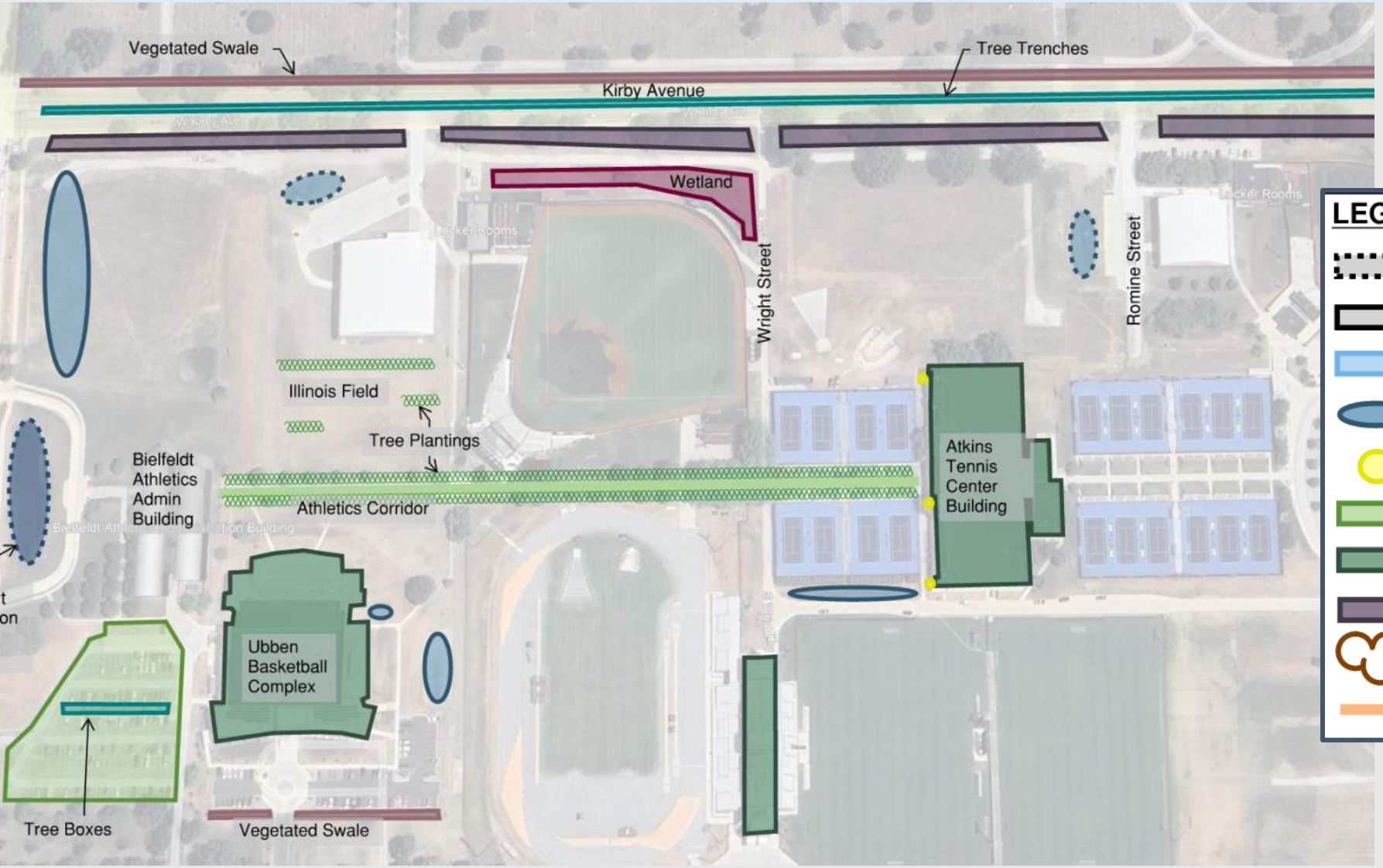
- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

AREA 3: *Eastern*



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- GREEN ROOF
- RAIN GARDEN
- NATIVE VEGETATION
- ABANDONED STEAM TUNNEL STORAGE

