



# A.I. Integration with Green Stormwater Infrastructure Intelligent Cultivation of Urban Ecosystems

December 1, 2023

FOR THE

#GATORGOOD

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# Green Stormwater Infrastructure



Lot & Street  
Level Runoff



Water Quality Volume

Bypass/Overflow

Treated Flow Through



Stormwater Collection System

Stormwater Pond Meets  
Flood Control  
Flow Rate

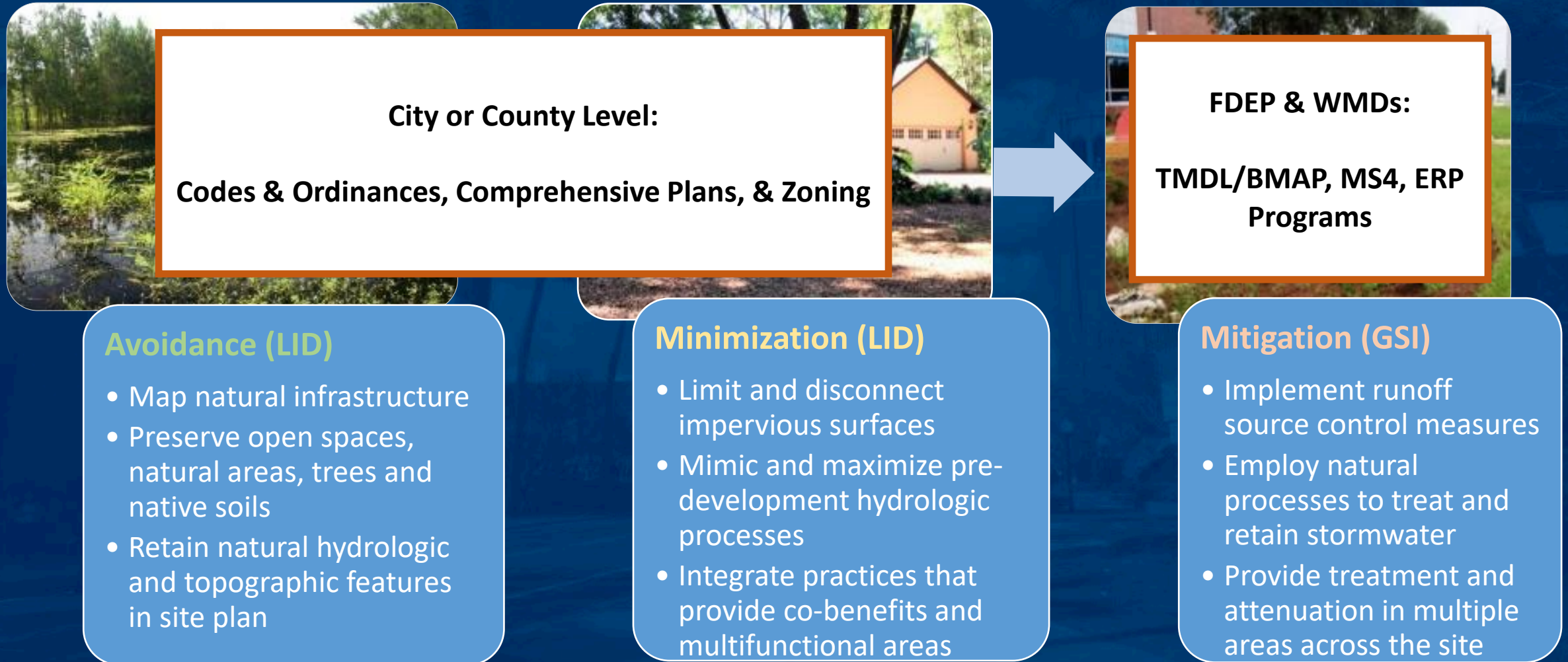


Overflow

Discharge



# LID vs. GSI: Development Process







## Curb & Gutter Requirements

- Directly Connected Impervious Area
- Indirectly Prohibits Swales



# Minimum Parking Requirements

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- Commercial and residential codes
- Directly/indirectly increases impervious parking areas
- Seldomly used spaces
- Pervious parking

