Low-Impact Development Guidance Manual

Volusia County
FLORIDA

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Chapter 1: Introduction

1.1 Purpose of Manual

The Low-Impact Development (LID) Guidance Manual is tailored to support land development projects in Volusia County, Florida. This resource offers detailed technical guidance and design specifications for effective stormwater management, focusing on LID techniques, and serves as a tool for developers, engineers, and stakeholders involved in shaping the county's landscapes. By providing information on LID stormwater management practices, this manual will assist in implementing environmentally friendly solutions that align with Volusia County's objectives.

While LID practices are not mandatory, Volusia County recognizes their significant contribution to achieving water resource objectives, environmental sustainability, and resilience goals. In support of this, Volusia County has implemented an incentivized menu approach, affording flexibility and choice to those engaged in development projects. This menu approach empowers stakeholders to select LID practices that align with their specific needs and project requirements, fostering a collaborative effort towards responsible stormwater management. Volusia County's commitment to encouraging LID practices reflects a proactive stance in balancing urban development with environmental conservation, promoting a community-wide commitment to sustainable water resource management.

1.2 Background

Low-Impact Development (LID) is an ecologically driven stormwater management approach, prioritizing soft engineering strategies to mitigate rainfall on-site through a network of vegetated treatments. By leveraging the innate abilities of vegetation, LID seeks to emulate and sustain the natural hydrological functions of a site prior to development. *The essence of LID lies in its capacity to infiltrate, filter, store, and evaporate stormwater in a decentralized manner.* Diverging from the conventional "pipe-and-pond" approach, which funnels runoff away through pipes, catchment basins, and curbs and gutters, LID mitigates stormwater close to the source. It strategically addresses the challenges of polluted runoff by utilizing a distributed treatment landscape, weaving together nature-based solutions that harmonize with the environment. This background section explores the core principles and practices of LID, unraveling the potential it holds for sustainable and resilient stormwater management in diverse landscapes, such as those found in Volusia County, Florida.

A site-specific suite of LID best management practices can be applied to many development scenarios in Volusia County. Regardless of the project context, LID requires consideration of the following core site planning and design objectives:

1. Preserve or conserve existing site features and assets that facilitate natural hydrologic function.
2. Minimize generation of runoff from impervious surfaces and contamination as close to the source as possible.
3. Promote the distribution of retention, detention, treatment, and infiltration of runoff.
4. Harvest stormwater and rainwater on site.
5. Minimize site disturbance and compaction of soils through low impact clearing, grading, and construction measures.

The toolbox of LID best management practices is most effective when applied in a treatment train, or series of complementary stormwater management practices and techniques.

1.3 Implementing Low-Impact Development

The principles of Low-Impact Development (LID) transcend project size and land-use types, offering scalability and adaptability to diverse development scenarios. By breaking down development into four key components — building, property, street, and open space — stakeholders gain a clear framework for action within each realm. This approach highlights the multifaceted nature of LID, providing stakeholders with actionable opportunities to integrate sustainable practices at various scales.

Embracing LID means engaging in practices that not only minimize adverse effects on the environment but actively contribute to the restoration and enhancement of ecosystem functioning. In essence, LID is a dynamic and forward-thinking approach that empowers stakeholders to play a role in shaping development patterns for the betterment of current and future generations.

1.3.1 Building Design

Low-impact buildings consider innovative approaches for the roof, walls, and ground. Implementing LID techniques in these key areas can significantly contribute to sustainable stormwater management and overall community resilience.

Figure 1 - Conventional: drain, direct, discharge

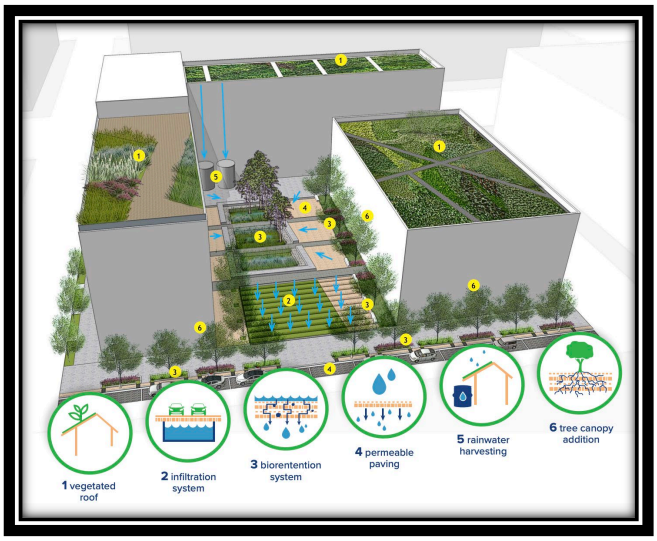


Figure 2 - Low-Impact: slow, spread, soak

1.3.2 Property Design

Unlike conventional property designs, low-impact property design involves a thoughtful approach to introduce productive landscapes, increase biodiversity, enhance on-site infiltration, and minimize impervious surfaces.

Figure 3 - Conventional Parking: drain, direct, discharge

Figure 4 - Low-Impact Parking: slow, spread, soak

Figure 5 - Conventional Lawn: drain, direct, discharge

Figure 6 - Low-Impact Lawn: slow, spread, soak

1.3.3 Street Design

LID techniques within the street, employ curb alternatives, and integrate Florida native landscapes, while maintaining safety and accessibility.

Figure 7 - Conventional: drain, direct, discharge

Figure 8 - Low-Impact: slow, spread, soak

1.3.4 Open Space Design

When contemplating the integration of LID principles into open space design, it's crucial to explore strategies that prioritize conservation, transform parks, and enhance corridors.

Figure 9 - Conventional: drain, direct, discharge

Figure 10 - Low-Impact: slow, spread, soak

1.4 Stormwater Quality Performance Standards

Volusia County recognizes the critical importance of maintaining high standards for stormwater quality. To ensure the protection of our water resources and the preservation of ecological integrity, the County requires that all development activity comply with the water quality standards set forth by the Florida Department of Environmental Protection (FDEP) and the St. Johns River Water Management District (SJRWMD).

Chapter 2:

Technical Requirements & Incentives

2.1 Standards

The following standards for development are required in conjunction with Division 19 Low Impact Development, Chapter 72 Code of Ordinances, as amended.

2.1.1 Overall

All LID best management practices and incentives are permitted by right and do not require any additional waivers from enforcement officials, the Development Review Committee, or variances from the Planning and Land Development Regulation Commission.

A developer must choose a minimum of four (4) Site Design Best Management Practices (BMPs) and two (2) Stormwater Storage, Treatment, and Conveyance BMPs to gain incentives. Once the six (6) BMPs are chosen, the developer can use all applicable incentives as identified within the BMP Incentive Matrix (Section 2.3), BMP Table (Section 2.4), and Chapter 4.

2.1.2 Pre-Application Meeting

A pre-application meeting, coordinated by the Land Development Activity, is recommended to discuss the proposed project, best management practices, and incentives.

2.1.3 Submittal Documents

The following submittal documents are required for applications using LID techniques, as referenced below. The BMP Table and Chapter 4 may list additional requirements if a specific BMP is chosen by the developer.

1. A cover letter detailing all best management practices and incentives implemented in the design, is required with submission of all applications utilizing LID techniques.
2. An Environmental Impact Assessment (EIA) is required with submission of an Overall Development Plan and Final Site Plan. This must include the following:
    a. Identification and evaluation of predevelopment conditions including hydrology, topography, soils, air quality, critical habitat, threatened and endangered species, historic/specimen trees, and invasive species.
    b. Identification of minimum federal, state, and local minimum requirements for protection and permitting.
    c. Evaluation of how the application of chosen LID best management practices for the proposed development assists with impacts to the predevelopment conditions. *See Chapter 3: Evaluating Your Site for helpful information.*
    d. Evaluation of whether the proposed development will negatively impact the environment.

2.1.4 Subdivisions

1. A Final Plat shall designate a managing entity (i.e. homeowners' association or property owners' association) for all LID improvements, which shall be responsible for raising all monies required for operations, maintenance, or future improvements to these areas. This language shall be incorporated into the covenants and restrictions enforced by the association.

2.1.5 Site Plans

1. A statement on the final site plan, affirming a perpetual commitment to LID practices and compliance with maintenance obligations, is required.
2. Inspection of compliance with these requirements will be overseen by the Land Development Manager, centralizing enforcement efforts and ensuring consistent adherence to specified maintenance obligations for LID practices.

2.2 Incentives

The following incentives are designed to appeal to a variety of stakeholders, encouraging widespread adoption of sustainable stormwater management techniques. Once the minimum six (6) Best Management Practices (BMPs) are chosen, the developer receives all incentives associated with implementing each chosen BMP, as permitted within the regulations below. Please be advised, these incentives do not override any regulations within the Florida Fire Prevention Code, other state and federal regulations, or those stated within Section 72-1167(a), of the Land Development Code.

2.2.1 Lot Development

A. Flexible Lot Sizes

The developer may create the preferred minimum lot size for the subdivision development. A lot development plan must be provided with the Overall Development Plan and Preliminary Plat applications.

B. Flexible Building Setbacks

The developer may identify the preferred minimum building setbacks for any primary or secondary structure within an interior lot in the development. However, on a project's perimeter lots, boundaries, or tracts, primary or secondary structures must comply with the minimum principal or accessory use yard requirements of the property's zoning classification.

The minimum building setbacks must be identified on a lot development plan with the Overall Development Plan and Preliminary Plat applications, and within the notes on a Final Site Plan application.

C. Increased Density

The developer may increase the density in urban residential zoning classifications within Urban Low Intensity to 8 dwelling units per acre and increase to 16 dwelling units per acre within Urban Medium Intensity.

Increased density is not permitted within rural land use classifications. In addition, conservation subdivisions cannot gain additional density bonuses for implementing LID BMPs beyond those permitted by Section 72-547, of the Land Development Code.

D. Increased Floor Area Ratio

The developer may increase the floor area ratio by 10% of the maximum within Urban Low Intensity, Urban Medium Intensity, Urban High Intensity, Commercial, and Industrial land use classifications.

2.2.2 Zoning

A. Increased Maximum Height

The maximum height permitted within Section 72-241, of the Zoning Ordinance, may be increased by 30 feet within multifamily, commercial and industrial zoning classifications.

Height incentives are not permitted in the following areas:

1. Between the Atlantic Ocean and the westerly boundary of any lots or parcels that abut the easterly right-of-way line of the easternmost north-south public maintained roadway.
2. The area 50 feet west of the westerly right-of-way line of the easternmost north-south public maintained roadway.

B. BMP Permitted within Landscape Buffers and Building Setbacks

The engineer does not have to abide by the prohibitions related to stormwater within Section 72-284, of the Zoning Ordinance.

C. BMP Permitted within Landscape Islands and Row-Ends

The engineer does not have to abide by the prohibitions related to stormwater within Section 72-284, of the Zoning Ordinance.

D. BMP Credited as Landscaping

The engineer does not have to abide by the specific planting requirements of Section 72-284, of the Zoning Ordinance, but may propose an alternative native planting plan with the stormwater best management practice to the Zoning Enforcement Official.

E. BMP Credited as Common Open Space

The specific Site Design or Stormwater Storage, Treatment and Conveyance best management practice is permitted within and counts toward common open space areas. A maximum 50% of the pond area can be used as common open space.

F. Off-Street Parking Flexibility

The minimum and maximum number of off-street parking spaces, required within Section 72-286, of the Zoning Ordinance, may be increased or decreased by 25%. This does not apply to single-family dwellings.

G. Increased Lot Coverage

The maximum lot coverage consisting of principal and accessory buildings and structures permitted within Section 72-241, of the Zoning Ordinance, may be increased by 5%.

2.2.3 Environmental

A. Reduction in Tree Replacement Requirements

This incentive allows for a five-percent reduction in tree replacement required by Section 72-842(a), of the Land Development Code. Therefore, the tree replacement for this incentive is based on the replacement of 10 percent of the total cross-sectional area of the trunk of the tree removed.

2.2.4 Fees

Fees will be reduced when the initial application is submitted. If the developer chooses to remove LID best management practices from the plan during the review process, the reduced fee amount must be paid prior to issuance of a Development Order or Certificate of Occupancy, as determined by the Land Development Manager.

A. Reduced Building Permit Application Fees

Building permit application fees for residential (RES) and commercial (COM) structures may be reduced by 10 percent. This does not include application fees for accessory structures or ancillary permits, or applications that are using a Private Provider service for plan review as described in Florida Statutes 553.

B. Reduced Land Development Application Fees

The following initial application fees may be reduced by 10 percent:

Subdivision Review Fees

Overall Development Plan Development Order

Preliminary Plat Development Order

Final Plat Development Order

Site Plan Review Fees

Final Site Plan Development Order

2.2.5 Other

A. Variance and/or Waiver Not Required

The BMP and associated incentive are permitted by right, unless otherwise stated within the Comprehensive Plan

2.3 BMP Incentive Matrix

The BMP Incentive Matrix aims to provide a snapshot of the BMP categories and incentives, giving a planner or design engineer a quick guide to utilize when designing a site.

Site Design Best Management Practices & Incentives

	Flexible Lot Sizes	Flexible Building Setbacks	Increased Density	Increased Floor Area Ratio	Increased Maximum Height	BMP Permitted within Landscape Buffers and Building Setbacks	BMP Permitted within Landscape Islands and Row-Ends	BMP Credited as Landscaping	BMP Credited as Common Open Space	Off-Street Parking Flexibility	Increased Lot Coverage	Reduction in Tree Replacement Requirements	Reduced Building Permit Application Fees	Reduced Land Development Application Fees	Variance and/or Waiver not Required
Maintain Natural Topography – **Option A**	x	x	x	x	x					x	x		x	x	x
Maintain Natural Topography – **Option B**	x	x			x					x			x	x	x
Preserving Floodplain	x	x	x	x	x						x	x	x	x	x
Retaining Tree Canopy and Native Landscaping												x	x	x	x
Retaining Large Riparian or Vegetated Natural Buffers		x				x		x			x		x	x	x
Cluster Subdivision	x*	x*									x	x	x	x	x
Conservation Subdivision	x*	x*	x*								x*	x	x	x	x
Common Open Space	x	x								x	x		x	x	x
Corridor Protection						x	x		x	x	x		x	x	x

Site Design Best Management Practices & Incentives (cont.)

	Flexible Lot Sizes	Flexible Building Setbacks	Increased Density	Increased Floor Area Ratio	Increased Maximum Height	BMP Permitted within Landscape Buffers and Building Setbacks	BMP Permitted within Landscape Islands and Row-Ends	BMP Credited as Landscaping	BMP Credited as Common Open Space	Off-Street Parking Flexibility	Increased Lot Coverage	Reduction in Tree Replacement Requirements	Reduced Building Permit Application Fees	Reduced Land Development Application Fees	Variance and/or Waiver not Required
Native Landscape, Fertilizers, and Irrigation - **Option A**										x			x	x	x
Native Landscape, Fertilizers, and Irrigation - **Option B**										x		x	x	x	x
Habitat Management		x				x		x					x	x	x
Alternative Surface Material										x			x	x	x
Concentrated Landscape Parking Islands and Row-Ends							x	x	x	x			x	x	x
Minimizing Building Construction Footprint				x	x					x			x	x	x
Total Impervious Area - **Option A**		x		x	x					x			x	x	x

Site Design Best Management Practices & Incentives (cont.)

	Flexible Lot Sizes	Flexible Building Setbacks	Increased Density	Increased Floor Area Ratio	Increased Maximum Height	BMP Permitted within Landscape Buffers and Building Setbacks	BMP Permitted within Landscape Islands and Row-Ends	BMP Credited as Landscaping	BMP Credited as Common Open Space	Off-Street Parking Flexibility	Increased Lot Coverage	Reduction in Tree Replacement Requirements	Reduced Building Permit Application Fees	Reduced Land Development Application Fees	Variance and/or Waiver not Required
Total Impervious Area - **Option B**	x	x											x	x	x
Minimize Directly Connected Impervious Areas						x	x		x				x	x	x

*These incentives are currently within Section 72-304, of the Zoning Ordinance, and Section 72-547, of the Land Development Code.

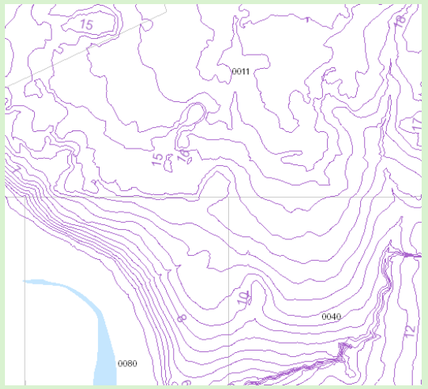
Stormwater Storage, Treatment and Conveyance Best Management Practices & Incentives

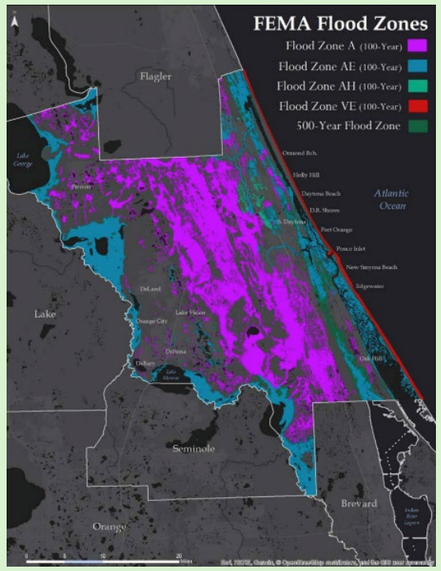
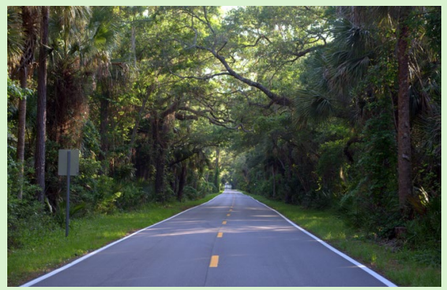
	Flexible Lot Sizes	Flexible Building Setbacks	Increased Density	Increased Floor Area Ratio	Increased Maximum Height	BMP Permitted within Landscape Buffers and Setbacks	BMP Permitted within Landscape Islands and Row-Ends	BMP Credited as Landscaping	BMP Credited as Common Open Space	Off-Street Parking Flexibility	Increased Lot Coverage	Reduction in Tree Replacement Requirements	Reduced Building Permit Application Fees	Reduced Land Development Application Fees	Variance and/or Waiver not Required
Stormwater Treatment Park						x		x	x				x	x	x
Wet Pond	x	x											x	x	x
Dry Pond	x	x											x	x	x
Underground Retention and Detention Systems	x	x	x								x		x	x	x
Stormwater Harvesting		x				x							x	x	x
Vegetated Stormwater Conveyance						x	x	x					x	x	x
Rain Gardens						x	x	x	x				x	x	x
Tree Box Filters and Rainfall Interceptor Trees							x	x					x	x	x
Vegetated Roofs and Walls		x						x					x	x	x

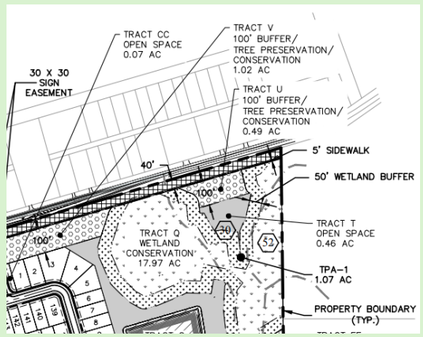
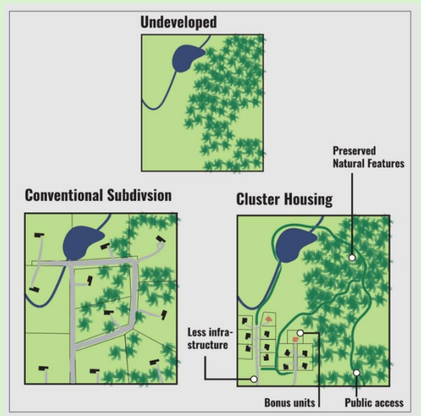
2.4 BMP Table

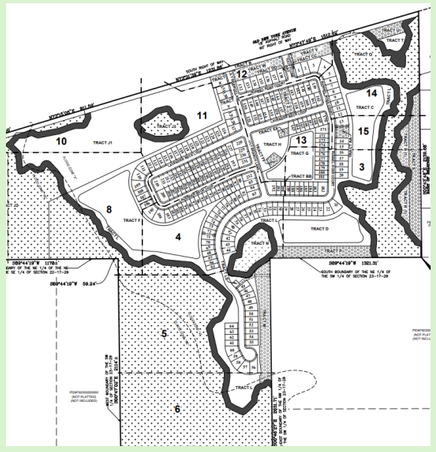
The BMP Table provides a brief definition, examples, the associated incentives, requirements to receive incentives, and reviewing entity.

LID Best Management Practices (BMPs) Table – Site Design

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.1.A.	Maintain Natural Topography	 Figure 11	Design buildings and infrastructure around existing topography, rather than re-contouring the land to fit the building design.	**Option A:** • **All incentives for Option B** • **Increased Density** (Section 2.2.1.C.) • **Increased Floor Area Ratio** (Section 2.2.1.D.) • **Increased Lot Coverage** (Section 2.2.2.G.) **Option B:** • **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Increased Maximum Height** (Section 2.2.2.A.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	**Option A**: Maintain natural topography for 30% of the site. The area must be contiguous and preserved with a conservation easement dedicated to Volusia County, severing all development rights. The submitted Final Site Plan or Overall Development Plan and Preliminary Plat must identify the square-footage/acreage of these areas. **Option B:** Require stem-wall construction for all primary structures. This must be noted on the Final Plat or Final Site Plan. If a subdivision, this must also be stated within the Declaration of Covenants, Conditions and Restrictions (DCCRs). Fill/grading is limited to the footprint of and a 15-foot perimeter around the structure to facilitate stormwater conveyance. This must be depicted within the engineered drawings on the Final Site Plan or Preliminary Plat. *Pairs well with: Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B.), Habitat Restoration or Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), and Minimize Total Impervious Area (Section 4.2.6.B.)*	**Option A:** Development Engineering **Option B:** Land Development

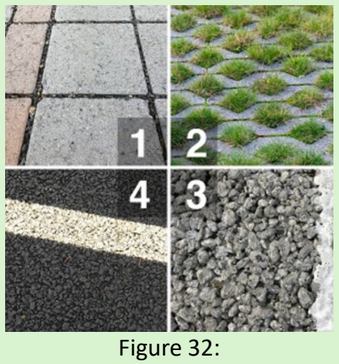
Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.1.B.	Preserving Floodplain	 Figure 14	Preserving floodplains is crucial for mitigating flood damage and maintaining ecological balance. Floodplains store excess water, reducing flood peaks and velocities, particularly vital in urban areas. Floodplains slow runoff, promoting water infiltration and groundwater recharge, essential for local water sources. During non-flood periods, they regulate flow through groundwater discharge, mitigating flood peaks and low flows. Protecting floodplains not only safeguards communities from disasters but also sustains the health of riverine environments.	• **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Increased Density** (Section 2.2.1.C.) • **Increased Floor Area Ratio** (Section 2.2.1.D.) • **Increased Maximum Height** (Section 2.2.2.A.) • **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduction in Tree Replacement Requirements** (Section 2.2.3.A.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Protect 100% of the FEMA Flood Hazard Areas identified at the time of application through a conservation easement dedicated to Volusia County, severing all development rights, when they encompass 30% or more of the site. This can include the tree preservation area required by Section 72-837, of the Land Development Code (LDC). *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B.), Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), and Minimize Total Impervious Area (Section 4.2.6.B.)*	Development Engineering & Land Development
4.2.2.A.	Retaining Tree Canopy and Native Vegetation	 Figure 15: Large tree canopies in Ormond Beach, Florida.	This refers to the intentional preservation and incorporation of existing natural vegetation, including trees, shrubs, and ground cover. This approach aims to minimize disturbance to natural ecosystems and preserve biodiversity.	• **Reduction in Tree Replacement Requirements** (Section 2.2.3.A.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Retain an additional 5% of the square footage of any development for the preservation of existing trees beyond the minimum requirements of Section 72-837, of the LDC. A conservation easement dedicated to Volusia County, severing all development rights, is required. *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B), Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), and Minimize Total Impervious Area (Section 4.2.6.B.)*	Environmental Management

