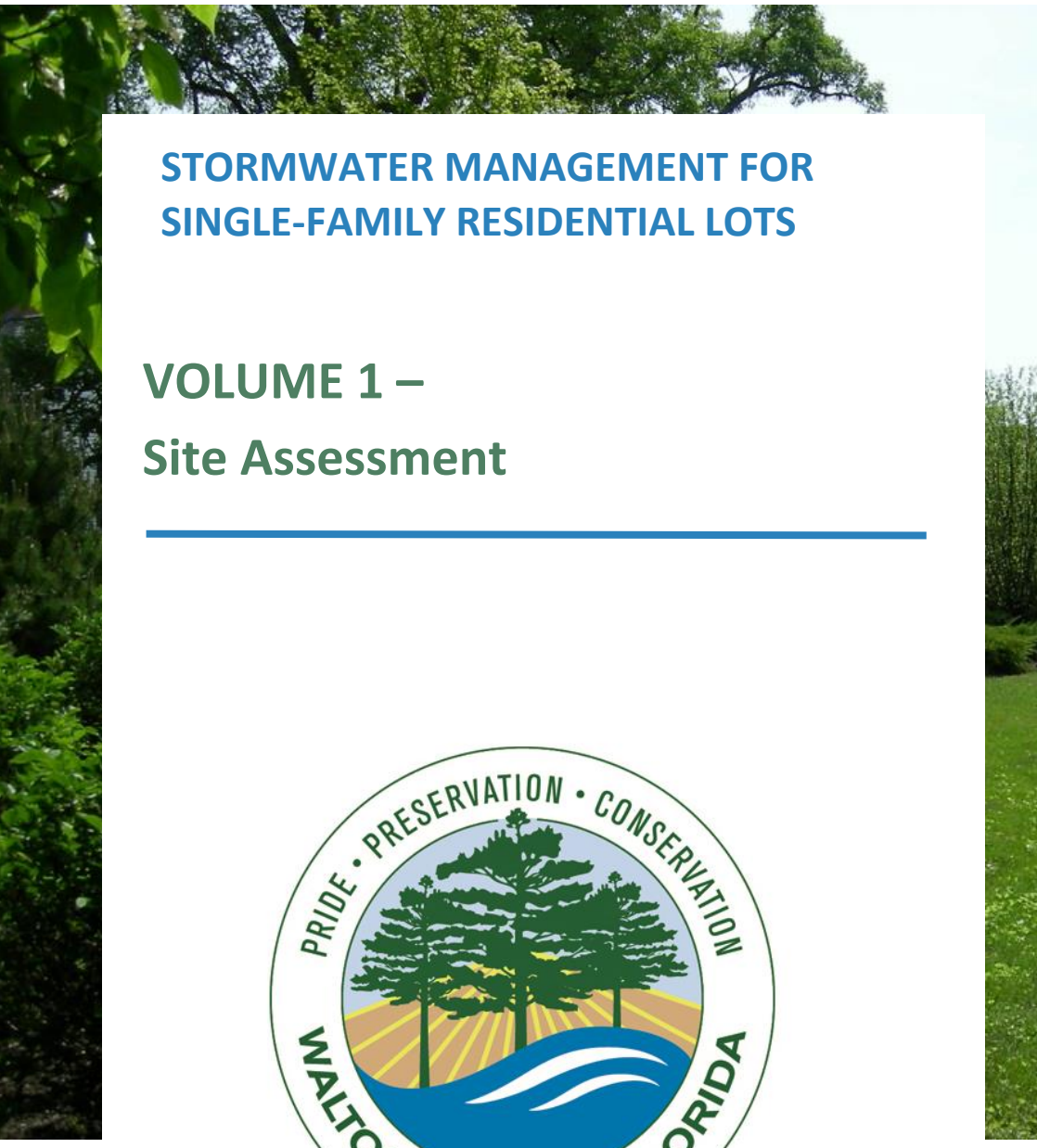


STORMWATER MANAGEMENT FOR SINGLE-FAMILY RESIDENTIAL LOTS

VOLUME 1 –

Site Assessment

PRIDE • PRESERVATION • CONSERVATION

WALTON COUNTY, FLORIDA

WALTON COUNTY PLANNING

LIVE | WORK | PLAY

"Stormwater Management System (SMS) - A system that is designed and constructed or implemented to control discharges which are necessitated by rainfall events, incorporating methods to collect, convey, store, absorb, inhibit, treat, use, or reuse water to prevent or reduce flooding, over drainage, environmental degradation, and water pollution or otherwise affect the quantity and quality of discharges from the system."

We acknowledge Andrea Ward, P.E. and Rita Banhunyadi, P.E. contributing authors.

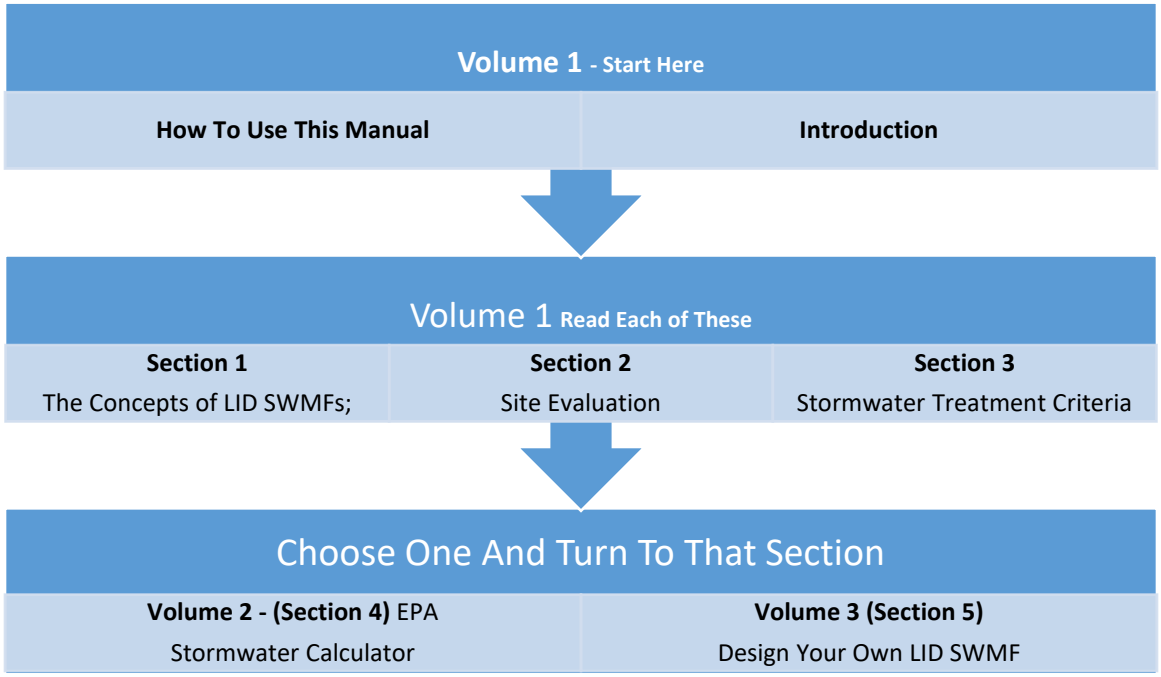
We thank Keli Frymire, P.L.A. for the wonderful images.
We thank Kristen Shell, A.I.C.P. for supervision and support.
We also thank many others for support and feedback.

Table of Contents

How To Use This Manual

When planning a project, this Manual is best used for addressing on-site stormwater mitigation, storage, and reuse associated with single-family residences. Multiple Low Impact Development (LID) stormwater management approaches can be used together to attain the required storage quantity and treatment quality that the Walton County Land Development Code (LDC) and Comprehensive Plan requires. This manual is organized so that each section is independent of the other. If you are not installing one of the LID stormwater management facilities (SWMFs) then you do not need to read the section pertaining to that approach.

In order to become familiar with the general concepts of site evaluation and the Walton County stormwater criteria, homeowners (or their representatives) need to read **Section 1 through 3** to get started. Once you are acquainted with site evaluation and storage requirements you can either choose to use the EPA Stormwater Calculator; or you can choose the LID SWMF that most interests you and design it by hand. You also have the option to use a design spreadsheet available on the County website, in this case you will turn to the specific section focusing on the LID(s) of your choice and familiarize yourself with the required input parameters.



The following is a brief description of each section:

- **Section 1** introduces the concepts of LID SWMFs;
- **Section 2** guides the homeowner through the site evaluation process;
- **Section 3** provides guidance associated with stormwater treatment criteria;
- **Section 4** provides an in depth description of how to use the EPA National Stormwater Calculator (https://www.epa.gov/water-research/national-stormwater-calculator).
    - The National Stormwater Calculator is free software designed to assist homeowners, landscapers, and local governments in expanding the use of green infrastructure.

- **Section 5** presents a variety of LID stormwater management solutions along with a description of optimal site conditions, design considerations, and calculation examples that will assist in determining if the chosen LID SWMF is feasible for your property.
- **Section 6** contains additional design considerations.
- **Appendicies** – Plant recommendation, definitions, and precipitation tables.