AREA 3: Athletic District

ARTFUL RAINWATER CONCEPTS

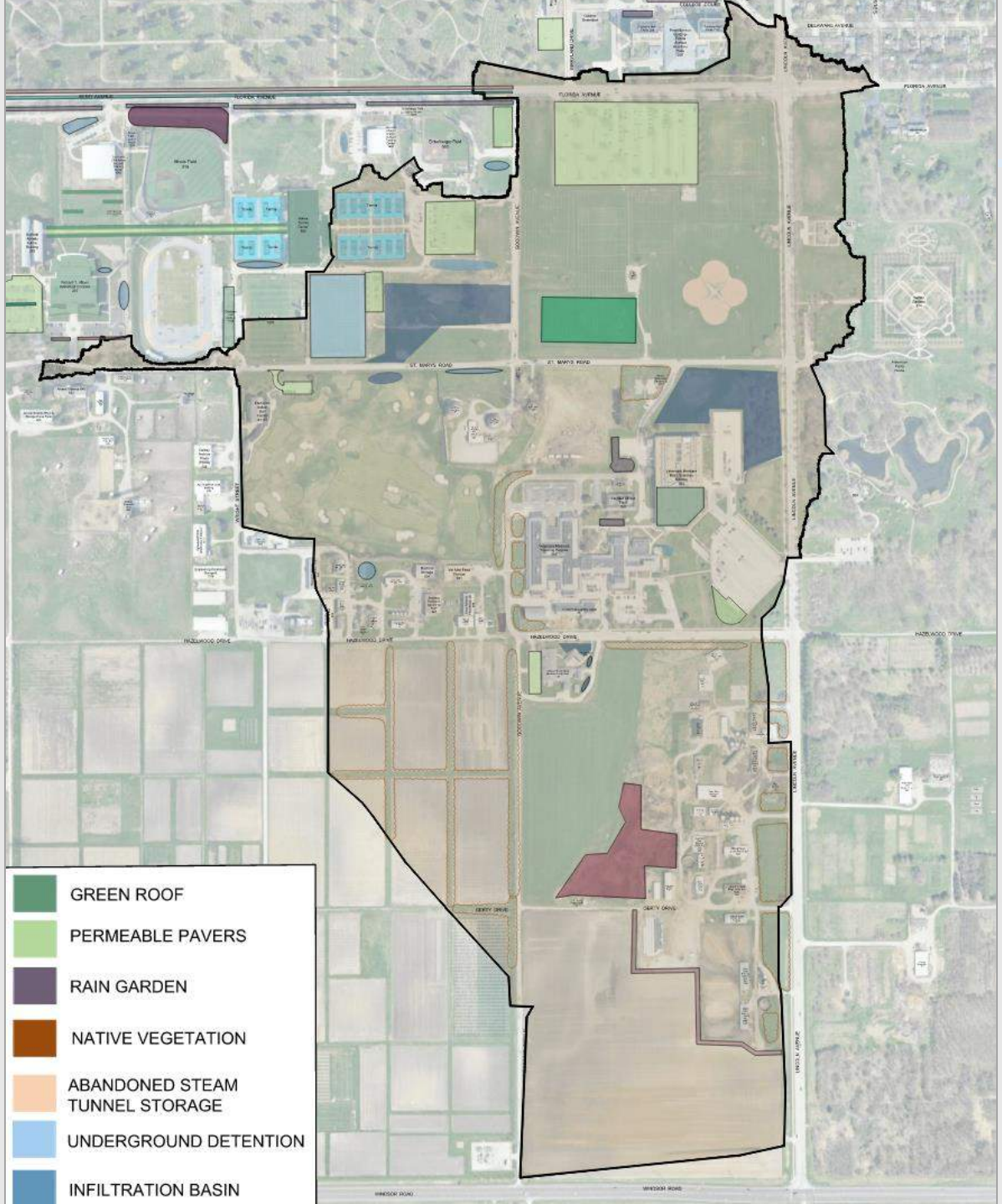

Lattice boxes for vining plants


Athletic Corridor permeable pavers, rain garden, trees


Crosswalk permeable pavers | Memorial Stadium, State Farm Center

AREA 4: Vet Med District

PROPOSED GREEN INFRASTRUCTURE FACILITIES
TOTAL STORAGE: 850,000 CF



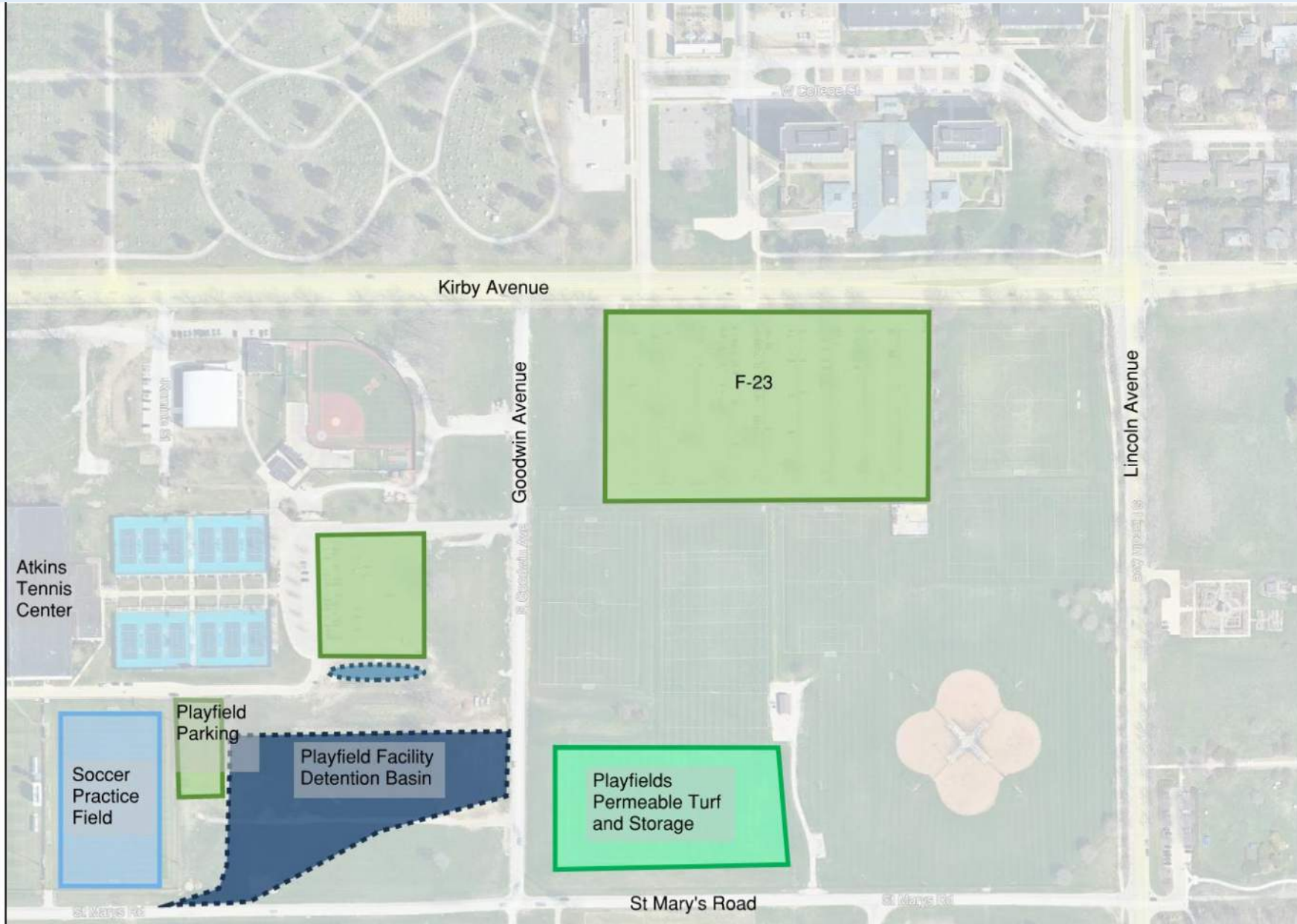
AREA 4: Vet Med District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