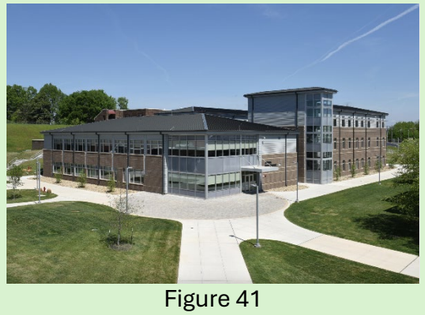
Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.2.B.	Retaining Large Riparian or Vegetated Natural Buffers	 Figure 17: Excerpt of subdivision construction plan	This refers to strips or areas of vegetation strategically located along the edges of water bodies, drainage channels, or developed areas to mitigate the impacts of stormwater runoff and protect water quality. These buffers help to slow down, filter, and absorb stormwater before it enters water bodies.	• **Flexible Building Setbacks** (Section 2.2.1.B.) • **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Credited as Landscaping** (Section 2.2.2.D) • **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	**<u>Option A</u>:** Retain a 20% greater buffer than the minimum required by Division 11, of the LDC, adjacent to all wetland/surface waters on 100% of the site. **<u>Option B</u>:** Retain a 20% greater natural landscape buffer than the minimum required by Section 72-284, of the Zoning Ordinance (ZO), along all property boundaries. *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B.), Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), and Minimize Total Impervious Area (Section 4.2.6.B.)*	**Option A:** Environmental Management **Option B:** Zoning
4.2.2.C.	Cluster Subdivisions	 Figure 18	This refers to a development design technique that permits a reduction in lot area by concentrating building in a specific area to allow the remaining land to be used for recreation, open space, or preservation of environmentally sensitive areas.	**<u>Incentives currently within Section 72-304, of the ZO</u>:** • **Flexible Lot Sizes** (Section 72-304(b)(2), of the ZO) • **Flexible Building Setbacks** (Section 72-304(b)(4), of the ZO) **<u>Additional Incentives</u>:** • **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduction in Tree Replacement Requirements** (Section 2.2.3.A.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.)	Follow the provisions of Section 72-304, of the ZO. *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B.), Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), Minimize Total Impervious Area (Section 4.2.6.B.), and Stormwater Treatment Park (Section 4.3.1.A.)*	Zoning

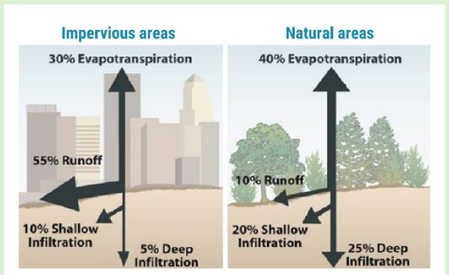
Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
				• **Variance and/or Waiver Not Required** (Section 2.2.5.A.)		
4.2.2.D.	Conservation Subdivisions	 Figure 20	A development design to implement the smart growth initiative goals, objectives and policies established in the Comprehensive Plan. The regulations within Section 72-547, of the Land Development Code, set forth a flexible process for authorizing conservation subdivisions with innovative designs, provide for standards and locational criteria to site lots in an area suitable for development, and provide procedures for permanent conservation management of valuable natural resources.	**<u>Incentives currently within Section 72-547, of the LDC</u>:** • **Flexible Lot Sizes** (Section 72-547(c)(3), of the LDC) • **Flexible Building Setbacks** (Section 72-547(c)(3), of the LDC) • **Increased Density** (Section 72-547(c)(12), of the LDC) • **Increased Lot Coverage** (Section 72-547(c)(11), of the LDC) **<u>Additional Incentives</u>:** • **Reduction in Tree Replacement Requirements** (Section 2.2.3.A.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Follow the provisions of Section 72-547, of the LDC. *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Common Open Space (Section 4.2.3.A.), Corridor Protection (Section 4.2.3.B.), Habitat Management (Section 4.2.4.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), Minimize Total Impervious Area (Section 4.2.6.B.), and Stormwater Treatment Park (Section 4.3.1.A.)*	Land Development

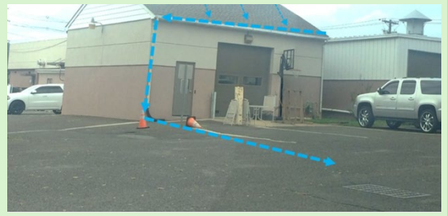
Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.3.A.	Common Open Space	 Figure 21: Sunset Point Park located in Tamarac, FL.	Areas reserved and designed for the leisure or recreational use of the owners of a residential development and may contain recreational facilities.	• **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	**Option A:** Provide an additional 5% common open space beyond the minimum required. This area may be preserved in a natural state but cannot include the minimum tree preservation area required by Section 72-837, of the LDC. **Option B:** Where no minimum common open space is required, provide a minimum 15% common open space. This cannot include the minimum tree preservation area required by Section 72-837, of the LDC. *Pairs well with: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Corridor Protection (Section 4.2.3.B.), Habitat Management (Section 4.2.4.B.), and Stormwater Treatment Park (Section 4.3.1.A.)*	**All Options:** Zoning
4.2.3.B.	Corridor Protection	 Figure 22: Vegetated multi-use trail in Volusia County, Florida	Linear corridors of protected open space that connect natural areas, parks and communities for recreational, ecological, and transportation purposes.	• **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Common Open Space** (Section 2.2.2.E.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	**Option A:** Preserve natural land which provides a connection to (or is within) the Florida Wildlife Corridor or the Volusia Conservation Corridor and continues through the development project to allow future connection and expansion of the corridor. This area must be at least 30 feet wide and can count toward the required 15% tree preservation area. A conservation easement dedicated to Volusia County, severing all development rights, is required. **Option B:** Create an internal vegetated multi-use trail of pervious material that connects to a larger pedestrian/bicycle network. The area dedicated to this use must include existing or planted native shade tree species and native understory vegetation. Tree species chosen must have enough space from the trail to ensure survival, as approved by the County Forester. *Pairs well with: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Corridor Protection (Section 4.2.3.B.), Native Landscape, Fertilizers*	**Option A:** Environmental Management **Option B:** Development Engineering, Environmental Management & Traffic Engineering

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
					and Irrigation (Section 4.2.4.A.), and Habitat Management (Section 4.2.4.B.)	
4.2.4.A.	Native Landscape, Fertilizers and Irrigation	 Figure 23	This involves intentionally using plant species native to Florida, adapted to local conditions without requiring excessive irrigation or chemicals. Incorporating native vegetation into landscaping reduces water, fertilizer, and maintenance needs while providing habitat for local wildlife. Native landscapes preserve Volusia County's biodiversity, support ecosystem functions like pollination, and contribute to regional ecological health.	**Option A:** • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.) **Option B:** • **All incentives for Option A** • **Reduction in Tree Replacement Requirements** (Section 2.2.3.A.) - for subdivision common areas and individual lots.	**Option A:** Require all planted vegetation within a commercial site to consist of Florida native species (including grasses). Smart Irrigation Controllers are required for the irrigation system. Educational signage describing the benefits of native plants and Be Floridian Now fertilizer principles are placed throughout public spaces. **Option B:** Require all subdivision common areas/landscape buffers to consist of Florida native vegetation (including grasses - non-native turfgrass is not permitted), Smart Irrigation Controllers for the irrigation system, and educational signage describing the benefits of native plants and Be Floridian Now fertilizer principles placed throughout the common areas. In addition, 20% of the square-footage of each residential lot must be planted with and maintain native vegetation. Irrigation systems for the individual lots must have Smart Irrigation Controllers. The plat notes and Declaration of Covenants, Conditions, and Restrictions must identify the individual lot requirements. A typical planting detail is required to be provided with the Preliminary Plat application. *Pairs well with: Corridor Protection (Section 4.2.3.B.), Concentrated Landscape Parking Islands and Row Ends (Section 4.2.5.B.), Stormwater Treatment Park (Section 4.3.1.A.), Wet Pond (Section 4.3.1.B.), Dry Pond (Section 4.3.1.C.), Vegetated Stormwater Conveyance (Section 4.3.2.A.), Rain Gardens (Section 4.3.2.B.), Tree Box Filters and Rainfall Interceptor Trees (Section 4.3.2.C.), and Vegetated Roofs and Walls (Section 4.3.2.D.)*	**All Options:** Environmental Management

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.4.B.	Habitat Management	 Figure 25: The left image depicts a sandhill community in 2011 before restoration management, and the right side shows the same sandhill community in 2017 after the implementation of restoration management.	This involves actions to rehabilitate, enhance, or sustainably manage natural habitats in and around development areas. The primary goal is to restore ecological function, biodiversity, and ecosystem services while minimizing adverse impacts on the environment and maximizing benefits for both humans and wildlife.	• **Flexible Building Setbacks** (Section 2.2.1.B.) • **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Preserve 10 acres or more of contiguous undeveloped area, with a conservation easement dedicated to Volusia County, severing all development rights. This can include the tree preservation area required by Section 72-837, of the LDC. A habitat management plan must be submitted with the Final Site Plan or Preliminary Plat application. The Declaration of Covenants, Conditions, and Restrictions must identify the habitat management requirements. Annual reports must be submitted to the Land Development Office. *Pairs well with: Maintaining Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), and Corridor Protection (Section 4.2.3.B.)*	Environmental Management
4.2.5.A.	Alternative Pervious Surface Material	 Figure 32: 1 – permeable pavers, 2 – grass pavers, 3 – pervious concrete, 4 – porous asphalt	Pervious pavements are retention systems and should be used as part of a treatment train to reduce stormwater volume. The treatment efficiency is based on the amount of annual runoff volume infiltrated, which depends on the available storage volume within the pavement system, the underlying soil permeability, and the ability for the system to readily recover.	• **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize alternative surface material (permeable pavers, grass pavers, pervious concrete, or porous asphalt) for a minimum 50% of the off-street parking spaces (excluding ADA parking spaces) and 100% of the sidewalks (excluding sidewalks identified as ADA accessible routes) . The pervious surface type must be identified on the site plans. *Pairs well with: Minimize Total Impervious Area (Section 4.2.6.B.) and Minimize Directly Connected Impervious Area (Section 4.2.6.C.)*	Development Engineering

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.5.B.	Concentrated Landscape Parking Islands and Row-Ends	 Figure 37	Concentrated landscape islands and row ends are deliberate design elements that focus vegetation in specific areas within a developed site, commonly found in parking lots. These areas feature native plants chosen for local conditions to enhance biodiversity, provide habitat for wildlife, improve air quality, and reduce heat island effects. They also manage stormwater runoff, promote soil infiltration, and enhance overall sustainability and resilience.	• **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **BMP Credited as Common Open Space** (Section 2.2.2.E.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Provide concentrated landscape islands and row-ends in all parking areas within commercial sites and subdivision common areas. These areas must have a minimum area of 300 square feet with width no less than 20 feet, if it abuts one parking space. If abutting two parking spaces, the minimum size must be doubled. Design must include an alternative curb design to facilitate stormwater runoff. Concentrated landscape islands and row-ends must be at a sufficient distance from structures to ensure clearance for fire engines at mature tree growth. *<u>Pairs well with</u>: Alternative Pervious Surface Material (Section 4.2.5.A.), Minimize Total Impervious Area (Section 4.2.6.B.), and Minimize Directly Connected Impervious Area (Section 4.2.6.C.)*	Zoning
4.2.6.A.	Minimize Building Construction Footprint	 Figure 41	Maximizing multi-story building designs reduces site disturbance and impervious footprint, reducing stormwater runoff. Stem-wall construction on sloping sites minimizes disturbance and environmental impact.	• **Increased Floor Area Ratio** (Section 2.2.1.D.) • **Increased Maximum Height** (Section 2.2.2.A.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize multistory construction to reduce building lot coverage by at least 25% of the maximum building lot coverage permitted within Section 72-241, of the Zoning Ordinance. This is only permitted within commercial and industrial zoning classifications. *<u>Pairs well with</u>: Maintain Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), and Minimize Total Impervious Area (Section 4.2.6.B.)*	Zoning

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.6.B.	Total Impervious Area	 Figure 42	Total impervious areas encompass all surfaces within a developed site that prevents or inhibits the infiltration of water into the ground.	**<u>Option A</u>:** • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Increased Floor Area Ratio** (Section 2.2.1.D.) • **Increased Maximum Height** (Section 2.2.2.A.) • **Off-Street Parking Flexibility** (Section 2.2.2.F.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.) **<u>Option B</u>:** • **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	**<u>Option A</u>:** Restrict the total impervious area within a commercial or industrial site to 50%. The notes on the Final Site Plan must state this maximum. **<u>Option B:</u>** Design the stormwater system to account for 10% more than the allowable lot coverage permitted within Section 72-241, of the Zoning Ordinance, for each individual lot within a residential development. This must be reflected on the site plans and within the stormwater calculations. *<u>Pairs well with</u>: Maintain Natural Topography (Section 4.2.1.A.), Preserving Floodplain (Section 4.2.1.B.), Retaining Tree Canopy and Native Vegetation (Section 4.2.2.A.), Retaining Large Riparian or Vegetated Natural Buffers (Section 4.2.2.B.), Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Alternative Pervious Surface Material (Section 4.2.5.A.), Concentrated Landscape Islands and Row Ends (Section 4.2.5.B.), Minimize Building Construction Footprint (Section 4.2.6.A.), and Minimize Directly Connected Impervious Area (Section 4.2.6.C.)*	Development Engineering

Section	Site Design BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.2.6.C.	Minimize Directly Connected Impervious Areas	 Figure 43: An example of directly connected impervious area.  Figure 44: An example of disconnected impervious areas.	Directly connected impervious areas allow runoff to be conveyed without interception by permeable areas that allow for infiltration and treatment. Disconnecting impervious areas from roofs allows runoff to flow onto adjacent pervious areas where it is infiltrated and filtered.	• **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Common Open Space** (Section 2.2.2.E.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Direct all roof stormwater runoff into a pervious area (i.e. rain garden, swale, etc.). The disconnected area must be identified on the site plans and within a table. *Pairs well with: Alternative Pervious Surface Material (Section 4.2.5.A.), Concentrated Landscape Islands and Row Ends (Section 4.2.5.B.) and Minimize Total Impervious Area (Section 4.2.6.B.)*	Zoning

LID Best Management Practices (BMPs) Table – Stormwater Storage, Treatment and Conveyance

Section	Stormwater BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.3.1.A.	Stormwater Treatment Park	 Figure 45: Stetson University Sandra Stetson Aquatic Center	Creation of stormwater treatment park within a commercial site or subdivision can serve as a multifunctional landscape that can enhance water quality, reduce flood risks, and promote groundwater recharge, while offering opportunities for passive/active recreation.	• **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **BMP Credited as Common Open Space** (Section 2.2.2.E.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Create a passive/active recreational stormwater treatment park with educational signage related to low impact development, one or more clearly defined, visible entrances connecting to other internal sidewalks, a pervious sidewalk surrounding the pond with pedestrian scale lighting, with no fewer than three of the following: a. Playground meeting the Consumer Product Safety Commission playground safety guidelines for public use, b. Two 15’ x 20’ picnic shelters with a minimum of 2 picnic tables each, c. One 20’ x 30’ covered pavilion or shelter with a minimum of 5 picnic tables each, d. Five standalone picnic tables, e. Open “free play” areas, f. Fenced dog park, or g. Three-piece ASTM F3101 Compliant Outdoor Fitness Site or individual stations. All passive/active recreational facilities and ponds must be located on the site plans. Planted vegetation must be shown on the landscape plan. **<u>Option A</u>:** Wet Pond – Must include a littoral zone comprised of native emergent and submerged aquatic macrophytic vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.). **<u>Option B</u>:** Dry Pond – Must include an upland buffer of native trees, shrubs and understory vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.). *<u>Pairs well with</u>: Cluster Subdivisions (Section 4.2.2.C.), Conservation Subdivisions (Section 4.2.2.D.), Common Open Space (Section 4.2.3.A.), Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.), Wet Pond (Section 4.3.1.B.), Dry*	**All Options:** Development Engineering and Zoning

Section	Stormwater BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
					Pond (Section 4.3.1.C.), and Stormwater Harvesting (Section 4.3.1.E.)	
4.3.1.B.	Wet Pond	 Figure 49: The above image depicts a wet pond with littoral shelf vegetation.	A wet pond refers to a constructed stormwater management facility designed to collect and temporarily store stormwater in a permanently wet impoundment in such a manner as to provide for treatment through physical, chemical, and biological processes with subsequent gradual release of the stormwater. Depending on the design, wet ponds may incorporate additional features such as forebays, outlet structures, and emergency spillways to regulate water levels and ensure proper functioning during storm events.	• **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A)	A wet detention system must include a pretreatment retention system equivalent to 15% more rainwater than required by the minimum standards within Division 8, of the LDC. The entirety of the pond must include a littoral zone comprised of native emergent and submerged aquatic macrophytic vegetation. Note: The 15% shall not include additional capacity for compensating storage for fill in the floodplain. *<u>Pairs well with</u>: Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.), Stormwater Treatment Park (Section 4.3.1.A.), and Stormwater Harvesting (Section 4.3.1.E.)*	Development Engineering & Environmental Management
4.3.1.C.	Dry Pond	 Figure 54	A dry pond is a constructed stormwater management facility designed to prevent the discharge of a given volume to stormwater runoff into surface waters. It stores a defined quantity of runoff, allowing it to percolate through permeable soils into the shallow ground water aquifer. Vegetation may be incorporated into the pond's design to stabilize soil, enhance infiltration, and provide habitat for wildlife.	• **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A)	Utilize a dry pond designed to capture 15% more stormwater than required by the minimum standards within Division 8, of the LDC. The entirety of the pond must include an upland buffer of native trees, shrubs and understory vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.). Note: The 15% shall not include additional capacity for compensating storage for fill in the floodplain. *<u>Pairs well with</u>: Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.) and Stormwater Treatment Park (Section 4.3.1.A.)*	Development Engineering & Environmental Management
4.3.1.D.	Underground Retention and Detention Systems		Underground stormwater management systems store excess stormwater underground using chambers, tanks, or pipes. These systems are designed to manage stormwater runoff by temporarily storing and infiltrating	• **Flexible Lot Sizes** (Section 2.2.1.A.) • **Flexible Building Setbacks** (Section 2.2.1.B.) • **Increased Density** (Section 2.2.1.C.)	Utilize an underground storage system on a commercial or multifamily site. The site plan must demonstrate a 10% reduction in natural area impact. The water table must be appropriate for the use of this BMP.	Development Engineering

Section	Stormwater BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
		 Figure 57: An underground detention system.	excess water into the surrounding soil or continually holding water, only discharging into other stormwater infrastructure.	• **Increased Lot Coverage** (Section 2.2.2.G.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Note: The applicant cannot gain an incentive if this is the only option to meet minimum stormwater management requirements of Division 8 on-site (i.e. the site is constrained). *<u>Pairs well with</u>: Maintaining Natural Topography (Section 4.2.1.A.), and Common Open Space (Section 4.2.3.A.).*	
4.3.1.E.	Stormwater Harvesting	 Figure 63: Cistern at fire station in Sarasota County, FL	Stormwater harvesting captures, treats, and reuses runoff from surfaces like rooftops for various purposes. It involves collecting water into storage tanks, cisterns, rain barrels, or ponds, then treating it for potable or non-potable uses.	• **Flexible Building Setbacks** (Section 2.2.1.A.) • **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize stormwater harvesting on-site to capture a volume of water sufficient to meet the minimum irrigation of the site per week (1 inch of irrigation per week). The volume will be counted toward the total stormwater volume required by Division 8, of the Land development Code. The proposed stormwater harvesting vessel (pond, cisterns, etc.) and all related piping, etc. and the reuse activity must be demonstrated on the Final Site Plan or Preliminary Plat construction plans. This is only permitted within multifamily, commercial, and industrial projects or subdivision common areas. Note: 1. Harvested stormwater for non-potable uses must be approved by the Florida Department of Health. 2. A cistern must be designed to eliminate openings for mosquitos and protected from sunlight. 3. Incentives cannot be gained by using a stormwater harvesting park to meet minimum fire water requirements required by the Florida Fire Prevention Code, only. An additional non-potable use must be included. *<u>Pairs well with</u>: Stormwater Treatment Park (Section 4.3.1.A.), Wet Pond (Section 4.3.1.B.), and Vegetated Roofs and Walls (Section 4.3.2.D.)*	Development Engineering & Environmental Management

Section	Stormwater BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
4.3.2.A.	Vegetated Stormwater Conveyance	 Figure 65	Vegetated stormwater conveyance areas (swales) are shallow channels that hold water only after rainfall, planted with suitable vegetation for soil stabilization and stormwater treatment. Swales are designed considering soil erodibility, percolation, slope, length, and drainage area to prevent erosion and reduce pollutant concentration in discharge.	• **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize vegetated stormwater conveyance on-site. The storage volume of the BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code. Utilize native vegetation on the slopes and flat areas up to 5 feet in width. This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area. <u>Pairs well with</u>: *Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.), Concentrated Landscape Parking Islands and Row Ends (Section 4.2.5.B.), Stormwater Treatment Park (Section 4.3.1.A.), and Wet Pond (Section 4.3.1.B.)*	Development Engineering & Environmental Management
4.3.2.B.	Rain Gardens	 Figure 70: Small retention basins that are integrated into a sites landscaping.	Rain gardens are shallow depressions planted with native Florida vegetation, placed in landscapes or parking lot islands to capture runoff from hard surfaces like roofs or sidewalks. They slow water flow, holding it briefly to allow natural infiltration or evaporation.	• **BMP Permitted within Landscape Buffers and Building Setbacks** (Section 2.2.2.B.) • **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **BMP Credited as Common Open Space** (Section 2.2.2.E.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.)	Utilize a rain garden on-site. The storage volume of the BMP, as demonstrated by stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code. This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area. The landscape plan must depict native plant species, location, number and any landscape rocks, etc. Species do not need to be chosen from the Zoning Landscape Plant List, as they may be aquatic in nature. <u>Pairs well with</u>: *Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.), Concentrated Landscape Parking Islands and Row Ends (Section 4.2.5.B.), Minimize Total Impervious Area (Section 4.2.6.B.), Minimize Directly Connected Impervious Area (Section 4.2.6.C.), and Stormwater Treatment Park (Section 4.3.1.A.)*	Development Engineering & Zoning

Section	Stormwater BMP	Examples	Description	Incentive	Requirements to gain Incentives	Reviewing Entity
				• **Variance and/or Waiver Not Required** (Section 2.2.5.A.)		
4.3.2.C.	Tree Box Filters and Rainfall Interceptor Trees	 Figure 79: A tree box filter.	A tree box filter is a tree vault containing amended soils underlain with crushed gravel media, which is connected to the overall stormwater system through perforated underdrain pipes. Inceptor trees are used adjacent to impervious surfaces as part of the stormwater treatment system to reduce runoff volume and pollution from the area by intercepting and capturing rainfall before it reaches the ground.	• **BMP Permitted within Landscape Islands and Row-Ends** (Section 2.2.2.C.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize a tree box filter with a Florida native rainfall interceptor tree on-site. The storage volume of the BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code. This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area. *<u>Pairs well with</u>: Native Landscape, Fertilizers and Irrigation (Section 4.2.4.A.), and Concentrated Landscape Parking Islands and Row Ends (Section 4.2.5.B.)*	Development Engineering & Environmental Management
4.3.2.D.	Vegetated Roofs and Walls	 Figure 82: A green roof located on the Escambia County Office in Pensacola, Florida.	Vegetated roofs and walls reduce the stormwater volume and annual mass of pollutants discharged. A vegetated roof can have a portion, or the entire area covered with vegetation. Vegetated walls are constructed to house plant material and engineered soil or inorganic growing medium.	• **Flexible Building Setbacks** (Section 2.2.1.B.) • **BMP Credited as Landscaping** (Section 2.2.2.D.) • **Reduced Building Permit Application Fees** (Section 2.2.4.A.) • **Reduced Land Development Application Fees** (Section 2.2.4.B.) • **Variance and/or Waiver Not Required** (Section 2.2.5.A.)	Utilize a vegetated roof or wall on-site. The storage volume of the BMP, as demonstrated by stormwater calculations, may be used to meet the total stormwater volume required by Division 8, of the Land development Code. This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area. All vegetation must be native and identified within the landscape plans. *<u>Pairs well with</u>: Native Landscape, Fertilizers, and Irrigation (Section 4.2.4.A.) and Stormwater Harvesting (Section 4.3.1.F.)*	Development Engineering & Environmental Management

To promote creativity in site design, the applicant may present alternative LID Best Management Practices (i.e. biosorption activated media (BAM), oversized pipes, flow control devices, up-flow filter systems, perforated pipes, floating wetland mats, etc.) and gain appropriate incentives, as approved by the Development Review Committee.

Chapter 3: Evaluating Your Site

3.1 Evaluating Predevelopment Conditions

Assessing predevelopment conditions is a crucial step in determining the most suitable Best Management Practices (BMPs) for your site. Predevelopment conditions refer to the natural state of the site before any construction or development takes place. Understanding these conditions helps in identifying potential environmental impacts and selecting appropriate BMPs to mitigate those impacts. These conditions encompass the existing features of the site, including both assets and constraints. While new development projects may exhibit natural or native landscapes, redevelopment projects often involve altered environments. During this phase, planners or design engineers should thoroughly identify and document site conditions conducive to various LID processes such as rainfall interception, capture, storage, evaporation, transpiration, infiltration, treatment, and harvesting. Equally important is the documentation of any constraints present, which aids in determining mitigation strategies to address degraded conditions effectively.