What you need to submit to the County:

1. **Summary page of the proposed stormwater management approach;**
2. **A map of existing contours / elevations;**
3. **Soils Printout**
4. **Site plan / drawing showing the location of the stormwater system along with proposed spot elevations, flow arrows depicting the conveyance of sheetflow, or proposed contours;**
5. **A description of each proposed impervious surface and the respective square footage of each;**
6. **Include the dimensions and a cross-section of each LID SWMF on the site plan;**
7. **Landscape Plan (if applicable);**
8. **Calculations sheets (provided in each section);**
9. **Final topographic survey showing extents of SWMF;**
10. **Completed Certification Form after the system is constructed.**

To Determine the Stormwater Retention Volume
Turn To Section 3
(Page 43)

To Use the EPA Design Software Turn To Section 4
(Page 53)

To Design The LID SWMF By Hand
Turn To Section 5
(Page 79)

Additional Design Considerations
See Section 6 (Page 155)

To Use the Spreadsheets Provided By Walton County Visit
https://www.co.walton.fl.us/1240/Stormwater-for-Single-Family-Lots

1.0 Introduction

Best Management Practices (BMP):

Actions taken to prevent or reduce detrimental impacts to the environment while maintaining the natural characteristics of the environment.

This Technical Manual is incorporated by reference in the Walton County LDC and therefore operates as a rule of Walton County. The manual provides specific detailed and simplified design and performance methodologies intended to meet the water quality and quantity requirements of stormwater management systems associated with small residential projects located in South Walton County. This technical manual is intended to serve as guidance for small residential projects south of the Choctawhatchee Bay without an existing approved stormwater management plan. Small residential projects are defined as projects encompassing less than 5 acres. Additionally, small residential projects north of the bay may be subject to Walton County stormwater management criteria if stormwater runoff originating from the property is attributing to localized flooding of contiguous parcels.

This document will be updated as necessary pending considerations for new technology, regulatory requirements, performance based approaches, community comments and concerns, and review by governing authorities.

This manual does not apply if:

- The property is located north of the Choctawhatchee Bay
    - (unless stormwater runoff originating from the property is attributing to localized flooding);
- Is located in South Walton County in a subdivision with a previously approved master stormwater management plan;
- If your property does not exceed the threshold for the impervious surface ratio (ISR) as described in **Section 2.3** of this manual.

For projects located south of the Choctawhatchee Bay, all of the following criteria must be met in order to qualify for the stormwater management exemption established in **Chapter 5.06.01(A)(1)**:

A. The structure must be pile supported;
B. No additional grading or filling will be conducted with the exception of the de minimis criteria required for a driveway and/or garage or carport.;
C. The maximum ISR must be equal to or less than 40%. The ISR is a percentage and is calculated by dividing the total impervious area by the total area of the site. To determine the maximum amount of impervious area refer to the example presented in Section 2.3.

If your project meets all of the previously mentioned criteria then you are exempt from the stormwater management requirements presented in the LDC Chapter 5.06.00 *Stormwater Management.*

Additional de minimis exemptions established in **Chapter 5.06.01(A)(2)** are as follows (In order for this exemption to apply, only one of the following criteria must be met): :

A. The project creates 3% or less of the total lot area or a maximum of 250 square feet of cumulative new impervious surface area (whichever is larger);
B. New and existing single family projects creating 5% or less impervious surface in relation to the total lot area are exempt from meeting flood attenuation requirements;
C. Single-family lots, immediately adjacent to a coastal dune lake or other tidally influenced waterbodies and connected, protected jurisdictional wetlands are exempt from meeting flood attenuation requirements; however, water treatment criteria must still be achieved.

Section 2.3 provides additional details to determine if your project qualifies for exemption.

Site Characteristics presented in Section 2 along with the data presented in Section 3 and 4 or 5 (depending on the design approach) will be required for County review and approval. Additionally, the Certificate of Completion form provided in Section 5 will need to be included in the submittal prior to the County issuing a building permit or Certificate of Occupancy.

New development or improvements to a parcel must be designed to comply with the stormwater quality and quantity requirements outlined in the Walton County LDC, The Walton County Comprehensive Plan, all applicable state and federal regulations, as well as, the Florida Building Code. An applicant for an individual permit must provide reasonable assurance that a SWMF, dam, impoundment, reservoir, works, or appurtenant work will meet the established criteria including a determination that the activity:

A. Will not cause adverse water quantity impacts to receiving waters and adjacent lands;
B. Will not cause adverse flooding to on-site or off-site property, and/or structure;
C. Will not cause adverse impacts to existing (natural or manmade) surface water storage and conveyance capabilities;
D. Will not cause adverse secondary impacts to water resources, and will not otherwise adversely impact the maintenance of surface or groundwater levels or surface water flows (natural or manmade);
E. Will be capable, based on generally accepted engineering and scientific principles, of being performed and of functioning as proposed;
F. Will not adversely impact the value of functions provided to fish, wildlife, and listed species by wetlands and other surface waters.

Additionally, final finished contours / grades must direct all stormwater runoff contributing to sheet flow towards the stormwater basins, or LID SWMFs. **LDC Section 5.06.00 *Stormwater Management*** requires that any

substantial ground disturbing activities are properly stabilized. Erosion and sediment transport shall be mitigated through the appropriate temporary or permanent best management practices (BMPs), as applicable. BMPs include hay bales, silt fences, geotextiles fabrics, and/or the placement of sod. It is in the best interest of the property owner to preserve as many trees as possible when considering the placement of LID SWMFs. Utilizing plants and natural areas to slow down and filter stormwater is the most cost effective and efficient approach to stormwater management.

Proposed grades should conform to existing grades to the greatest extent practical and the project should strive to achieve gentle slopes towards the proposed LID SWMFS or the location of proposed stormwater management basins. You will save money on construction costs if the chosen LID SWMF takes advantage of existing grades, which allows stormwater to naturally flow into the area designated for the SWMF.

The goal for stormwater management is to meet or exceed the requirement presented in the LDC; this affords an increased level of safety from localized flooding.

1.1 Low Impact Development Concept

The LID SWMF concept is to promote a method of stormwater management that will not adversely affect water quality in or around the area. Generally known as “green infrastructure”, LID SWMFs should focus on treating stormwater on site via natural infiltration. The goal is to mitigate negative changes to water quality and groundwater levels by allowing enough natural area for stormwater to naturally infiltrate into the soil. Additionally, it alleviates flooding or extreme changes in stormwater run-off patterns. A LID SWMF is designed and constructed or implemented to control discharges which are necessitated by rainfall events, incorporating methods to collect, convey, store, absorb, inhibit, treat, use, or reuse water to prevent or reduce flooding, over drainage, environmental degradation, and water pollution or otherwise affect the quantity and quality of discharges from the system.

LID is a stormwater management approach that uses a suite of hydrologic controls (structural and non-structural) distributed throughout the site and may be integrated as a treatment train (i.e., in series) to replicate the natural hydrologic functioning of the landscape. LID systems are designed to promote volume attenuation and treatment at or near the source of stormwater runoff via distributed retention, detention, infiltration, treatment, and harvesting mechanisms. A site-specific suite of LID-integrated management practices can be applied to most if not all development scenarios in Walton County. Regardless of the project context, LID implementation requires consideration of the following core site planning and design objectives:

A. Preserve or conserve existing site features and assets that facilitate natural hydrologic function.
B. Reduce stormwater storage requirements for your property by decreasing impervious (paved) surfaces.
C. Promote the distribution of retention, detention, treatment, and infiltration of runoff.
D. Harvest stormwater and rainwater on site.

E. Minimize site disturbance and compaction of soils through low impact clearing, grading, and construction measures.

LID is most effective when a site is evaluated for compatibility as early as possible in the planning process, and site conditions are considered carefully in the design and construction of each LID practice.

It is the goal of LIDs to work with the natural hydrology of a site instead of forcing stormwater to flow in un-natural patterns. Managing stormwater using LID methods takes full advantage of the natural cycles of adsorption, infiltration, and evaporation. By following LID guidelines, you can save on construction costs, as well, as time and effort.

Take note that any type of major ground disturbing activities will require the proper mitigation techniques to reduce erosion and sediment transport.

A. Mitigation approaches include the installation of silt fences, hay bales, geotextile fabrics, turbidity curtains, etc. around the perimeter of the area being disturbed. Guidance associated with the proper methods and techniques can be found in the Florida Department of Environmental Protection (FDEP) Stormwater, Erosion, and Sedimentation Manual.[1, 2]
B. Prior to any site disturbance, silt fencing shall be installed around the perimeter.
C. Erosion control measures shall be maintained throughout all phases of construction.
    a) Erosion control mitigation will prevent soil migration off site until permanent erosion control has been established.
D. It is extremely important to remember that all stormwater should be directed away from the foundation of structures.
E. The stormwater retention areas or LID SWMF will be stabilized with sod or the proposed plants **within 48 hours**, with the intent of establishing permanent stabilized ground cover.
F. Once construction is complete, the site must be stabilized with sod or the proposed plants on slopes equal to or greater than 4 feet (ft) horizontal to 1 foot vertical (4H:1V). All other areas will need to be seeded and mulched with the ultimate goal of establishing permanent stabilization.
G. Once the site has been stabilized, silt fencing and all other sediment control devices may be removed and disposed of or reused in accordance with appropriate regulations.