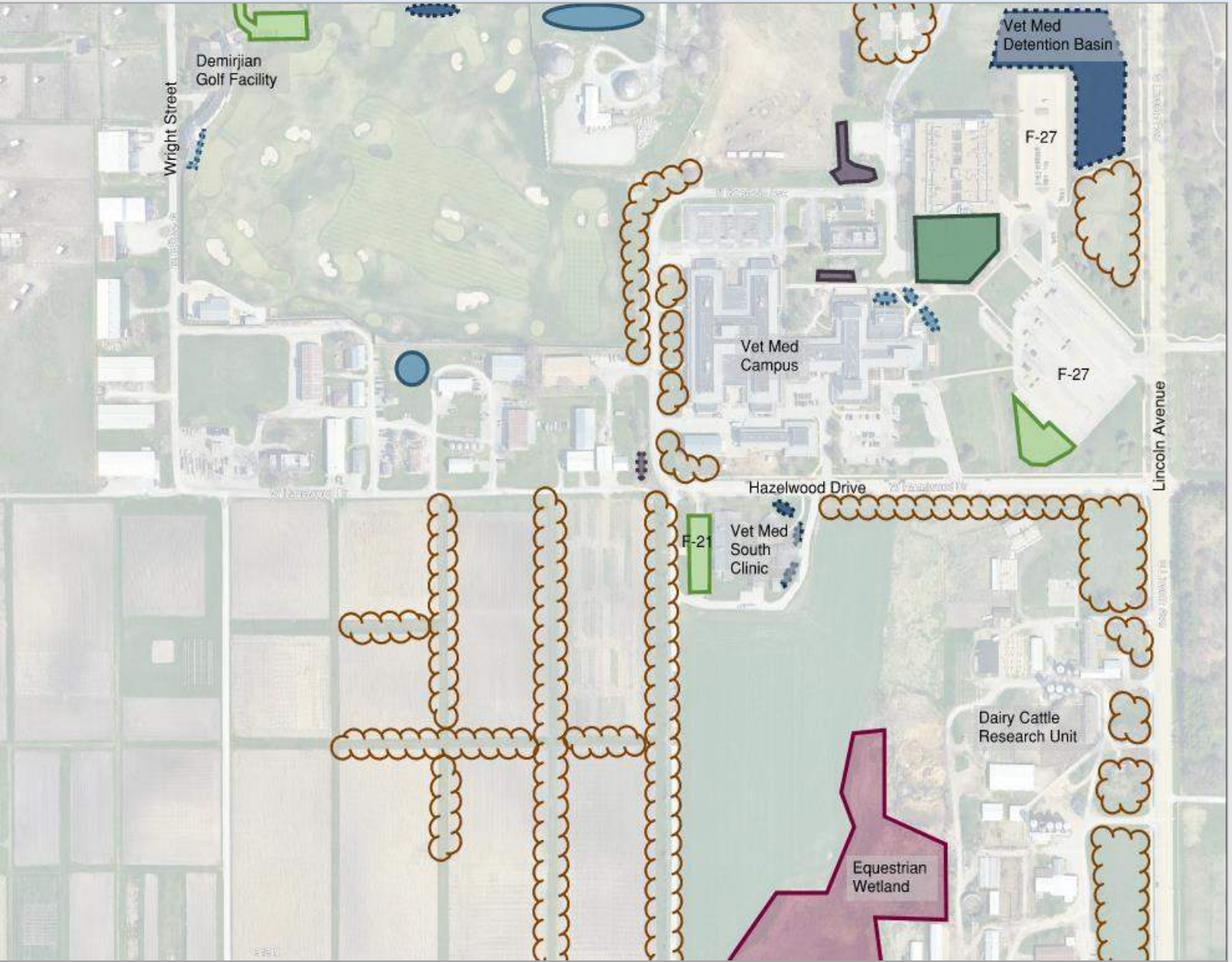
TOTAL STORAGE: 850,000 CF

Total area: 254 acres
Existing release rate: 55 cfs
Proposed release rate: 0 cfs

AREA 4: *Northern*



AREA 4: *Central*



LEGEND

- EXISTING INFRASTRUCTURE
- PROPOSED INFRASTRUCTURE
- UNDERGROUND DETENTION
- INFILTRATION BASIN
- CISTERN
- PERMEABLE PAVEMENT
- PERMEABLE TURF & STORAGE
- GREEN ROOF
- RAIN GARDEN
- WETLAND
- NATIVE VEGETATION

AREA 4: *Southern*

LEGEND

- EXISTING INFRASTRUCTURE
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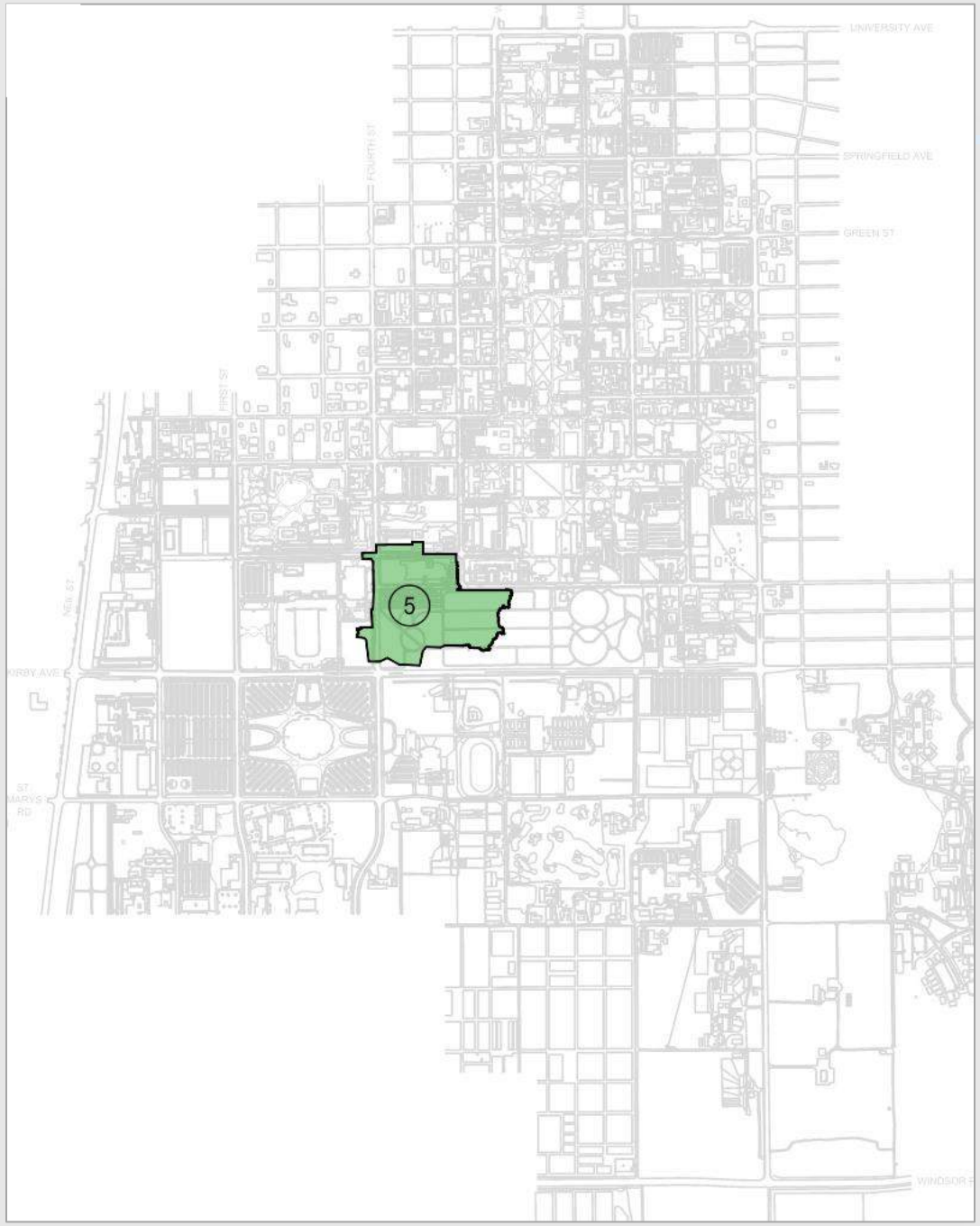