One way to begin this evaluation is by tracing the path of rainfall as it moves within and through the site, considering the following:

- Natural features such as tree canopies and vegetation intercept and capture rainfall, facilitating evaporation and transpiration back into the atmosphere.
- The topography of the site may either encourage stormwater drainage away from the site or promote on-site capture and infiltration.
- Understanding the hydrologic soil groups present on the site is essential for assessing their infiltration capacity and managing stormwater effectively.
- Consideration should be given to any soil disturbances or compaction, as these factors can significantly impact infiltration rates and increase runoff.
- Evaluating the water table elevation across the site provides insights into groundwater dynamics and potential impacts on stormwater management.
- Identification and protection of critical areas such as wetlands or riparian zones are vital for their role in natural pollutant filtration and water quality preservation.
- Physical structures such as buildings and parking alter natural drainage patterns; parking lots intercept rainfall and convey stormwater to other areas or away from the site.
- Impervious surfaces, both natural and structural, hinder stormwater infiltration and promote runoff.
- Assessing the effectiveness of existing engineered stormwater treatment systems and exploring opportunities for enhancement or retrofitting can improve overall water quality management on-site.

Recommended data sets and analyses to gather for the site and surrounding areas include but are not limited to the following:

- Historical and current land-use maps
- Aerial imagery
- Road and utility surveys
- Topographic and drainage maps
- Floodplain and wetland maps

- Riparian zone/stream buffer maps
- Historical soil information
- Tree and vegetation surveys
- Rainfall data
- Hydrologic analyses

With this information, planners and design engineers can pinpoint crucial site assets and constraints pertinent to LID.

3.2 Hydrology

Evaluating a site's natural hydrology allows for a comprehensive study of the site's water flow patterns, including the identification of natural drainage pathways, water sources, and areas potentially prone to flooding. Understanding the hydrological characteristics of the site enables planners and design engineers to develop strategies that mimic natural processes, reduce runoff, and protect water quality. The table demonstrates the inverse relationship between impervious surface coverage and key hydrological processes. As impervious surface coverage increases, runoff increases, while infiltration and evapotranspiration decrease. This highlights the importance of managing impervious surfaces to mitigate the adverse effects on the hydrological cycle and overall ecosystem health.

Impervious Surface	Runoff	Infiltration	Evapotranspiration
0% (Natural Ground)	10%	50%	40%
10%-20%	20%	45%	35%
35%-50%	30%	35%	35%
75%-100%	55%	15%	30%

3.3 Topography

The evaluation of a site's topography aims to provide a thorough analysis of the site's elevation, slope, and overall landform. By inventorying topographical assets, planners and design engineers can identify opportunities for sustainable design interventions, such as strategically locating impervious surfaces, preserving natural drainage channels, and implementing contour-based landscaping. Understanding the topography ensures that LID practices are tailored to the site's unique physical characteristics, optimizing stormwater management, and minimizing environmental impact.

Traditional construction methods typically require the alteration of natural contours and soil conditions. Preserving the natural slope of the landscape is crucial during LID site development. It's essential to design buildings and infrastructure around the existing topography rather than altering the land to accommodate building designs. Constructing buildings in harmony with the slope of the landscape is achieved by considering methods such as stem wall construction or pier and beam/raised floor foundations, as opposed to the traditional slab-on-grade approach. Raised floor construction without exterior fill on sloped sites minimizes the need for fill and reduces disturbances to the lot-level soil. Raised floor construction, with the finished floor elevation exceeding both the existing base flood elevation and projected sea level rise, minimizes the need for fill and reduces disturbances to the existing topography while providing resilience against future sea level rise and flooding.

3.4 Soils

Evaluating a site's soil composition is fundamental to effective LID. The objective is to delineate the extent of each soil type, determine their hydrologic group classifications, and assess their capacity for stormwater infiltration.

The soil profile includes the hydrologic soil group, depth, extent, and infiltration capacity that is present throughout the site. The diverse range of soil profiles will guide where the placement of impervious areas, open, or vegetated space will be located. Soil groups with low hydrologic function, such as clays and disturbed soils, are the ideal placement for infrastructure such as buildings, parking areas, roadways, ponds, and other impervious structures. Site locations with highly permeable soils are ideal areas for the inclusion of LID techniques. To protect the natural soil characteristics of the site, it is essential that construction activities limit soil compaction in areas where there are higher permeable soils.

3.5 Vegetation

Vegetation is a key component in the ecological balance of a site, influencing both stormwater management and overall environmental health. By cataloging plant species, density, and distribution, planners and design engineers can make informed decisions about preserving natural habitats, integrating green infrastructure, and strategically placing vegetated buffers. Understanding the vegetation assets of a site facilitates the incorporation of practices like green roofs, rain gardens, and permeable surfaces, enhancing biodiversity and contributing to the aesthetic and ecological value of the developed area.

The protection of trees and native vegetation plays an important role in promoting carbon dioxide adsorption, oxygen production, dust filtration, soil stabilization and enrichment, erosion prevention, surface drainage improvement and aquifer recharge, water pollution reduction, wildlife habitat, energy conservation, scenic beauty, and well-being of the community. Traditional site development typically includes clearing onsite vegetation and introducing new vegetation. This not only disturbs native soils but requires greater amounts of water and nutrients compared to the vegetation that was present pre-development. Preserving pre-development vegetation on the site and planting native vegetation is a sustainable practice that decreases the efforts and costs of maintenance.

Chapter 4: Catalog of Stormwater Best Management Practices

4.1 Introduction to Best Management Practices

This section of the guidance manual showcases the practices designed for the effective design, construction, operation, maintenance, and management of stormwater treatment systems that incorporate Low-Impact Development (LID) techniques or Best Management Practices (BMPs). These practices can be employed individually or orchestrated in a strategic sequence known as the BMP Treatment Train. The BMP Treatment Train operates as a dynamic and integrated framework, combining the strengths of various BMPs to achieve a synergistic effect in the removal of pollutants from stormwater runoff. Effective stormwater management practices aim to reduce pollutant loads by intercepting, capturing, treating, and infiltrating stormwater runoff before it reaches receiving waters. Pollutant load reduction refers to the amount of sediment, nutrients, and other contaminants that are carried by stormwater runoff into local water bodies. The BMPs are categorized into two key categories: Site Design BMPs and Stormwater Storage, Treatment, and Conveyance BMPs.

The toolbox of LID best management practices is most effective when applied in a treatment train, or series of complementary stormwater management practices and techniques.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I Appendix O (effective 6/28/2024), the calculated overall efficiency of a treatment train must account for the reduced loading or concentrations that are available for removal by the subsequent downstream treatment device. This relationship is shown the in equation below.

$$Overall\ Treatment\ Train\ Efficiency = Eff1 + [(1 - Eff1)x\ Eff2] + [\{(1 - Eff1) - ((1 - Eff1)xEff2)\}\ x\ Eff3\ ]$$

$$or\ (in\ simplified\ form)$$

$$= 1 - [(1 - Eff1) \times (1 - Eff2) \times (1 - Eff3) \times \ldots \times (1 - Effn)]$$

where:
Eff1 = efficiency (as a decimal) of initial or first treatment system
Eff2 = efficiency (as a decimal) of second treatment system
Eff3 = efficiency (as a decimal) of third treatment system
Effn = efficiency (as a decimal) of the n^{th} treatment system

"The Agencies [The Florida Department of Environmental Protection and Florida's five water management districts] encourage the use of Low Impact Design (LID) approaches, such as Green Stormwater Infrastructure (GSI), which can be used to supplement or replace traditional stormwater infrastructure for managing the impacts of rain and stormwater runoff. GSI and LID reduce pollution and treat stormwater by detaining or retaining rainfall near its source and providing treatment processes for stormwater use, instead of conveying stormwater to a downstream conventional treatment and discharge system. When applied early in the design process, low impact design techniques can reduce stormwater runoff volume and pollutants generated from project areas. Thus, the

use of GSI and LID, depending on the technology, can also treat stormwater in a manner similar to a traditional stormwater treatment BMP by treating total nitrogen and total phosphorus." (Environmental Resource Permit Applicant's Handbook Volume I, 2024 June 28).

4.2 Site Design BMPs

Site Design BMPs focus on strategies that preserve the existing natural features and minimize the disruption to the natural hydrology of a site. The primary goal is to design and plan developments in a way that reduces impervious surfaces, protects, and enhances essential ecosystems, and maintains the site's natural drainage patterns.

Traditional stormwater management approaches aim to target runoff away from development sites into man-made drainage systems. LID uses the natural, pre-development features of a site to maximize on-site filtration, storage, and treatment of runoff while reducing the disruptive effects of urban runoff patterns. Benefits of implementing site design LID techniques include:

- Maintain natural infiltration of stormwater.
- Reduce the discharge of pollutants into local waterways.
- Reduce flood impacts on county infrastructure.
- Create a more aesthetically pleasing development.
- Lower water management and treatment costs.
- Promote water conservation.

4.2.1 Retain Natural Landforms

As described in section 3.3, retention of natural landforms is a key LID practice, which ensures development of the site is tailored to its unique physical characteristics, optimizing stormwater management, and minimizing environmental impact.

A. Maintain Natural Topography

Understanding the significance of maintaining natural topography is fundamental for effective LID practices. Preserving natural topography, the inherent arrangement of landforms and surface features, enables us to utilize its innate capabilities in regulating water flow, controlling erosion, and reducing the risks related to flooding. Protecting natural hydrology helps minimize erosion by diverting additional flow and safeguards existing channels or flow paths, thereby maintaining water velocity through the site. Preserving natural topography is crucial when designing resilient stormwater management systems that work in harmony with the landscape (Lake George Association, n.d.).

Retaining natural landscape depressions is a fundamental function of LID. This involves preserving and utilizing existing low-lying areas in the landscape to manage stormwater runoff, enhance biodiversity, and promote sustainable land use practices. These depressions can serve as valuable retention or detention areas for stormwater, allowing for natural infiltration, storage, and gradual release of runoff. By retaining natural landscape depressions, developers can minimize the need for costly stormwater management infrastructure while preserving the ecological integrity of the site.

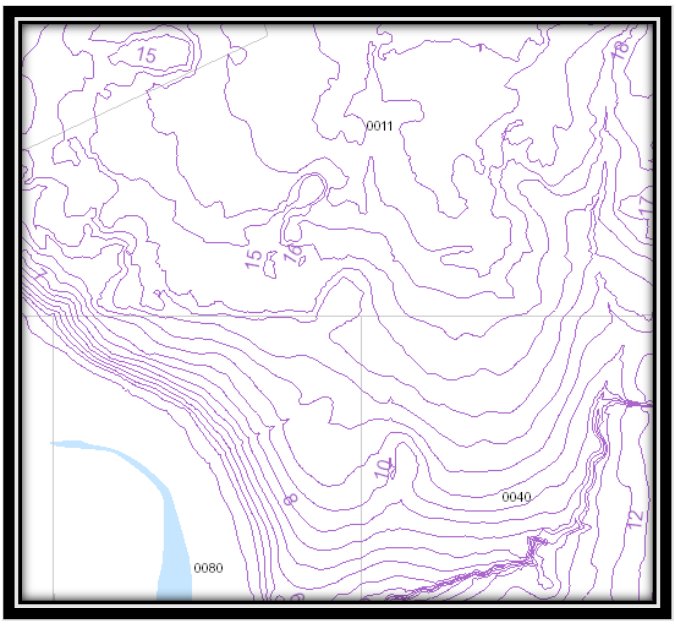


Figure 11: Topographic map

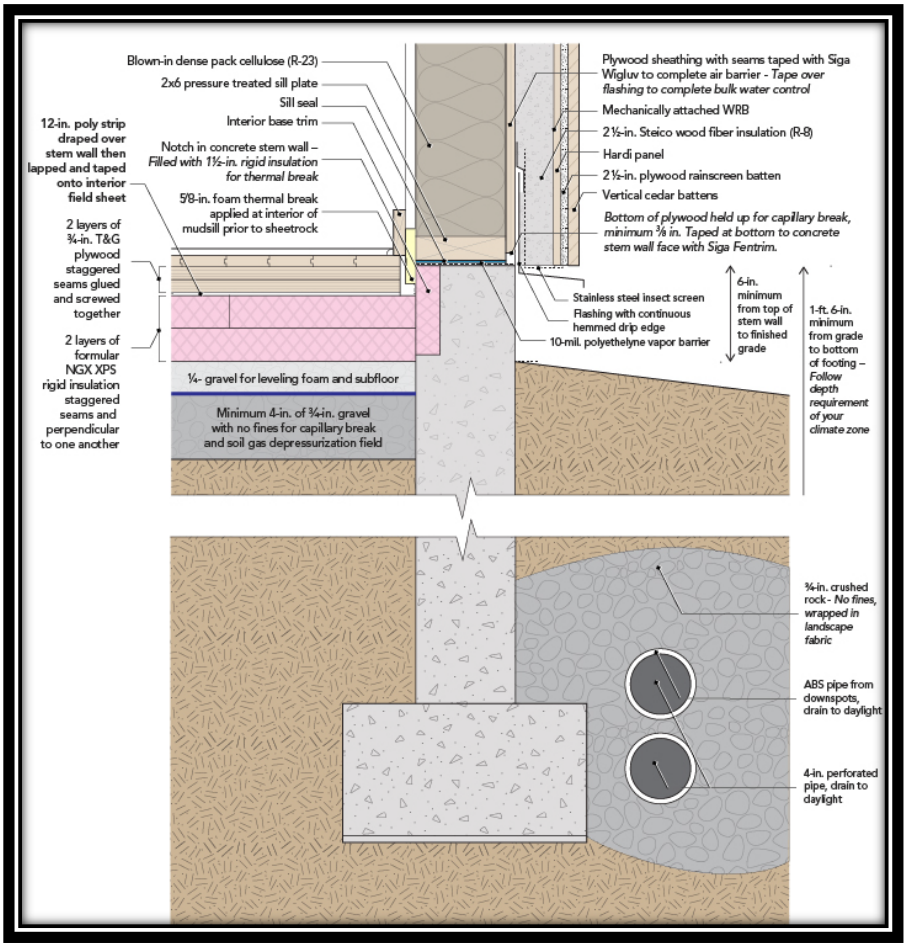


Figure 12

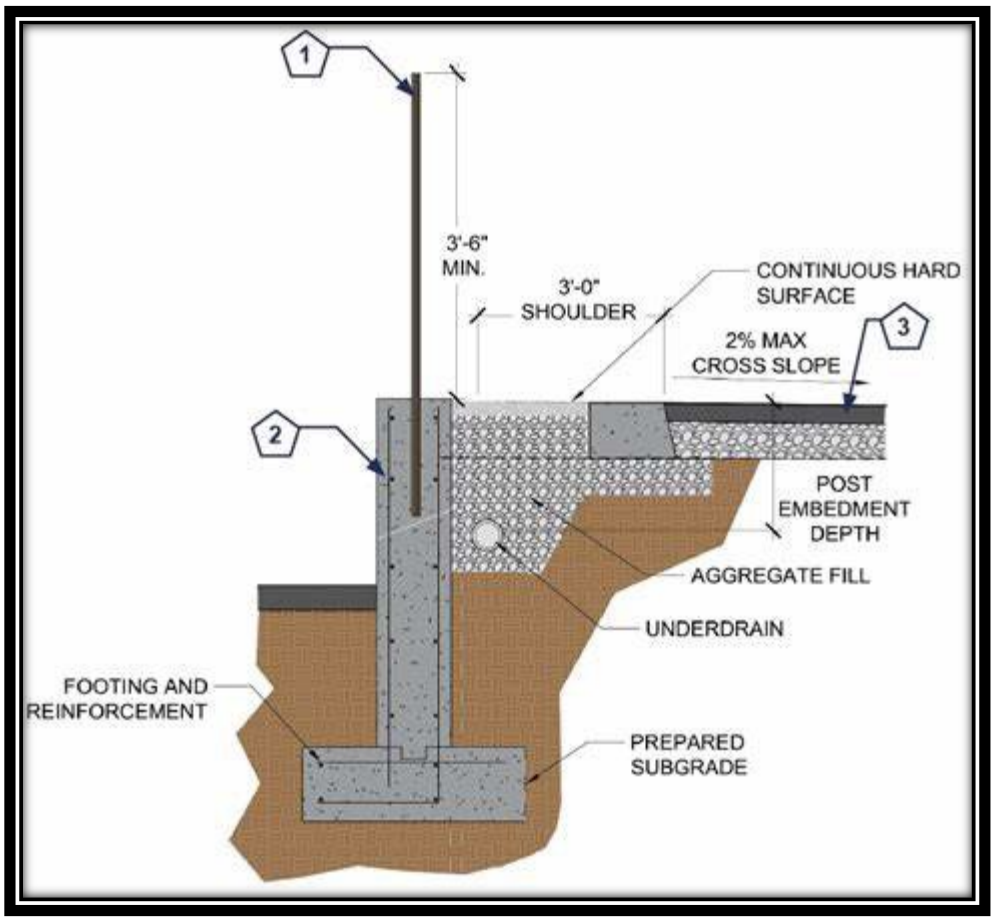


Figure 13

Requirements to gain incentives

Option A: Maintain natural topography for 30% of the site. The area must be contiguous and preserved with a conservation easement dedicated to Volusia County, severing all development rights. The submitted Final Site Plan or Overall Development Plan and Preliminary Plat must identify the square-footage/acreage of these areas.

Option B: Require stem-wall construction for all primary structures. This must be noted on the Final Plat or Final Site Plan. If a subdivision, this must also be stated within the Declaration of Covenants, Conditions and Restrictions (DCCRs).

Fill/grading is limited to the footprint of and a 15-foot perimeter around the structure to facilitate stormwater conveyance. This must be depicted within the engineered drawings on the Final Site Plan or Preliminary Plat.

Incentives

Option A: All incentives for Option B, Increased Density, Increased Floor Area Ratio, and Increased Lot Coverage.

Option B: Flexible Lot Sizes, Flexible Building Setbacks, Increased Maximum Height, Off-Street Parking Flexibility, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Preserving Floodplain

Preserving floodplains is paramount due to their multifaceted contributions to flood loss reduction and ecological stability. Floodplains serve as natural buffers against the destructive forces of flooding by storing excess water, effectively mitigating flood peaks and velocities. This storage capacity, particularly crucial in urban settings vulnerable to even minor storms, significantly minimizes the risk of severe damage. Moreover, the natural topography of floodplains, coupled with their vegetation, facilitates the reduction of flow rates and erosion, safeguarding riparian habitats and riverine ecosystems. Floodplains play a vital role in slowing runoff, allowing for water infiltration and groundwater recharge, which aids in maintaining local water sources and purifying water as it percolates through the soil. During non-flood periods, floodplains regulate flow by facilitating groundwater discharge, thereby mitigating seasonal flood peaks, and reducing the occurrence of extremely low flows. Preserving these invaluable natural features not only safeguards human settlements from flood-related disasters but also sustains the ecological health and resilience of environments (FEMA, 2022).

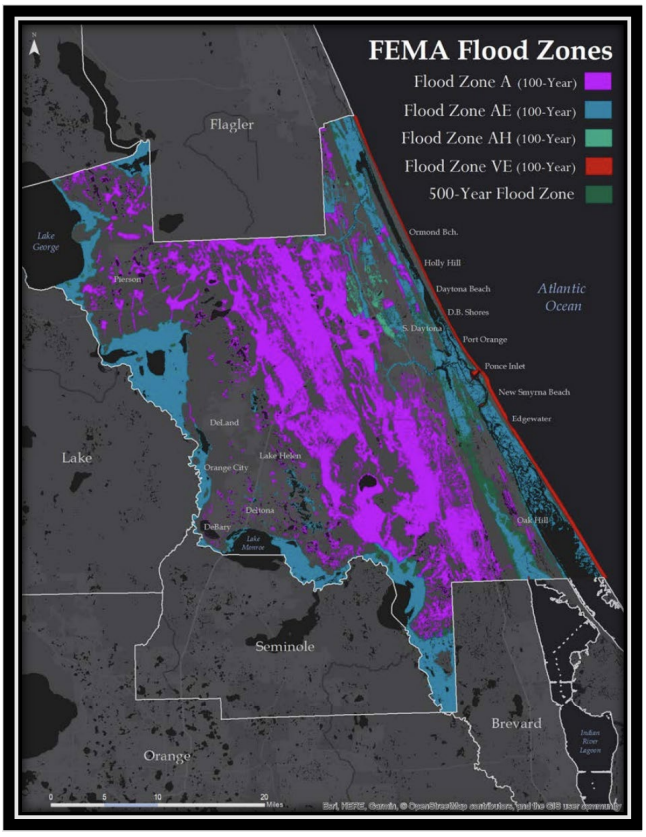


Figure 14: FEMA Flood Zones in Volusia County.

Requirements to gain incentives

Protect 100% of the FEMA Flood Hazard Areas identified at the time of application through a conservation easement dedicated to Volusia County, severing all development rights, when they encompass 30% or more of the site. This can include the tree preservation area required by Section 72-837, of the Land Development Code (LDC).

Incentives

Flexible Lot Sizes, Flexible Building Setbacks, Increased Density, Increased Floor Area Ratio, Increased Maximum Height, Increased Lot Coverage, Reduction in Tree Replacement Requirements, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.2.2 Preserve Existing Vegetation

Introduced in section 3.5, existing vegetation influences both stormwater management and overall health, acting as a key component in the ecological balance of a site.

A. Retaining Tree Canopy and Native Vegetation

Preserving tree canopy is crucial for effective stormwater management, serving as the first line of defense in controlling runoff. Retaining native and large tree canopies is an essential step in maximizing the interception and evapotranspiration capacity of landscapes, leading to a reduction in stormwater runoff generation. Research suggests that tree canopies have the capacity to intercept approximately 15-20% of the water from a storm event that falls on their leaves. This underscores the importance of prioritizing tree preservation to mitigate the impacts of urbanization on stormwater management and overall environmental health.

Figure 15: The above image depicts large tree canopies in Ormond Beach, Florida.

Requirements to gain incentives

Retain an additional 5% of the square footage of any development for the preservation of existing trees beyond the minimum requirements of Section 72-837, of the LDC. A conservation easement dedicated to Volusia County, severing all development rights, is required.

Incentives

Reduction in Tree Replacement Requirements, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Retaining Large Riparian or Vegetated Natural Buffers

Vegetated natural buffers are defined as areas with vegetation suitable for sediment removal, nutrient uptake, and soil stabilization, that are set aside between developed areas and a receiving water or wetland for stormwater treatment purposes. These strips or areas of vegetation strategically located along the edges of water bodies, drainage canals, or developed areas (such as landscape buffers) help to mitigate the impacts of stormwater runoff and protect water quality. These buffers typically consist of native trees, shrubs, grasses, and other vegetation that help to slow down, filter, and absorb stormwater before it enters water bodies. The benefits include serving as a wildlife corridor, reducing noise, and reducing the potential for siltation into a receiving water.

Vegetated natural buffers can also be used to treat stormwater runoff in rear-lot portions of a residential development that cannot be feasibly routed to the system serving the roads and fronts of the lots.

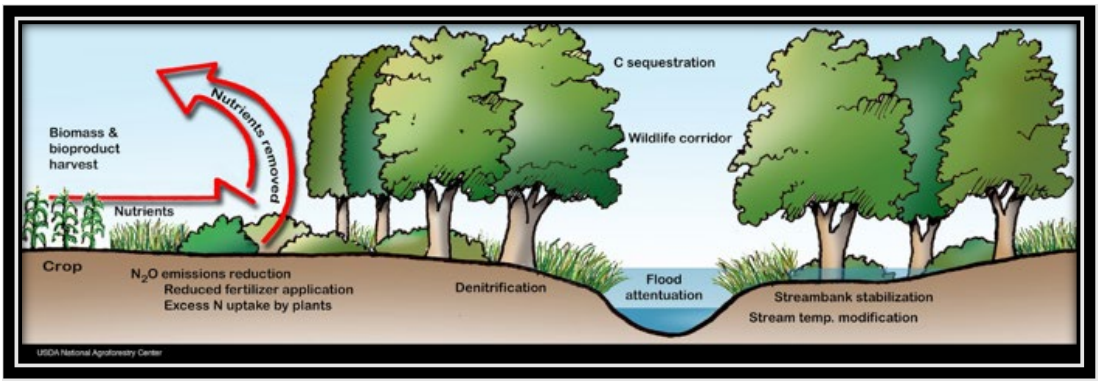


Figure 16: Benefits of vegetated buffers

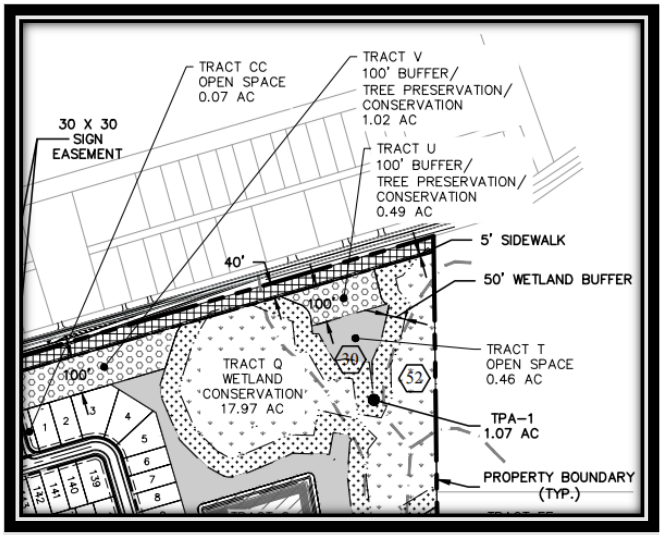


Figure 17: Excerpt of construction plan with large landscape buffers

Requirements to gain incentives

Option A: Retain a 20% greater buffer than the minimum required by Division 11, of the LDC, adjacent to all wetland/surface waters on 100% of the site.