The intent of this technical manual is to provide property owners with options when it comes to small projects such as building a single-family home or addition. LID SWMFs focus on treating stormwater on site, ultimately reducing the quantity of stormwater leaving a property. This in turn enhances the water quality of nearby streams, lakes, and estuaries. By collecting this valuable resource, the homeowner will have an opportunity to reuse the

[1] Florida Department of Environmental Protection. *Florida Stormwater Erosion and Sedimentation Control Inspectors Manual.* July 2018. http://publicfiles.dep.state.fl.us/DEAR/DEARweb/Stormwater_training/Manual/FSESCI%20TIER%20I%20Manual%20062918.pdf

[2] Florida Department of Environmental Protection. *Florida Stormwater Erosion and Sedimentation Control Inspectors Manual. Tier II: Manual for Best Management Practices (BMP) Inspectors.* July 2018. http://publicfiles.dep.state.fl.us/DEAR/DEARweb/Stormwater_training/Manual/FSESCI%20TIER%20II%20Manual%20062918.pdf).

water for irrigation or other re-use applications. Demonstrating the effectiveness of a stormwater treatment system will be a critical step in permitting any proposed improvements in Walton County. This document provides guidelines for demonstrating the effectiveness of LID practices associated with meeting the appropriate water quantity and water quality requirements and standards.

LID stormwater mitigation applications work the best when several methods are employed to control stormwater quantity. The effectiveness of the entire LID SWMF must be demonstrated by first quantifying the effectiveness of each individual LID SWMF approach and then determining the overall effectiveness of the entire system. Several key factors must be taken into consideration prior to developing a LID SWMF for your property such as: the size of your parcel and the amount of space available to build the SWMF, soil type, land use, depth to the groundwater table, amount of existing vegetation, and proximity to dunes, wetlands, natural waterbodies, and potable water wells.

The primary goal of stormwater management is to not only move water away from structures and roadways but to slow down the water as it travels across the land. Slowing down stormwater flowing across yards of residential developments reduces erosion and inhibits sediment transport to nearby streams and wetlands. In addition, it allows plants to absorb nutrients and filter out pollutants generated from fertilizers and vehicles. It is imperative that the new LID SWMF be placed in an area that collects stormwater without requiring major alterations to or regrading the land. The primary goal of a LID SWMF approach is to promote infiltration of stormwater on site. To encourage this, the soil conditions must be conducive to allowing stormwater to infiltrate.

Infiltration is the act of water moving down through the voids between the grains of soil, similar to the way a sponge absorbs water.

Developing a LID SWMF is an iterative process that takes in to consideration a variety of site characteristics. **Table 1** provides a brief overview of the LID approaches along with the optimal parameters, and maintenance schedules. **Certificate of completion forms, Transfer of Ownership forms, and maintenance forms are described below, these must be submitted to the County**

1. Once construction of the approved LID SWMF is complete you will need to submit a Certificate of Completion to the County, this form is provided in **Section 1**.
2. If the property is sold, a transfer of ownership will need to accompany the deed; this form is provided in **Section 1**.
3. Maintenance forms are provided at the end of each LID approach in **Section 5**, these will need to be submitted to the County.

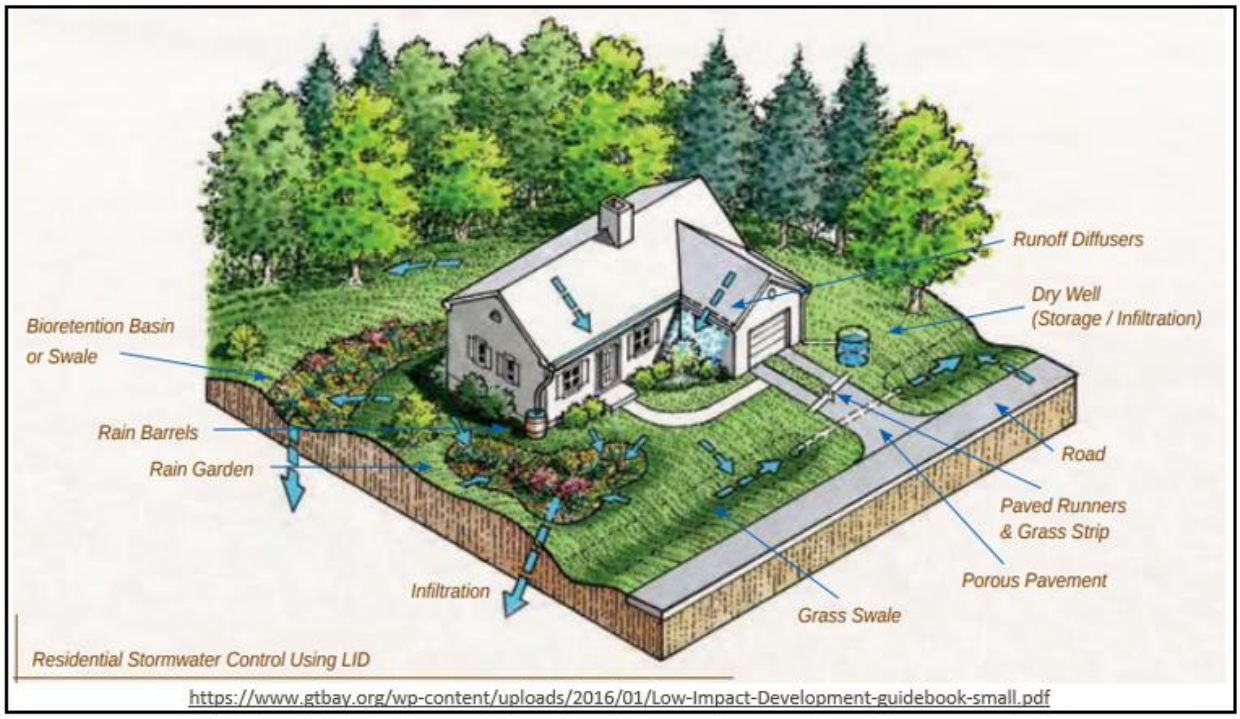


Table 1. LID Overview

LID SWMF	Water Table	HSG Soil Type	Water Storage	Slope	Maintenance
Rain Barrels / Cisterns 	High	Any	Minimal to Moderate	N/A	Low
Rain Gardens 	Low	Any	Moderate	Minimal to Moderate	Moderate
Planter Boxes 	Either	Any	Moderate	N/A	Moderate

LID SWMF	Water Table	HSG Soil Type	Water Storage	Slope	Maintenance
Tree Boxes 	Low	A & B	Significant	Minimal to Moderate	Low
Enhanced Shallow Swales 	Either	Any	Moderate	Minimal	Low / Moderate
Infiltration Trenches 	Low	A & B	Significant	Minimal to Moderate	Moderate / High
Pocket Wetlands 	High	C & D	Moderate	Minimal	Moderate
Pervious Pavement 	Low	Any	Moderate	Minimal	Moderate / High

1.2 LID Stormwater Certification Form

A certification form shall be completed by the homeowner or a representative of the homeowner once the LID SWMF is constructed and another one when ownership transfers. These forms need to be submitted to the County and recorded with the deed.

Certificate of Completion

Permit Number: _____

Parcel ID: _____

Contractor: _____

Contractor Certification Number: _____

Date of Completion: _____

Owner: _____

Address: _____

Contact Information: _____

Phone E-mail

To the best of my knowledge the drainage requirements for the property listed above have been completed in accordance with the above referenced approved permit encompassing the proposed LID SWMF design and specifications.

Any deviations from the approved LID SWMF due to extraneous circumstances encountered at the site are listed below:

_____

_____

_____

Deviations to be approved and initialed by the Planning Inspector on-site.

Contractor's Signature: _____

Signature **Date**

In addition, I understand that I and my successors in interest are required to maintain the approved drainage system and are not permitted to modify any element of the approved drainage system without obtaining prior approval from the County. This is an official notice to the County confirming that the engineered stormwater system has been completed and the system is ready for final inspection.

Additionally, the LID SWMF has been documented on the parcel deed to ensure that if the parcel is transferred to another interested party, they shall be made aware of its location and function. This shall be achieved through a Transfer of Ownership completed by both interested parties.

Owner Signature: _____

Signature **Date**

Parcel ID:_____

Return to:_____

_____

_____

(Owner's Address)

Permit #: _____

SINGLE-FAMILY STORMWATER MANAGEMENT SYSTEM ACKNOWLEDGEMENT

I, _____, acknowledge the construction and maintenance requirements associated with the attached single family residential stormwater management plan permitted utilizing the Walton County Stormwater Management for Single-Family Residential Lot Low Impact Development Technical Manual. Preservation and maintenance of this system shall be in accordance with Permit #_____ approved by the Walton County Planning Department on _____. A copy of the approved plan is attached hereto at Exhibit A.

I acknowledge construction and maintenance requirements shall run with the land and are binding on subsequent owners. Maintenance is the sole responsibility of the property owner.

Owner's Signature: _____ Date: _____

STATE OF FLORIDA
COUNTY OF WALTON

On this _____ day of _____, 20____, before me, a Notary Public in and for the above state and county, personally appeared _____, known to me or proved to be the person named in and who executed the foregoing instrument, and being first duly sworn, such person acknowledged that he or she executed said instrument for the purposes therein contained as his or her free and voluntary act and deed.

_____

NOTARY PUBLIC

My Commission Expires: _____

_____

Witness

_____

Witness

In accordance with Walton County Planning Department Ordinance 2019-6. ~Version 5/1/2019

Two witness signatures required for recordation.

Recordation fees are $10.00 for the first page and $8.50 for any subsequent pages. (Fees may change. Please confirm with Clerk of Court.)

You will need either a legal description of the property or a copy of the current deed in order to record.

Please note this acknowledgement and recordation requires the property owner's signature.