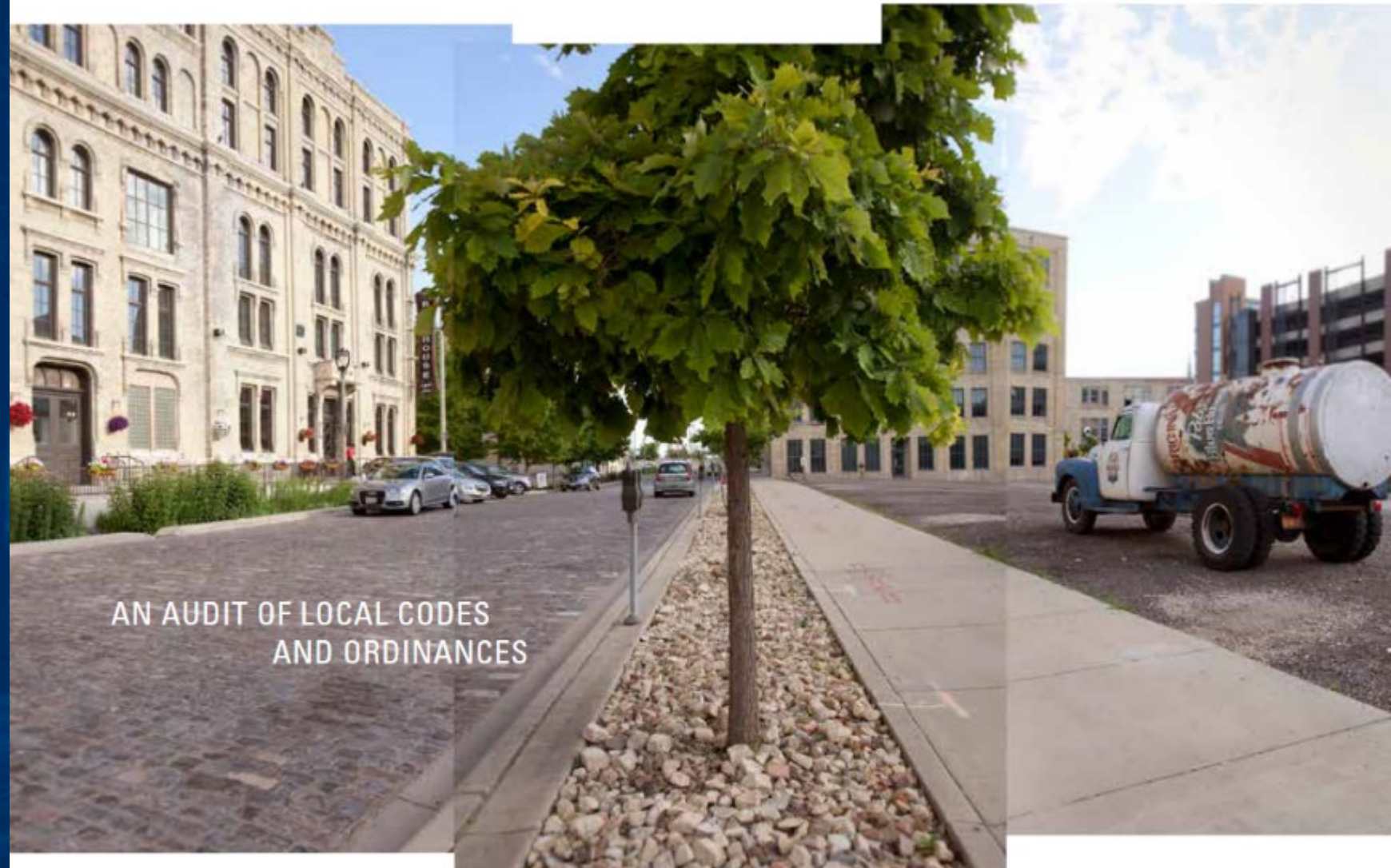




# Code Audit

- Work WITH Communities
- Identify explicit and implicit barriers
- Comp Plan, LDC, Zoning
- Trade PRESCRIPTIVE for DESCRIPTIVE
- Playing the cards we're dealt...