Option B: Retain a 20% greater natural landscape buffer than the minimum required by Section 72-284, of the Zoning Ordinance (ZO), along all property boundaries.

Incentives

Flexible Building Setbacks, BMP Permitted within Landscape Buffers and Building Setbacks, BMP Credited as Landscaping, Increased Lot Coverage, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

C. Cluster Subdivisions

Clustering built infrastructure at the development or subdivision scale represents a highly effective technique for mitigating the overall environmental impacts of a project. This strategy involves consolidating buildings and amenities into compact, cohesive clusters, which brings numerous benefits. This approach minimizes site disturbance, preserving valuable natural areas and wildlife habitat, and reduces the total stormwater runoff from the site by reducing the length of roads, minimizing total impervious area, and decreasing the need for extensive stormwater infrastructure, cluster development promotes more efficient land use. Cluster subdivision regulations are described in Section 72-304, of the ZO.

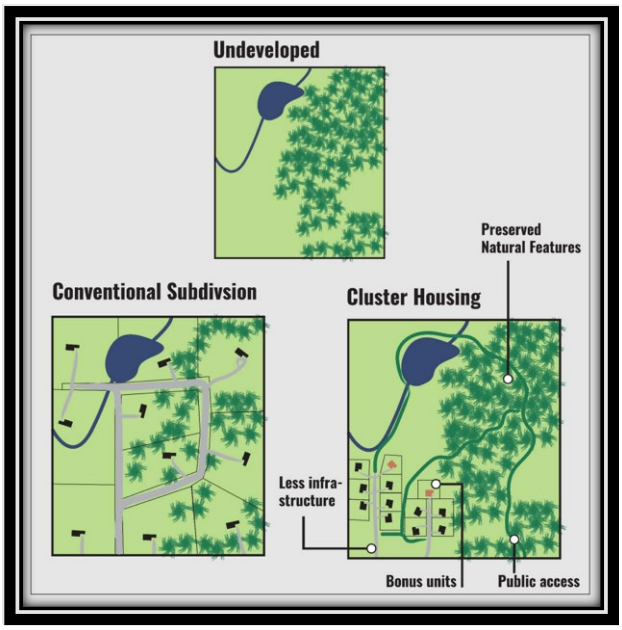


Figure 18

Requirements to gain incentives

Follow the provisions of Section 72-304, of the ZO.

Incentives

Currently within Section 72-304, of the ZO: Flexible Lot Sizes and Flexible Building Setbacks.

Additional Incentives: Increased Lot Coverage, Reduction in Tree Replacement Requirements, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

D. Conservation Subdivisions

Conservation Development (CD) is a land use planning strategy that integrates environmental conservation principles into the design and implementation of development projects. This approach seeks to preserve open space, protect natural habitats, and minimize ecological footprints while accommodating growth and development. A CD in Volusia County involves clustering buildings, preserving sensitive areas, and implementing conservation easements or land trusts to safeguard critical ecosystems. CD's require at least 60% of a site's buildable land to be permanently protected open space. CD regulations are described in Section 72-547, of the LDC, and can incorporate LID BMPs into the design.

Figure 19: The left image displays a traditional development, and the right image displays a conservation development

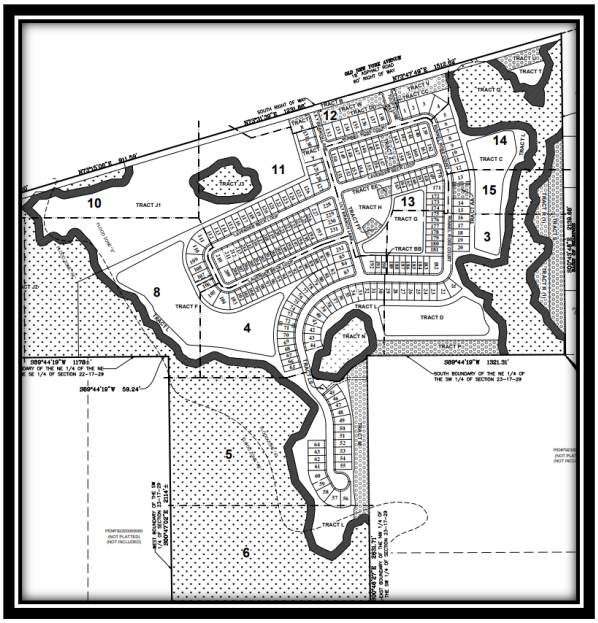


Figure 20: Conservation subdivision construction plan

Requirements to gain incentives

Follow the provisions of Section 72-547, of the LDC.

Incentives

Currently within Section 72-547, of the LDC: Flexible Lot Sizes, Flexible Building Setbacks, Increased Lot Coverage, and Increased Density.

Additional Incentives: Reduction in Tree Replacement Requirements, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.2.3 Preserve Functional Green Spaces

Functional green spaces include active and passive common open space areas and natural habitats. Preserving these areas and providing corridors within urban and suburban landscapes is important for maintaining ecological balance, fostering community well-being, and ensuring long-term sustainability.

A. Common Open Space

Common open space areas are reserved and designed for the leisure or recreational use of the owners of a residential development and may include recreational facilities. Common open space can be referred to as public space when including recreation facilities, or in nonresidential uses, such features as plazas or courtyards. Within the LID framework, stormwater best management practices are permitted within common open space areas, as provided within the BMP Table and Incentive Matrix.

Figure 21: Sunset Point Park located in Tamarac, FL.

Requirements to gain incentives

Option A: Provide an additional 5% common open space beyond the minimum required. This area may be preserved in a natural state but cannot include the minimum tree preservation area required by Section 72-837, of the LDC.

Option B: Where no minimum common open space is required, provide a minimum 15% common open space. This cannot include the minimum tree preservation area required by Section 72-837, of the LDC.

Incentives

Flexible Lot Sizes, Flexible Building Setbacks, Off-Street Parking Flexibility, Increased Lot Coverage, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Corridor Protection

Linear corridors of protected open space that connect natural areas, parks, and communities for recreational, ecological, and transportation purposes can preserve and restore nature in urban developments and can revitalize underutilized urban sectors. Corridors offer pathways for walking and cycling, spaces for outdoor activities, and vegetated buffers along waterways or urban areas. They serve to preserve wildlife habitats, promote biodiversity, and mitigate the effects of urban development.

Figure 22: Vegetated multi-use trail in Volusia County, Florida

Requirements to gain incentives

Option A: Preserve natural land which provides a connection to (or is within) the Florida Wildlife Corridor or the Volusia Conservation Corridor and continues through the development project to allow future connection and expansion of the corridor. This area must be at least 30 feet wide and can count toward the required 15% tree preservation area. A conservation easement dedicated to Volusia County, severing all development rights, is required.

Option B: Create an internal vegetated multi-use trail of pervious material that connects to a larger pedestrian/bicycle network. The area dedicated to this use must include existing or planted native shade tree species and native understory vegetation. Tree species chosen must have enough space from the trail to ensure survival, as approved by the County Forester.

Incentives

BMP Permitted within Landscape Buffers and Building Setbacks, BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Common Open Space, Off-Street Parking Flexibility, Increased Lot Coverage, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.2.4 Planted Vegetation

Intentionally planting, preserving, or restoring habitats and vegetation indigenous to the State of Florida will reduce the use of fertilizers and irrigation, giving a development a dramatic leg up on nutrient uptake, water storage and soil stability, compared to developments which utilize non-native or invasive species.

A. Native Landscape, Fertilizers, and Irrigation

Native plants have evolved to thrive in the local climate, soil types, and hydrological conditions. Incorporating a native Florida landscape design is resource-efficient and will minimize the need for supplemental inputs like fertilizers, irrigation, pesticides, or herbicides and is crucial for effective stormwater management and ecological balance. Additionally, native landscapes help to preserve the unique biodiversity of Volusia County and contribute to the overall ecological health of the region by promoting plant diversity and supporting ecosystem functions such as pollination and soil stabilization.

Plant material on any developed site should limit the use of non-native turf grass, such as St. Augustine Grass and Zoysia Grass, and utilize alternatives like Seeding Paspalum or native Florida groundcovers for active recreational areas. Moreover, incorporating native plants such as live oaks, magnolias, hickories, slash pine, and longleaf pine enhances the sustainability and resilience of development projects while preserving local ecosystems and biodiversity. The Volusia County Habitat Planting Guidelines and Zoning Landscape Buffer Plant List provide specific examples of trees, scrubs, and groundcovers to assist with developing a landscape plan.

Incorporating smart irrigation controllers, such as evapotranspiration controller or soil moisture sensors, are more efficient than a typical rain sensor. A soil moisture sensor helps to provide real-time data on soil moisture levels, enabling precise and targeted irrigation practices. By accurately assessing the moisture content of the soil, irrigation systems can adjust watering schedules based on actual plant needs, reducing water waste, and promoting water conservation. This proactive approach ensures that plants receive adequate hydration while minimizing the risk of overwatering, which can lead to soil erosion, nutrient runoff, and increased water consumption. Additionally, the use of moisture sensors helps optimize resource allocation, improve plant health, and contribute to the overall resilience and efficiency of LID practices in urban and suburban landscapes.

Standard requirements for fertilizer use in Volusia County can be found in Article VIII Florida Friendly Fertilizer Use, Chapter 50 Code of Ordinances. The Volusia County irrigation requirements are found in Section 72-284(6), Division 8 Supplementary Regulations, Article II Zoning, Chapter 72 Code of Ordinances, and Division 10 Water Wise Landscape Irrigation, Article III Minimum Standards for Environmental Protection, Chapter 50 Code of Ordinances.

Figure 23

Figure 24

Requirements to gain incentives

Option A: Require all planted vegetation within a commercial site to consist of Florida native species (including grasses). Smart Irrigation Controllers are required for the irrigation system. Educational signage describing the benefits of native plants and Be Floridian Now fertilizer principles are placed throughout public spaces.

Option B: Require all subdivision common areas/landscape buffers to consist of Florida native vegetation (including grasses - non-native turfgrass is not permitted), Smart Irrigation Controllers for the irrigation system, and educational signage describing the benefits of native plants and Be Floridian Now fertilizer principles placed throughout the common areas.

In addition, 20% of the square-footage of each residential lot must be planted with and maintain native vegetation. Irrigation systems for the individual lots must have Smart Irrigation Controllers. The plat notes and Declaration of Covenants, Conditions, and Restrictions must identify the individual lot requirements. A typical planting detail is required to be provided with the Preliminary Plat application.

Incentives

Option A: Off-Street Parking Flexibility, Increased Lot Coverage, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

Option B: All incentives for Option A and Reduction in Tree Replacement Requirements.

B. Habitat Management

Habitat management plays a crucial role in promoting sustainable land use practices while preserving and enhancing natural ecosystems. This can include rehabilitating degraded or altered habitats to their natural state, such as restoring wetlands, re-establishing native plant communities, removing invasive species, or creating wildlife corridors and wildlife habitats within developed areas. By restoring and managing natural habitats, LID projects can improve biodiversity, enhance ecosystem services, and mitigate the impacts of urbanization on local ecosystems.

Figure 25: The left image depicts a sandhill community in 2011 before restoration management, and the right side shows the same sandhill community in 2017 after the implementation of restoration management.

Requirements to gain incentives

Preserve 10 acres or more of contiguous undeveloped area, with a conservation easement dedicated to Volusia County, severing all development rights. This can include the tree preservation area required by Section 72-837, of the LDC.

A habitat management plan must be submitted with the Final Site Plan or Preliminary Plat application. The Declaration of Covenants, Conditions and Restrictions must identify the habitat management requirements. Annual reports must be submitted to the Land Development Office.

Incentives

Flexible Building Setbacks, BMP Permitted within Landscape Buffers and Building Setbacks, BMP Credited as Landscaping, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.2.5 Alternative Street and Parking Area Designs

LID street designs aim to minimize impervious surfaces, enhance water quality, and promote groundwater recharge while simultaneously fostering vibrant, livable, and environmentally conscious urban spaces.

To facilitate a multi-pronged stormwater management approach in alternative street and parking area designs, the project engineer can incorporate planted Florida native vegetation (Section 4.2.4.A.) and engineered systems such has permeable pavements (Section 4.2.5.A.) and tree box filters (Section 4.3.2.C.) to slow, filter, and cleanse stormwater runoff from these impervious surfaces. This design approach will also contribute to replenishing groundwater reservoirs, absorbing carbon emissions, enhancing air quality, and enhancing the visual appeal of neighborhoods.

Curb elimination, curb cuts, perforated pre-cast curbs, flush curbs, and vegetated curb extensions are all alternative designs to facilitate the natural flow of stormwater, allowing for improved infiltration into the soil and reducing the volume of runoff reaching storm drains. This approach helps mitigate flooding, improve water quality, and promote groundwater recharge.

Alternative designs may be presented and reviewed by the County Development Engineer. All alternative street designs must be dedicated to and maintained by a homeowners or property owners association.

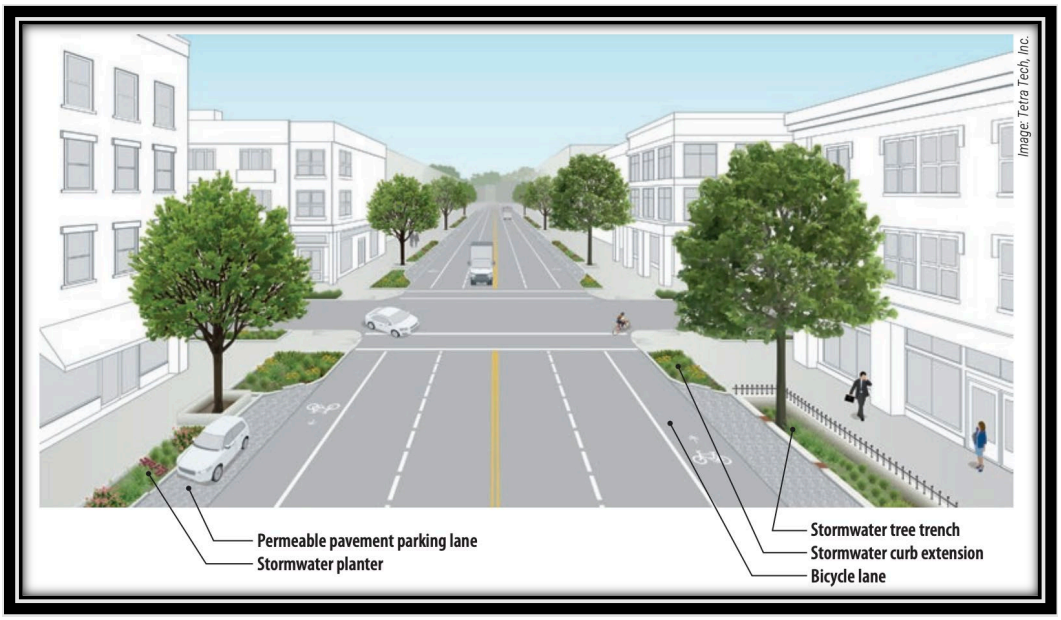


Figure 26: Alternative street design example.

Figure 27: Curb cut facilitates the entry of street runoff. If it reaches capacity, excess water will be directed to a bypass the system.

Figure 28: A permeable interlocking concrete paver parking lane is adjacent to a sidewalk planter.

Figure 29: Curb cut

Figure 30: Perforated Pre-Cast Curbs

Figure 31: Flush curb

A. Alternative Pervious Surface Material

Pervious pavement systems allow water to percolate and enter the soil below, reducing the volume and peak of stormwater runoff. Permeable surfaces include modular paving systems (concrete pavers, modular grass or gravel grids) or poured-in-place pavement (porous concrete, permeable asphalt). They work best on flat surfaces or with gentle slopes. Pervious pavement systems are retention systems that should be used as part of a BMP treatment train to reduce stormwater volume and pollutant load from parking lots and similar areas. These systems allow water to infiltrate through the pavement surface, rather than running off. The use of this BMP can enhance opportunities for green space creation and environmental sustainability within urban or built environments.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I (Revised 7/9/2024), the nutrient capability of these systems can be calculated in the same way as a dry retention system.

Figure 32: 1 – Permeable Pavers, 2 – Grass Pavers, 3 – Pervious Concrete, and 4 – Porous Asphalt

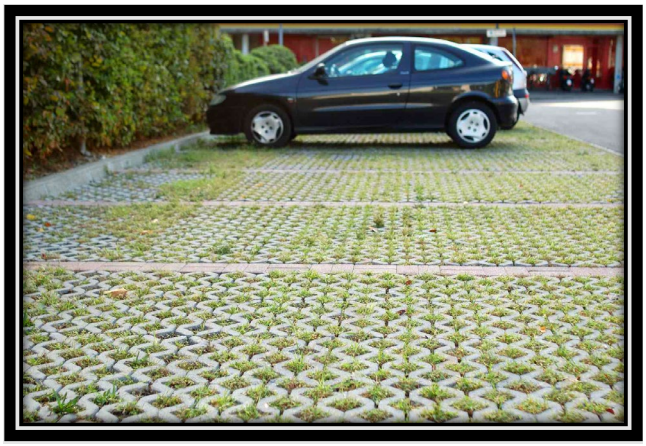


Figure 33: Grass Pavers

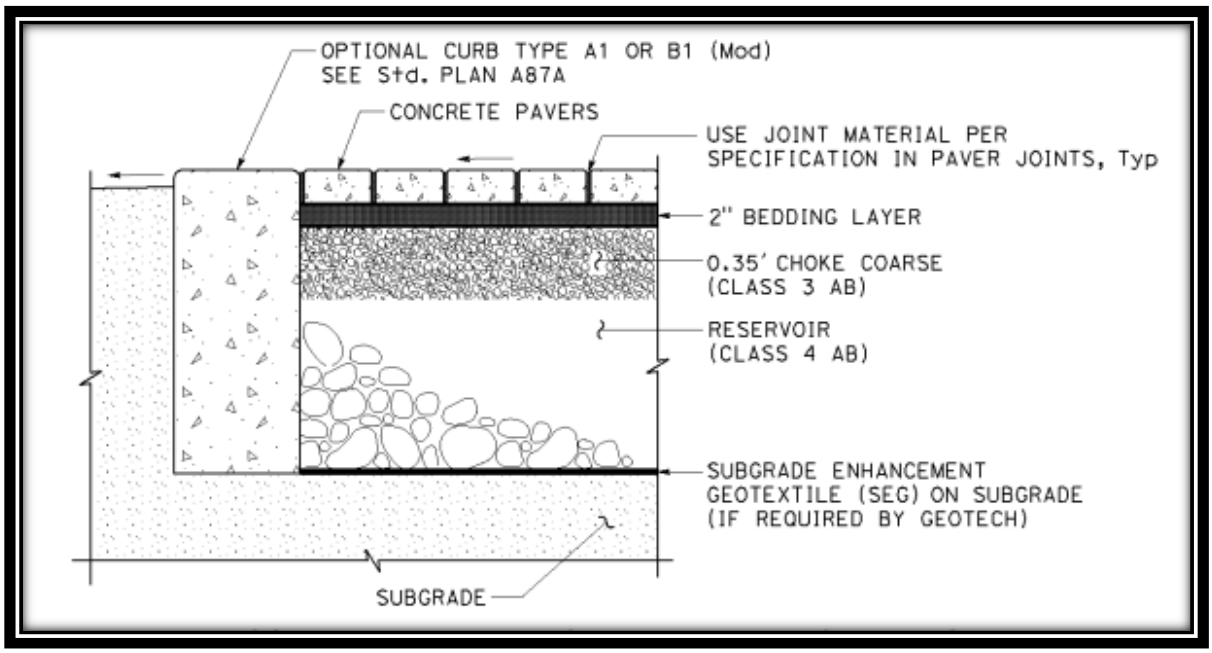


Figure 34: Example of a permeable interlocking concrete paver typical section.

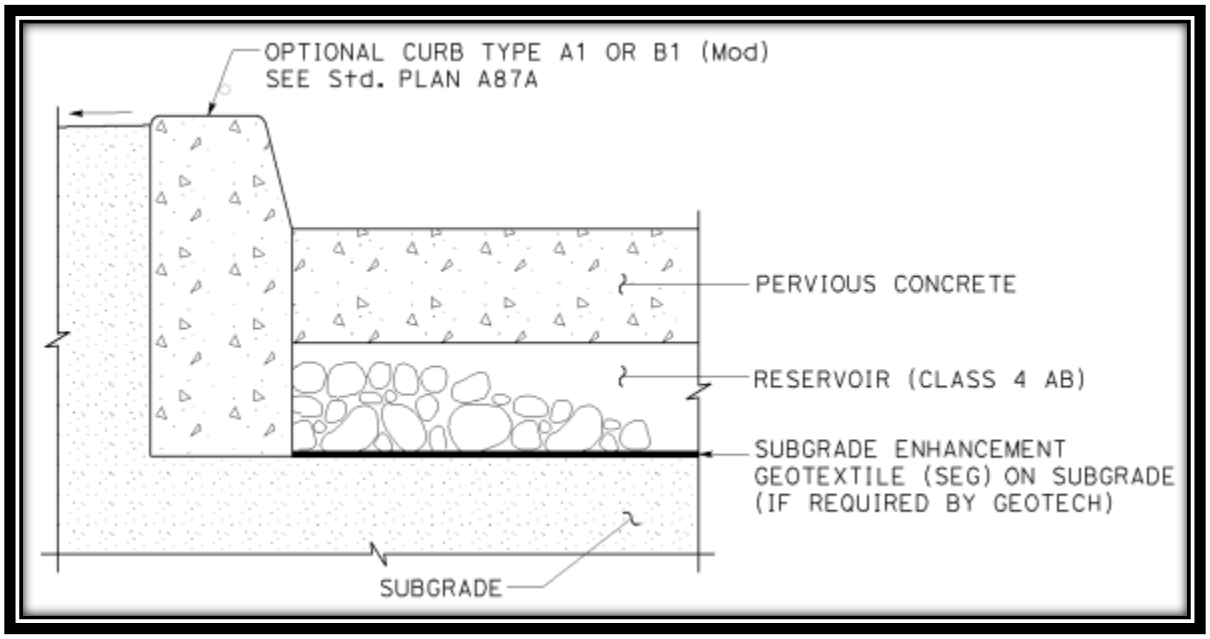


Figure 35: Example of a pervious concrete typical section.

