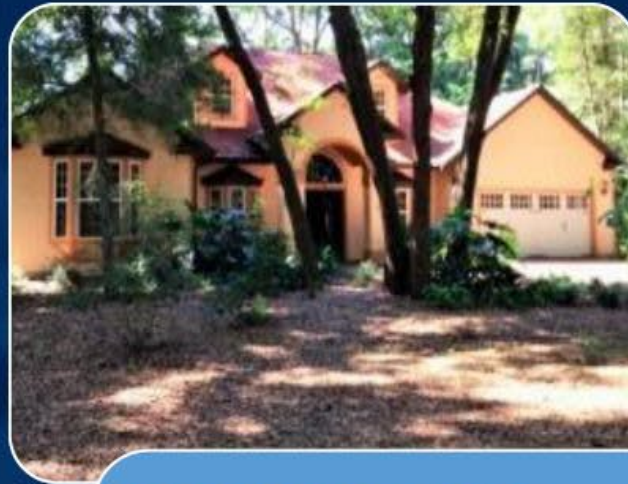


LID vs. GSI: Development Process



Avoidance (LID)

- Map natural infrastructure
- Preserve open spaces, natural areas, trees and native soils
- Retain natural hydrologic and topographic features in site plan

Minimization (LID)

- Limit and disconnect impervious surfaces
- Mimic and maximize pre-development hydrologic processes
- Integrate practices that provide co-benefits and multifunctional areas

Mitigation (GSI)

- Implement runoff source control measures
- Employ natural processes to treat and retain stormwater
- Provide treatment and attenuation in multiple areas across the site



Low Impact Development (LID) Implementation Guidebook with Ordinance Recommendations



Agenda



Project Overview

Katrina Locke

Sustainability and Resilience Manager, Volusia County



LID Implementation Guidebook

Michelle "Mo" Morrison

Planner, East Central Florida Regional Planning Council



LID Ordinance Recommendations

Jerry Murphy, JD, AICP, CFM

UF/IFAS Program for Resource Efficient Communities

State Specialized Program Agent (SSPA) – Flood Resilient Communities

Project Overview



Katrina Locke

Volusia County, Sustainability & Resilience Manager
klocke@volusia.org



FDEO Grant



- Community Planning Technical Assistance Grant, Ch 163.3168, F.S.
Help communities find creative solutions to foster vibrant, healthy communities, while protecting the functions of important state resources and facilities
- Advance resilient, nature-based stormwater strategies
- Consider mechanisms, incentives, and processes to incorporate LID in Volusia County site planning and stormwater management
- Share outcomes throughout East Central Florida region



Implementing Resilience



Adopted 2018 (Volusia & Brevard)

Infrastructure and Environment

Encourage development of cross-disciplinary plans, policies and strategies to protect the health, safety and economic welfare of residents, businesses and visitors through recognition that natural disasters, changes to climate, and human manipulation require careful consideration of when and how to develop infrastructure, natural resources and a built environment that can withstand and adapt to these changes.

Objectives

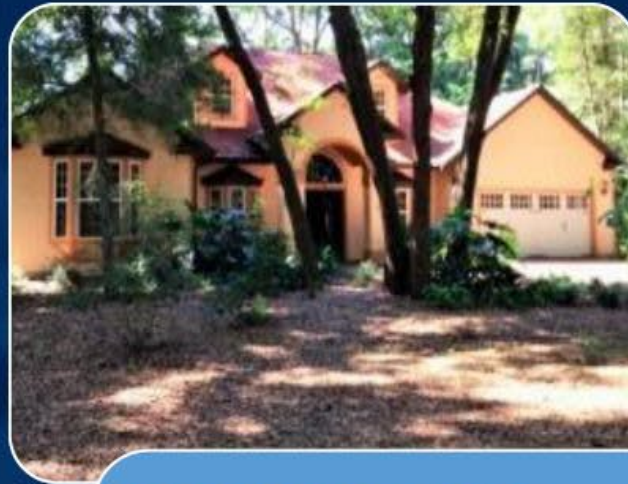
- Prioritize the use of Green Infrastructure as a first line of defense.
- Promote interconnectivity of natural lands for habitat migration.
- Enhance stormwater systems to be more resilient.
- Improve water quality in surface water bodies.
- Incorporate resiliency into local and regional plans, policies, processes and objectives.
- Preserve and adapt the built environment to keep people safe from and mitigate current and future natural hazards.
- Improve community mobility while improving vulnerable transportation infrastructure.

Definition of LID and GSI

*LID: (Low Impact Development) a comprehensive site planning and design strategy for **maintaining the predevelopment hydrologic regime** (peak discharge rate, timing, and volume) and mitigating pollutant loads from land development using **distributed structural and non-structural design techniques**. The goals of LID are to avoid and minimize additional runoff produced from site development.*

*GSI: (green stormwater infrastructure) includes the range of **structural and non-structural retention and detention measures** that infiltrate, evaporate, detain, filter, or store stormwater runoff closer to the source. The goal of GSI is to mitigate the runoff produced from site development.*

LID vs. GSI: Development Process



Avoidance (LID)

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Mitigation (GSI)

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- Employ natural processes to treat and retain stormwater
- Provide treatment and attenuation in multiple areas across the site

Grant Phases

February

LID Regional Roundtable (RR)

- LID technical experts from permitting, design, implementation
- Understand LID barriers & challenges
- Brainstorm LID opportunities & strategies

March

Develop LID Ordinance Recommendations

- Review RR lessons learned
- Review Comp Plans & LDRs
- Review Best Practices & implementation cases
- Draft LID Ordinance recommendations

April

Develop LID Implementation Guidebook

- Review BMPs (Appendix)
- Sample LID/GSI GOPs & LDRs
- Sample LID/GSI Implementations
- Sample LID/GSI Technical Manuals

Volusia ENRAC Meeting

- Introduce grant project
- Share RR lessons learned
- Discuss LID Ordinance recommendations

Regional Resilience Collaborative Green, Gray, Blue Infrastructure TAC Meeting

Discuss Draft LID Implementation Guidebook & Ordinance Recommendations

May

Volusia ENRAC Meeting
Deep dive into Draft LID Ordinance Recommendations

Revise

- LID Ordinance Template & Recommendations
- LID Implementation Guidebook

Share Results

Conduct & record virtual meeting to share LID Implementation Guidebook & Ordinance Recommendations

Summer

Grant Project End
6.13.23

Submit LID Ordinance Recommendations Guidebook to FDEO

ECFRPC Website

Share webinar recording, LID Ordinance Recommendations & Implementation Guidebook



LID Regional Roundtable Highlights



Presentations

LID Best Practice Strategies – UF/IFAS

- Source Control
- Mitigating Impacts: Current Trends
- Florida Stormwater Rules

Case Study - Volusia LID Implementation Challenges

Roundtable Discussions

- Priority challenges/barriers to LID/GSI
- Strategies for priority challenges



Technical experts (79) from across the East Central Florida region

Regional Priority LID Challenges



- Local Code Inhibits LID
- Code Enforcement
- Streamline Design Process
- Maintenance
(Cost/Labor/Training)
- Lack of Regional Approach
(Uniform Policies & Codes)
- Regulations & Regulator
Involvement
- Public Education/Training
(recorded webinar)