## TACKLING BARRIERS TO Green Infrastructure



AN AUDIT OF LOCAL CODES  
AND ORDINANCES

# Code Audit Tools

## Enabling Low Impact Development and Green Stormwater Infrastructure

A CODE AUDIT TOOL FOR FLORIDA COUNTIES AND MUNICIPALITIES

Points	Criteria	Example Code Requirement
4	Required	The practices are specifically required by the code for appropriate situations.
3	Incentivized	The practice is incentivized, either monetarily or through accelerated review or other benefits, but not required and no penalties if the practice is not used.
2	Encouraged/ Allowed	The practice is allowed or encouraged within the code, but no incentives are available.
1	Silent	The practice is not mentioned in the code.
0	Prohibited	The practice is restricted or prohibited in code.

### Administrative

- About
- Definitions
- Codes Review Log
- Contact Information
- Scoring Instructions
- Score Summary

### Local Government Planning and Policy

- Comprehensive Plan
- Zoning

### Protecting Nature

- Natural Resources Protection and Management
- Coastal Areas
- Trees
- Sensitive Groundwater Areas

### Stormwater and Water Quality

- Stormwater Management
- Pollutant Reduction

### The Built Environment

- Site Plan Review
- Buildings & Landscape
- Streets
- Parking
- Permeable
- Construction
- Subdivisions & Greenfield
- Education and Demonstration

# Code Audit: Scoring Examples

C3. Does code encourage infill and compact development to minimize urban sprawl and minimize land consumption?			
Tips	Code References	Notes, Ideas and Strategies	Score
<p>Purpose: Encourage LID+GSI</p> <p>Infill development adds growth to areas already served by city infrastructure rather than "greenfield" perimeter growth. Compact development can achieve the same or higher levels of economic and social activity with less land consumption. However, it is important to incorporate vegetated undeveloped areas in the overall plan and not allow infill to increase the site's overall imperviousness. The ultimate goal is to retain undeveloped land in its natural state.</p>	<p><b>Chapter 407</b> general development standards and <b>Chapter 403</b> zoning districts</p> <p><b>ULDC 400.02(12)-(13): Allows</b> for Clustering and flexible design options; <b>bonuses for clustering</b> where consistent with the Comp Plan</p> <p><b>Sec 406.03</b> "Applicants are encouraged to use conservation design techniques such as clustering and density transfer to produce marketable projects while protecting natural and historic resources." (c) <b>Eligibility for cluster bonus.</b> A parcel may be eligible to receive cluster bonus units for rural/agriculture clustered subdivisions under Table 407.78.2 where there are areas determined through ground-truthing to be non-conservation areas that are suitable for development to which density may be transferred, and protection of regulated natural and historic resources is provided in accordance with an approved management plan that identifies measures taken to conserve, maintain, and enhance ecological integrity and resource value while avoiding or minimizing adverse impact.</p>	<p>Yes through certain zoning districts, subdivision regulations, Traditional neighborhood and Transit Oriented development and other means. <b>Cluster bonus (incentive) via transfer of development rights and protection of valuable areas.</b></p>	3
M7. Is shared parking allowed for multiple businesses or sites with different peak usage times?			
Tips	Code References	Notes, Ideas and Strategies	Score
<p>Purpose: Reduce number of onsite parking spaces</p> <p>Facilities in close proximity to each other with different peak usage times, e.g., stores, restaurants, churches, and recreation areas, are good candidates to share parking. Physical access may be needed at multiple locations, and a legal agreement is necessary. Maintenance responsibilities must be addressed.</p>	<p><b>Article 40 chapter 407</b></p> <p><b>Sec. 407.18.</b> - Parking reductions or increases.</p> <p><b>Sec. 407.68.</b> - Transit supportive area design standards. (2)Parking spaces <b>may be</b> pooled and utilized anywhere within the development.</p>	<p>Code does not specifically address "Peak usage times" but it does consider shared parking as a means of sufficient documentation for a decrease in off street parking spaces. <b>Code allows for shared parking but does not encourage or incentivize</b></p>	2