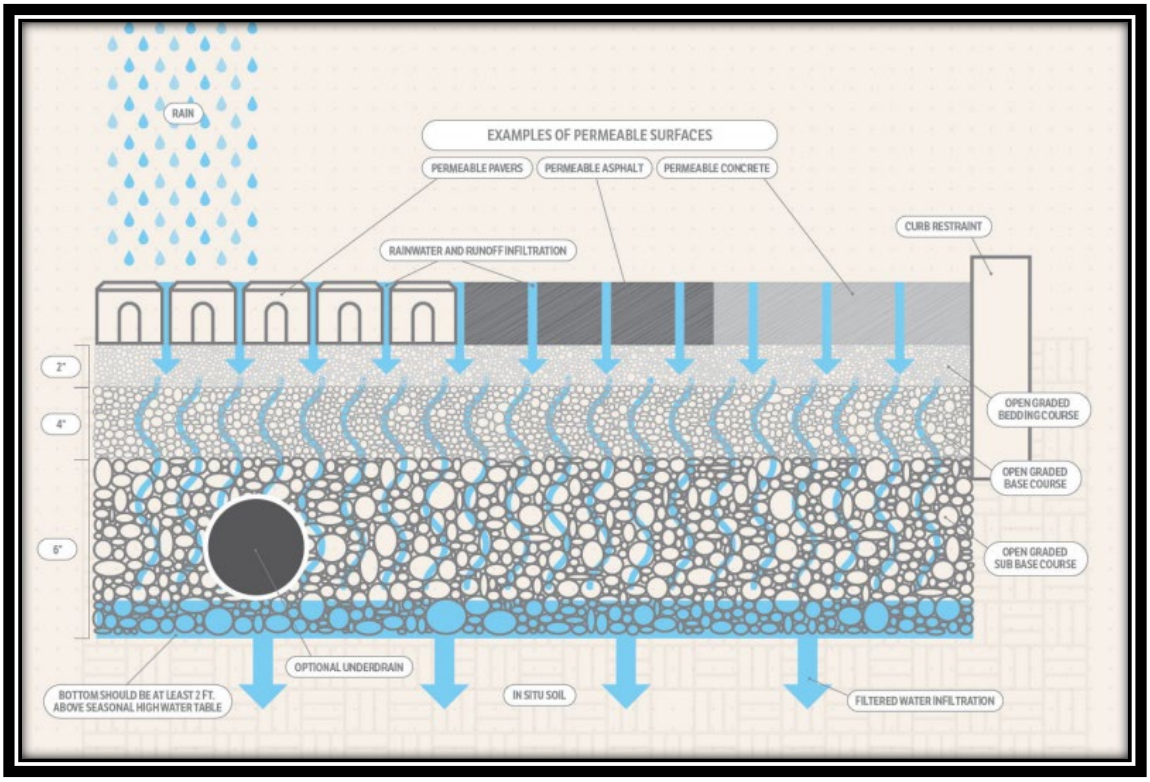


Figure 26: Examples of permeable surfaces

Requirements to gain incentives

Utilize alternative surface material (permeable pavers, grass pavers, pervious concrete, or porous asphalt) for a minimum 50% of the off-street parking spaces (excluding ADA parking spaces) and 100% of the sidewalks (excluding sidewalks identified as ADA accessible routes).

The pervious surface type must be identified on the site plans.

Incentives

Off-Street Parking Flexibility, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Concentrated Landscape Parking Islands and Row-Ends

Concentrated landscape islands and row ends refer to intentional design features that concentrate vegetation and landscaping in specific areas within a developed site. Concentrated landscape islands and row ends typically feature native plants, shrubs, and trees selected for their ability to thrive in the local climate, soil conditions, and heat generated by the parking area. By concentrating vegetation in these designated areas, developers can create green spaces that enhance biodiversity, provide habitat for wildlife, improve air quality, and reduce heat island effects. Additionally, these features can help manage stormwater runoff, promote soil infiltration, and contribute to the overall sustainability and resilience of the development.

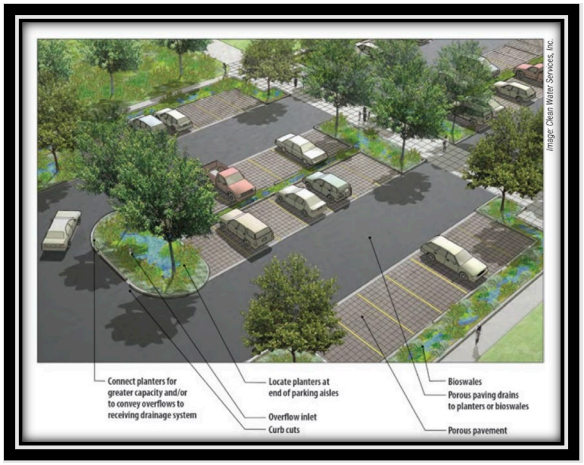


Figure 37

Figure 38

Figure 39

Figure 40

Requirements to gain incentives

Provide concentrated landscape islands and row-ends in all parking areas within commercial sites and subdivision common areas. These areas must have a minimum area of 300 square feet with width no less than 20 feet, if it abuts one parking space. If abutting two parking spaces, the minimum size must be doubled.

Design must include an alternative curb design to facilitate stormwater runoff.

Concentrated landscape islands and row-ends must be at a sufficient distance from structures to ensure clearance for fire engines at mature tree growth.

Incentives

BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Landscaping, BMP Credited as Common Open Space, Off-Street Parking Flexibility, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.2.6 Minimizing Runoff Volume and Rate

A. Minimize Building Construction Footprint

To minimize the impervious footprint and disturbance of the site, the design professional should consider multi-story building design options. By constructing vertically, projects can optimize square footage while reducing the area of impervious surfaces, reducing stormwater runoff from the site. Moreover, on sloping sites, rather than importing fill to level the terrain for slab-on-grade foundations, employing stem-wall construction techniques can significantly minimize the area disturbed and compacted. This approach not

only mitigates environmental disruption but also addresses concerns regarding the potential differences in composition between fill material and native soils.

Figure 41

Requirements to gain incentives

Utilize multistory construction to reduce building lot coverage by at least 25% of the maximum building lot coverage permitted within Section 72-241, of the ZO. This is only permitted within commercial and industrial zoning classifications.

Incentives

Increased Floor Area Ratio, Increased Maximum Height, Off-Street Parking Flexibility, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Total Impervious Area

By minimizing these impervious surfaces, developers can effectively manage stormwater runoff, reduce the risk of erosion and pollution, and promote sustainable land use practices.

Total Impervious Area (TIA) encompasses all surfaces within a development site that prevent or inhibit the infiltration of water into the ground, including but not limited to rooftops, roads, parking lots, sidewalks, and driveways. As TIA increases, so does the volume and velocity of stormwater runoff. Managing TIA is crucial for mitigating the adverse impacts of urbanization on hydrological systems and maintaining ecological balance. Effective strategies for minimizing TIA include prioritizing compact development layouts to reduce the overall footprint of impervious surfaces and using permeable pavement materials for parking lots and sidewalks to facilitate infiltration.

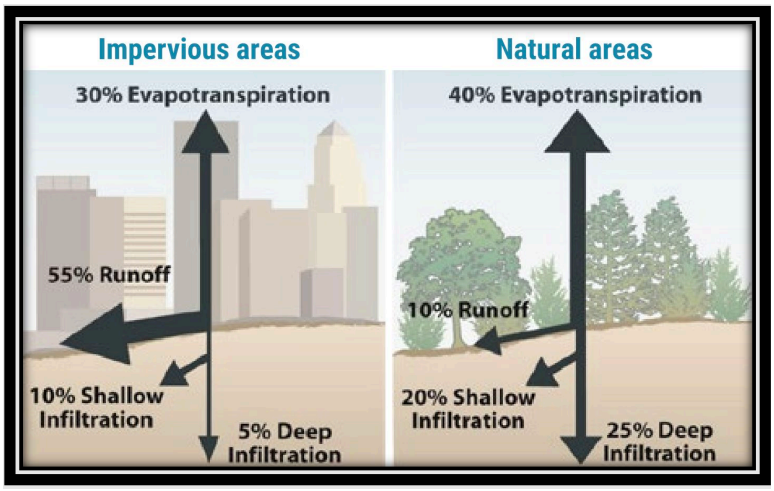


Figure 42

Requirements to gain incentives

Option A: Restrict the total impervious area within a commercial or industrial site to 50%. The notes on the Final Site Plan must state this maximum.

Option B: Design the stormwater system to account for 10% more than the allowable lot coverage permitted within Section 72-241, of the ZO, for each individual lot within a residential development. This must be reflected on the site plans and within the stormwater calculations.

Incentives

Option A: Flexible Building Setbacks, Increased Floor Area Ratio, Increased Maximum Height, Off-Street Parking Flexibility, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

Option B: Flexible Lot Sizes, Flexible Building Setbacks, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

C. Minimize Directly Connected Impervious Areas

Directly connected impervious areas (DCIAs) allow runoff to be conveyed without interception by permeable areas that allow for infiltration and treatment. Disconnecting impervious areas from roofs allows runoff to flow onto adjacent pervious areas where it is infiltrated and filtered.

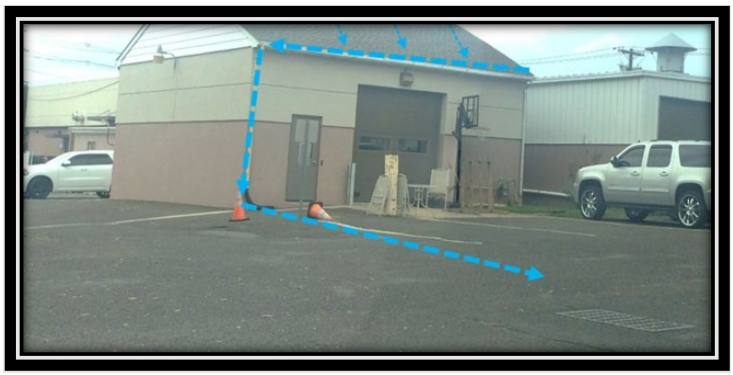


Figure 43: The image above depicts an example of directly connected impervious area.

Figure 44: The image above depicts an example of disconnected impervious areas

Requirements to gain incentives

Direct all roof stormwater runoff into a pervious area (i.e. rain garden, swale, etc.). The disconnected area must be identified on the site plans and within a table.

Incentives

BMP Permitted within Landscape Buffers and Building Setbacks, BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Common Open Space, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.3 Stormwater Storage, Treatment and Conveyance BMPs

These BMPs are designed to provide effective engineered solutions for storing and treating stormwater runoff. These practices involve the use of specialized structures such as wet/dry ponds, infiltration/exfiltration trenches, rain gardens, and other mechanical and biological solutions to capture, retain, and treat stormwater before it is discharged into natural water bodies.

4.3.1 Mechanical

Mechanical stormwater storage, treatment and conveyance refers to engineered solutions for stormwater management. One engineering solution which can be used within many stormwater management BMPs is Biosorption Activated Media (BAM). BAM is composed of natural or engineered materials with high surface area and adsorptive properties, such as activated carbon, zeolite, or biochar, which are specifically designed to capture and retain pollutants such as heavy metals, nutrients, organic compounds, and suspended solids. These systems are most used within retention BMPs such as basins, rain gardens, vegetated stormwater conveyance, planter boxes, exfiltration trenches, pervious pavements, and tree vaults.

A. Stormwater Treatment Park

Planners and design engineers can utilize parks for passive and active recreation, stormwater management, water conservation, and severing development rights within FEMA Flood Hazard Areas.

Stormwater Treatment Parks are green spaces designed to manage and filter stormwater runoff while providing recreational amenities and ecological benefits and can be designed at a smaller scale within a residential subdivision or a large commercial center. These parks can incorporate integrated bioretention areas and permeable pavements or filter strips and rain gardens, to capture, detain, and treat stormwater. Treatment Parks serve as multifunctional landscapes that enhance water quality, reduce flood risks, and promote groundwater recharge, all while offering opportunities for passive recreation, environmental education, and community engagement. Below is an example of the Sandra Stetson Aquatic Center's Stormwater Treatment Area. It will remove an estimated 80% of the total nitrogen and 56% of total phosphorous (both from fertilizers), along with 79% of sediments and suspended solids.

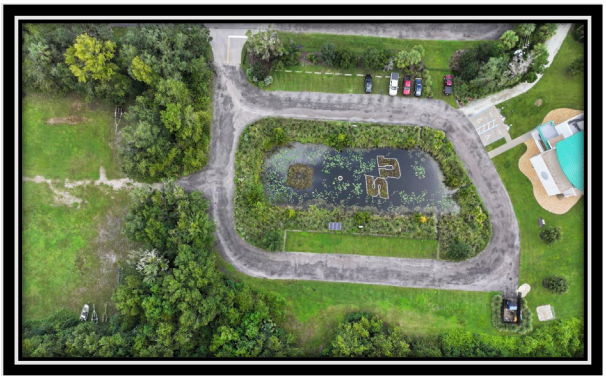


Figure 45: Stetson University Sandra Stetson Aquatic Center

Figure 43: Point Defiance Regional Stormwater Treatment Facility

Figure 44: Point Defiance Regional Stormwater Treatment Facility

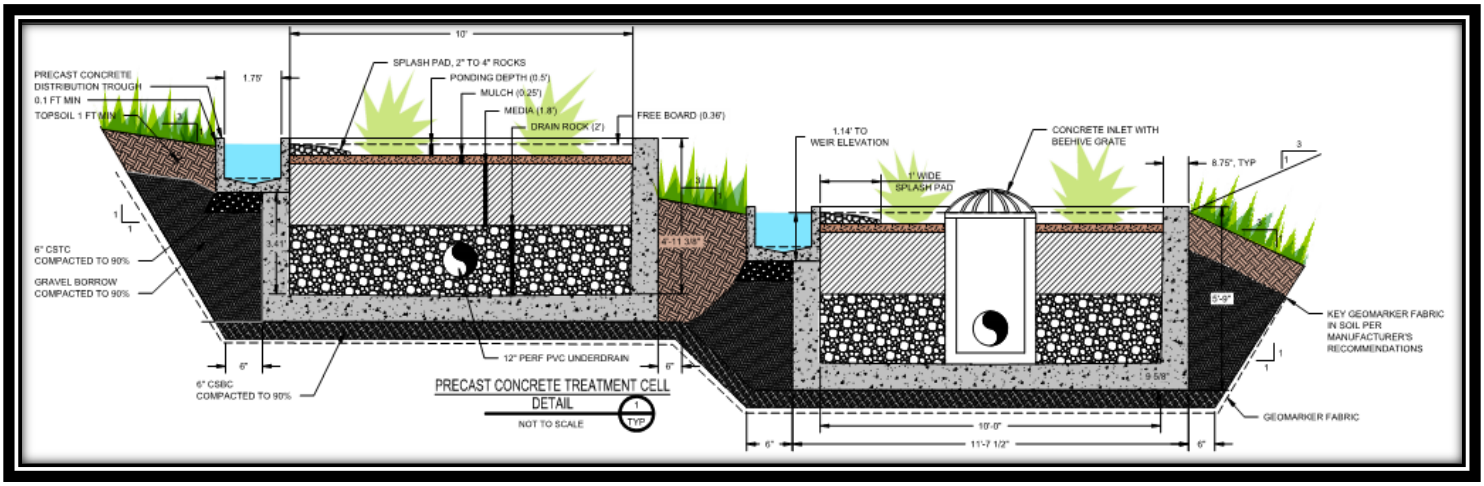


Figure 45: Treatment cells

Requirements to gain incentives

Create a passive/active recreational stormwater treatment park with educational signage related to low impact development, one or more clearly defined, visible entrances connecting to other internal sidewalks, a pervious sidewalk surrounding the pond with pedestrian scale lighting, with no fewer than three of the following:

a. Playground meeting the Consumer Product Safety Commission playground safety guidelines for public use,

b. Two 15’ x 20’ picnic shelters with a minimum of 2 picnic tables each,
c. One 20’ x 30’ covered pavilion or shelter with a minimum of 5 picnic tables each,
d. Five standalone picnic tables,
e. Open “free play” areas,
f. Fenced dog park, or
g. Three-piece ASTM F3101 Compliant Outdoor Fitness Site or individual stations.

All passive/active recreational facilities and ponds must be located on the site plans. Planted vegetation must be shown on the landscape plan.

Option A: Wet Pond – Must include a littoral zone comprised of native emergent and submerged aquatic macrophytic vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.).

Option B: Dry Pond – Must include an upland buffer of native trees, shrubs and understory vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.).

Incentives

BMP Permitted within Landscape Buffers and Building Setbacks, BMP Credited as Landscaping, BMP Credited as Common Open Space, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Wet Pond

A wet pond refers to a constructed stormwater management facility designed to collect and temporarily store stormwater in a permanently wet impoundment in such a manner as to provide for treatment through physical, chemical, and biological processes with subsequent gradual release of the stormwater. Depending on the design, wet ponds may incorporate additional features such as forebays, outlet structures, and emergency spillways to regulate water levels and ensure proper functioning during storm events.

The littoral zone can be established with native plants by planting rooted native aquatic plants. The planting plan must consider the design water elevation fluctuations of the wet pond and the ability of specific plants to be established and thrive. Specific design criteria for wet pond littoral zones are found in Section 8.6 of the Environmental Resource Permit Applicant’s Handbook, Volume II: For use within the geographic limits of the St. Johns River Water Management District (revised June 28, 2024).

Figure 49 & 50: The above images display wet ponds with littoral shelf vegetation, which improves nutrient uptake, reduces the erosion of banks, and provides wildlife habitat.

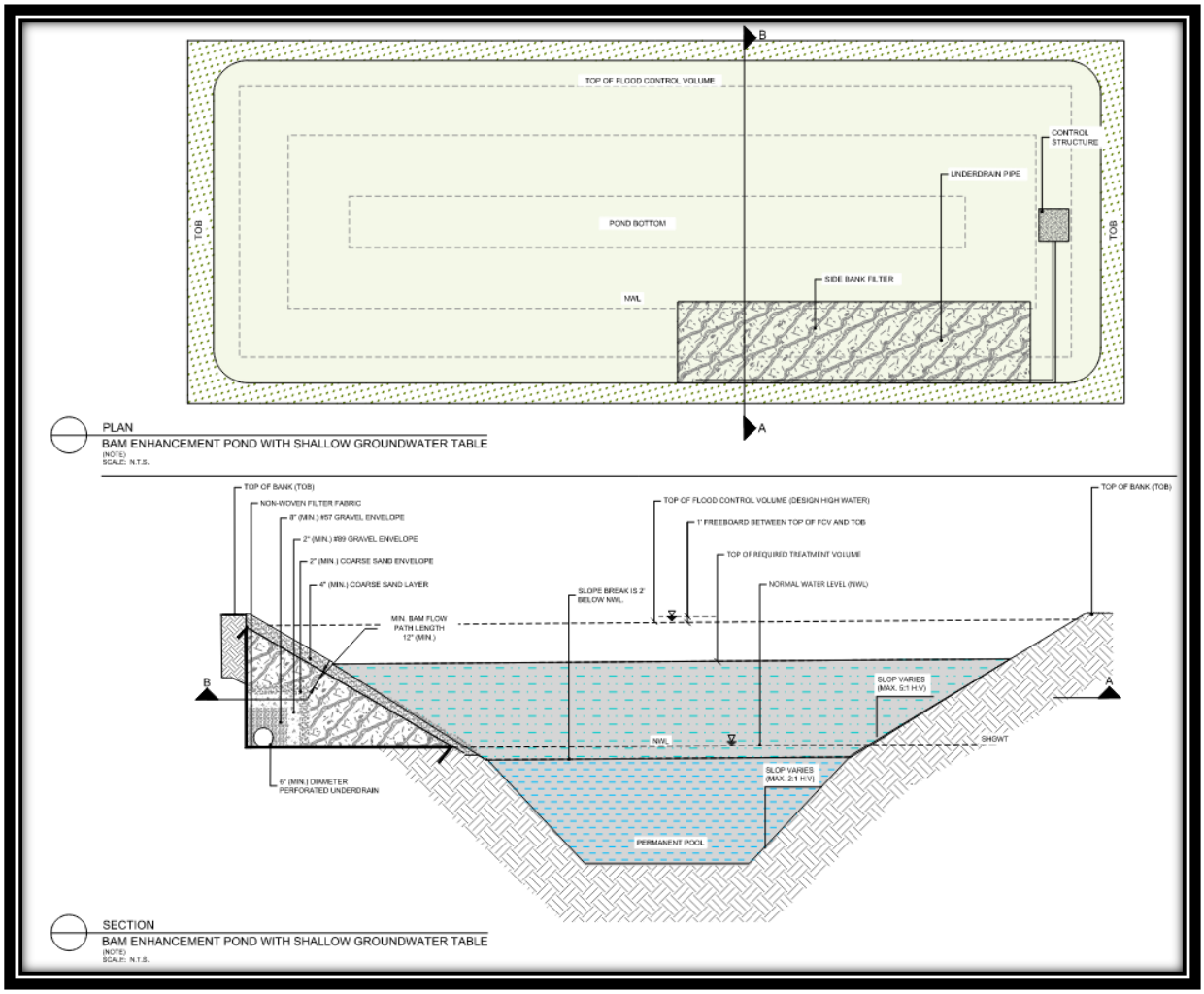


Figure 51: Example of BAM enhancement with a shallow groundwater table.

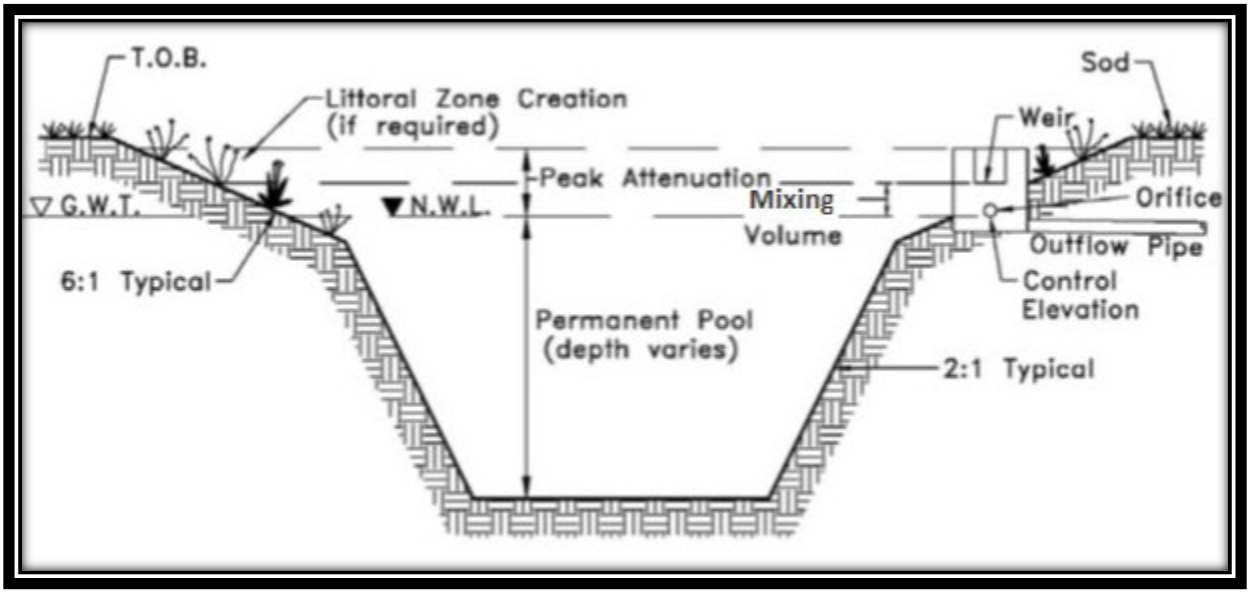


Figure 52

Detention with Engineered Media and Filtration

The treatment efficiency for these systems is calculated based on the following equation:

$$\begin{aligned} &Treatment\ efficiency\ for\ Detention\ Pond\ with\ Filtration \\ &= (Detention\ efficiency\ for\ Volume\ of\ the\ water\ Detained\ in\ the\ system\ ) \\ &+ (Volume\ of\ water\ filtered\ and\ not\ detained \\ &* Treatment\ Efficency\ of\ Media) \end{aligned}$$

Figure 53

Requirements to gain incentives

A wet detention system must include a pretreatment retention system equivalent to 15% more rainwater than required by the minimum standards within Division 8, of the LDC. The entirety of the pond must include a littoral zone comprised of native emergent and submerged aquatic macrophytic vegetation.

Note: The 15% shall not include additional capacity for compensating storage for fill in the floodplain.

Incentives

Flexible Lot Sizes, Flexible Building Setbacks, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

C. Dry Pond

A dry pond is a constructed stormwater management facility designed to prevent the discharge of a given volume to stormwater runoff into surface waters. It stores a defined quantity of runoff, allowing it to percolate through permeable soils into the shallow ground water aquifer. Vegetation may be incorporated into the pond's design to stabilize soil, enhance infiltration, and provide habitat for wildlife.