Reducing Landscaping Impacts
The Villages (Sumter County) Source: UF/IFAs

LID Implementation Guidebook

Michelle “Mo” Morrison

East Central Florida Regional Planning Council, Planner

mmorrison@ecfrpc.org



LID Implementation Guidebook



Contents

LID/GSI Implementation Examples

- Commercial
- Residential
- Municipal

LID/GSI Policy and Code Examples

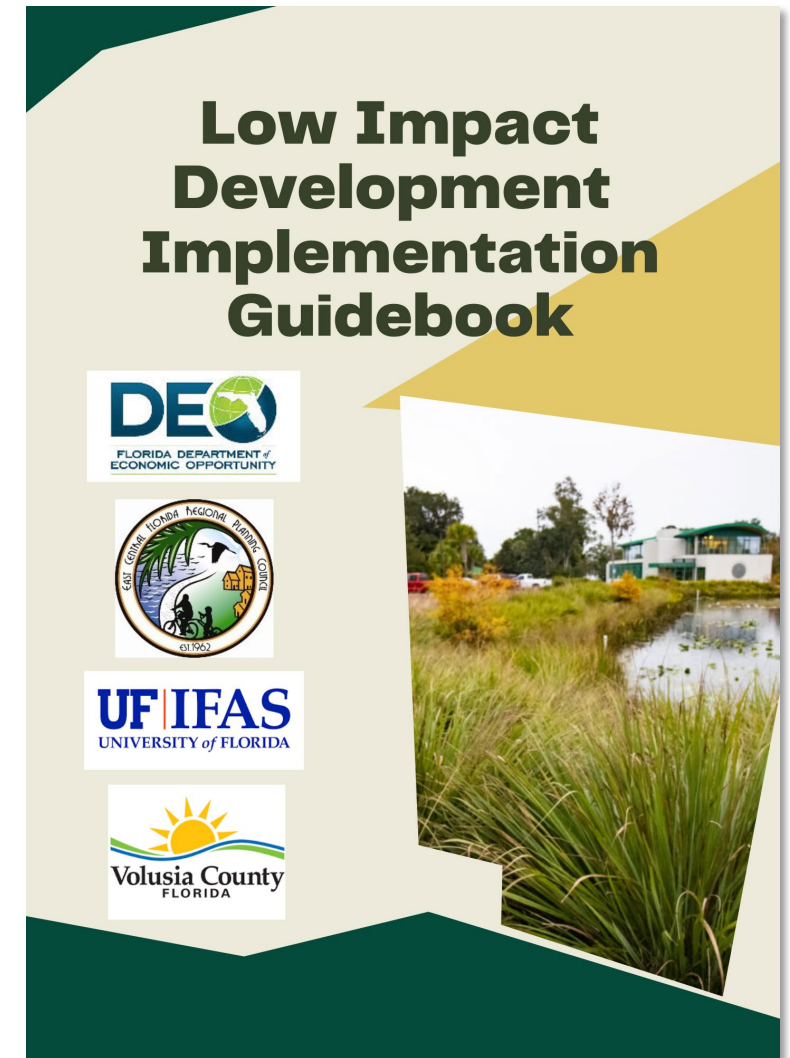
- Required/Incentivized
- Green Parking

LID Pollutant Removal Formulae & Technical Manuals

Appendix - Best Management Practices

Resources

LID/GSI Policies & Codes Spreadsheet



LID GSI Implementation: Commercial



Grove Roots Brewing Co. (Winter Haven, FL)

- Infill, redevelopment
- Reduced and disconnected a previously 100% impervious area from the City's piped stormwater conveyance system
- Infiltrates ~100% stormwater on site
- Integrated system of roof gutters/downspouts, infiltration basins, parking areas graded to flow into grassed swales, open areas, and trees
- Parking lot bioswales
- Mechanical reworking of compacted soil



Sources: Google Maps (top) and Thomas L. Singleton (bottom).

Source: Winter Haven From Gray to Green Enhanced Stormwater Permit Design Manual (Appendix D)

LID GSI Implementation: Commercial



This rain garden at P. F. Chang's, in downtown Sarasota, uses decorative rocks and plants with a variety of leaf shapes and colors to provide visual interest.



This rain garden uses palms, shrubs, and native bunchgrasses to give a natural feel to the outdoor patio. It also provides a noise and visual buffer from the busy urban roadways adjacent to the restaurant.

Photo Source: Sarasota County Government (<https://www.sarasota.wateratlas.usf.edu/lid/#rain-gardens>)

PF Chang's (Sarasota, FL)

- Rain gardens capture roof runoff
- Pervious pavers in driveway and parking lot
- More of site for restaurant & parking, avoided need for retention pond

LID GSI Implementation: Commercial



Photo Source: Sarasota County Government (<https://www.sarasota.wateratlas.usf.edu/lid/#rain-gardens>)

Marathon Gas Station (Sarasota, FL)

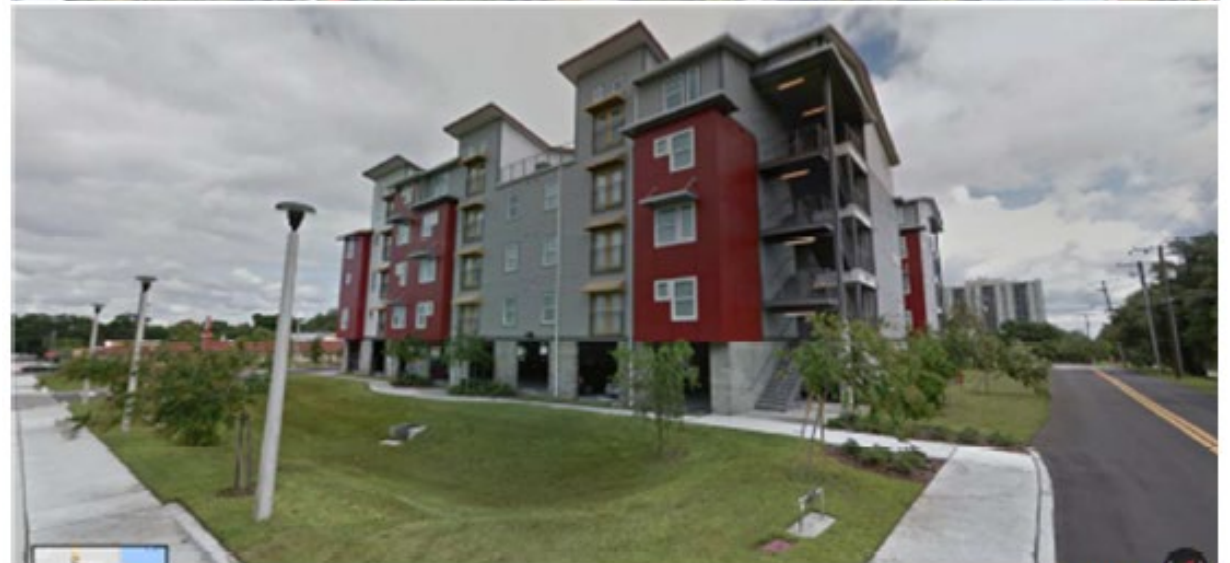
- Rain garden diverts driveway stormwater
- Attractive landscaping

LID GSI Implementation : Multi Family



Tupelo Vue (Winter Haven, FL)

- 5-story apartment complex
- Infill, redevelopment
- Infiltrate ~100% stormwater on site
- Integrated system of roof gutters/downspouts, infiltration basins/ponds, grassed bioswales and open areas, and trees
- Drainage and biological capacity of soils restored through mechanical reworking of soils and soil amendments using native topsoil
- Redevelopment included removal of all existing impervious areas (structures and pavement)
- Under-building parking reduced impervious area by 50%
- LID practices located within routinely maintained landscaped areas



Source: Google Maps.