# Code Audit: Summarization

Section Topic	Section	Total Points	Potential Points	Percentage of points credited	
				Section	Topic
Local Government Planning and Policy	Comprehensive Plan	0	104	0%	
Local Government Planning and Policy	Zoning	0	20	0%	
	Average for Local Government Planning and Policy	0	124		0%
Protecting Nature	Natural Resources Protection Management	0	36	0%	
Protecting Nature	Coastal Areas	0	24	0%	
Protecting Nature	Trees	0	28	0%	
Protecting Nature	Sensitive Groundwater	0	16	0%	
	Average for Protecting Nature	0	104		0%
Stormwater and Water Quality	Stormwater Management	0	68	0%	
Stormwater and Water Quality	Pollutant Reduction	0	28	0%	
	Average for Stormwater and Water Quality	0	96		0%
The Built Environment	Site Plan Review	0	24	0%	
The Built Environment	Building & Landscape	0	84	0%	
The Built Environment	Streets	0	60	0%	
The Built Environment	Parking	0	60	0%	
The Built Environment	Permeable Hardscape	0	28	0%	
The Built Environment	Construction	0	28	0%	
The Built Environment	Subdivisions & Greenfield	0	28	0%	
The Built Environment	Education & Demonstration	0	40	0%	
	Average for The Built Environment	0	284		0%
Average for full audit		0	608		0%

# Code Audit Process: Conducting Audit

## Adapt the CAST

- *Full audit, section of audit, or individual topics*
- *Gather applicable codes and ordinances*

## Perform the Code Audit

- *Work through questions, finding & referencing code locations*
- *Record comments and score questions*
- *Seek input from liaisons*

## Summarize Results

- *Calculate and compare scores by category or topic*
- *Identify relative strengths & weaknesses of sections*
- *Report findings*





## Current Efforts

- Code Audit Tools
  - Identifies opportunities, gaps, or problem areas
- Pilots
  - Alachua County
  - City of Cocoa
  - Brevard County
- Phase II underway
  - Example code language to address audit results
  - Exploring incorporation of AI

VERSION: [NOV 8, 2023 \(CURRENT\)](#)[Chapter 29 - LOBBYIST REGISTRATION ACT](#)[Chapter 30 - LAND DEVELOPMENT CODE](#)[ARTICLE I. - GENERALLY](#)[ARTICLE II. - DEFINITIONS](#)[ARTICLE III. - HOW-TO GUIDE](#)[ARTICLE IV. - ZONING](#)[ARTICLE V. - USE STANDARDS](#)[ARTICLE VI. - DEVELOPMENT STANDARDS](#)[ARTICLE VII. - PARKING AND LOADING](#)[ARTICLE VIII. - PROTECTION OF  
RESOURCES](#)[ARTICLE IX. - SIGNS](#)[ARTICLE X. - NONCONFORMITIES AND  
VESTED RIGHTS](#)[APPENDIX A - SCHEDULE OF FEES, RATES  
AND CHARGES](#)[CODE COMPARATIVE TABLE - 1960 CODE](#)[< Sec. 29-5. - Penalties.](#)

## Chapter 30 - LAND DEVELOPMENT CODE

### ARTICLE I. - GENERALLY

#### DIVISION 1. - GENERALLY

[Sec. 30-1.1. - Short title.](#)[Sec. 30-1.2. - Scope.](#)[Sec. 30-1.3. - Purpose.](#)[Sec. 30-1.4. - Objectives.](#)[Sec. 30-1.5. - Rules for construction of language.](#)[Sec. 30-1.6. - Engineering Design and Construction Manual.](#)

#### DIVISION 2. - ENFORCEMENT

[Sec. 30-1.7. - Generally.](#)[Sec. 30-1.8. - Compliance with chapter.](#)[Sec. 30-1.9. - Violations and penalties.](#)

### ARTICLE II. - DEFINITIONS

[Sec. 30-2.1. - Definitions.](#)

### ARTICLE III. - HOW-TO GUIDE

#### DIVISION 1. - REVIEWING AUTHORITIES

[Sec. 30-3.1. - Development review director.](#)[Sec. 30-3.2. - Reserved.](#)[Sec. 30-3.3. - City plan board.](#)[Sec. 30-3.4. - Development review board.](#)[APPENDIX A - SCHEDULE OF FEES, RATES AND CHARGES](#)[Link](#) [Print](#) [Word](#) [Email](#)