Figure 54

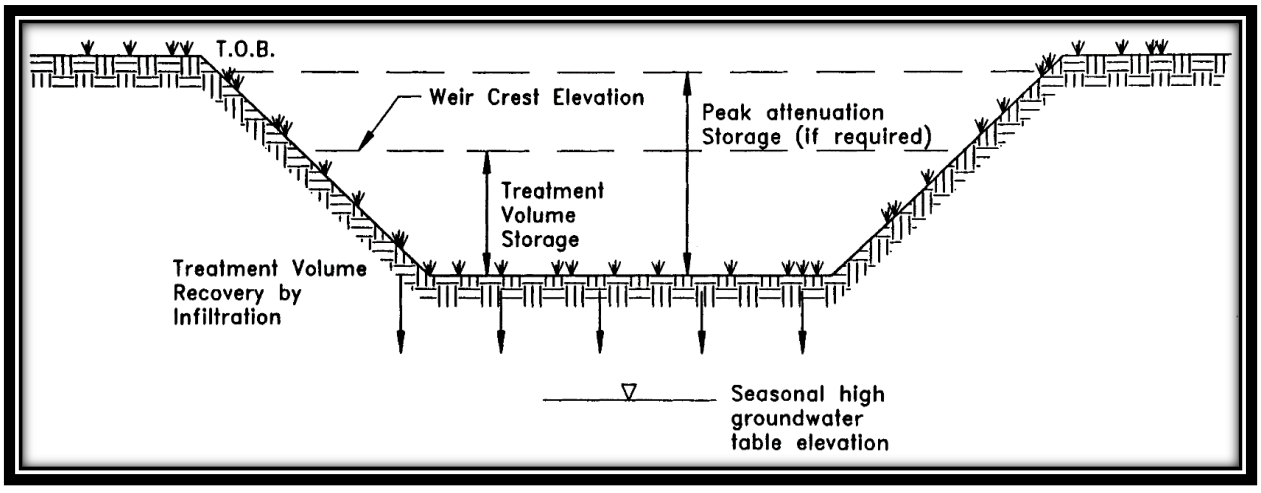


Figure 55

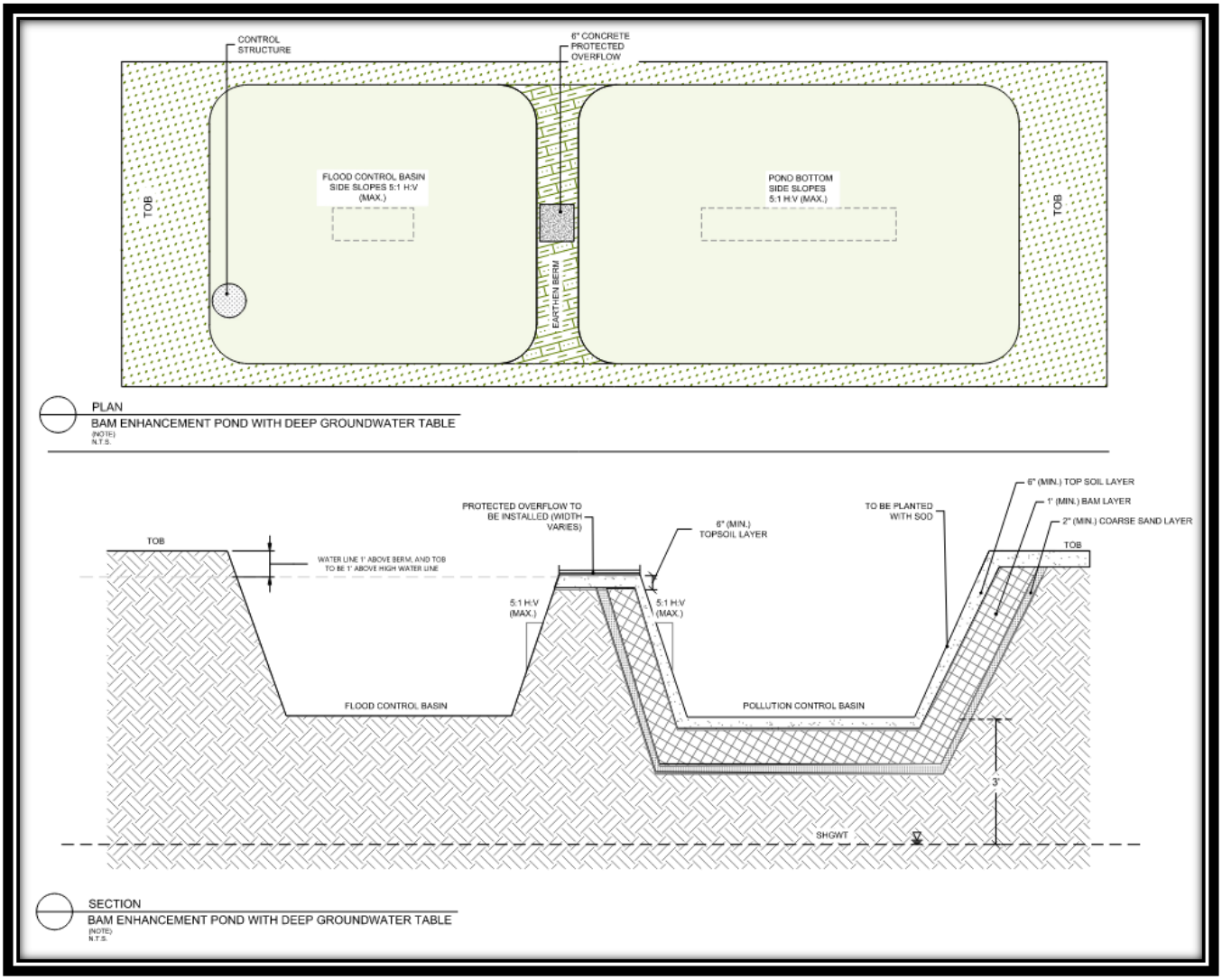


Figure 56: Example of BAM enhancement with a deep groundwater table.

Requirements to gain incentives

Utilize a dry pond designed to capture 15% more stormwater than required by the minimum standards within Division 8, of the LDC. The entirety of the pond must include an upland buffer of native trees, shrubs and understory vegetation. Biosorption Activated Media (BAM) must be used and can only contain non-petroleum-based products (expanded clay, sawdust, palm fronds, limestone, etc.).

Note: The 15% shall not include additional capacity for compensating storage for fill in the floodplain.

Incentives

Flexible Lot Sizes, Flexible Building Setbacks, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

D. Underground Retention and Detention Systems

Underground stormwater management systems store excess stormwater underground using chambers, tanks, or pipes. These systems are designed to manage stormwater runoff by temporarily storing and

infiltrating excess water into the surrounding soil or continually holding water, only discharging into other stormwater infrastructure. These underground systems help to reduce the volume and velocity of runoff, minimize erosion, improve water quality, and promote groundwater recharge, all while reducing the impact of the site for development.

Figure 57

Requirements to gain incentives

Utilize an underground storage system on a commercial or multifamily site. The site plan must demonstrate a 10% reduction in natural area impact. The water table must be appropriate for the use of this BMP.

Note: The applicant cannot gain an incentive if this is the only option to meet minimum stormwater management requirements of Division 8 on-site (i.e. the site is constrained).

Incentives

Flexible Lot Sizes, Flexible Building Setbacks, Increased Density, Increased Lot Coverage, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

E. Stormwater Harvesting

Stormwater harvesting refers to infrastructure designed to capture, store, treat, and reuse stormwater runoff for various purposes. Specifically, it prevents the discharge of a given volume of stormwater into surface waters by deliberate application of stormwater for irrigation or industrial uses (such as cooling water, process water, and wash water). These systems typically involve the collection of rainwater from impervious surfaces such as rooftops, driveways, and roads, which is then conveyed to storage tanks, rain barrels, cisterns, or ponds for storage and treatment. Stormwater harvesting systems may incorporate filtration, sedimentation, and biological treatment processes to remove pollutants and improve water quality. Once treated, the harvested stormwater can be reused for non-potable applications such as landscape irrigation, irrigating green roofs, washing vehicles, industrial cooling and processing, and toilet flushing.

Figure 62: Lake Victoria, DeLand, FL – Stormwater treatment facility and irrigation source for Victoria Commons neighborhood

Figure 63: Cistern at fire station in Sarasota County, FL

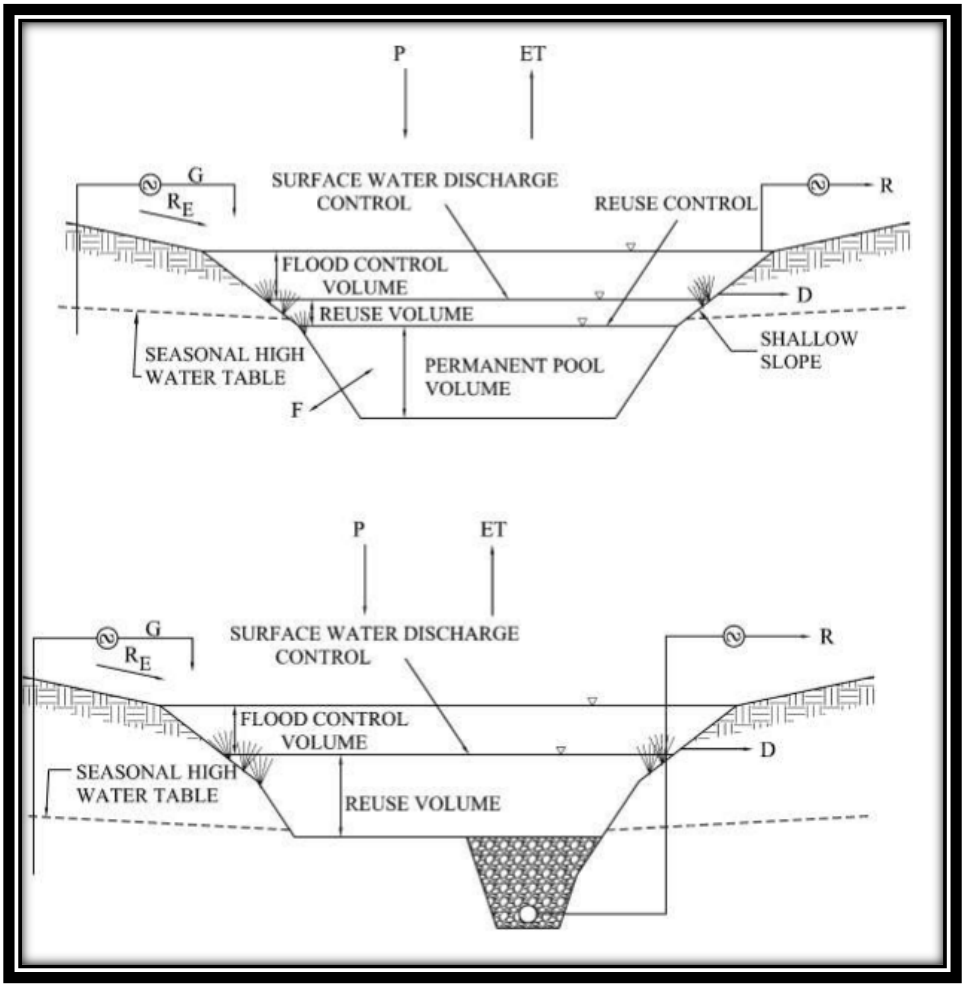


Figure 64: Stormwater pond with irrigation system equipment

Requirements to gain incentives

Utilize stormwater harvesting on-site to capture a volume of water sufficient to meet the minimum irrigation of the site per week (1 inch of irrigation per week). The volume will be counted toward the total stormwater volume required by Division 8, of the Land Development Code.

The proposed stormwater harvesting vessel (pond, cisterns, etc.) and all related piping, etc. and the reuse activity must be demonstrated on the Final Site Plan or Preliminary Plat construction plans. This is only permitted within multifamily, commercial, and industrial projects or subdivision common areas.

Note:

1. Harvested stormwater for non-potable uses must be approved by the Florida Department of Health.
2. A cistern must be designed to eliminate openings for mosquitos and protected from sunlight.
3. Incentives cannot be gained by using a water harvesting park to meet minimum fire water requirements required by the Florida Fire Prevention Code, only. An additional non-potable use must be included.

Incentives

Flexible Building Setbacks, BMP Permitted within the Landscaping Buffers and Setbacks, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

4.3.2 Biological

A. Vegetated Stormwater Conveyance

Swales have been used for conveyance of storm water along roads for decades. They are designed and constructed to properly convey and infiltrate stormwater runoff as it travels through the swale. These swales are designed to infiltrate a defined quantity of runoff (the treatment volume) through the permeable soils of the soil floor and side slopes into the shallow groundwater aquifer immediately following a storm event. A vegetated swale combines conveyance with treatment effectiveness directly related to the amount of annual stormwater volume that is infiltrated. If soil permeability is limited, a perforated underdrain and overflow grate may be required (UACDC: Low Impact Development: a design manual for urban areas).

Incorporating swales as part of a treatment train reduces the pollutant loading to the downstream treatment system, increase the pollutant efficiency of the overall stormwater management system, and reduces maintenance.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I Appendix O (effective 6/28/2024), the nutrient capability of these systems can be calculated in the same way as a dry retention system.

Figure 65: Planted vegetated swale between parking lot and road in Denver, CO

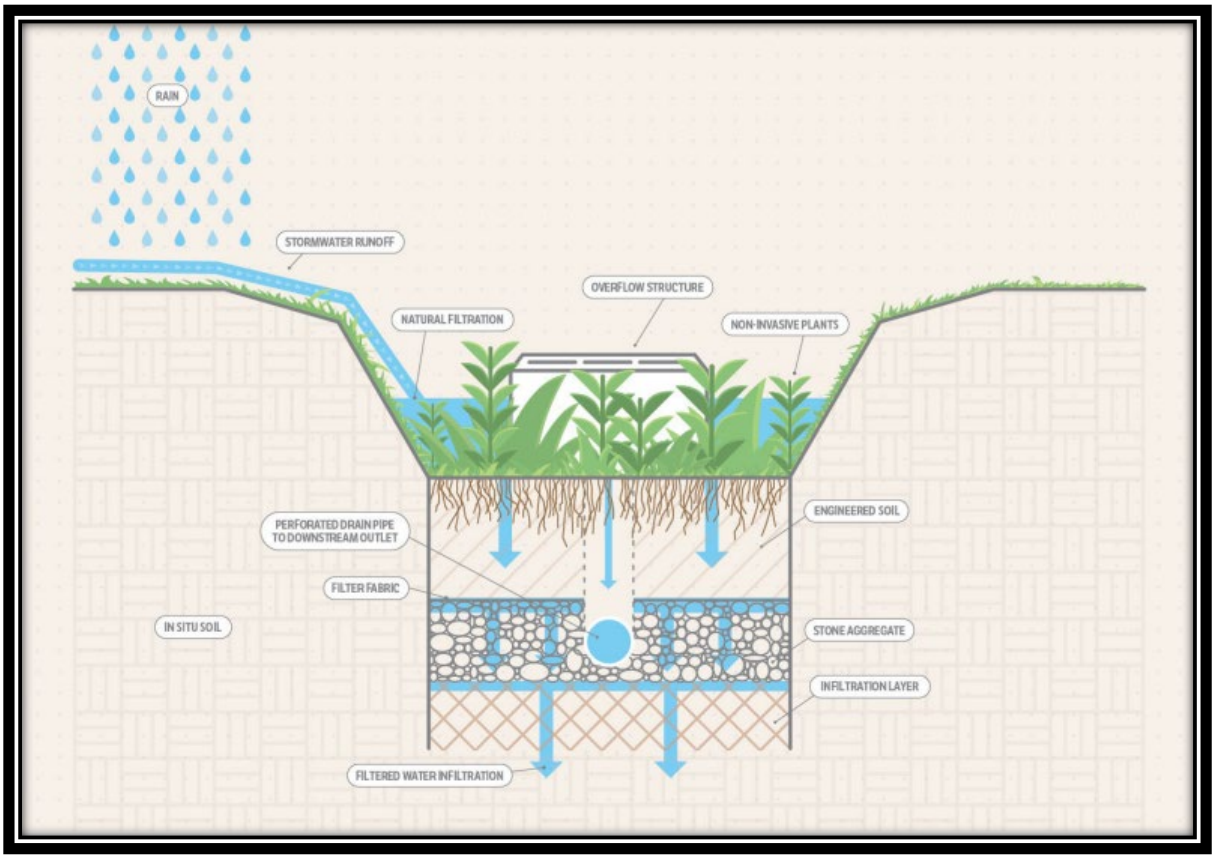


Figure 66

Requirements to gain incentives

Utilize vegetated stormwater conveyance on-site. The storage volume of the BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code.

Utilize native vegetation on the slopes and flat areas up to 5 feet in width.

This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area.

Incentives

BMP Permitted within Landscape Buffers and Building Setbacks, BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Landscaping, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

B. Rain Gardens

Rain gardens are small retention basins that are integrated into the site's landscaping. A rain garden is a shallow, constructed depression that is planted with deep rooted Florida native plants. They can be within parking lot islands or row ends to receive runoff from hard surfaces such as a roof, sidewalk, driveway, or parking area, or any other pervious area within a developed site. Rain gardens slow down the flow of

water from impervious surfaces, hold the water for short periods of time and allow it to naturally infiltrate into the ground or evaporate. The synergy between soil, microbes, and vegetation facilitates processes such as filtration, sedimentation, absorption, ion exchange of solids and metals, as well as biological absorption and decomposition of organics and nutrients found in stormwater. They replenish the local aquifer by enhancing water filtration into the soil, diminish the flow of stormwater pollutants—like fertilizers, pesticides, and car oil—entering storm sewers or nearby water bodies, offer habitats for birds, butterflies, and beneficial insects, and elevate property value by enhancing the landscape's aesthetic appeal.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I Appendix O (effective 6/28/2024), the nutrient capability of these systems can be calculated in the same way as a dry retention system.

Figure 67: Rain gardens at Veterans Memorial Park, Cape Canaveral

Figure 68: Rain gardens at Veterans Memorial Park, Cape Canaveral

Figure 69: Rain garden during storm event

Figure 70: Rain garden during clear skies

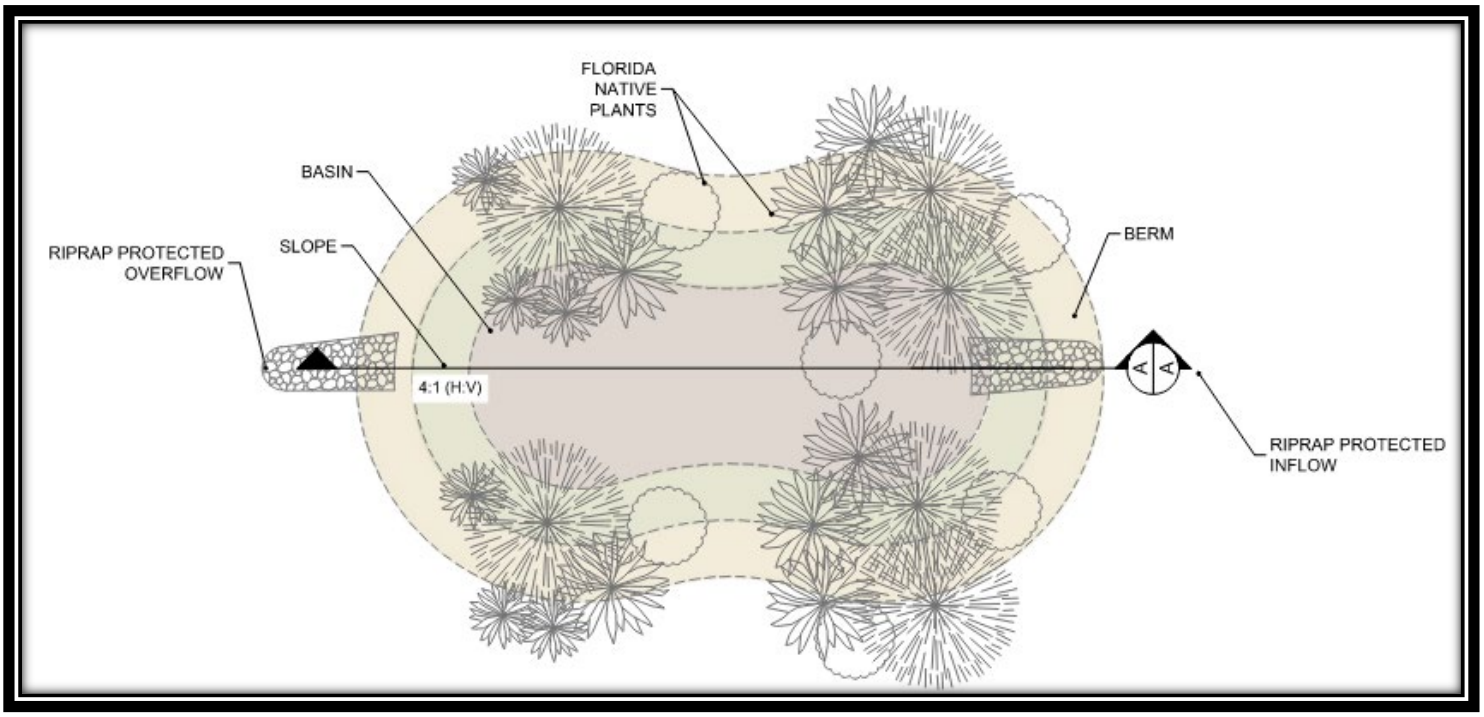


Figure 71: Example of a rain garden with a deep groundwater table.

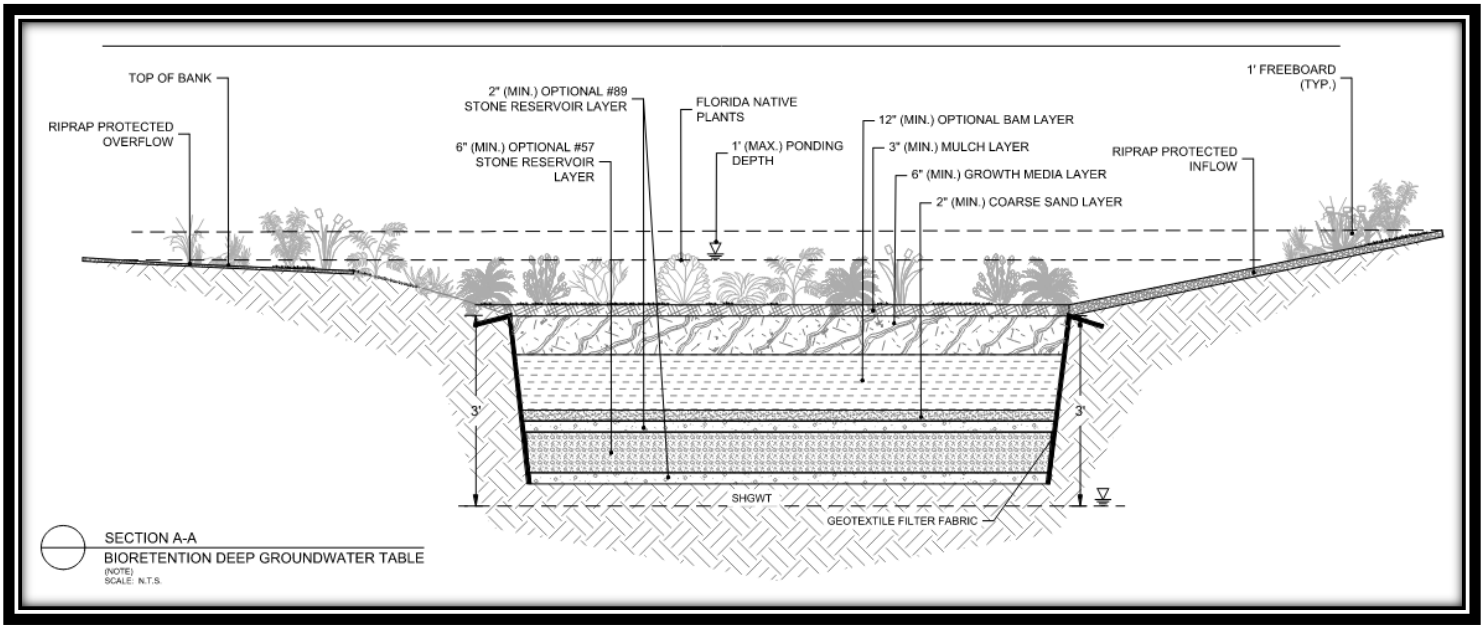


Figure 72: Example of a rain garden cross section with a deep groundwater table.