AREA 5: Law District

PROPOSED GREEN INFRASTRUCTURE FACILITIES
TOTAL STORAGE: 89,000 CF

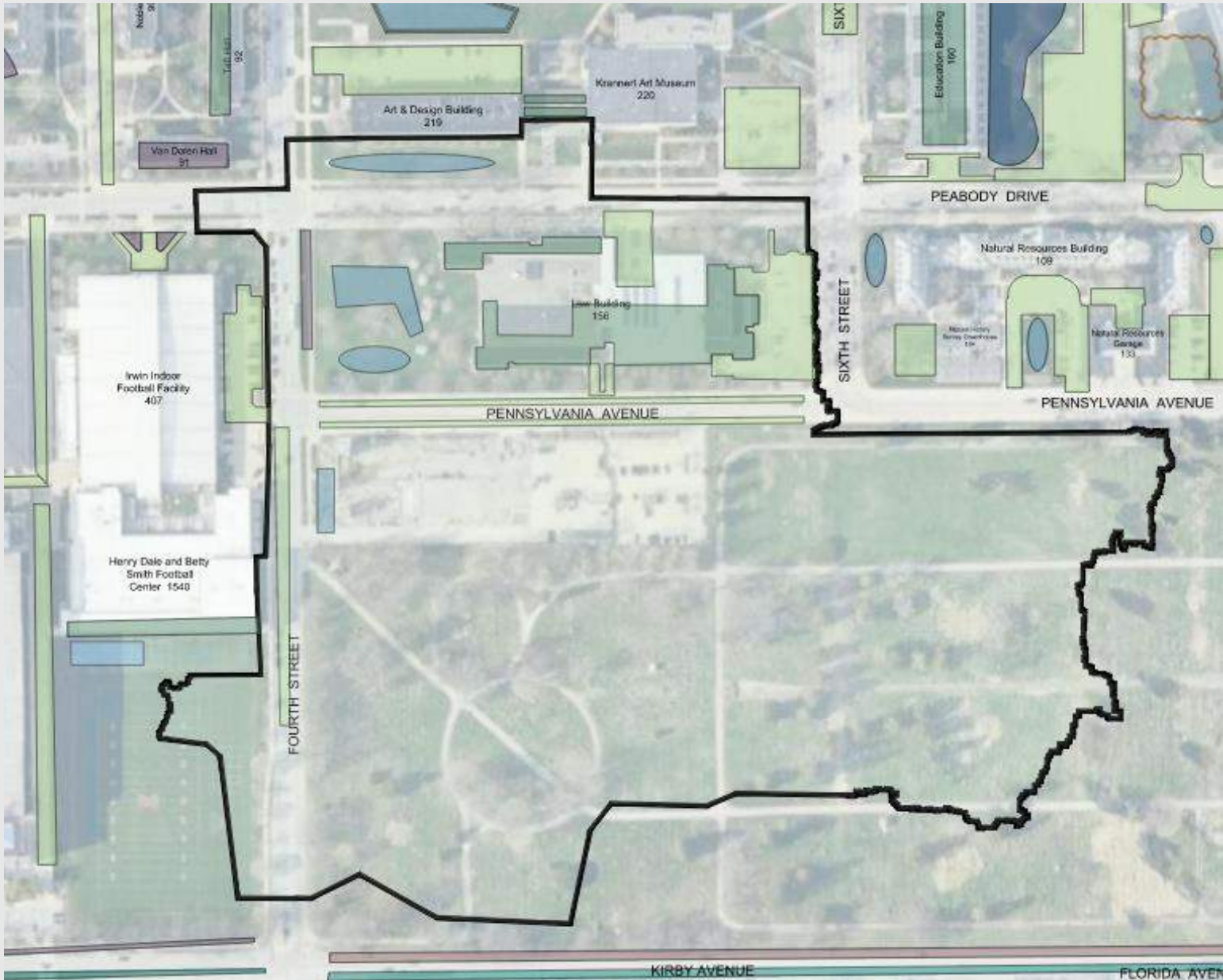
AREA 5: Law District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 89,000 CF