**ARTICLE VIII. PROTECTION OF RESOURCES****DIVISION 1. GENERALLY****Sec. 30-8.1. Purpose.**

- A. *Purpose.* This article is established for the purpose of protecting the immediate and long-term public health, safety and general welfare by preserving, enhancing, conserving or restoring the natural environment and cultural resources. The intent with respect to the urban forest is to establish and maintain a sustainable tree canopy in which the healthiest and strongest existing trees are preserved during development, and new high quality shade trees are planted. Development and other activities within the city shall be in accordance with this purpose.
- B. *Objectives.* The provisions of this article are intended:
1. To conserve energy through the cooling and shading effects of trees;
  2. To conserve water through the preservation of existing natural vegetation, the use of xeriscape techniques, and other water-conserving irrigation and landscape practices;
  3. To mitigate nuisances such as noise, glare, heat, air pollution and stormwater runoff;
  4. To preserve, enhance or restore the natural environment through the protection and establishment of native vegetation and existing natural systems for the enjoyment of present and future populations;
  5. To promote a linked open space system throughout the city and county;
  6. To preserve, enhance or restore the unique aesthetic character of the community;
  7. To mitigate, through buffering, potentially adverse impacts between land uses of differing type and intensity, and to ensure sufficient landscaping within areas designated for multiple-family uses and mixed uses;
  8. To assist in controlling vehicular and pedestrian movement to and within developed sites by:
    - a. Clearly delineating the boundaries of vehicular use areas, in such a manner that movement, noise and glare do not adversely impact activity in adjoining areas;
    - b. Establishing the points of ingress and egress so as to eliminate confusion and to control physical access to the site;
    - c. Establishing the direction of internal vehicular and pedestrian circulation;
  9. To prevent personal injury, loss of life and excessive property damage due to flooding;
  10. To prevent the installation of structures which reduce the flood channel capacity and increase flood heights, the installation of which may cause excessive property damage;
  11. To reduce public expenditures for emergency operations, evacuations and restorations;
  12. To prevent damage to industries, transportation and utility systems;

**ARTICLE I. GENERALLY****DIVISION 1. GENERALLY****Sec. 30-1.1. Short title.**

This chapter shall be known and may be cited as the "City of Gainesville Land Development Code."

**Sec. 30-1.2. Scope.**

The provisions of this chapter apply within the entire corporate area of the city to the use of all lands within such area by any person, corporation, other entity or public agency, including the city itself. Property outside the corporate city limits, but adjacent to the city limits, shall be provided protection from the impacts of development in the city as if it were in the city.

**Sec. 30-1.3. Purpose.**

This chapter implements the City of Gainesville Comprehensive Plan (Comprehensive Plan) to secure an environment for present and future generations that is environmentally sustainable, socially just and desirable, and economically sound through the scientific, aesthetic, and orderly disposition of land, resources, facilities and services.

<sup>1</sup>Printed herein is the Land Development Code of the city, Ordinance No. 140818, as adopted on July 20, 2017.

Amendments to the ordinance are indicated by parenthetical history notes following amended provisions. The absence of a history note indicates that the provision remains unchanged from the original ordinance. Obvious misspellings and punctuation errors have been corrected without notation. For stylistic purposes, headings and catchlines have been made uniform and the same system of capitalization, citation to state statutes, and expression of numbers in text as appears in the Code of Ordinances has been used. Additions made for clarity are indicated by brackets.

Cross reference(s)—Department of community development, § 2-211 et seq.; city beautification board, § 2-261 et seq.; code enforcement board, § 2-376 et seq.; downtown redevelopment agency, § 2-406 et seq.; tree board of appeals, § 2-430.16 et seq.; tree advisory board, § 2-430.31 et seq.; buildings and building regulations, Ch. 6; waiting period for demolition permit for historic structures, § 6-19; downtown minimum property standards, § 6-231 et seq.; housing, Ch. 13; miscellaneous business regulations, Ch. 14.5; nuisances, Ch. 16; parks and recreation, Ch. 18; credit and transferable development rights for park and open space dedication, § 18-2; streets, sidewalks and other public places, Ch. 23; repair of vehicles on residential property, § 26-138; utilities, Ch. 27.