This document may be recorded at:

Walton County Clerk of Court

31 Coastal Centre Blvd., Ste. 500
Santa Rosa Beach, FL 32459
(850) 267-3066

or

571 U.S. Highway 90 East
Defuniak Springs, FL 32433
(850) 892-8155

LID SWMF Transfer of Ownership

Permit Number: _____

Parcel ID: _____

Address: _____

Seller: _____

Seller Contact Information _____

Buyer: _____

Buyer Contact Information _____

Date of Title Transfer: _____

Title Company: _____

Contact Information: _____

Phone E-mail

This document servers as notice to the County of transfer of ownership of the above referenced previously approved LID SWMF. Operations and maintenance requirements for the existing LID SWMF have been provided to the buyer prior to the transfer of title of the above referenced property. The buyer agrees to maintain the existing LID SWMF and will not make changes to the system which may compromise the intended function or volume capacity as originally designed. The seller has provided a historic log documenting current and ongoing maintenance activities associated with the LID SWMF to the buyer.

This is an official notice to the County confirming that the LID SWMF has transferred ownership and the buyer is aware of the existing LID SWMF. Additionally, the buyer confirms that they are the responsible party, which shall become effective as of the date of title transfer listed above.

Seller Signature: _____

Signature **Date**

Buyer Signature: _____

Signature **Date**

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1.3 Maintenance Schedule

Regular maintenance is a vital component to ensuring that the LID SWMF that you install on your property is functioning as originally intended. Poorly maintained SWMF increase the risk of localized flooding.

Stormwater management systems shall be inspected and documented by the homeowner or by a representative of the homeowner as follows, unless otherwise specified in the permit:

Table 2. LID SWMF Inspection and Maintenance Schedule

TYPE OF SYSTEM	INITIAL INSPECTION AFTER CONSTRUCTION	AFTER THE FIRST YEAR OF SUCCESSFUL OPERATION
Dry Retention basins	1 Year	Once every 5 years
Exfiltration trenches	1 Year	Once every 2 Years
Underground retention	1 Year	Once every 2 Years
Sand Filters	1 Year	Once every 2 Years
Underdrain filtration	1 Year	Once every 2 Years
Underground vault/chambers	1 Year	Once every 2 Years
Swales (treatment)	1 Year	Once every 5 years
Wet Detention systems	1 Year	Once every 5 years
Vegetated Natural Buffers	1 Year	Once every 5 years
Above-ground Impoundments	1 Year	Annually

Homeowner, or the homeowner's representative shall document maintenance activities and dates on forms supplied at the end of each LID presented in Section 5. These documents will be submitted to the County and will also transfer with the deed in the event of sale of the property.

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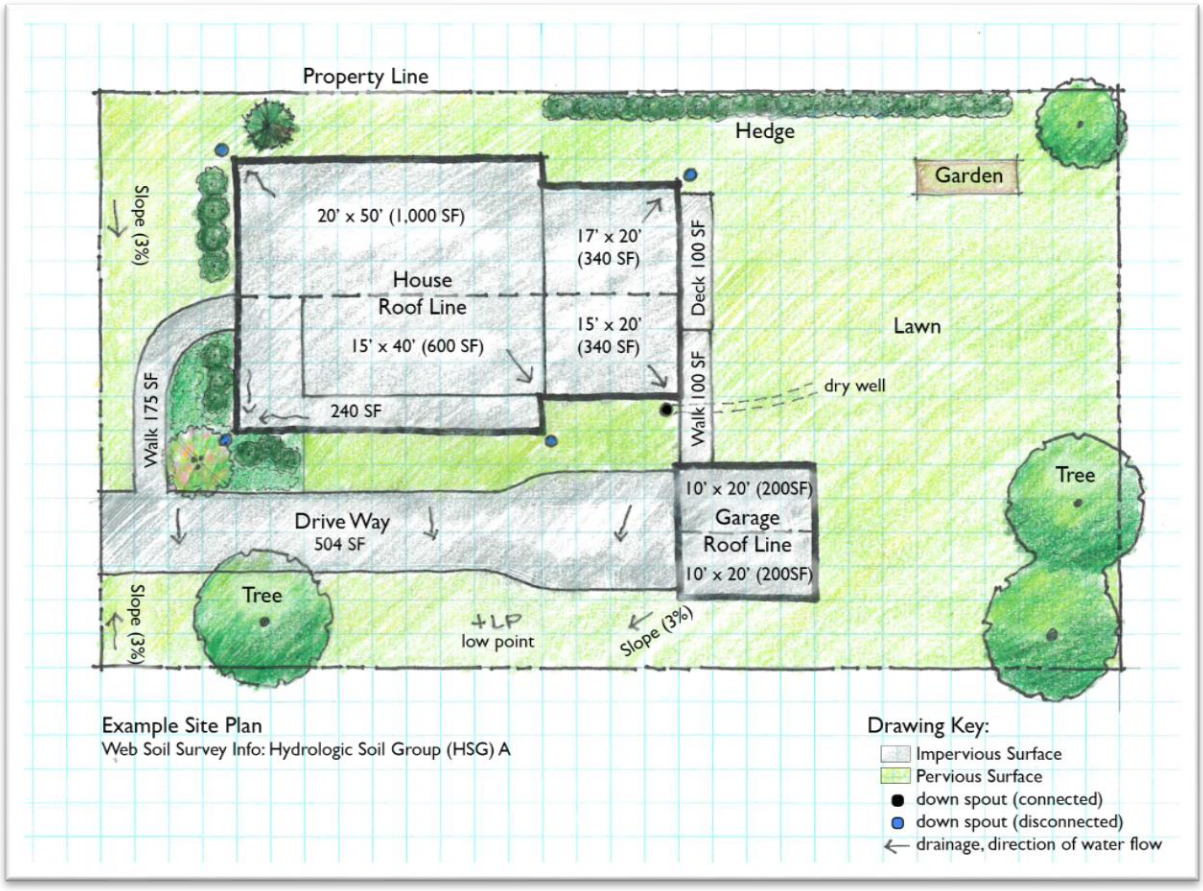
2.0 Site Evaluation

The most important component to stormwater management is a site assessment or evaluation. This section describes the first and most important steps in determining which LID SWMF will be successful on your property. A combination of factors must be taken into consideration, each are described in detail below.



2.1 Site Location

The location of your site could potentially have additional characteristics that you may need to take into consideration. This may increase or decrease your site-specific stormwater requirements.

important

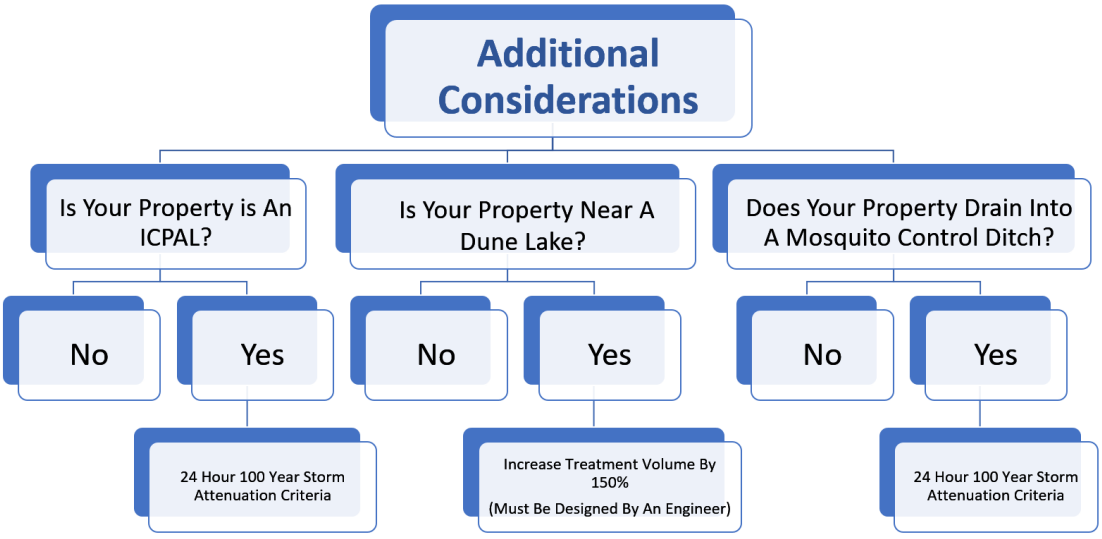
A. **<u>Sites within the Initial County Problem Area List (ICPAL)</u>** - Areas identified as having significant flooding issues require additional flood attenuation to prevent localized flooding. Within these areas, increased attenuation shall be the design goal. See **Section 3.4** for guidance on designing for an area in an ICPAL.

<u>Significant Localities</u> - Projects located within a coastal dune lake watershed shall require 150 percent of the required treatment volume. **LDC Chapter 4.02.03** ***Restriction on Development within the Coastal Dune Protection Zone*** states the following, "The Coastal Dune Lake Protection Zone is defined as being all

lands within an area beginning at the mean or ordinary high water line of the coastal dune lakes and their tributaries and extending 300 feet landward." See **Section 3.5** for guidance on designing a LID in an area within a Dune Lake buffer.