Source: Winter Haven From Gray to Green Enhanced Stormwater Permit Design Manual (Appendix D)

LID GSI Implementation: Residential



Source: <https://gsiphotosflorida.org/photo/stormwater-drainage-at-el-prado-stormwater-garden/>

The Nature Conservancy All Rights Photo credit: Roberto Gonzalez

El Prado Stormwater Garden (Tampa, FL)

- SWFWMD Cost-Share Funding Project
- Created to address stormwater flooding in residential areas
- Amended soils, bioretention, gravel pathway & storage areas, native vegetation

LID GSI Implementation: Residential



Existing/Restored/Created Wetlands



Rain Gardens



Community gardens capture rainwater for irrigation
Vandy Major /Babcock Ranch Telegraph

FGBC YouTube Babcock Ranch: A Blueprint for Sustainability in the Built Environment'

Babcock Ranch (Charlotte County)

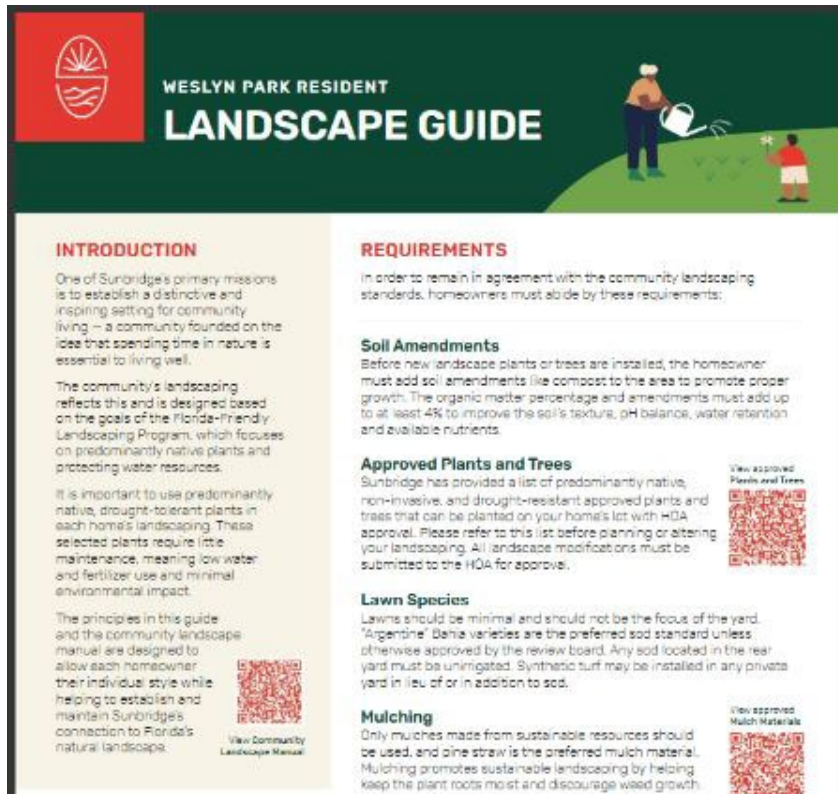
- FGBC Platinum “Florida Green” Land Development Certification
- Low impact native plants & naturalized landscape materials
- 90% stormwater recapture & repurpose
- Earle B. Phelps Award - highest removal of pollutants in transforming wastewater into reclaimed water
- Restored historic water flow
- Stormwater management played key role in disaster mitigation/resilience (Hurricane Ian)

LID GSI Implementation: Residential



Sunbridge Weslyn Park (Osceola County, FL)

- Florida-Friendly Landscaping
- Requirement: Homeowners must abide by landscaping standards



Source: LID Regional Roundtable Presentation by Pierce Jones, UF/IFAS Program for Resource Efficient Communities (2.2.23)



LID GSI Implementation: Green Roofs



Caspersen Beach Park Restroom

Photo Source: Sarasota County Government



O'Leary's Tiki Bar & Grill in Bayfront Park

Sarasota County: Municipal & Commercial

- Restroom – reduce runoff, cooling for restroom with no AC, wildlife habitat, native landscaping
- Bar & Grill – funded through Sarasota Bay Estuary Program grant, FFL, cisterns capture excess rainwater used for irrigation and pressure washing building

LID GSI Implementation: Municipal



Source: <https://gsiphotosflorida.org/project/escambia-county-office-complex/>

Escambia County Office Complex (Pensacola, FL)

- Largest FL Green Roof (33,000 sf),
- Biofiltration with native vegetation
- Energy savings

LID GSI Implementation: Municipal



Source: <https://gsiphotosflorida.org/project/cascades-park/>
The Nature Conservancy All Rights Photo credit: Tyler Jones

Cascades Park (Tallahassee, FL)

- 25-acre public park with wildlife, ponds, interconnected multi-use trail system, amphitheater, restaurant, historic markers, playgrounds, open space
- Former brownfield site with runoff, erosion, flash flooding issues
- 2021: Construction on adjacent 5-acre mixed use live-work-play-stay destination
- Biofiltration, bioretention, rain garden, wetland

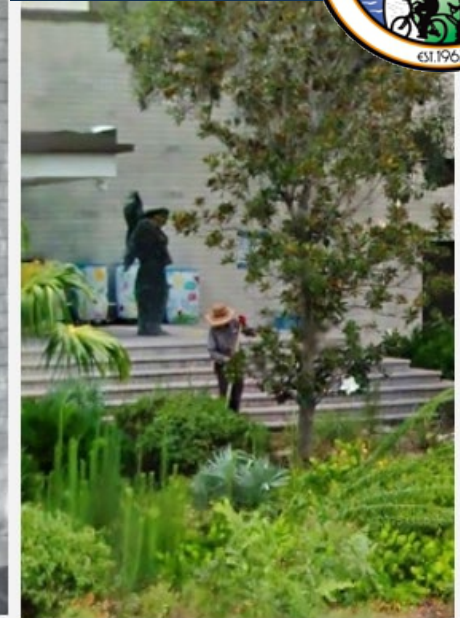
LID GSI Implementation: Municipal



Two cisterns are visible in this photo. The one on the left is located in the tower.



Interconnected rain barrels collect water from the roof of Sarasota City Hall. Water from decorated rain barrels is used to irrigate nearby flowerbeds.