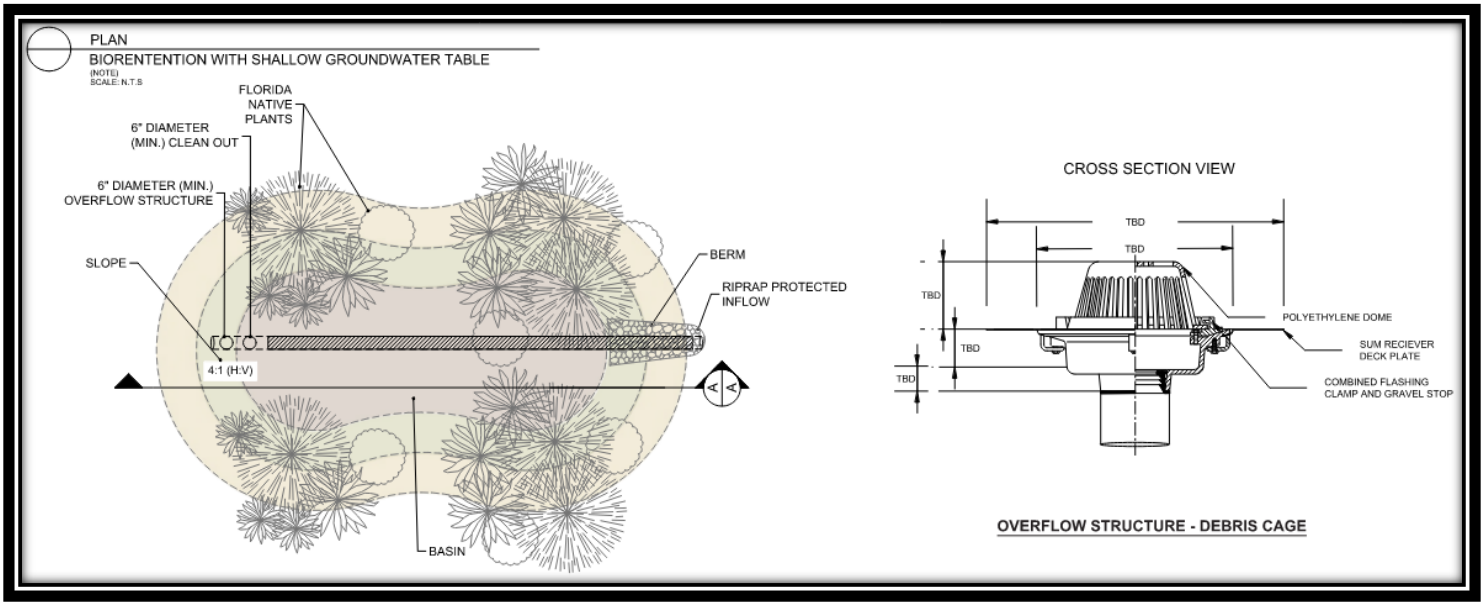


Figure 73: Example of a rain garden and overflow structure with a shallow groundwater table.

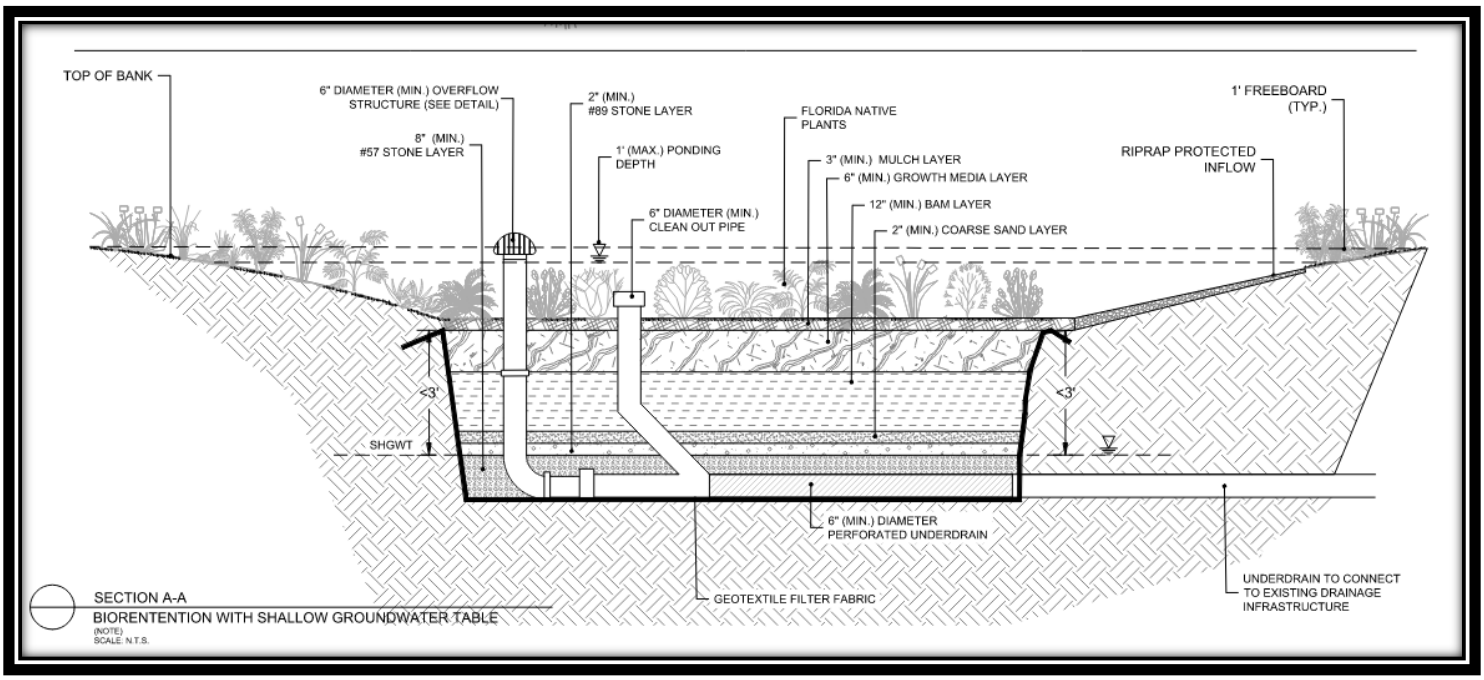


Figure 74: Example of a rain garden cross section with a deep groundwater table.

Figure 75: Planter boxes capture and treat much of the stormwater from roads and sidewalks.

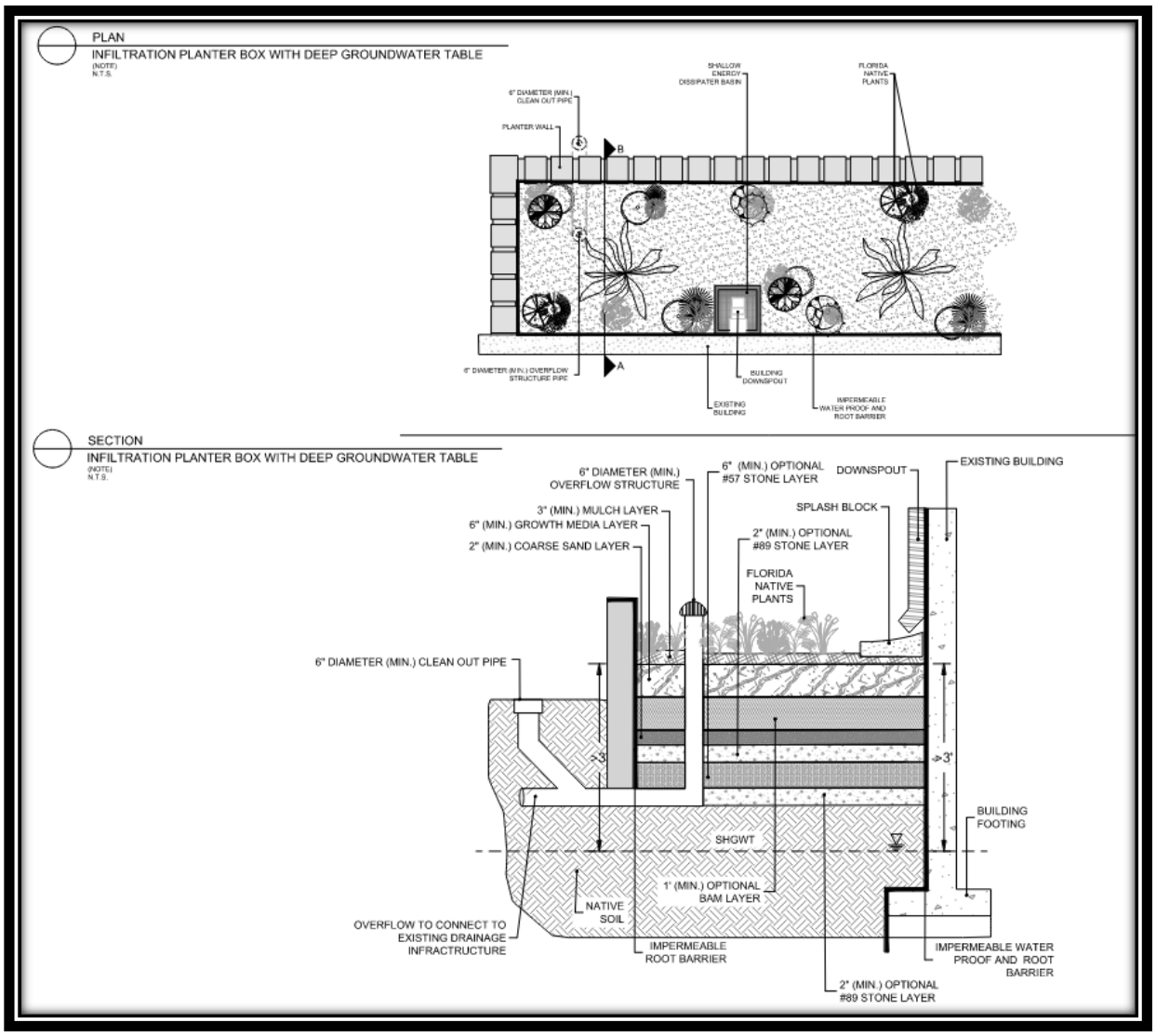


Figure 76: Example of an infiltration planter box with a deep groundwater table.

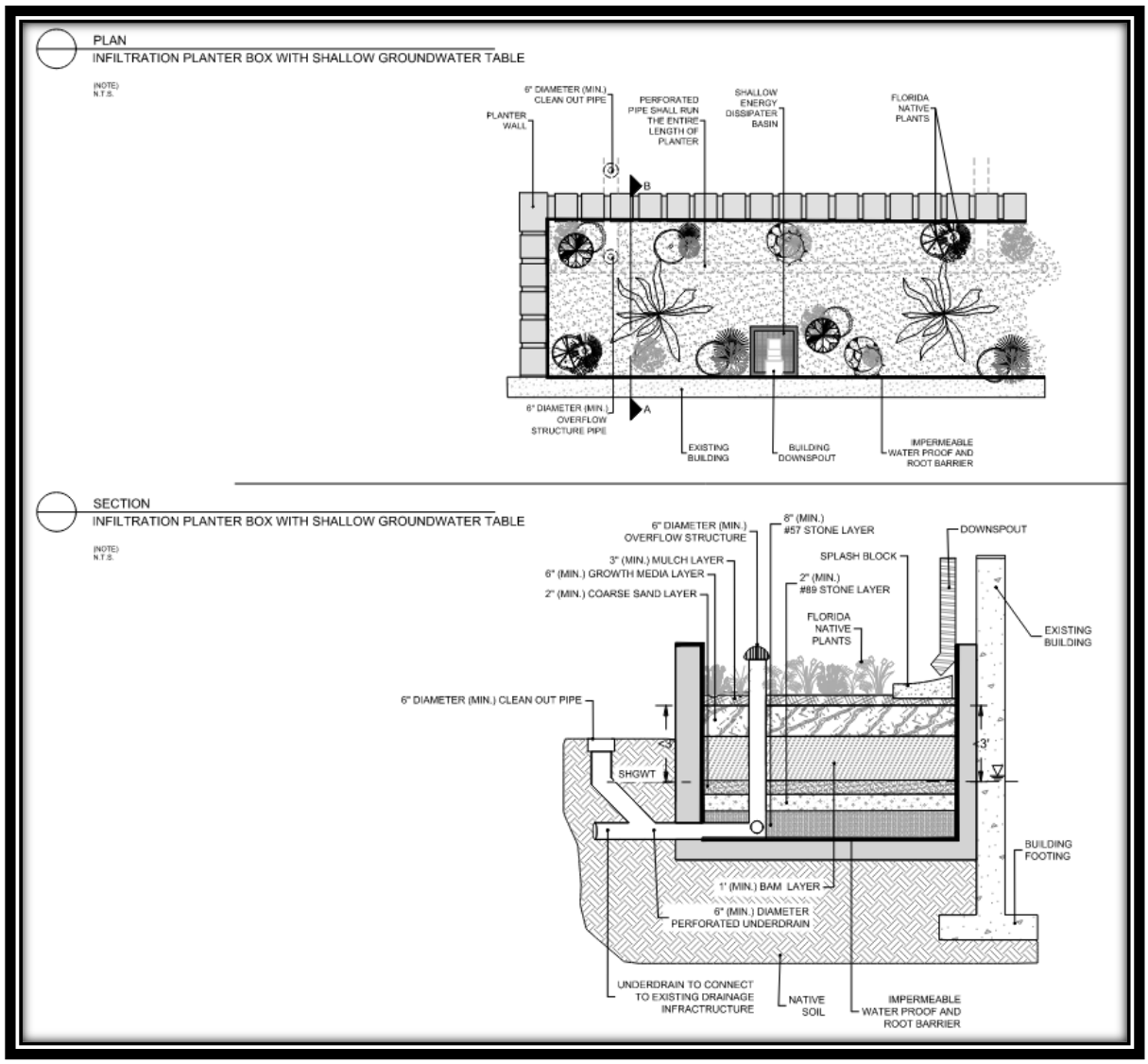


Figure 77: Example of an infiltration box with a shallow groundwater table.

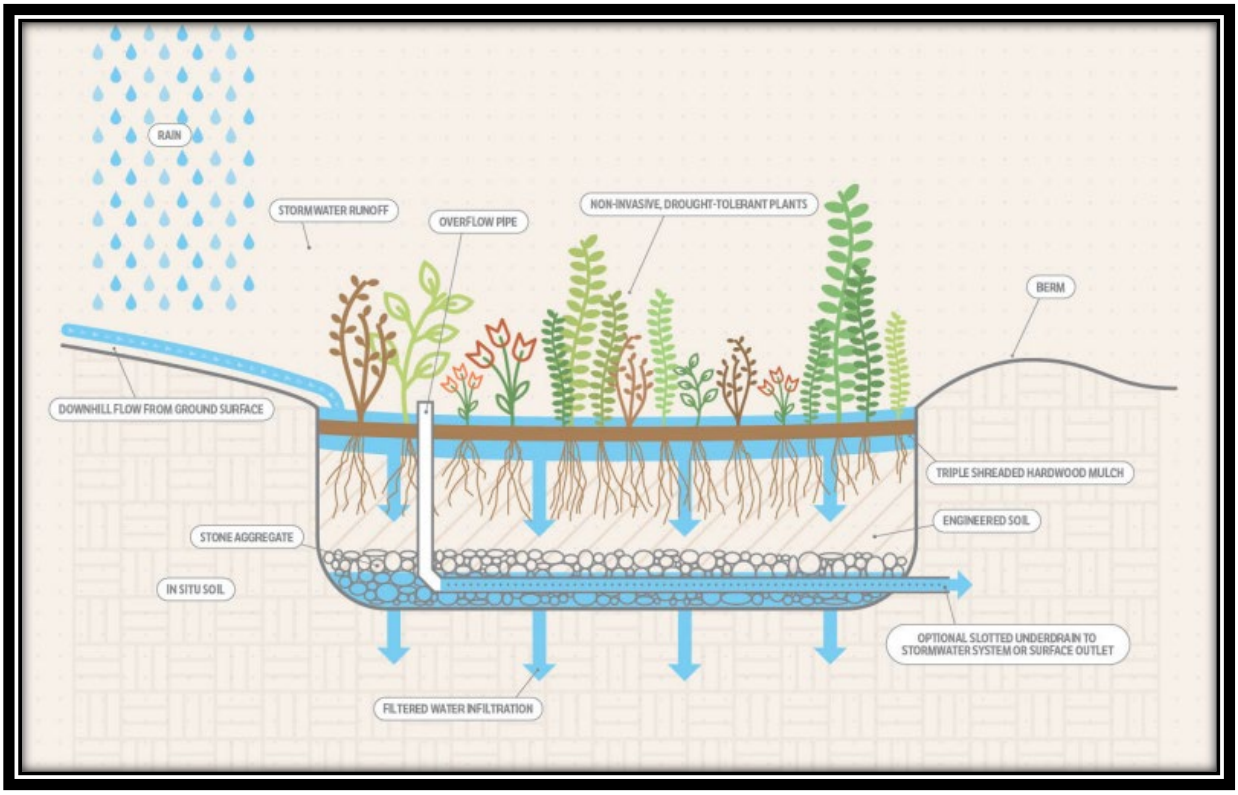


Figure 78

Requirements to gain incentives

Utilize a rain garden on-site. The storage volume of this BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code.

This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area.

The landscape plan must depict native plant species, location, and number and any landscape rocks, etc. Species do not need to be chosen from the Zoning Landscape Plant List, as they may be aquatic in nature.

Incentives

BMP Permitted within Landscape Buffers and Building Setbacks, BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Landscaping, BMP Credited as Common Open Space, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

C. Tree Box Filters and Rainfall Interceptor Trees

A tree box filter is a tree vault containing amended soils underlain with crushed gravel media, which is connected to the overall stormwater system through perforated underdrain pipes (UACDC Low Impact Development: a design manual for urban areas). Constructing tree box filters along streets and parking

areas helps to manage stormwater runoff at its source by effectively filtering and attenuating runoff during rain events. These should be used in conjunction with curb cuts (described in Section 4.2.5.) to facilitate the flow of stormwater into curb extensions and planted with interceptor trees.

Interceptor trees are used adjacent to impervious surfaces as part of the stormwater treatment system to reduce runoff volume and pollution from the area by intercepting and capturing rainfall before it reaches the ground. These trees are selected for their canopy structure, foliage density, and height to effectively capture precipitation and reduce stormwater runoff. The United States Forest Service states that trees planted over impervious surfaces like parking lots could reduce stormwater runoff by as much as 20 percent. Branches and stems can capture and retain as much as 15 percent of total rainfall. A large tree can capture and retain as much as 332 gallons of water (US Forest Service, 2018). By intercepting rainfall, these trees help mitigate the impact of heavy rainfall events, reduce soil erosion, and promote groundwater recharge. Additionally, they contribute to the overall sustainability of the development by improving air quality, providing shade, and enhancing aesthetic value.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I Appendix O (effective 6/28/2024), the nutrient capability of these systems can be calculated in the same way as a dry retention system.

Figure 79

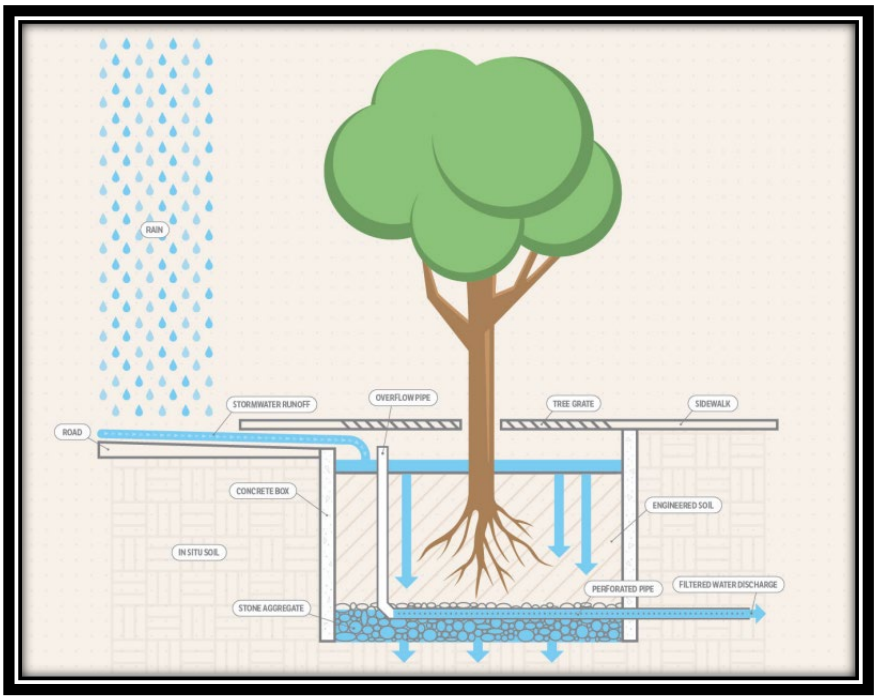


Figure 80

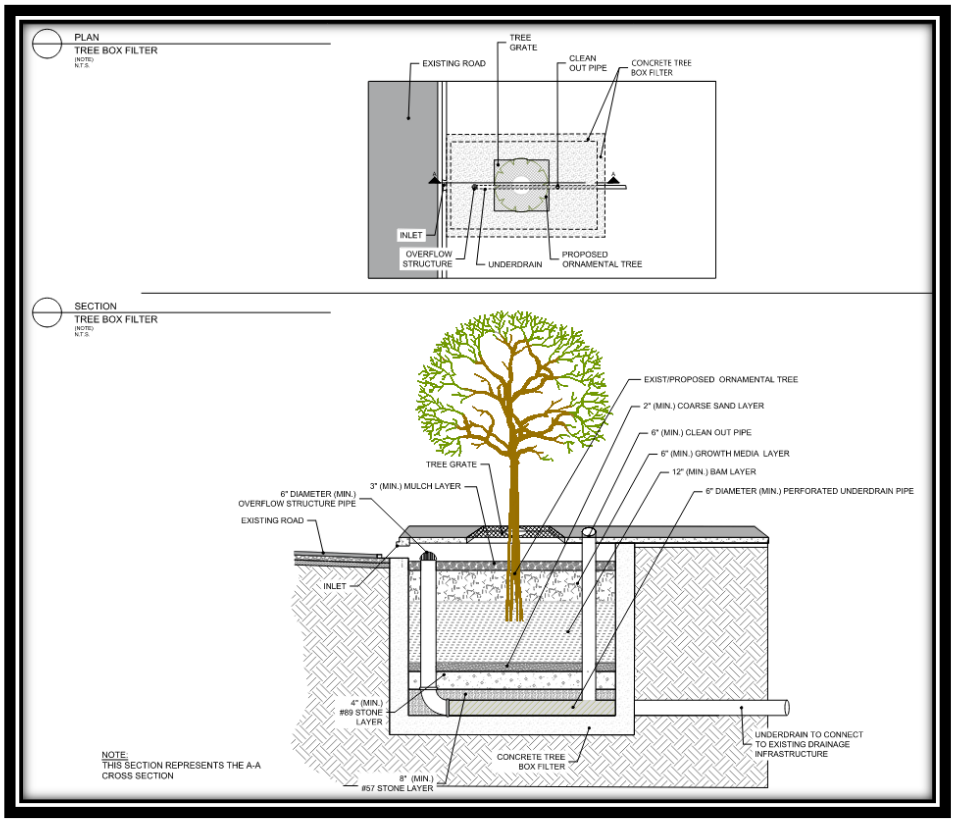


Figure 81: Example of a tree box filter.

Requirements to gain incentives

Utilize a tree box filter with a Florida native rainfall interceptor tree on-site. The storage volume of the BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code.

This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area.

Incentives

BMP Permitted within Landscape Islands and Row-Ends, BMP Credited as Landscaping, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

D. Vegetated Roofs and Walls

Vegetated roofs are roofs with planted vegetation on a portion or the entirety of the area, filtering and controlling the flow of rainwater before it leaves a structure. By utilizing natural vegetation and soil substrates, vegetated roof systems have been shown to assist in stormwater management by attenuating hydrographs, neutralizing acid rain, reducing volume of discharge, and reducing the annual mass of pollutants discharged.

Pursuant to the Environmental Resource Permit Applicant's Handbook Volume I Appendix O (effective 6/28/2024), the nutrient capability of a vegetated roof system can be calculated in the same way as a dry retention system.