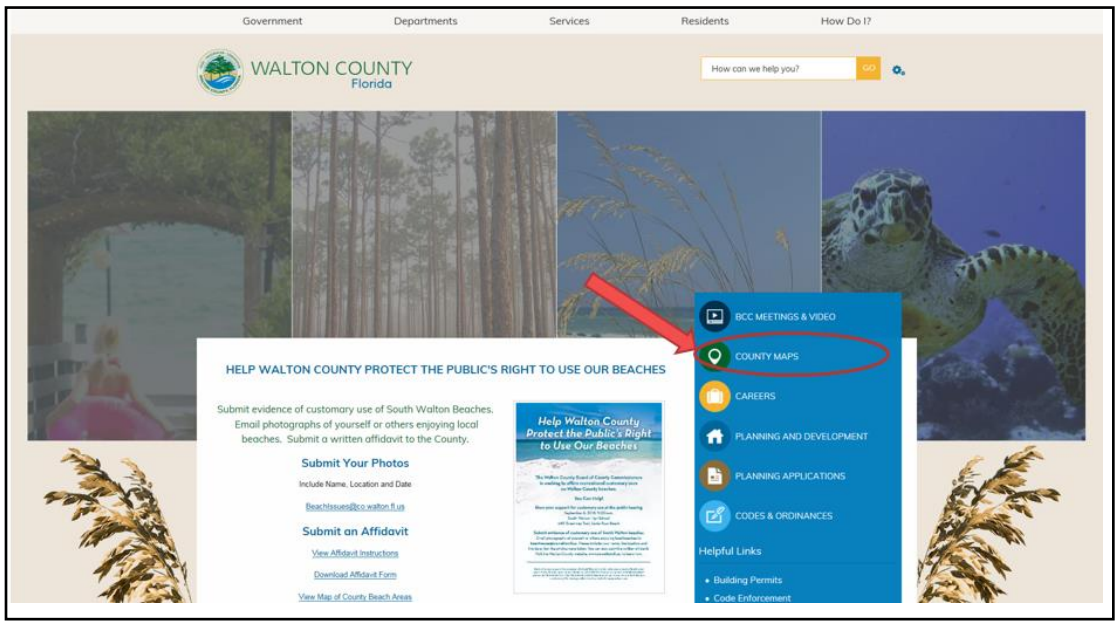
B. Mosquito Control Ditches require special attention so the system is not overwhelmed with stormwater runoff. Properties that discharge into a mosquito control ditch will need to provide additional attenuation. See **Section 3.6** for guidance on designing a LID in an area discharging into a mosquito control ditch.

C. Sites adjacent to the Gulf, Bay, most Coastal Dune Lakes, and other tidally influenced waterbodies are only required to provide stormwater treatment (i.e. no attenuation is required).

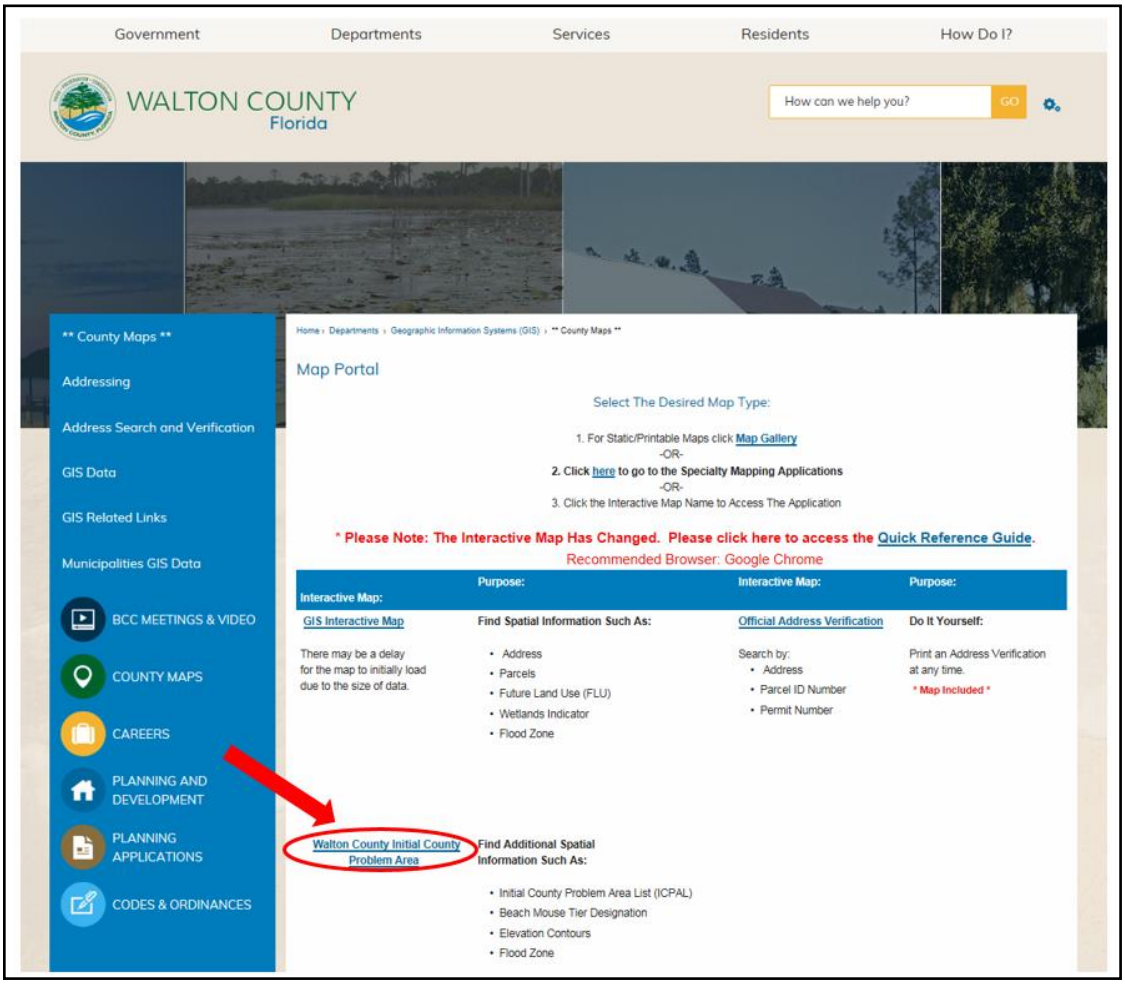


To determine if your property is located in one of the previously identified area check the Walton Count GIS page.

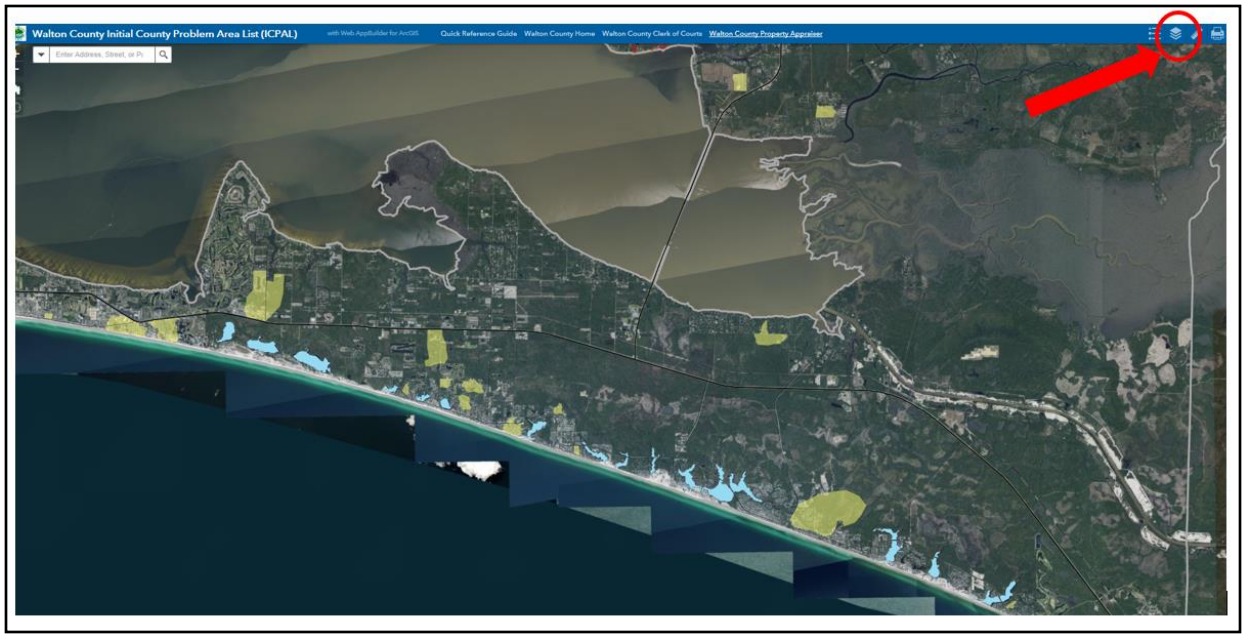
1. Go to www.co.walton.fl.us.