Sarasota County Cisterns & Rain Barrels

(<https://www.sarasota.wateratlas.usf.edu/lid/#rain-barrels-and-cisterns>)

Fire Station #1

- 3 cisterns capture thousands of gallons of stormwater
- Water used for irrigation, washing trucks & equipment, emergency source for filling fire trucks

County Government Complex & Sarasota City Hall

- 2 cisterns @ County Complex: Hundreds of gallons stored from ½" rainfall event, used for irrigation
- City Hall demonstration project for watering flower beds (four 50-gallon rain barrels, FFL landscaping)

LID GSI Implementation: Municipal



Wagner Park



Manatee Sanctuary Park

Photo Source: City of Cape Canaveral

Cape Canaveral LID Guide

Wagner Park

- Permeable walkways, native plants, bioswale, limited use of grass

Manatee Sanctuary Park

- Floating Vegetative Islands/Beemat/Floating Wetlands
- Improve water quality (& decrease odor)
- Growing plant roots sequester excess nutrients
- Periodic harvesting prevents stored nitrogen and phosphorus from entering water

DIY Floating Treatment Wetlands



LID GSI Implementation: Institutional



Source: <https://gsiphotosflorida.org/project/stetson-aquatic-center/>
The Nature Conservancy All Rights Photo credit: Tyler Jones

Sandra Stetson Aquatic Center (Deland, FL)

- Stetson Institute for Water & Environmental Resilience
- GSI Demonstration project
- Biofiltration, rain garden, floating wetland system/beemat, native vegetation

WMD Collaboration Potential



- WMD permit by state law
 - Local jurisdictions can impose stricter requirements (responsible for enforcement)
- Provide technical assistance
- Potential to expedite LID projects
- Consider public pilot projects
 - Collect data (pre- and post-)
 - Benefits future projects
 - Demonstration for private projects
- Cost-share funding
 - Identify hotspots (flooding/water quality)
 - Apply for funding



Ocala Wetlands Recharge Park (cost-share funding)

<https://www.sjrwmd.com/streamlines/ocala-recharge-park/#gsc.tab=0>

LID GSI Policies and Codes



Examples	County	Notes	Source
Volusia County Comprehensive Plan			
Objective 9.1.2 Volusia County shall at a minimum maintain current standards regulating the design, construction, and management of drainage systems used for stormwater management to the extent financially and environmentally feasible when considering future flood conditions.	Volusia	Volusia County Comp Plan Drainage Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-9-Drainage-Element.pdf
Policy 9.1.2.6 Volusia County will encourage the use of low-impact development/green infrastructure as a method of stormwater management.	Volusia	Volusia County Comp Plan Drainage Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-9-Drainage-Element.pdf
Objective 10.1.1 Potable water resources shall be protected and conserved such that the recharge function of the aquifers shall be maintained. Dependence upon the Floridan aquifer for non-potable uses shall be reduced, and withdrawals from the surficial aquifer shall not cause damage to the resource.	Volusia	Volusia County Comp Plan Groundwater Aquifer Recharge Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-10-Groundwater-Aquifer-Recharge-Element.pdf
Policy 10.1.1.13 Volusia County shall encourage the use of green infrastructure and low impact development .	Volusia	Volusia County Comp Plan Groundwater Aquifer Recharge Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-10-Groundwater-Aquifer-Recharge-Element.pdf
Objective 11.9.1 Develop strategies to identify and address issues related to the impacts of sea-level rise.	Volusia	Volusia County Comp Plan Coastal Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-11-Coastal-Element.pdf
Policy 11.9.1.9 Volusia County will promote green infrastructure as a tool for resiliency and the protection of water quality and coastal systems.	Volusia	Volusia County Comp Plan Coastal Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-11-Coastal-Element.pdf
Objective 12.1.3 To protect and appropriately utilize the physical and ecological functions of natural drainageways and drainage patterns	Volusia	Volusia County Comp Plan Conservation Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-12-Conservation-Element.pdf
Policy 12.1.3.6 Volusia County shall encourage the use of green infrastructure to protect the ecological functions of natural drainageways.	Volusia	Volusia County Comp Plan Conservation Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-12-Conservation-Element.pdf
Objective FG 4 Development within the Farmton Local Plan shall promote high standards for water conservation, and energy efficiency.	Volusia	Volusia County Comp Plan Future Land Use Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-1-Future-Land-Use-Element.pdf
Policy FG 4.1 Sustainable Development Area (SDA) districts shall promote protection of green infrastructure , natural resource protection, water and energy conservation, and low impact compact development . Higher density, mixed use, and compact development will be an integral part of any future development as it is recognized to reduce trip lengths, promote walking, support regional mass transit and reduce the development foot print. It also is recognized to provide tangible social and cultural benefits by encouraging more connected social support systems and a stronger sense of community.	Volusia	Volusia County Comp Plan Future Land Use Element	https://www.volusia.org/core/fileparse.php/7370/urlt/Chapter-1-Future-Land-Use-Element.pdf
Volusia County LDC			
Sec. 72-547. - Conservation subdivisions. ... (13)Innovative development practices that are consistent with the purposes of conservation development are strongly recommended. These include, but are not limited to, low impact development , Dark Skies, Water Star, Firewise, US Green Building Council LEED certified development, Florida Green Building Coalition designation or other county approved certifications which promote sustainability, or water neutrality, or for environmental restoration of degraded wetlands or habitat. Provisions of the land development regulations, excluding the provisions of section 72-547, may be waived by DRC to the extent they are in conflict with the above innovated development practices.	Volusia	Volusia LDC	https://library.municode.com/fl/volusia_county/codes/code_of_ordinances?nodeId=PTIICOOR_CH72LAPL_ARTIIIILADERE_DIV2SURE_S72-547COSU

LID Required



Doral (LID Requirements)

New buildings and redevelopment sites shall incorporate the following low impact development (LID) practices into project design, site and building plans...

Doral: ARTICLE XVI. - LOW IMPACT DEVELOPMENT PRACTICES

Developers shall implement the following non-structural LID practices to the maximum extent practical

Developers shall implement a minimum of two structural LID practices from the following list, where one meets the water quantity requirement and the other meets the water quality requirement, per Section 11.0 of the 2021 LID Master Plan Update and the SFWMD ERP Applicant's Handbook Volume II.

Maintenance is required to preserve the efficacy of the implemented LID practice(s).

Doral (LID Incentives)

To encourage developers to design site plans using more than the minimum required LID practices, the City may offer the following incentives: Expedited review of permits, Implementation of open space credit, Reduced application fee, Award recognition program



City of Doral

Low Impact Development
Master Plan

Draft Report

Prepared by:



8550 NW 33rd Street, Suite 202
Doral, Florida 33122

Updated December 2019

2019

LID GSI Encouraged/Incentivized



Incentives include:

- Technical assistance for LID practices
- Plan review fees waived
- Permitting/site development credits
- Process expedited
- Additional density (height, lot coverage)
- Setback reduction
- Parking reduction
- Stormwater fee credit (up to 52%) to non-SFH property owners to operate and maintain onsite detention or retention stormwater management systems
- Stormwater fee credit (up to 50%) to non-residential property owners who reduce water pollution by implementing LID and GSI practices
- Rebates for Florida-Friendly landscaping, irrigation, rain gardens, and rain barrels
- Stormwater on-site mitigation loan program to prevent or reduce future interior flooding for residents



*El Prado Stormwater Garden (Tampa, FL)
TNC Photo credit: Roberto Gonzalez*

LID GSI Green Parking Examples



Apopka

Incentives for use of pervious pavement on at least 50% of parking lot and driveway area include: Additional height/lot coverage & Parking reduction

Groveland

Requires the application of permeable parking lot surfaces for commercial developments proposed within high aquifer recharge areas

Winter Haven

Requires all off-street parking lots to provide for the attenuation and treatment of stormwater and landscape and buffer areas to be designed and located to filter, store and/or convey the expected stormwater flows from surrounding paved areas through the use of LID techniques

Doral

Developers **shall** implement ... to the maximum extent practical:
Utilize alternative roadway, sidewalk, parking lot, and driveway designs to minimize imperviousness and promote natural infiltration.