Total area*: 10 acres
Existing release rate: 52 cfs
Proposed release rate: 0 cfs

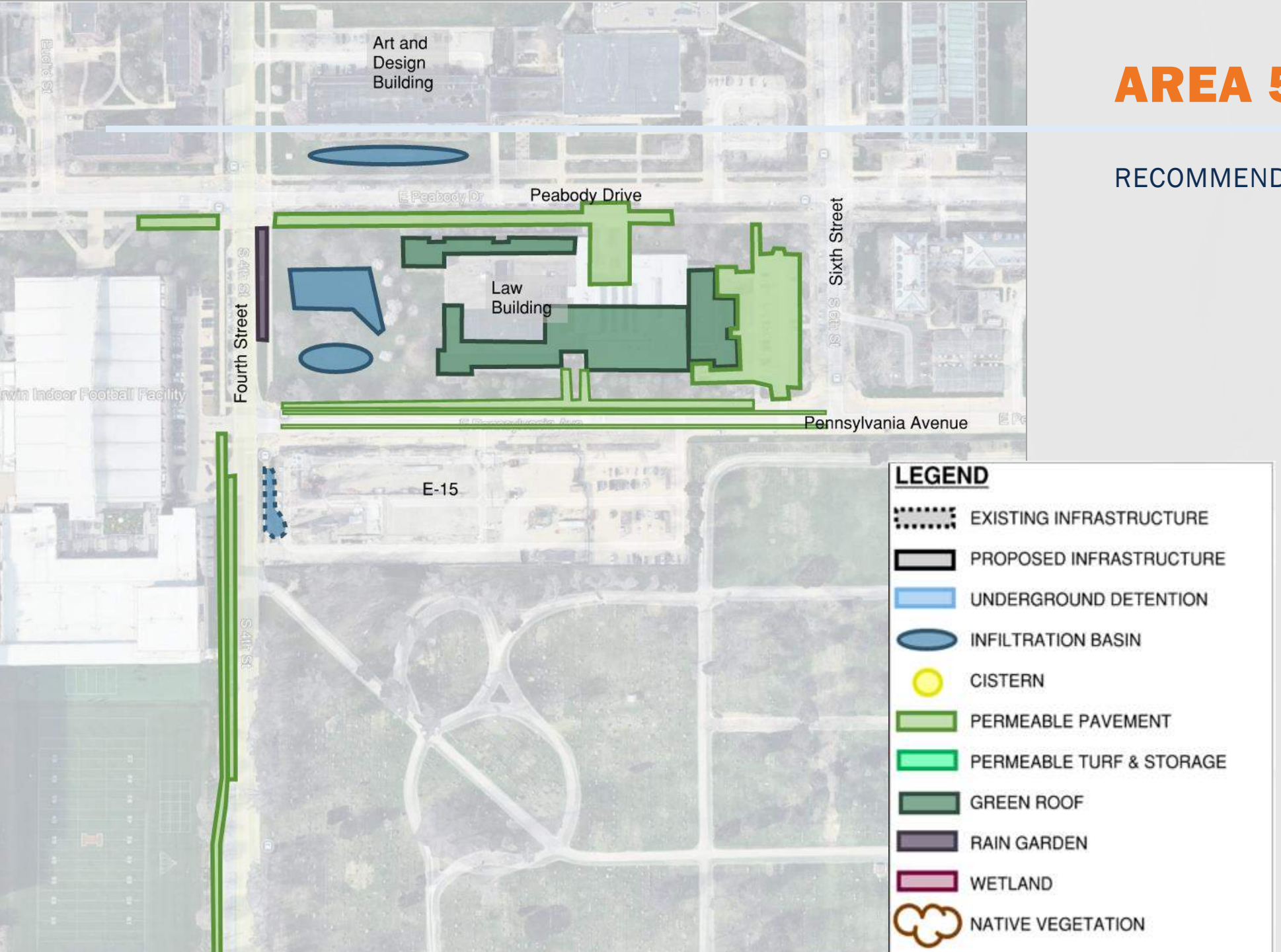
**University-owned area*

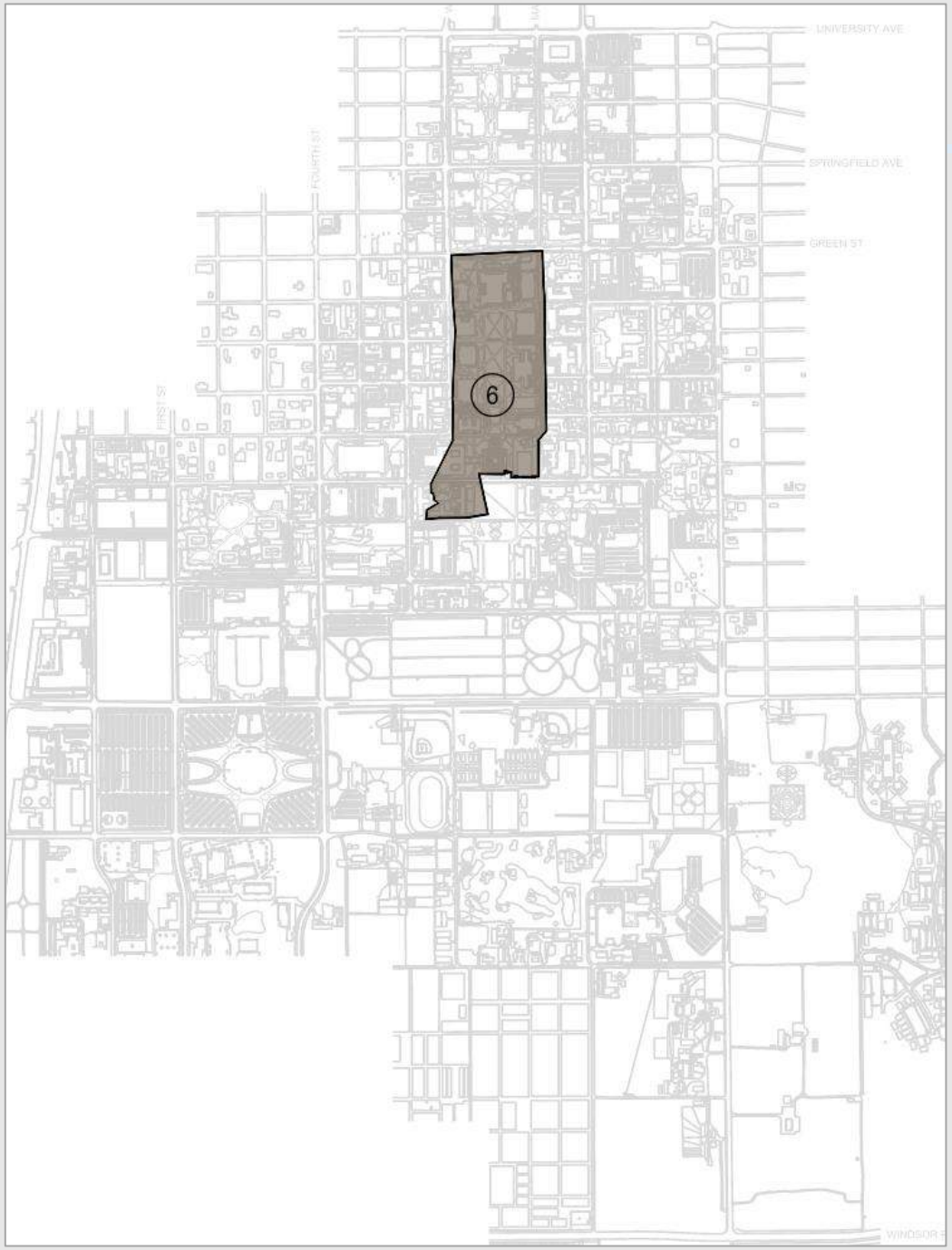


ABANDONED STEAM TUNNEL STORAGE	PERMEABLE PAVERS	GREEN ROOF
UNDERGROUND DETENTION	RAIN GARDEN	
INFILTRATION BASIN	NATIVE VEGETATION	