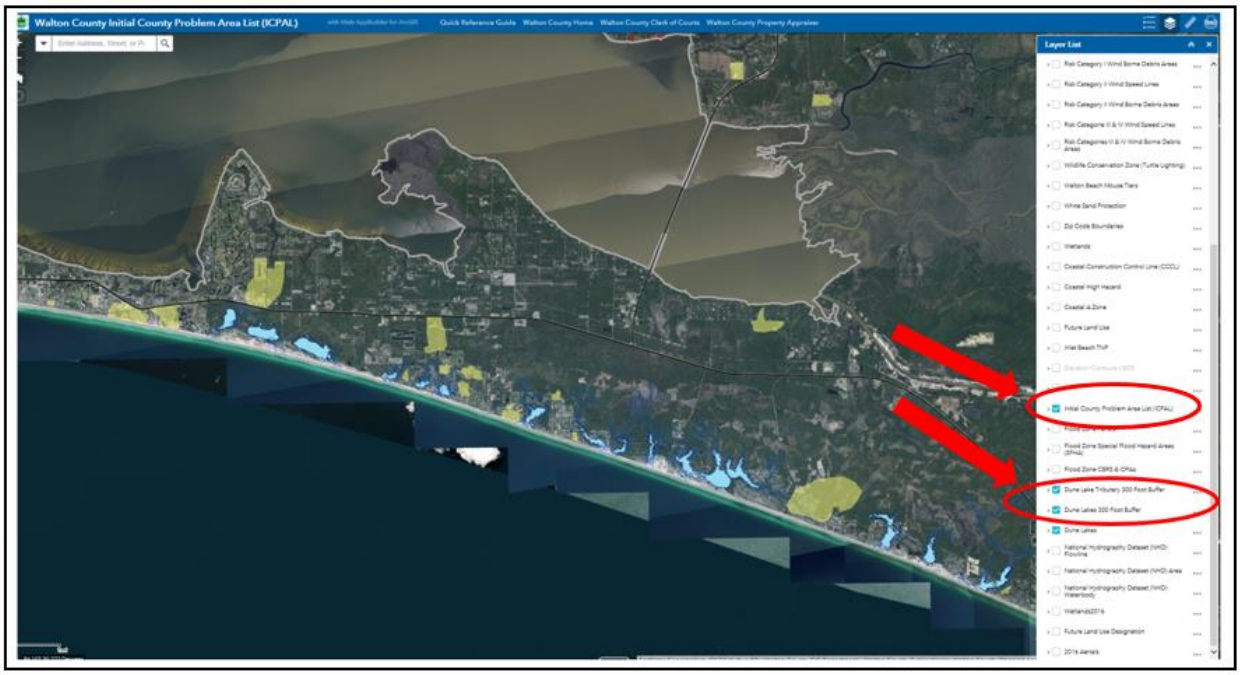
2. Click “County Maps” on the right, and then follow the “Walton County Initial County Problem Area” link.



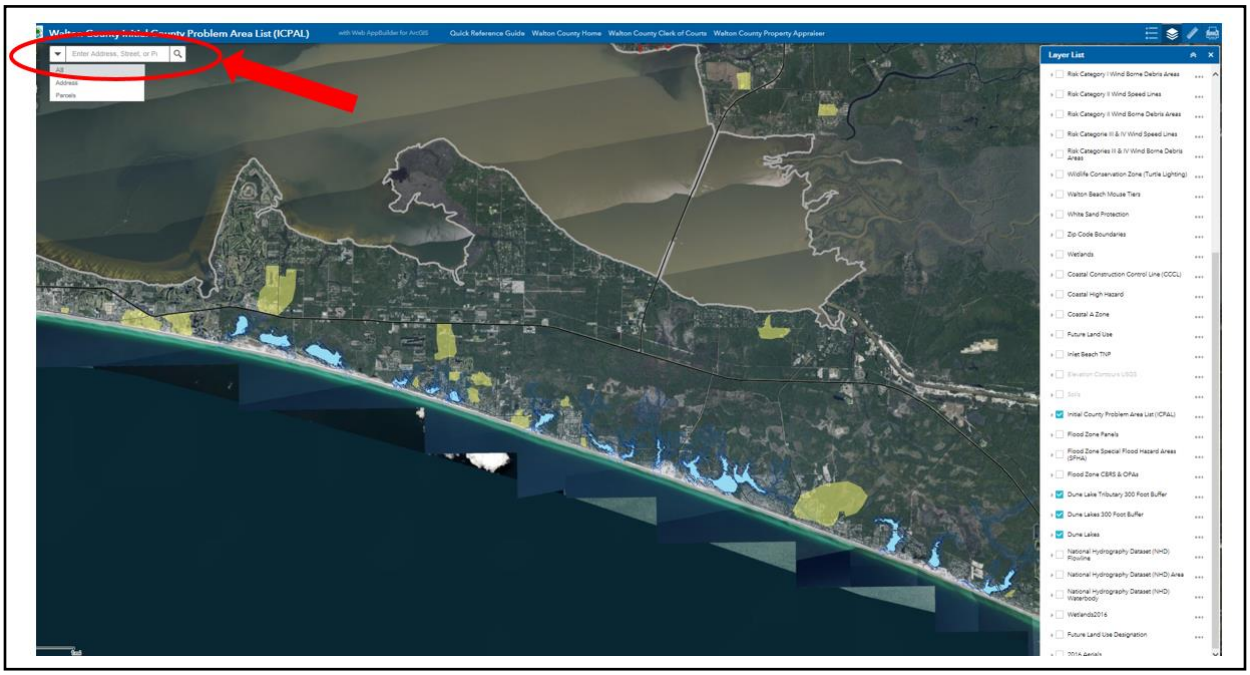
3. On the upper right corner click the middle “Layer List” icon



4. Once the menu expands, scroll down to find “Initial County Problem Area List (ICPAL)”, “Dune Lake”, “Dune Lake Tributary 300 Foot Buffer”, “Dune Lake 300 Foot Buffer”, and “South Walton Mosquito Control Ditches” layers (close to the bottom of the list); then click the box to the left of each one to turn on the layer.



5. At the top left search window, click the down arrow to select the type of location you wish to enter, then type in the location. From this map, you can gather additional information regarding your site.



The elevation contours of your property are extremely important when deciding where to place a stormwater management system. If you plan your LID SWMF according to the natural topography of your property, you will save money on construction costs associated with grading. The next time it rains, pay attention to the natural path of the water as it crosses your property. The areas that water is ponding or naturally collecting is generally a good place for your LID SWMF.

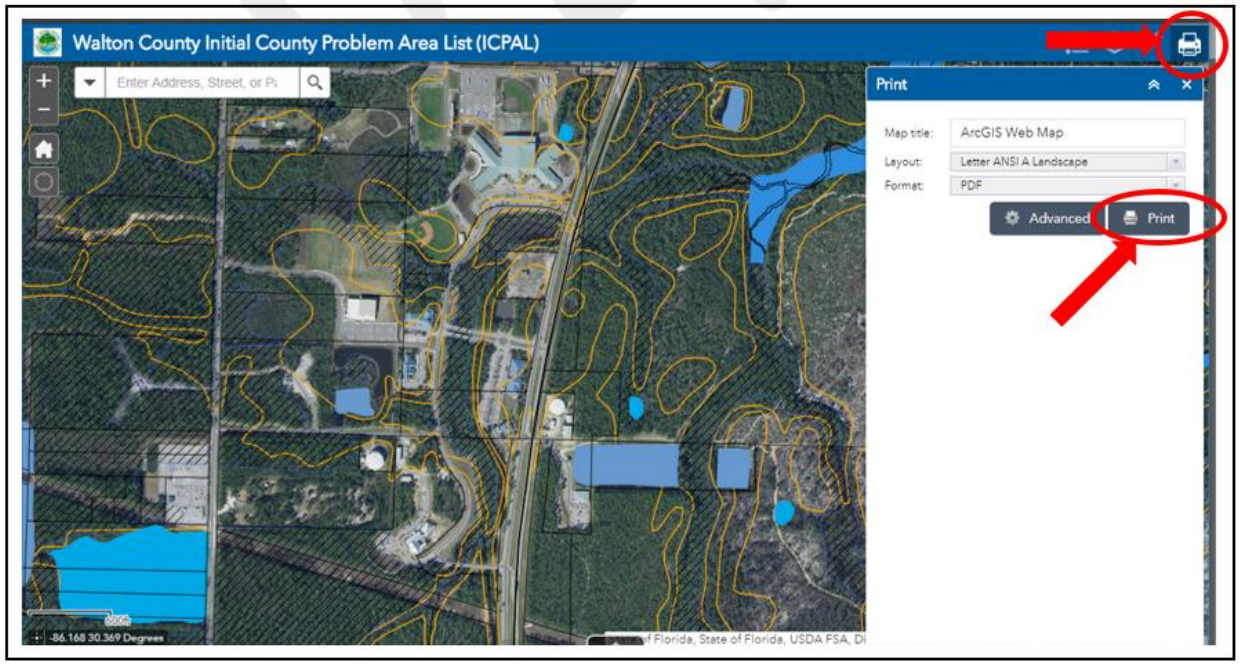
6. To assist with determining which way water will flow during a storm click on the layers option located on the top right corner.

7. In the layer menu, check the box next to “Elevation Contours USGS” and “wetlands”.

The elevation contours should show up as orange lines and wetlands will show up in blue.

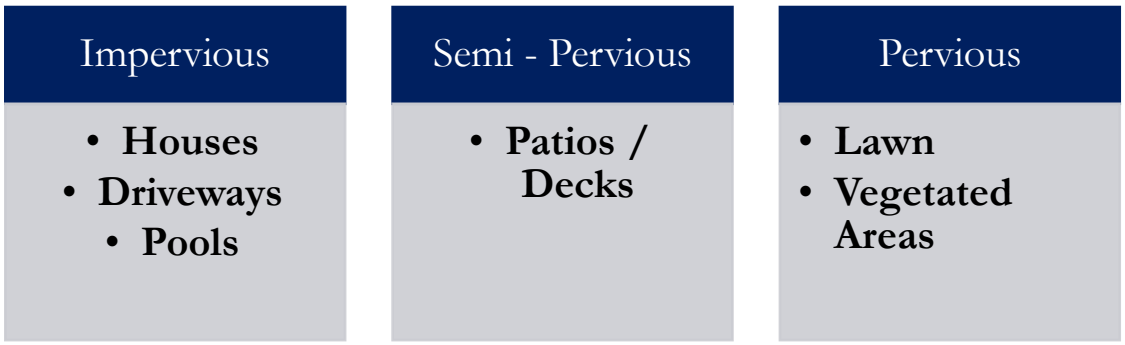
reminder **Please print this report, as you will need to provide this with your application. The information on this report is key to determining the optimal location for your LID SWMF.**

If you are unsure about identifying the special areas previously listed, please contact the planning department for assistance. Once you have identified your property using the steps described above, save the map to a pdf by clicking on the printer icon located on the top right corner of the screen.