Utilize stabilized grass or other similar surfaces for parking spaces provided above the minimum requirement.



Cox's Landing Renovation FPA Award of Excellence
Source City of Ft. Lauderdale



Shell and sod-covered parking lot at Sharky's on the
Pier restaurant Source: Sarasota County

LID/GSI in Comprehensive Plan: Ormond Beach



UTILITIES

OBJECTIVE 2.2. DEVELOPMENT REVIEW

Policy 2.2.6. Drainage and stormwater management systems shall use natural systems to the greatest extent possible, and land development modifications shall resemble natural features to the greatest extent practicable.

FUTURE LAND USE

OBJECTIVE 2.6. SUSTAINABILITY

POLICY 2.6.5. Encourage integration of passive solar design, **green roofs**, active solar and other renewable energy sources into development projects through the Land Development Code.

CONSERVATION

OBJECTIVE 7.3. SUSTAINABILITY

POLICY 7.3.4 Create, protect and manage systems of **green infrastructure** (i.e., urban forests, parks and open spaces, **green roofs**, natural drainage systems).

POLICY 7.3.6 Encourage **site design techniques** that restore natural “**green infrastructure**” (i.e., urban forests, parks and open spaces, natural drainage systems) instead of relying solely on engineered systems that require higher energy and carbon inputs.

LID/GSI in Comprehensive Plan: Ormond Beach



CONSERVATION

GOAL 12. LOW IMPACT DEVELOPMENT

FOR NEW DEVELOPMENT AND REDEVELOPMENT, APPLY BETTER **SITE DESIGN AND LOW IMPACT DEVELOPMENT (LID) TECHNIQUES**, AND PURSUE COMMITMENTS TO REDUCE STORMWATER RUNOFF VOLUMES AND PEAK FLOWS, TO INCREASE GROUNDWATER RECHARGE, AND TO INCREASE PRESERVATION OF UNDISTURBED AREAS.

OBJECTIVE 12.1. LAND DEVELOPMENT CODE AMENDMENTS

Policy 12.1.1. Integrate into the Land Development Code (LDC) the **source control concept** which places a greater importance on managing smaller, cost-effective landscape features located on each lot rather than through costly pipe and pond stormwater management design.

The remaining policies in this objective use phrases such as:

- Maintain or improve infiltration, frequency and volume of discharges, and groundwater recharge
- Integrate **alternative stormwater management practices**
- Reduce the use of centralized best management practices (BMPs)
- Amend the LDC and Construction Details to **permit LID designs**

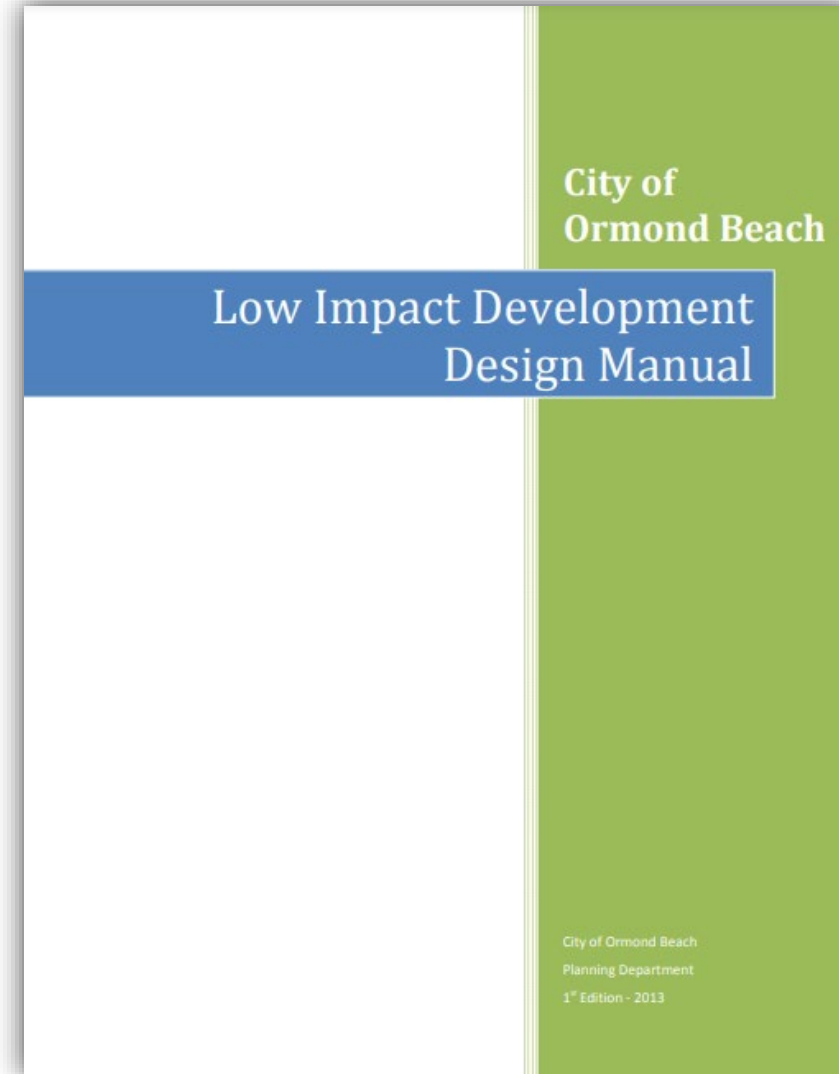
LID/GSI in LDC: Ormond Beach



Sec. 1-20. - Codes and standards adopted by reference.

(e) *Low Impact Development Manual for the City of Ormond Beach.*

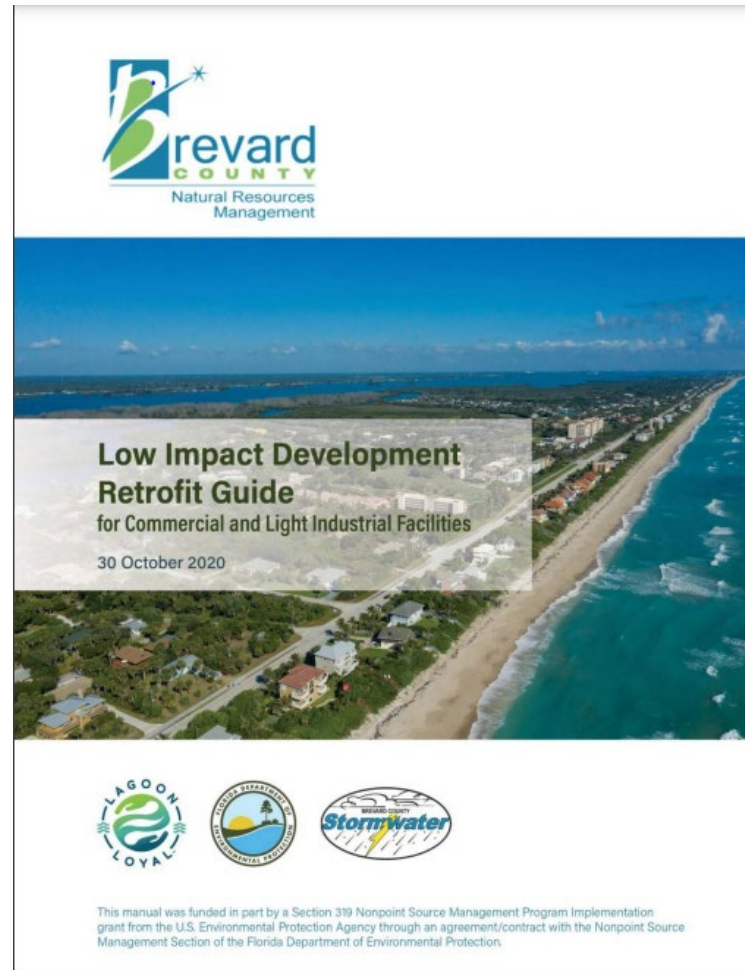
The Low Impact Development Manual as published by the city planning department, is adopted.