AREA 5: Law District

RECOMMENDED IMPROVEMENTS





AREA 6: Main Quad District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 169,000 CF

AREA 6: Main Quad District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

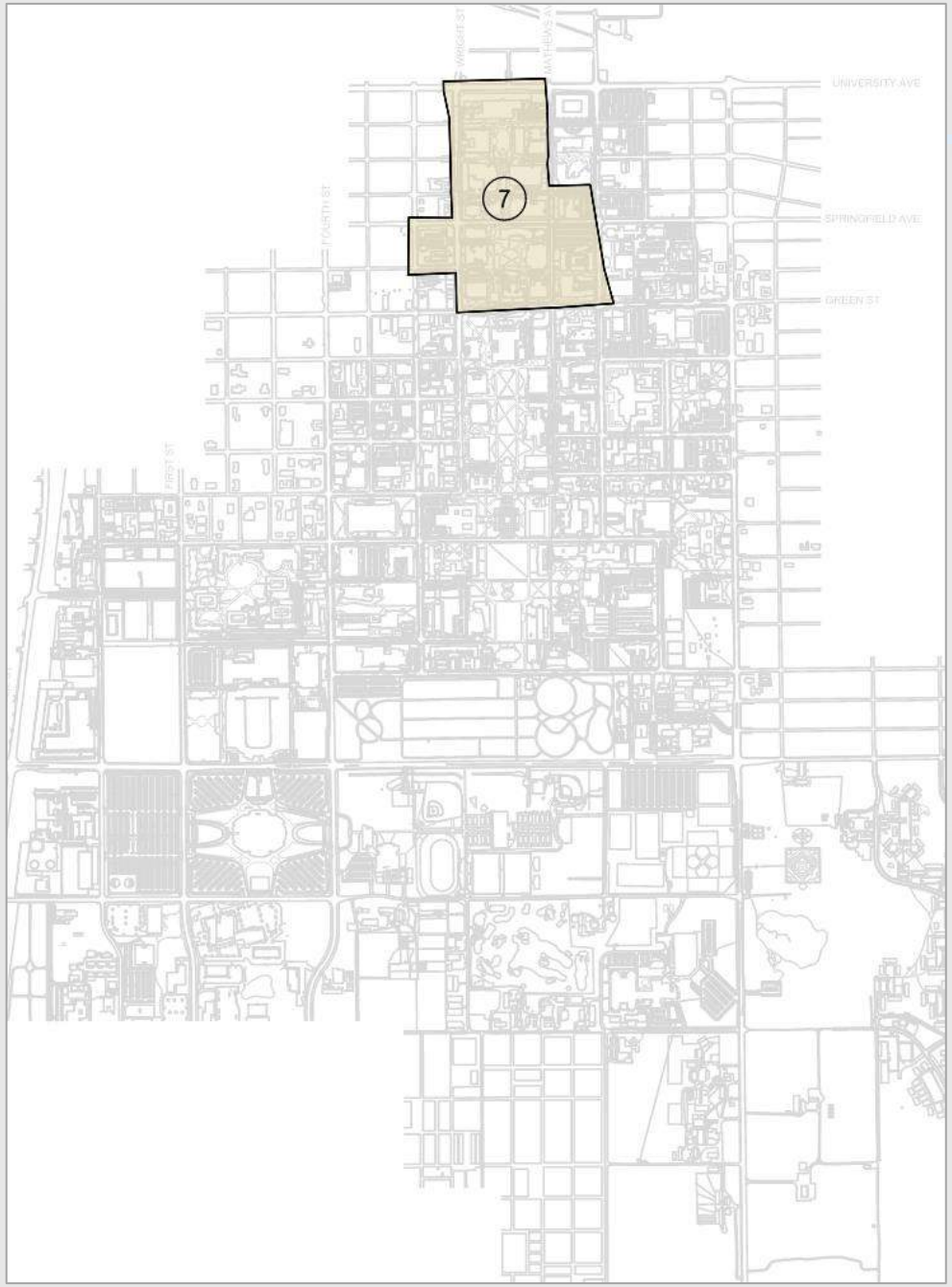
TOTAL STORAGE: 169,000 CF

Total area: 37.5 acres
Existing release rate: 18 cfs
Proposed release rate: 6.5 cfs

PROPOSED RECOMMENDATIONS

- Gathering space
- Green street
- Future building*
- Rainwater capture via cistern
- Downspout re-routing
- Soil restoration
- Bioretention/rain garden

(*ALL REFERENCES TO FUTURE BUILDINGS ARE PER THE 2017 CAMPUS MASTER PLAN)



AREA 7: Engineering Quad District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 8,000 CF

AREA 7: Engineering Quad District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