ANTHROPIC



# Welcome back, Eban

Start your first message with Claude...



Start a new chat ➤

## Last month

Questions about Gainesville land development code and stormwater ma...

## Try these

Example: "Summarize this PDF document"

Example: "Help me practice my Spanish vocab"

Example: "Explain how this python game works"



PDF CODE\_OF\_OR...  
945.44 KB

Hi Claude, I'm interested in auditing a local land development code to determine how it relates to stormwater management practices. Attached is a section of code. Can I ask you a few questions about it?

EB

Sure, I'd be happy to try to help answer any questions you have about this section of code related to stormwater management. What questions do you have?

Copy

Copy

Does the code establish requirements to protect mature native or ecologically important trees?

EB

Yes, the code includes a few provisions that aim to protect mature, native, and ecologically important trees:

1. Section 30-8.7 establishes more stringent protections and higher mitigation requirements for "high quality heritage trees", which are defined as trees that are high quality specimens of native species. This includes requirements to maximize preservation of these trees during development.
2. Section 30-8.8 requires enhanced protective barriers during construction for high quality heritage trees intended to be preserved.
3. The mitigation requirements in Section 30-8.7 are more stringent for high quality heritage trees - either payment based on the tree's appraised value or a higher ratio of replacement caliper inches. This places greater importance on preservation or comparable mitigation.
4. Section 30-8.3.F.1 encourages preservation of existing high quality trees, especially those within 20 feet of public rights-of-way, through fitting development and infrastructure around the valuable trees.

So in short, yes the code does establish more protective requirements and mitigation aimed at preservation of mature, native tree specimens that have high ecological value. The code seeks to maintain these important trees that provide benefits like shade, habitat, and aesthetic value.

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## • Sec. 30-8.7. Permits for tree removal; mitigation.

- D. 5. The requirements for mitigation of regulated trees approved for removal as part of development plan or subdivision plat review are as follows:

CATEGORY	MITIGATION
High quality heritage trees, in fair or better condition.	Mitigation payment based on tree appraised value, limited to three trees per acre averaged over the entire site. If more than three trees per acre in this category are located on the site then the trees with the highest tree appraised value throughout the site shall be used to calculate the payment. High quality heritage trees proposed for removal in excess of the overall average of three per acre shall require mitigation trees on an inch-for-inch on a diameter basis.
High-quality heritage trees in 100 percent affordable housing developments as defined by section 30-8.7.B.2.; heritage trees of other than high quality species, in fair or better condition, excluding laurel oaks and water oaks.	Mitigation trees on an inch-for-inch diameter basis.
Any heritage trees in less than fair or better condition; any heritage laurel oak or water oak; and any other regulated tree.	Mitigation trees consisting of two trees of high quality shade species established for each tree removed.

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## • **Sec. 30-8.7. Permits for tree removal; mitigation.**

- *C. 2. Mitigation payment.* Mitigation payment shall be based on tree appraised value, or as otherwise specified in this code. Payment shall be made prior to the approval of a final development order, or prior to issuance of a certificate of occupancy for any development requiring only building permits. Mitigation payments received by the city shall be deposited in the city tree mitigation fund, which must be used in accordance with this subsection. This fund may be used for new tree plantings associated with public improvement projects or for the preservation of trees through the purchase of conservation lands, but shall not be used for tree maintenance or toward the installation of new trees that would already be required for a development. In addition, this fund may be used for an ecological assessment of the urban forest every five years, and for an update of the urban forest management plan every ten years.

## • **Sec. 30-8.44. Violations, enforcement and penalties.**

- *B. 1. b. vi.* The total sum of the caliper inches of replacement or mitigation trees shall equal, at a minimum, to the total sum of the caliper inches of the regulated trees which were removed without a permit. If a regulated tree was removed without a permit, then the required mitigation shall be double what is required as in mitigation in this article. It shall be assumed that the tree removed without a permit was in fair or better condition.