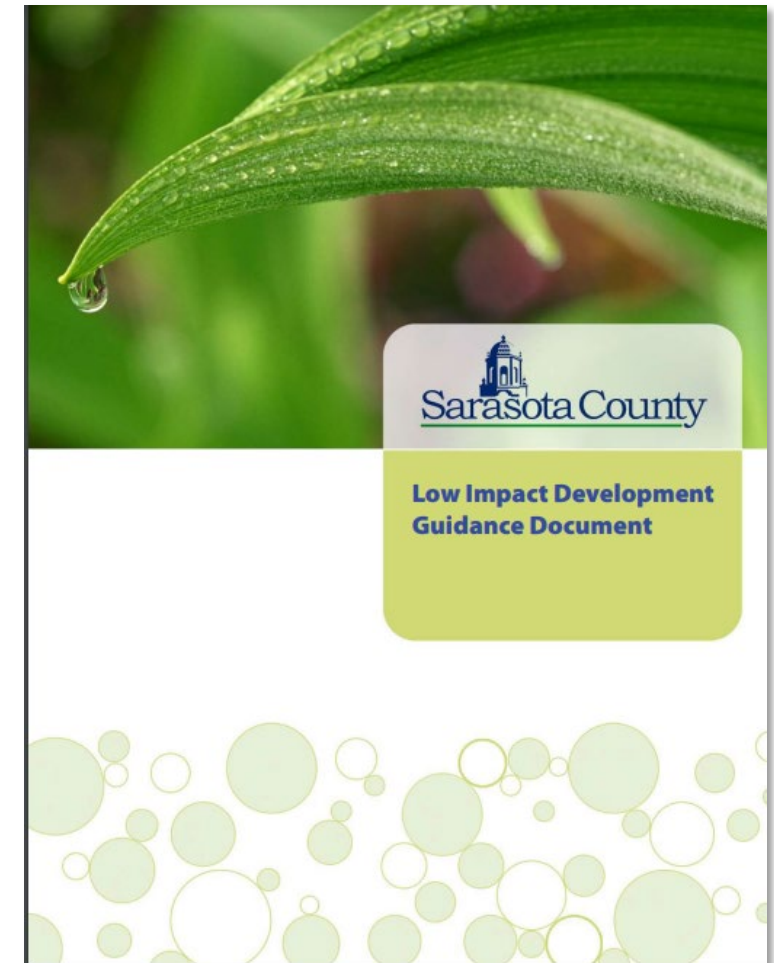
LID Technical Manuals: County



2018



2020





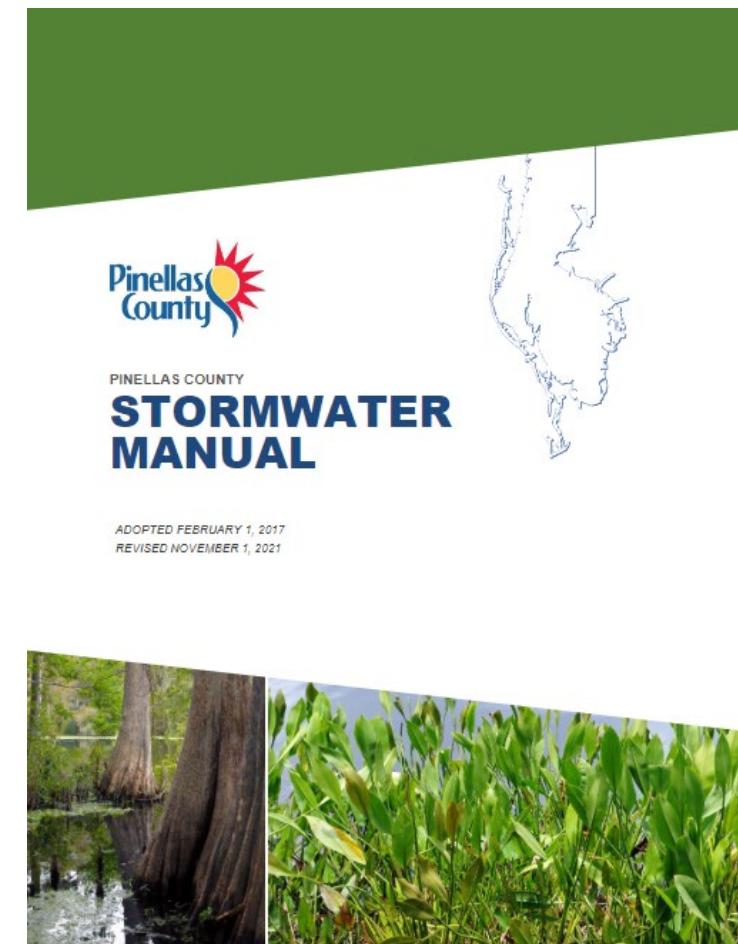
2015

LID Technical Manuals: County



LID / GSI Benefits to Developer & Public (Table 4.0.1)

LID / GSI BMP	Benefits	
	Developer	Public
Bioswales  PK Ave. Auburndale, FL	Reduces Upfront Site Infrastructure Costs	Reduces dependence on public regional stormwater systems
	Contributes to Site Appeal and Aesthetics	Reduces community heat island effect
	Assists in Compliance with Stormwater Management Requirements for Quality and Quantity	Improves water quality of runoff from the sit
	Helps with Green Buffer Site Requirements	Enhances neighborhood aesthetics
	Less infrastructure conveyance elements to maintain	Contributes to Community Resilience
		Increases groundwater recharge
Pervious Pavement  Henrietta Ave./Jean St.Largo, FL	Reduces Overall Site Impervious Area	Improves water quality of runoff from the site
	Requires less On-Site Retention/Detention Area	Contributes to Community Resilience
	Assists in compliance with onsite parking regulations	Reduces burden on public regional stormwater systems
	Reduces the needed treatment and attenuation of runoff from the site	Increases groundwater recharge