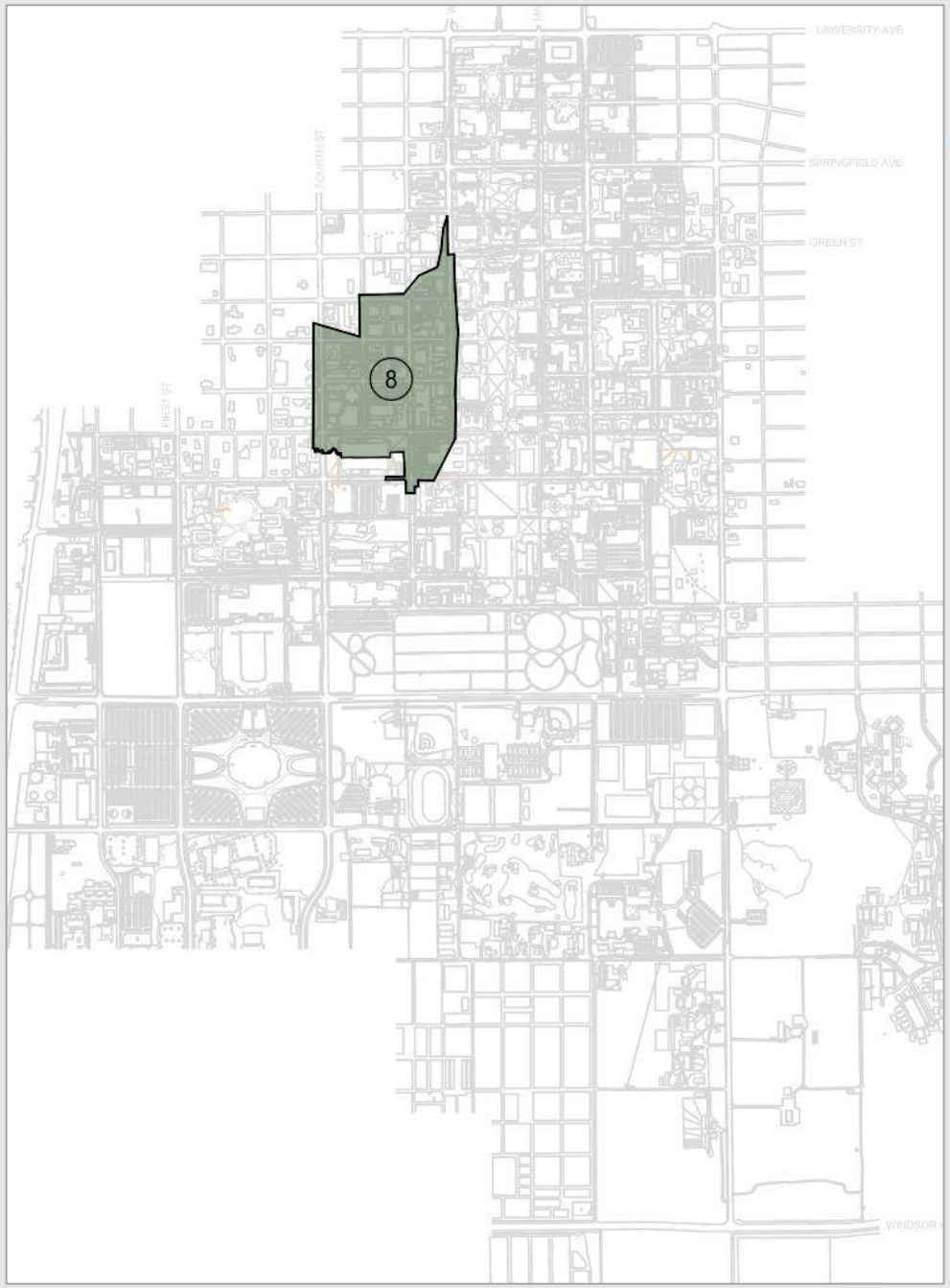
TOTAL STORAGE: 8,000 CF

Total area: 59 acres
Existing release rate: 30 cfs
Proposed release rate: 10.6 cfs

PROPOSED RECOMMENDATIONS

- Outdoor classroom
- Stream restoration
- Wetland creation
- Bioretention/rain garden
- Green street
- Future building*
- Gathering space
- Enhanced gateway

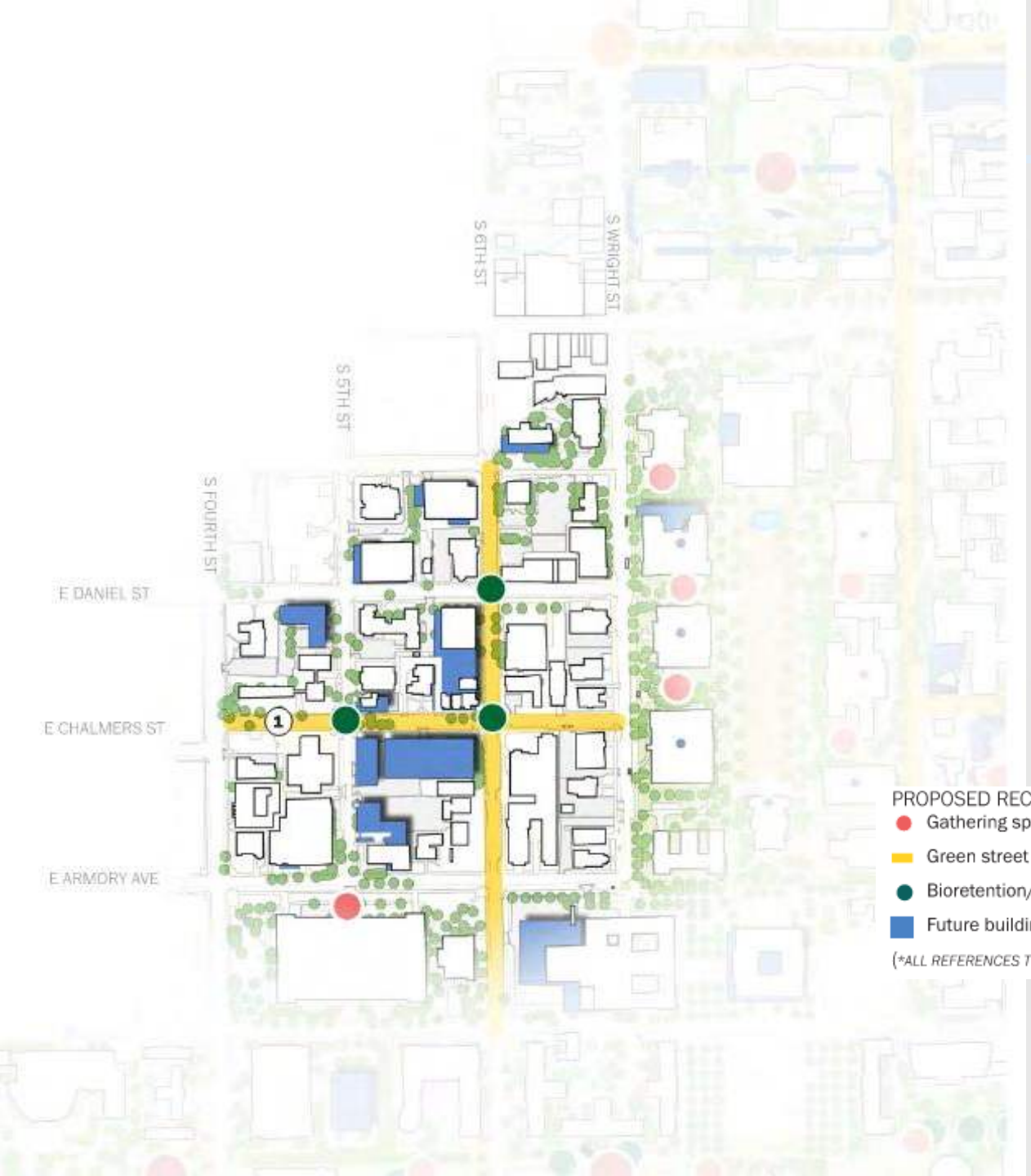
(*ALL REFERENCES TO FUTURE BUILDINGS ARE PER THE 2017 CAMPUS MASTER PLAN)