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Copy



- **Sec. 30-8.8. Tree preservation during development and construction.**
- A. Prior to clearing, demolition, or other construction activities, the city manager or design *Barriers required.* nee or reviewing board shall determine which trees, if any, require protection. Protective barriers shall be constructed, as necessary, to prevent the destruction or damaging of regulated trees that are located within 50 feet of any construction activity or storage of equipment and materials. Trees identified for preservation which are destroyed or severely damaged shall be mitigated in accordance with section 30-8.7 prior to issuance of a certificate of occupancy or use. To avoid conflicts between barrier placements and demolition and construction activities, barriers shall be drawn to scale on the demolition, grading and paving sheets of the development plan.
- B. *Barrier zones.* All regulated trees in areas of demolition or construction that have not been permitted nor designated for removal by either the terms of the permit or approved development order shall be protected by barrier zones erected and inspected prior to construction of any structures, road, utility service or other improvements.
- C. *Preservation generally.* Trees may be preserved on development sites in locations where a new tree would be required. Credit for the preservation of such a tree will be given if the requirements listed below are met. During construction, if the requirements are not being met and/or the preserved tree is unlikely to survive in satisfactory condition, the owner shall apply for a tree removal permit in accordance with the requirements of this code.

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- **Sec. 30-8.3.F *Design principles and standards.* All landscaped areas required by this article shall conform to the following general guidelines:**

- 1. The preservation of structurally sound native trees of high quality shade tree species and shrubs is strongly encouraged to maintain healthy, varied and energy-efficient vegetation throughout the city, and to maintain habitat for native wildlife species. Developments should be designed to preserve existing high quality heritage trees, especially those located within 20 feet of the public right-of-way.



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4	Required	<i>The practices are specifically required by the code for appropriate situations.</i>
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1	Silent	<i>The practice is not mentioned in the code.</i>
0	Prohibited	<i>The practice is restricted or prohibited in code.</i>

Using a scale of 1-4, with 1 meaning the code does not say anything about the topic and 4 meaning the code includes requirements, how would you score this?

EB

Based on my review of the provided section of land development code, I would rate the strength of the tree protection requirements in the code as follows on a 1-4 scale:

Preserving existing trees: 4

The code includes explicit requirements to preserve existing high quality heritage trees during development and lays out barrier specifications and prohibitions on construction activities within tree protection zones (Sec 30-8.8).

Limiting tree removal: 3

The code requires mitigation for removal of regulated trees through a permit process and aims to limit removal, but does provide certain exemptions (Sec 30-8.7).

Protecting mature, native trees: 3

More stringent protections are established for high quality heritage trees, but protections could be expanded to cover a broader group of mature native trees (Sec 30-8.7).

So in summary, I would rate the overall tree protection requirements as relatively robust, focusing especially on preservation of heritage trees. The code earns high marks on preserving trees, but could do more to protect mature native trees beyond just heritage specimens. Please let me know if you have any other questions!

AI

Copy Retry



# Possibilities & Challenges

Accelerate arduous evaluation of codes

Objective (repeatable?) assessment of codes

Generate code solutions that incorporate best practices (e.g. who is responsible?)

Size limitations

How to validate?

Above all:

TRUST BUT VERIFY





# Questions?

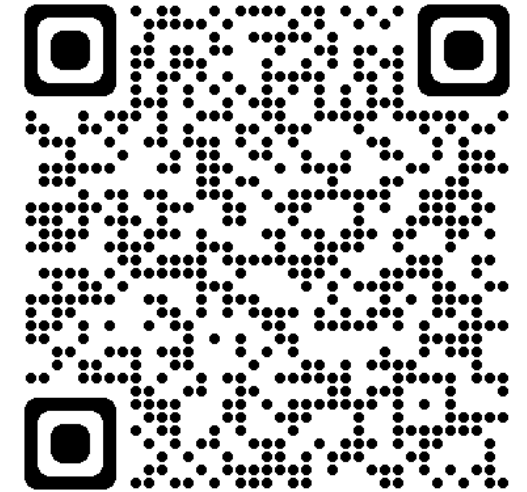
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SUSTAINABLE HUMAN AND  
ECOLOGICAL DEVELOPMENT