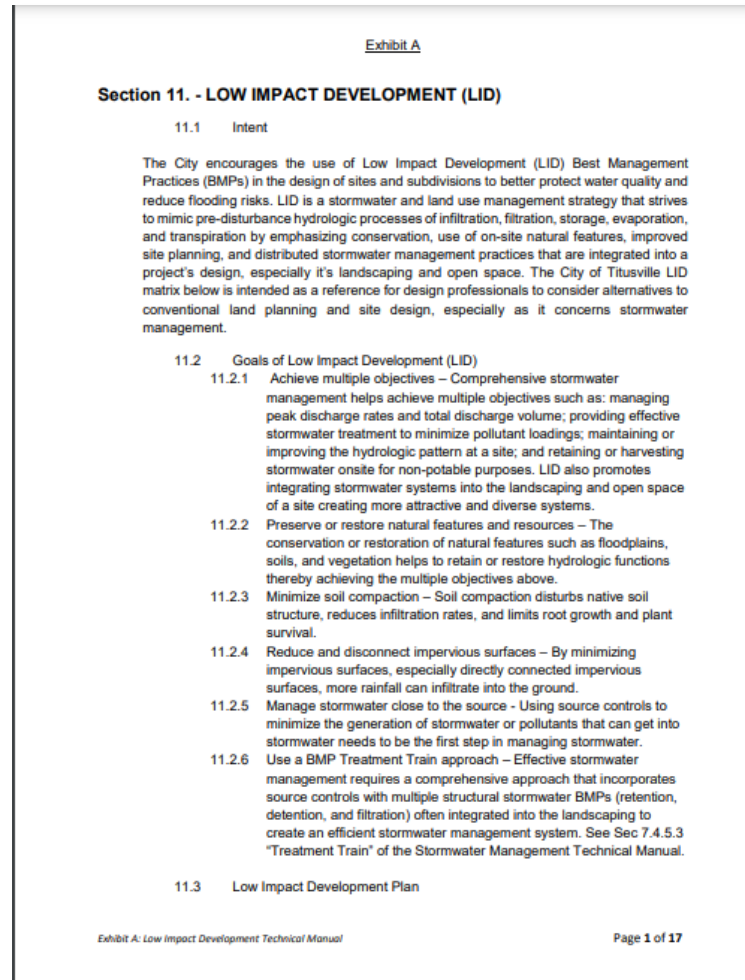


2021

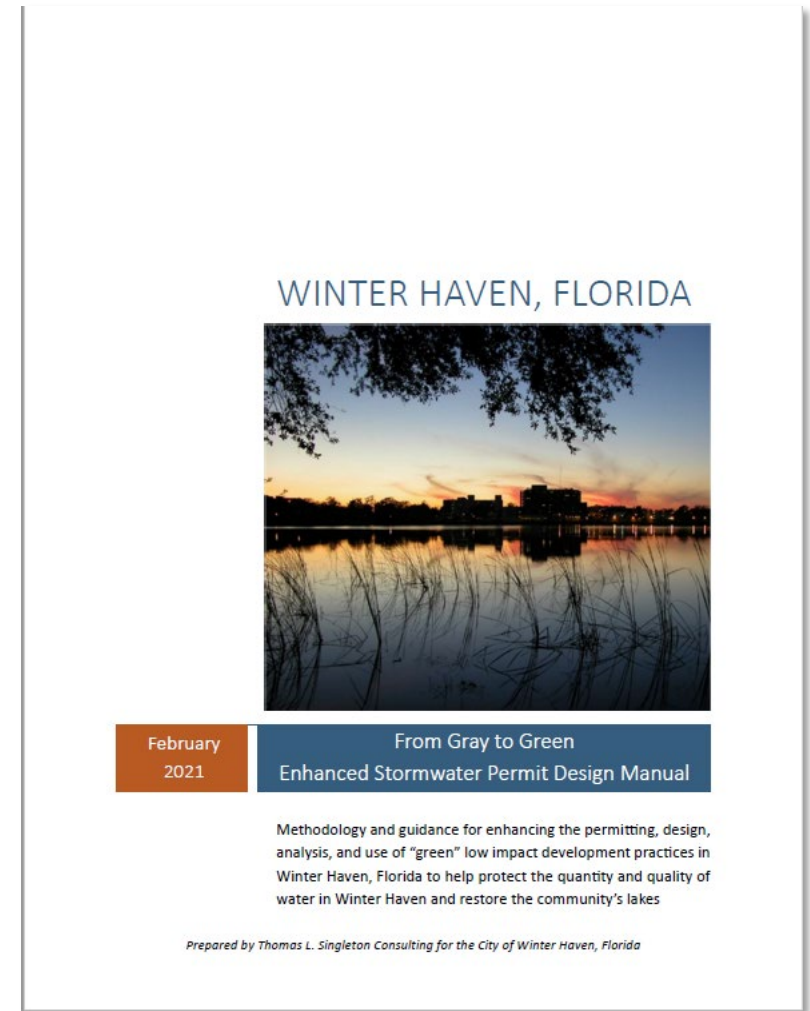
LID Technical Manuals: City



2013



Titusville - 2021



2021

LID Ordinance Recommendations

Jerry Murphy, JD, AICP, CFM

UF/IFAS Program for Resource Efficient Communities

State Specialized Program Agent (SSPA) – Flood Resilient Communities

murphyge@ufl.edu

LID Ordinance Recommendations

Intent and Purposes.

Applicability.

Environmental Site Design (ESD).

Site Design Strategies.

Pollutant Removal.

Channel Protection Flow.

Conveyance Flow.

Flood Protection.

High Density Residential and Non-Residential Redevelopment
Projects.

Land Uses with High Pollutant Loads.

Implementing and Integrating GSI + LID Strategies in Development.

Waiver of GSI + LID Requirements.



Environmental Site Design (ESD)

The strategies of Environmental Site Design (ESD) are the basic building blocks for GSI + LID. The ESD process focuses on natural landform and the natural environmental systems. There are many environmental systems on a land parcel including, but not limited to, wetlands, watercourses, vernal pools and other intermittent wetlands, floodplains, steep slopes ($\geq 20\%$), significant individual trees, unusual vegetative communities, and soils with varying infiltrative capacities. The ESD process requires these natural environmental systems be fully evaluated prior to the creation of a development or redevelopment project concept. The ESD process should be specified in the Ordinance and must be developed and documented by appropriate professionals as part of a development permit application.

LID Design Process

- (a) Base Map. Qualified professionals identify, evaluate, and delineate natural resources on a boundary survey.
- (b) Additional documentation. Soils; sub-watershed basin boundaries; generalized vegetative types; significant field-located trees that warrant protection from development; 20% slopes.
- (c) Determination of Developable Area.
- (d) Preliminary Site Plans.
- (e) Reduce Impacts.
- (f) Manage Impacts.

Environmental Site Design (ESD)

Apply these strategies during the ESD process:

- (a) Road and Street Design;
- (b) Driveway Layouts; and
- (c) Lot Design.

- (a) The *Guidebook* includes references to various GSI/LID technical manuals with formulae to calculate pollutant loads. The local government will identify and adopt a [Technical Manual] with the GSI + LID strategies the local government chooses to follow.
- (b) Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—**Pre-Development** Conditions.
- (c) Procedure to calculate pollutant loads and the effectiveness of stormwater treatment systems—**Post-Development** Conditions.

Pre-Development Conditions

- (1) Delineate the watershed areas on the site.
- (2) Label and determine the area of each watershed on the site.
- (3) Determine the type of land cover for each watershed area.
- (4) Obtain annual rainfall amount for general location of the site.
- (5) Use formulae in *Guidebook* [Technical Manual] to calculate pollutant loads for pre-development conditions.