Figure 82: Escambia County Office in Pensacola, Florida

Figure 83: University of Florida Perry Building

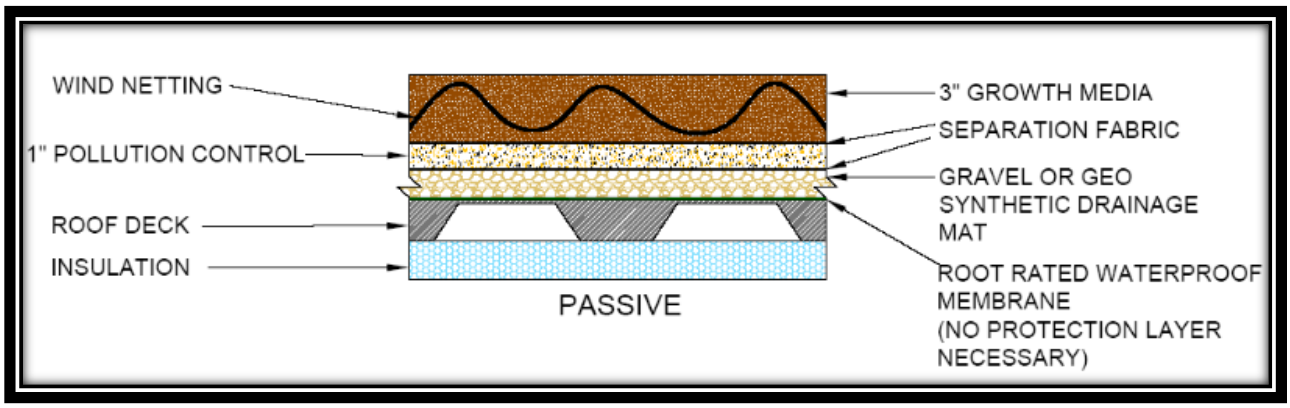


Figure 84: Extensive Green Roof Section (Passive Function)

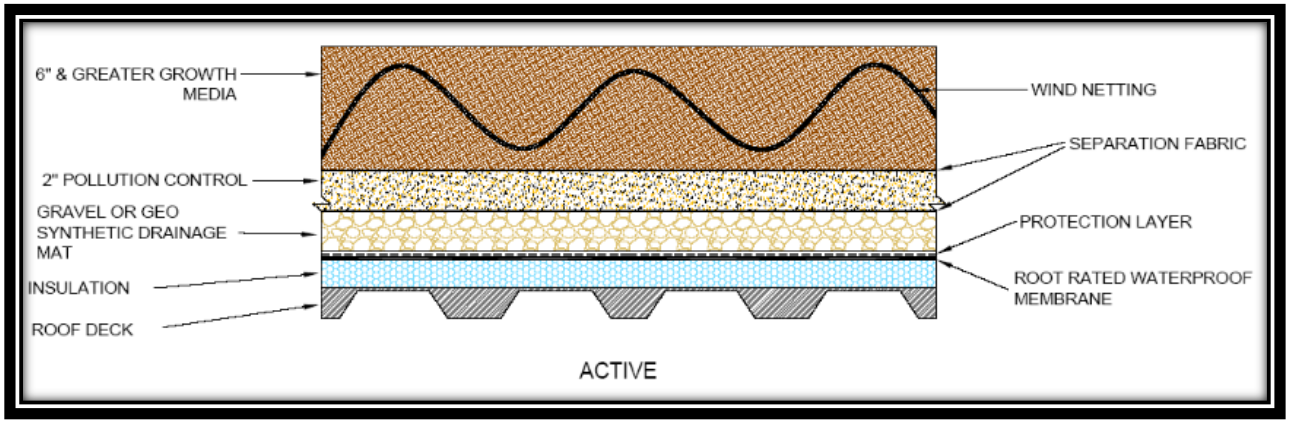


Figure 85: Intensive Green Roof Section (Active Function)

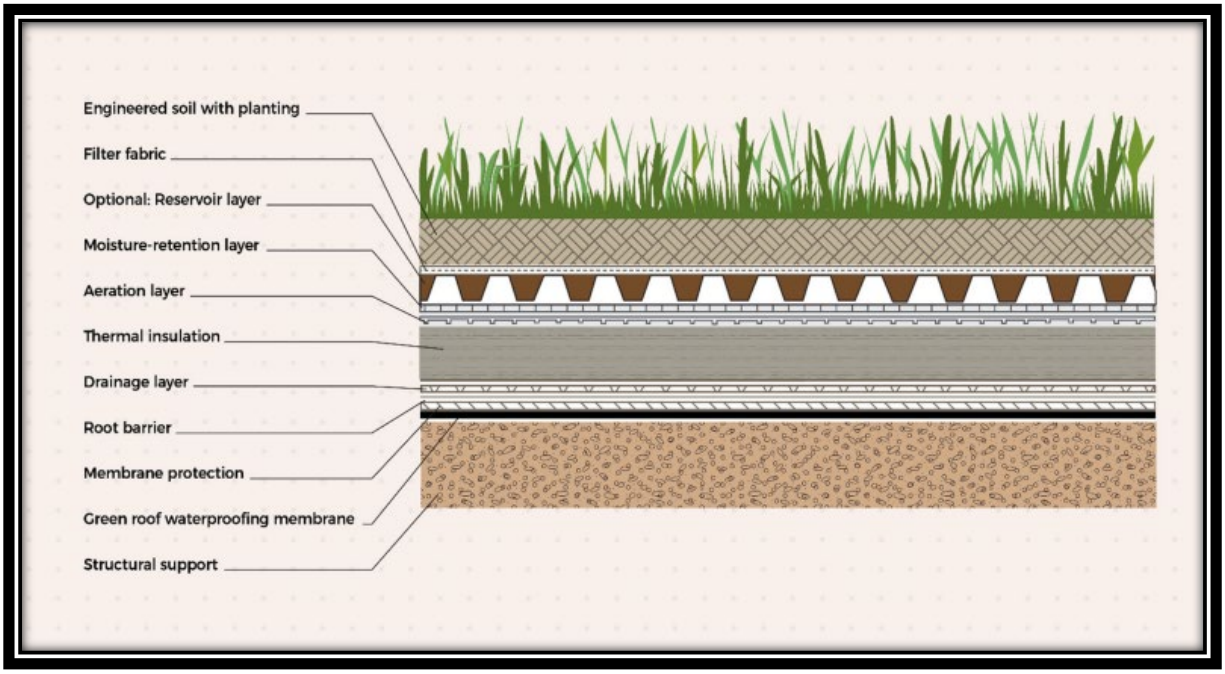


Figure 86

Vegetated walls are constructed to house plant material and engineered soil or inorganic growing medium. They can act as rainfall inceptors and provide water uptake, reducing stormwater runoff loads.

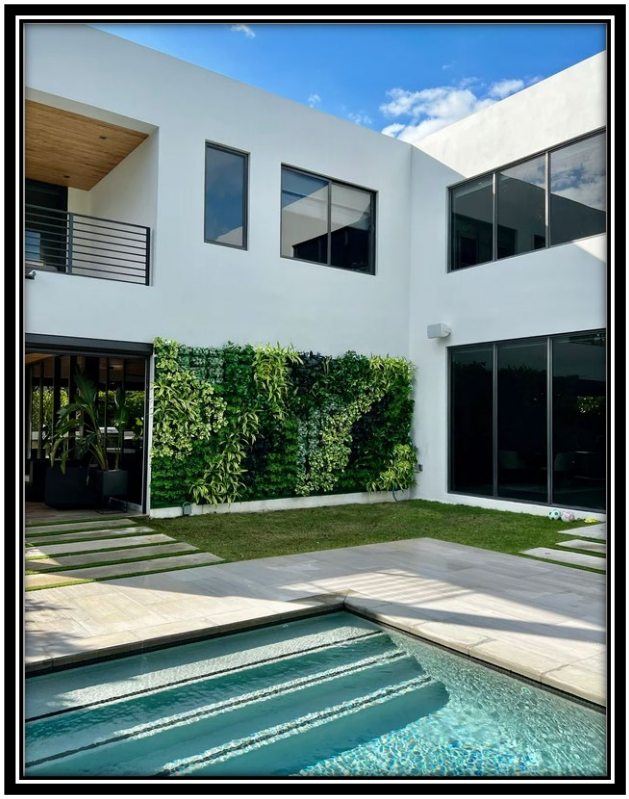


Figure 87: Vegetated wall in Coral Gables, Florida

Requirements to gain incentives

Utilize a vegetated roof or wall on-site. The storage volume of the BMP, as demonstrated by the stormwater calculations, may be used to meet total stormwater volume required by Division 8, of the Land Development Code.

This BMP should be combined with other biological stormwater BMPs and must total at least 10% of the site area.

All vegetation must be native and identified within the landscape plans.

Incentives

Flexible Building Setbacks, BMP Credited as Landscaping, Reduced Building Permit Application Fees, Reduced Land Development Application Fees, and Variance and/or Waiver Not Required.

Chapter 5: Maintenance of LID Practices

5.1 Introduction

In this section, we delve into the essential practices and protocols necessary for the ongoing care and upkeep of certain LID infrastructure, beyond the typical requirements of green and gray infrastructure maintenance. It is imperative to ensure that these systems are not only effectively implemented but also properly maintained to maximize their benefits and longevity. Maintenance of LID infrastructure encompasses a spectrum of activities, ranging from routine inspections to proactive measures aimed at preserving functionality and environmental performance. Through diligent maintenance practices, we aim to uphold the integrity of LID features, mitigate potential risks, and safeguard the surrounding environment against adverse impacts.

5.2 Maintenance Responsibilities for LID Techniques in Subdivisions

In implementing Low Impact Development (LID) techniques for subdivision designs to gain incentives, it's crucial to note that maintenance responsibilities lie with individual property owners, Homeowners Associations (HOA), and Property Owners Associations (POA) within the subdivision. Section 2.1 requires submission of covenant and restriction documents and language on the Final Plat which include perpetual maintenance by a HOA or POA. While the County doesn't enforce covenant and restriction documents directly, embedding maintenance provisions within them ensures understanding of upkeep responsibilities for LID infrastructure.

5.3 Maintenance Responsibilities for LID Techniques in Site Plans

As with subdivisions, by implementing Low Impact Development (LID) techniques for site plan designs to gain incentives, individual property owners are responsible for perpetual maintenance. Section 2.1 requires a statement on the final site plan, affirming this commitment.

5.4 Site Design LID Maintenance Requirements

5.4.1 Native Landscape, Fertilizers and Irrigation

- Ensure all HOA/POA members and homeowners understand the requirement to retain the native vegetation and that removal or replacement with non-native species is not permitted.
- Regularly inspect trees for health and structural integrity, pruning as needed.
- Control invasive species to protect native plants.
- Mulch and water to retain moisture and promote healthy growth. Conduct soil testing and amend soil for optimal plant health.
- Monitor and adjust irrigation for efficient water use. Removal of the smart irrigation controllers is not permitted.

5.4.2 Habitat Management

- A long-term vegetation management plan must be prepared to maintain the conservation area in natural or vegetative condition.
- Assess habitat health through surveys and identify degradation factors.
- Establish clear restoration goals and prioritize them based on significance and feasibility.
- Implement tailored restoration techniques, emphasizing sustainability.
- Monitor progress, adapt strategies as needed, and engage stakeholders.
- Remove litter and debris for a clean landscape.
- Control invasive species to protect native plants.
- Ensure all vegetation management practices comply with wildfire urban interface standards.
- Annual reports must be submitted to the Land Development Office and reviewed by Environmental Management and Fire Rescue.

5.4.3 Alternative Pervious Surface Material

Inspect pavement regularly for settlement and structural defects. Replace broken pavers immediately to prevent structural instability. Pavers can be removed individually and replaced during utility work. Pavement sections can be cut out and replaced with permeable materials. Proper maintenance is crucial to keeping any GSI system functional. Permeable pavement should be routinely inspected, and any needed maintenance performed as soon as possible. The frequency of maintenance will depend on the system size and location. In general, permeable pavement should be inspected at least monthly and after heavy rain events to identify any issues early. Use the below checklist to document system inspections and recommended maintenance practices. Keeping record of system maintenance can alert you to any potential problems before they seriously disrupt the system's function. Types of maintenance may include:

- At least annual vacuum sweeping is recommended to remove clogging material from the pavement surface. Pressure washing is discouraged, except as a last option.
- Check drainage area for bare soil or erosion, and replant or stabilize adjacent areas as necessary.
- Check to see whether underdrains are clogged by inspecting cleanouts or observation wells and looking for extended water storage.
- For smaller areas, remove the damaged pavers, check and fill the underlying gravel.
- Repair as per manufacturer specification. Do not apply sealants to permeable pavement.
- Sweep leaf litter and sediment regularly to prevent surface clogging and ponding.
- Prevent large root systems from damaging subsurface structural components.
- Manually remove, mow, or torch weeds.
- Use an herbicide only if it is approved for use in or near water (check with your local UF/IFAS Extension Office for suggestions).
- Replace paver pore space with aggregate per original design.

5.5 Stormwater Storage, Treatment, and Conveyance LID Maintenance Requirements

5.5.1 Wet Pond

- Routine maintenance is needed during the initial stage after the installation of plants to allow expansion of the desirable plants and control the growth of invasive species.
- Routine maintenance requirements are generally minimal after plantings become established.
- Remove weeds and invasive plants in the shoreline area. When practical remove roots of these species to prevent regrowth.
- A lake mower can be used to control aquatic vegetation by selectively cutting some lily pads and leaving others for fish habitat. Because lilies spread their roots (rhizomes) laterally, the only other method to prevent spread is planting in submerged containers.
- Selectively harvest vegetation for permanent nutrient removal before they die back. Otherwise, nutrients can return to the pond.
- Remove sediment, debris, and blockages from inlet and outlet structures. Sedimentation in the flow path can clog inlets and outlets and reduce conveyance efficiency and infiltration.
- Identify obstructions and clear them immediately.
- Identify any areas with at least 2 inches of erosion or sedimentation. Immediately remove accumulated sediment of more than 4 inches, as this may affect GSI function.
- Repair or replace broken inlet and outlet structures or components as needed. Monitor minor damage such as dents, rust, or minor cracks for indicators of when repair or replacement is required.

5.5.2 Dry Pond

- Routine maintenance is needed during the initial stage after the installation of plants to allow expansion of the desirable plants and control the growth of invasive species.
- Routine maintenance requirements are generally minimal after plantings become established.
- Remove weeds and invasive plants. When practical, remove roots of these species to prevent regrowth.
- Remove sediment, debris, and blockages from inlet and outlet structures. Sedimentation in the flow path can clog inlets and outlets and reduce conveyance efficiency and infiltration.
- Identify obstructions and clear them immediately.
- Identify any areas with at least 2 inches of erosion or sedimentation. Immediately remove accumulated sediment of more than 4 inches, as this may affect GSI function.
- Occasionally mechanically scarify the pond bottom to maintain percolation.
- Repair or replace broken inlet and outlet structures or components as needed. Monitor minor damage such as dents, rust, or minor cracks for indicators of when repair or replacement is required.

5.5.3 Underground Retention and Detention Systems

- Regular, routine inspection and maintenance is an important component of this type of underground system to ensure that it functions in a satisfactory manner. The maintenance intervals for an underground retention system are typically more frequent than standard ponds. The performance of the underground system will be related to the effectiveness of the upgradient sediment/ trash removal devices and the frequency of inspections and maintenance activities for each of the underground retention systems components.
- Inspection frequency:

- *After a large storm event of greater than one (1) inch of rainfall:* to ensure the (continued) free flow of stormwater, inspect the system and remove accumulated trash and debris from the up-gradient sediment/trash removal devices, and the inflow and outflow points of the down-gradient underground retention systems.
- *Every 6 months*: perform a comprehensive inspection of the underground retention system for accumulated trash, debris, and organic matter, and remove/dispose of these contaminates to ensure unimpeded stormwater flow. As appropriate, clean the surface of the sub-grade sands by ranking, and check for accumulations in the various underground areas. If the sediment/contaminate accumulation is greater than two (2) inches a vacuum truck and/or similar equipment may be necessary for removal operations. Removed contaminants shall be taken to an approved off-site landfill.
- *Annually, during September-November:* monitoring of the drawdown time of the stormwater through the sub grade sands shall be done to ensure recovery within 72 hours after the last rainfall event. Monitoring and observing the drawdown times can be done visually through the inspection ports or observation well after a storm event. the drawdown of the water quality treatment volume (RTV) must recover within 72 hours after the storm event. If appropriate, post construction hydraulic conductivity testing of the non-compacted soil floor shall be performed by the appropriate Florida licensed professional. Any post construction soil testing reports should be submitted to the county upon request.
- drawdown times that exceed 72 hours are indicative of subgrade clogging and will likely require the removal of contaminants and ranking of the subgrade soils. actual depth of the removal can be done visually by looking at the discoloration of the entrapped fine silts, hydrocarbons (greases and oils), and organic matter. If required, replacement sub-grade soils must meet the design specifications under the original permit authorization.
- in addition to the subgrade soils, other elements of the stormwater management system such as pipes, inlets, geotextile fabric, gravel, sediment/trash removal devices, etc. are to be inspected and repaired/replaced if needed.

5.5.4 Infiltration Trench

- Replace pea gravel and topsoil when clogged.
- Clear inlets of debris, including sediment and oil/grease monthly.
- Mow grass and remove grass clippings from filter strip areas, if applicable.
- Repair undercut and eroded areas at inflow/outflow structures.
- Inspect pretreatment devices and diversion structures for debris accumulation and structural integrity; take corrective action as needed.
- Aerate pretreatment basin bottom or de-thatch basin bottom, if applicable.
- Scrape pretreatment basin bottom to remove accumulated sediment and reseed ground cover, if applicable.
- Totally rehabilitate the trench and restore its design storage capacity upon failure.
- Excavate trench walls to expose clean soil, if applicable.

5.5.5 Exfiltration Trench

- Monitor facility for sediment accumulation in the pipe (when used) and storage volume recovery (i.e., drawdown capacity). Observation wells and inspection ports should be checked following three days minimum dry weather. Failure to percolate stored runoff to the design treatment volume level within 72 hours indicates binding of soil in the trench walls and/or clogging of geotextile wrap with fine solids. reductions in storage volume due to sediment in the distribution pipe, also reduces efficiency. Minor maintenance measures can restore infiltration rates to acceptable levels short term. Major maintenance

(total rehabilitation) is required to remove accumulated sediment in most cases or to restore recovery rate when minor measures are no longer effective or cannot be performed due to design configuration.

- Inspect appurtenances such as sedimentation and oil and grit separation traps or catch basins as well as diversion devices and overflow weirs when used. Diversion facilities and overflow weirs should be free of debris and ready for service. Sedimentation and oil/grit separator should be scheduled for cleaning when depth approaches clean out level. Clean out levels should be established not less than 1 foot below the invert elevation of the chamber.
- Remove sediment from sediment or/grease traps, catch basin inlets, manholes, and other appurtenant structures and dispose of properly.
- Remove debris from the outfall or "Smart Box" (diversion device in the case of off-line facilities).
- Remove sediment and clear trench system. This process normally involves facilities with large pipes. Clean out may be performed by suction hose and tank truck and/or by high-pressure jet washing.
- Periodic clean out or rehabilitation of the system to remove any accumulated trash, sediment and other inflow debris and remediate any clogging or perforated pipes.
- Total replacement of the system. In some cases, the system may not be able to be rehabilitated sufficiently to restore the design storage and infiltration rate. In these cases, complete replacement of the system may be necessary. The applicant shall provide an estimate of the expectant life expectancy of the exfiltration trench and an estimate of the cost to replace the trench.

5.5.6 Stormwater Harvesting

- Repair any components of the Stormwater Harvesting System that are not functioning properly and restore proper flow and filtration of stormwater.
- Repair or replace any damaged components of the Stormwater Harvesting System and irrigation as needed for proper operation.

5.5.7 Vegetated Stormwater Conveyance

Vegetated stormwater conveyance systems (swales) should be routinely inspected, and any needed maintenance performed as soon as possible. The frequency of maintenance will depend on the system size, location, and plants selected. In general, bioswales should be ideally inspected at least monthly and after heavy rain events to identify any issues early. Use the below checklist to document system inspections and recommended maintenance practices. Keeping record of system maintenance can alert you to any potential problems before they seriously disrupt the system's function. Types of maintenance may include:

- Remove sediment and debris from catch basins, curb inlets, and pipes.
- Maintain at least 50% conveyance at all times.
- Repair or replace damaged inlet and outlet structures as needed.
- Repair or seal cracks and replace when repair is insufficient.
- Maintain or replace check dams per design specifications.
- Replant per planting plan or substitute from the approved plant list.
- Irrigate only as needed until established and maintain 2-3 inches of mulch in landscape beds.
- Irrigate and mulch as necessary.
- Maintain grass to a height of 6 to 9 inches.
- In areas where appropriate, prune to allow for sight lines and foot traffic.
- Prune to ensure inlets and outlets freely convey stormwater into and/ or out of facility
- Manually remove weeds and monitor for invasives.

- Fill in and lightly compact areas of erosion. Replant according to planting plan or substitute from the plant list. Any erosion deeper than 2 inches must be addressed. Sediment more than 4 inches deep must be removed.
- Whenever possible, attempt to identify the cause of erosion or sedimentation to address the cause rather than the effect alone.
- Ensure splash blocks or inlet gravel/rock are adequate to distribute flow and prevent erosion.
- Rake, till, or amend soil surface to restore infiltration rate as needed

5.5.8 Rain Gardens

- Repair or replace broken inlet and outlet structures as soon as possible.
- Ensure splash blocks or inlet gravel/rock are adequate by checking for nearby erosion.
- Water levels should recede below the mulched surface within 24 hours (preferably, but absolutely within 48 hours) after a rain event.
- If ponding routinely remains after 48 hours, inspect subsurface water levels in observation wells and clean outs at or greater than 96 hours to determine if subsurface soils or underdrain are extending ponding durations. If accessible, check underdrain outlet into storm drain to evaluate flow.
- If surface soils are limiting infiltration and extending ponding, till, amend, or rake soils as needed to ensure ponding water drains within 48 hours.
- Identify any obstructions to flow and clear them immediately. Remove sediment, debris, and blockages from catch basins, trench drains, curb inlets, and pipes to always maintain flow capacity.
- Manually remove weeds, invasive species, and dead plant material. Replant per original planting plan, or substitute from the plant list.
- Ideally, plant selection would avoid including plants that would need irrigation and instead populate with plants that can tolerate periodic drought conditions.
- Irrigate only as needed until established and maintain 2-3 inches of mulch in landscape beds.
- Fill in and lightly compact areas of erosion. Replant according to planting plan or substitute from the plant list. Whenever possible, attempt to identify the cause of erosion or sedimentation to address the cause, rather than the effect alone.
- Identify and note any areas with at least 2 inches of erosion or sedimentation. Immediately remove accumulated sediment of more than 6 inches as this may affect GSI function.

5.5.9 Tree Box Filters

Tree box filters should be routinely inspected, and any needed maintenance performed as soon as possible. The frequency of maintenance will depend on the system size, location, and plants selected. In general, tree box filters should be ideally inspected at least monthly and after heavy rain events to identify any issues early. Use the below checklist to document system inspections and recommended maintenance practices. Keeping record of system maintenance can alert you to any potential problems before they seriously disrupt the system's function. Types of maintenance may include:

- Tree box filters should be checked seasonally and after major storm events to maintain optimum storage and drainage functions.
- Following storm events, tree box filters should be inspected to ensure that standing water is not present in the planter for more than 36 hours to avoid mosquito breeding and adverse effects on trees.
- Monitor and maintain the health of trees using best landscape maintenance practices. Prune and replace as necessary.
- Herbicides should not be used in or around tree boxes. Weeds and invasive plants should be removed manually.

- Remove sediment and debris from catch basins, trench drains, curb inlets, pipes, and around tree(s); maintain at least 50% conveyance at all times.
- Extend and secure liner to tree box walls above the high-water mark. The facility must be watertight if adjacent to foundations to prevent moisture from affecting a foundation.
- Replant per original planting plan or substitute from plant list. Irrigate, mulch, trim, and prune as needed.
- Check regularly for diseases.
- Repair or seal cracks in tree box structure.

5.5.10 Vegetated Roofs and Walls

Green roofs should be routinely inspected, and any needed maintenance performed as soon as possible. The frequency of maintenance will depend on the system size, location, and plants selected. In general, green roofs should be ideally inspected at least monthly and after heavy rain events to identify any issues early. Use the below checklist to document system inspections and recommended maintenance practices. Keeping record of system maintenance can alert you to any potential problems before they seriously disrupt the system's function. Types of maintenance may include:

- Vegetation will require supplemental irrigation, at least initially, and only very hardy plants should be selected for green roof systems. Depending on the green roof, required plant maintenance will range from two to three yearly inspections to check for weeds or damage, to weekly visits for irrigation, pruning, and replanting.
- To ensure continuity in the warranty and the maintenance requirements, the building architect, structural engineer and/or owner should specify and maintain everything up to and including the waterproof membrane. The green roof designer and installer should only be responsible for those items above the waterproof membrane, including soils, drainage and plantings.
- A one-foot barrier must be maintained around the roof drain to prevent vegetation and debris from clogging the drain as well as providing easy inspection.
- When the vegetation density is less than 80%, new plants shall be added.
- Immediately after construction, property owners need to regularly monitor green roofs to ensure that vegetation is healthy. During the first season, owners may need to water green roofs periodically if precipitation is insufficient. After the first season, property owners may only need to inspect and lightly fertilize extensive green roofs approximately once per year.
- Property owners need to maintain intensive green roofs like any other landscaped area. Maintenance may involve gardening and irrigation in addition to general roof maintenance.
- Green roofs are less prone to leaking than conventional roofs. In most cases, detecting and fixing a leak under a green roof is no more difficult than doing the same for a conventional roof. Still, a qualified professional should use proper construction techniques and conduct leak testing before planting occurs. Many green roof guidance documents provide helpful descriptions of leak detection methods, including flood tests and low-voltage leak detection.
- Remove sediment and debris if necessary.
- Repair any leaks or structural deficiencies and contact the manufacturer for repair or replacement.
- Replant per original planting plan or substitute from plant list.
- Trim dry grasses and remove clippings. Irrigate or prune as needed.
- Manually remove weeds before they go to seed. Cover with plants and mulch as needed.
- Fill, hand tamp, or lightly compact and plant to disperse flow.
- Rake or amend to restore infiltration or flow
- Clear drains. Check the irrigation system for leaks.

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