2.2 Site Coverage (Pervious versus Impervious Areas)

Another very important aspect to stormwater management is the site coverage. This will determine how much water you need to capture. The amount of area that does not absorb water (impervious) will significantly contribute to water flowing across your property (sheet flow); therefore, to improve water quality a certain amount of stormwater must be captured and stored on your property. Water quality of streams, lakes, and the bay are greatly impacted by stormwater runoff. Multiple properties in one location without any type of stormwater management will exasperate runoff and compound sheet flow creating localized flooding. Plants and soil naturally filter stormwater, which greatly reduces stormwater runoff and enhances the water quality of surrounding streams, lakes, and bays. The amount of natural undisturbed land (pervious) that is preserved on a property provides a greater opportunity to naturally capture and filter stormwater runoff.



To determine the amount of area on your property that does not absorb water (impervious) you can use one of four methods.

1. If you have a new design, obtain the total impervious area proposed from the design plans and/or ask your engineer or architect to provide it to you.

2. If you have an existing site and you are making improvements that add additional impervious area, you need to use a recent survey to calculate the existing site coverage and add the area of the new addition, as well as, anything that might be missing from the survey.

A description of each new impervious area and the square footage associated with each area is required for the County to review the SWMF.

The disturbed area associated with a project is calculated by taking the area proposed for improvements plus an additional ten foot perimeter to account for access needed for construction equipment.

Only Enter Information In To The Green Boxes - All Other Boxes Are Automatically Calculated

Low Impact Development Calculation Sheet

Owner		Line 1
Address		Line 2
Phone		Line 3
E-mail		Line 4
Parcel Identification Number		Line 5
Total Proposed Disturbed Area	ac	Line 6

Proposed Impervious Area Totals

House	ft^2	Line 7
Detached Garage	ft^2	Line 8
Shed	ft^2	Line 9
Driveway	ft^2	Line 10
Patio / Porch / Deck	ft^2	Line 11
Pool	ft^2	Line 12
Misc Description:	ft^2	Line 13

Is Your Property In The Following Locations:

		Yes	No
ICPAL	If "yes" see section 3.4	☐	☐
Dune Lake	If "yes" see section 3.5	☐	☐
Near a Mosquito Control Ditch	If "yes" see section 3.6	☐	☐

Area Totals

Total Impervious Area	ft^2	Line 14
Total Impervious Area (acres)	ac	Line 15
Total Impervious Area (acres)	= Total Area (ft^2) * (1 acre/ 43,560 ft^2)	
Total Pervious Area	ac	Line 16
Total Pervious Area (ft^2)	ft^2	Line 17

Total Pervious Area (acres) = Total Area (acres) - Total Impervious Area (acres)

Next Determine the Volume Required Per the LDC Section 5.06.00

Total Property (square feet)	ft^2	Line 18

Soils Characteristics

Depth to Seasonal High Groundwater Table		ft below ground surface		Line 19

Predominant Soil Type

Predominant Soil Type			Value Taken From USGS Soils Survey	Line 20
Infiltration	Actual K_{sat}	in/hr	Provided in Table 3	Line 21
Design Infiltration	Design K_{sat}	in/hr		Line 22

Stormwater Volume Requirements

0.5 in Rainfall Over Disturbed Area	ft^3		Line 23
1 in Runoff Over Proposed Impervious Surface	ft^3		Line 24
Attenuation Volume	ft^3	Find Largest Value Between Line 23, 24, and 25 And Enter The Value On Line 26	Line 25
Required Retention Volume	ft^3		Line 26

*****Special Circumstances Only - Verify Your Location****

Section 3.4 Stormwater Volume Requirements for ICPAL

0.5 in Rainfall Over Disturbed Area	ft^3		Line 27
1 in Runoff Over Proposed Impervious Surface	ft^3		Line 28
Attenuation Volume	ft^3	Find Largest Value Between Line 27, 28, and 29 And Enter The Value On Line 30	Line 29
Required Retention Volume	ft^3		Line 30

Section 3.5 Stormwater Volume Requirements for Dune Lake

0.5 in Rainfall Over Disturbed Area	ft^3		Line 31
1 in Runoff Over Proposed Impervious Surface	ft^3		Line 32
Attenuation Volume	ft^3	Find Largest Value Between Line 31, 32, and 33 And Enter The Value On Line 34	Line 33
Required Retention Volume	ft^3		Line 34

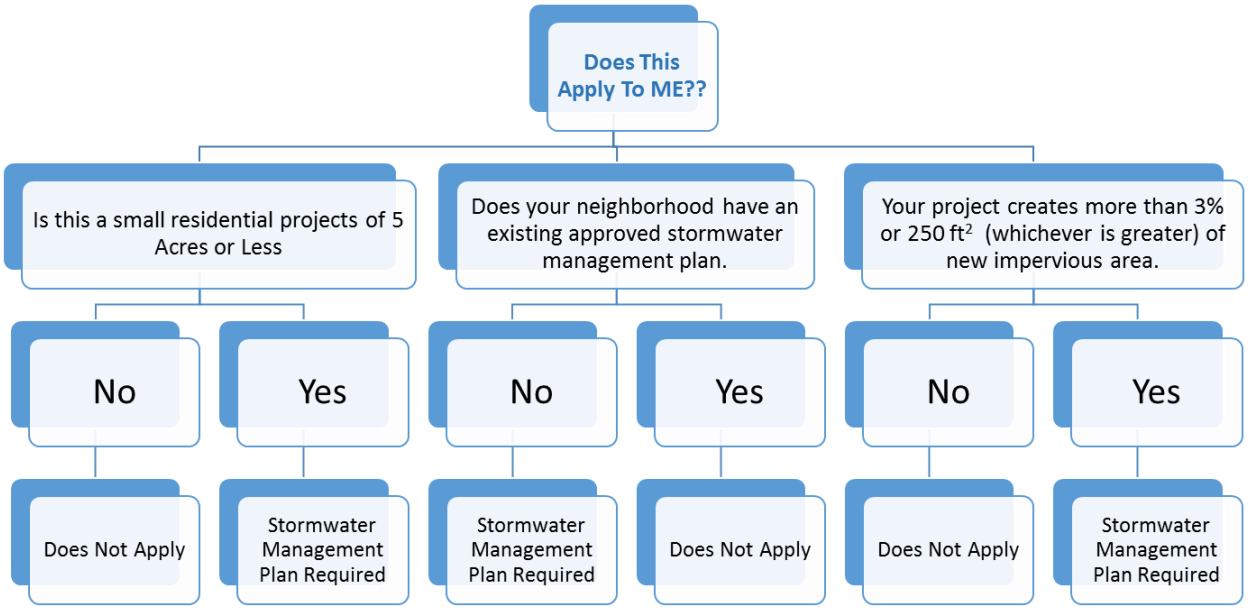
Section 3.6 Stormwater Volume Requirements for Mosquito Control Ditch

0.5 in Rainfall Over Disturbed Area	ft^3		Line 35
1 in Runoff Over Proposed Impervious Surface	ft^3		Line 36
Attenuation Volume	ft^3	Find Largest Value Between Line 35, 36, and 37 And Enter The Value On Line 38	Line 37
Required Retention Volume	ft^3		Line 38

Exemptions

If your project meets the following criteria established in the **LDC Chapter 5.06.01(A)** ***Exemptions*** then you are exempt from the stormwater management requirements presented in the **LDC Chapter 5.06.00** ***Stormwater Management***. In order for the exemption to apply, the following criteria must be met:

A. The project creates 3% or less of the total lot area or a maximum of 250 square feet of cumulative new impervious surface area (whichever is larger);
B. New and existing single-family projects creating 5% or less of total lot area of cumulative new impervious surface are exempt from meeting flood attenuation requirements;
C. Single-family lots, immediately adjacent to a coastal dune lake or other tidally influenced waterbodies and connected protected jurisdictional wetlands are exempt from meeting flood attenuation requirements; however, water treatment criteria must still be achieved.
D. Additionally, applicants will need to demonstrate the following:
    a) No drainage system shall act in a manner that will divert and channelize areas of overland sheet flow, thereby creating point source discharges that will adversely affect wetlands, or areas beyond the applicant's perpetual control; and
    b) The applicant shall include a site plan depicting proposed driveways, buildings, and other impervious areas, as well as, the anticipated percentage of impervious surfaces.