Post-Development Conditions

- (1) Evaluate the type and location of treatment systems during design phase.
- (2) Prepare a Conceptual Development Plan for the project.
- (3) Delineate watershed boundaries for future conditions.
- (4) Calculate the area of each watershed.
- (5) Estimate impervious coverage within each watershed above the treatment systems.
- (6) Calculate the land area below the treatment system to the design point or point of concern.

Post-Development Conditions – continued.

- A design point would typically be the point where a watercourse or overland flow would leave the site boundary.
- A point of concern would typically be the limit of a delineated wetland or watercourse proximate to or within the site boundary.

Post-Development Conditions – continued.

(7) Use *Guidebook* [Technical Manual] formulae to calculate preliminary pollutant loads for post-development conditions based upon the Conceptual Development Plan.

(8) Use pollutant removal efficiencies and formulae in step (11) to determine treatment systems needed to achieve water quality requirements.

(9) The final site design must incorporate the necessary stormwater treatment systems.

Post-Development Conditions – continued.

- (10) After site design is complete, repeat steps (3) through (8) with the accurately calculated areas for the final watershed(s) and impervious cover.
- (11) *Pollutant Removal Calculation Procedure.*
- a. (total load * 1st removal efficiency)
 - b. (total load – (load removed in a.)) * 2nd removal efficiency
 - c. (total load – (load removed in a. + b.)) * 3rd removal efficiency
 - d. (total load – (load removed in a. + b. + c.)) * 4th removal efficiency ...

Total Percentage Removed by Treatment Systems,

(load removed in a. + load removed in b. + load removed in c....) / total load * 100

LID Ordinance: Intent and Purpose

(a) To improve and protect water quality and quantity, better address the land/water dynamic in local government watersheds to benefit the health, safety, and general welfare of current and future generations of citizens, the local government employs Green Stormwater Infrastructure and Low Impact Design/Development (GSI + LID) strategies to manage stormwater for the greater good of the local government and its citizens. The implementation of GSI + LID for new development will minimize adverse changes in water quality. Wherever feasible on redevelopment sites, GSI + LID stormwater treatment systems will decrease the adverse impacts of stormwater runoff.

(b) Stormwater discharges in the local government area have clearly caused pollution and other adverse impacts on the aquatic and overall natural environment. These impacts range from increased flows that cause erosion of natural stream channels to limitations on the use of certain waters for recreational uses due to high levels of pollutants in the water, to elevated potential flood risks due to increased runoff volume.

LID Ordinance: Intent and Purpose

(c) Increasing impacts from accelerated climate change, e.g.—drought, extreme heat, other unprecedented extreme weather events, sea-level rise, increased precipitation depths and intensity, etc.—augment these adverse impacts and present existential challenges to the health, safety, and general welfare *status quo*, and pose threats to private and public property interests, the public fisc, the public trust, and the accessibility and use of public lands and infrastructure for the local government and municipal facilities, purposes, and services.

(d) This ordinance requires **development and redevelopment** to incorporate the technical framework of a [Technical Manual] (referenced in the *Guidebook*) to implement GSI + LID management strategies that improve surface water quality and groundwater quality to achieve water quality requirements. Absent implementation of the requirements in the, long-term adverse impacts to both surface and groundwater will continue to occur in the local government.

(a) The standards and processes stated in [Technical Manual] identified and adopted by the local government apply to all **new development** proposed in the local government. This can be as broadly applicable as the local government elected officials decide. Where feasible, new development **initiated by the local government** must comply with the adopted [Technical Manual] standards. Specific performance standards have been developed for new development, as well as commercial/high-density residential/industrial redevelopment that may change the extent of impervious cover on a regulated site.

(b) The *Guidebook's* intended audience is design professionals, property owners, developers, homeowners, local government officials, and others involved with the design of development and redevelopment projects in the local government. While not required, all the stormwater management practices and strategies outlined in the *Guidebook* and the adopted [Technical Manual] should be applied to the maximum extent practicable on existing approved vacant single-family lots or parcels.

LID Ordinance: Applicability

(c) The practices, specifications, and strategies identified and provided in the *Guidebook* and the adopted [Technical Manual] must be implemented by individuals with a demonstrated level of professional expertise in stormwater management, such as Florida-licensed professional engineers. The *Guidebook* is also intended for non-technical individuals interested in GSI + LID stormwater management, but the application of the stormwater requirements of the adopted [Technical Manual] must be prepared by a Florida-licensed professional engineer.

(d) **All development and redevelopment project designs must comply with all applicable GSI + LID stormwater management and performance standards provided in [Technical Manual].** The schematic details provided for the various types of treatment and storage systems must demonstrate the various components included in the design of the water treatment system to function effectively. Final design plans for any type of stormwater treatment or storage system must include all relevant design specifications for that particular system.

Other Ordinance Recommendations

Channel Protection Flow

Conveyance Flow

Flood Protection

**High Density Residential and Non-Residential Redevelopment
Projects**

Land Uses with High Pollutant Loads

Implementing and Integrating GSI + LID Strategies in Development

Waiver of GSI + LID Requirements

10 Steps to Effective Incentives

1. Determine Objectives – Set goals and measures

Here we want to improve stormwater management and water quality through effective implementation of GSI + LID standards and strategies from the [Technical Manual] in new development and redevelopment projects; and wherever else possible

2. Analyze the Audience – Who can impact the objectives?

- Developers; Engineers; Home Builders; Property Owners; Public
- Regulators; Enforcers; Officials; Public

3. Fact Finding & Audience Involvement (ENRAC, etc.)

Here: What do we do to improve stormwater management and water quality through effective implementation of GSI + LID in new projects; and wherever else possible?

Recommendation:

- Ordinance requirements to utilize GSI + LID standards and strategies from the adopted [Technical Manual] for new development and redevelopment projects, e.g., residential subdivisions; large multi-family and non-residential projects.
- Incentives for existing development.

4. Create Rules Structure and Develop Budget – rules of the program; fixed and variable costs

Here: Available resources to administer the program or need for additional resources; available processes to administer the program or need for new procedures; program management.

5. Select Awards – appealing; affordable; match incentives with GSI + LID techniques from the adopted [Technical Manual]

What incentives will the Audience value? bonus density (caps); reduced dimensional regulations; fee waivers; property tax abatements; priority permit processing; compliance grants; etc.

6. Communicate the Program – Appropriate media to expand audience

Outreach to the public – possible parallel with the educational efforts we use to promote the local NFIP regulations to capture credits for the Community Rating System. Celebrate local government-initiated GSI + LID compliant projects (LEAD)

7. Operations – Track results with regular progress updates.

Again, a function of budget, capacity, and resources

8. Fulfill the Awards – the more immediate = the better!

9. Evaluate & Measure – Objective accomplished? Any outside factors?

This is the back end of steps 4 (Rules) and 7 (Tracking). Are our incentives progressing toward our objective(s)?

10. Celebrate Success! – Reward achievers; communicate results; annual dinner; awards; public recognition.

This is probably the most public-facing aspect and provides additional incentives to participate whether through regulatory (LDRs) or voluntary compliance. Nominate local government GSI + LID-compliant projects for local and national project awards.

Questions???

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