AREA 8: Urban Town and Gown District

PROPOSED GREEN INFRASTRUCTURE FACILITIES | **TOTAL STORAGE:** 9,600 CF

AREA 8: Urban Town and Gown District



PROPOSED GREEN INFRASTRUCTURE FACILITIES

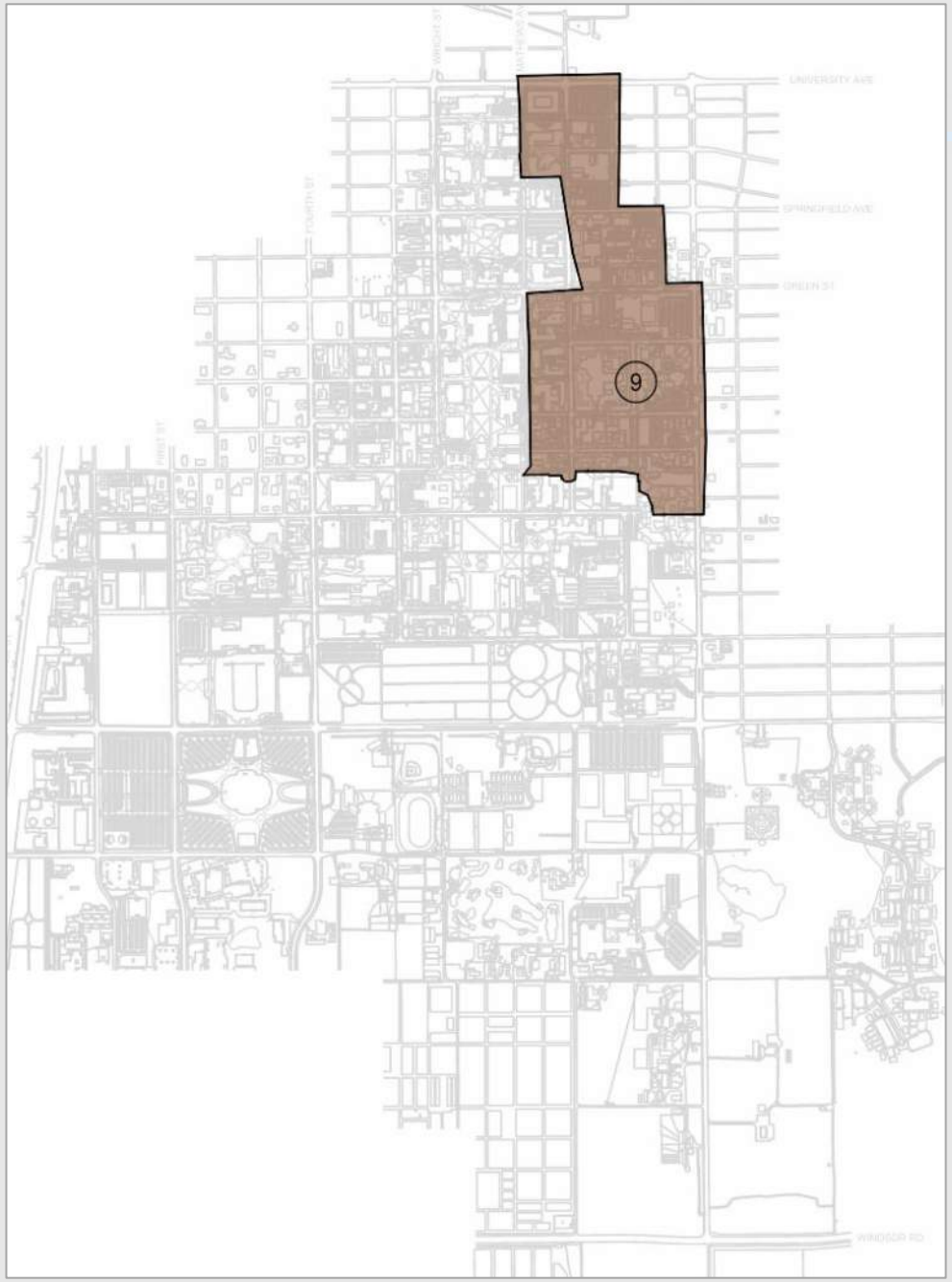
TOTAL STORAGE: 9,600 CF

Total area: 39 acres
Existing release rate: 21 cfs
Proposed release rate: 6.9 cfs

PROPOSED RECOMMENDATIONS

- Gathering space
- Green street
- Bioretention/rain garden
- Future building*

*(*ALL REFERENCES TO FUTURE BUILDINGS ARE PER THE 2017 CAMPUS MASTER PLAN)*



AREA 9: Urban Campus District

PROPOSED GREEN INFRASTRUCTURE FACILITIES | **TOTAL STORAGE**: 48,000 CF

AREA 9: Urban Campus District

PROPOSED GREEN INFRASTRUCTURE FACILITIES

TOTAL STORAGE: 48,000 CF

Total area: 176 acres
Existing release rate: 88 cfs
Proposed release rate: 31.6 cfs

PROPOSED RECOMMENDATIONS

- Outdoor classroom
- Stream restoration
- Wetland creation
- Impervious surface removal
- Bioretention/rain garden
- Green street
- Future building*
- Quad space
- Gathering space
- Enhanced gateway
- Eco-asset
- Eco-corridor
- Prairie planting

(*ALL REFERENCES TO FUTURE BUILDINGS ARE PER THE 2017 CAMPUS MASTER PLAN)

Compiling Plan

COMPILING THE PLAN

1. Visual representation of proposed recommendations
2. Updates to Rainwater Standards
3. Addresses funding mechanisms

IMPROVING Rainwater Standards

- Strengthens design criteria to limit runoff
- Provides guidance for green infrastructure design and maintenance
- Updates erosion control standards to protect water quality

FUNDING Green Infrastructure Projects

- Lists all recommended projects by area, range of cost, and volume of rainwater stored
- Enforces rainwater management in future campus development projects
- Provides grant and loan options for stand-alone projects

Conclusions

CONCLUSIONS

- Redefine stormwater as rainwater
- Provide knowledge to foster ownership of rainwater
- Recommend green infrastructure facilities to:
  - *Protect water quality*
  - *Improve flooding issues*
- Recommend varied facilities
- Address funding and marketing options
- **Deliver a plan to inspire, educate, and nurture an ecologically diverse campus**


ARTFUL RAINWATER


WETLANDS

THANK YOU!

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Farnsworth GROUP