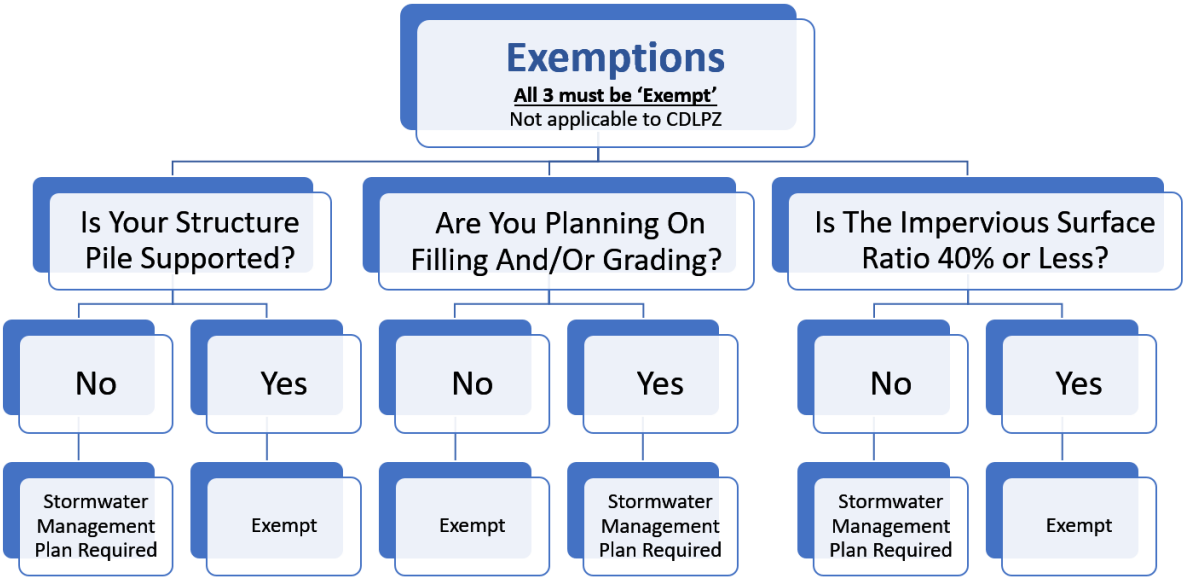
For projects located south of the Choctawhatchee Bay, all of the following criteria must be met in order to qualify for an exemption:

A. The structure must be elevated by non-backfilled stem walls, pilings or piers; and
B. No additional grading or filling will be allowed with the exception of the driveway and up to a two car garage [See de Minimis criteria listed in **LDC Chapter 5.06.01(A)(1)(c)**];
C. The maximum ISR must be equal to or less than 40%. The ISR is a percentage and is calculated by dividing the total impervious area by the total area of the site. To determine the maximum amount of impervious area allowed to qualify for the stormwater exemption use the following equation:

Total Site Area x 0.4 = Maximum Impervious Area (ft^2)

Use the following equation to calculate the current impervious surface ratio:

Impervious Area (ft^2) / Total Site Area (ft^2)	=	***Impervious Surface Ratio***
$\frac{17{,}424\ ft^2}{43{,}560\ ft^2}$	=	*0.4*



All of the scenarios above must lead to "exempt" in order for this to be valid.

2.3 Soil Data

The biggest factors in determining which LID SWMF will work best at your site are the soil characteristics. More specifically your soil's permeability rate (K), hydraulic soil group (HSG) and the depth of the seasonal high groundwater (SHGW). Permeability is the soil's ability to allow water to move through it. Infiltration is the movement of water through the soil and is the component of rainwater that recharges groundwater. Infiltration rates are highly dependent on the soil structure and slope of the land. By following the steps presented in the next few sections, the information that is gathered should provide sufficient soil data for projects associated with small single-family residential stormwater requirements in Walton County.

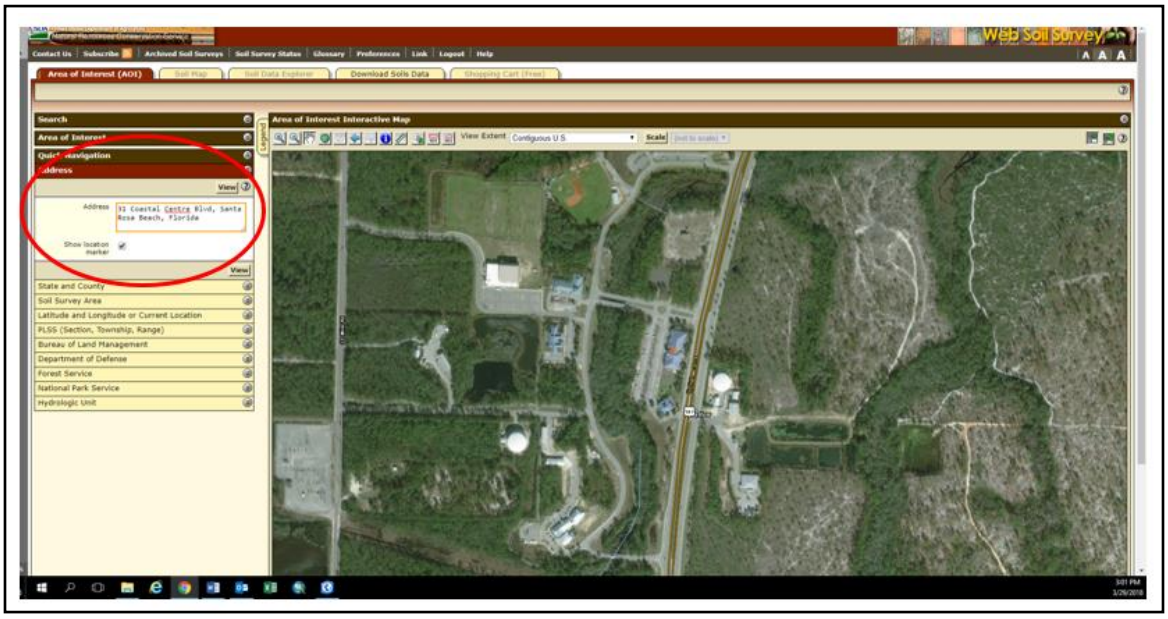
2.3.1 Hydraulic Soil Groups, Infiltration Rate, and SHGW

Stormwater systems should be designed to mimic the natural hydrologic functioning of a site. The hydrologic soil groups, as classified by the Natural Resource Conservation Service (NRCS) are as follows: Types A (well drained), A/D (well drained when dry, not well drained when wet), B/D (moderately well drained when dry, not well drained when wet), B (moderately well drained), C (somewhat poorly drained), and D (poorly drained). Most soils in South Walton County are A/D (60%) and A (25%). These are both well-draining, mostly sandy soils. Soil type A/D is generally located in areas with high to very high water tables, limiting the type of SWMF you can implement. Performance of infiltration-dependent LID applications will be constrained under wet conditions in areas with this soil type.

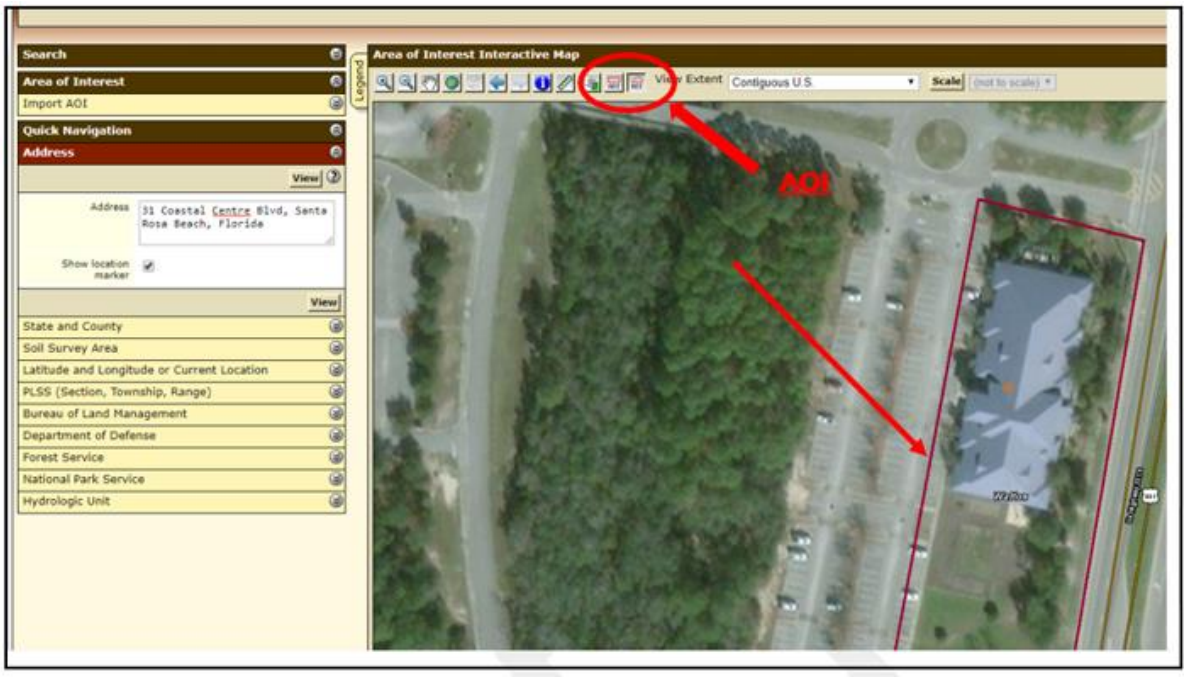
To gather site-specific information for your permit application start by going to the following Web Soil Survey page: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Look up your address on the following webpage and find the soil information needed to complete the drainage design.

1. Go to the Web Soil Survey page, under the left side "Quick Navigation" click on "Address" and enter your site address, click "View". If you don't have an address pan and zoom to the location of your parcel or use one of the other search options available.

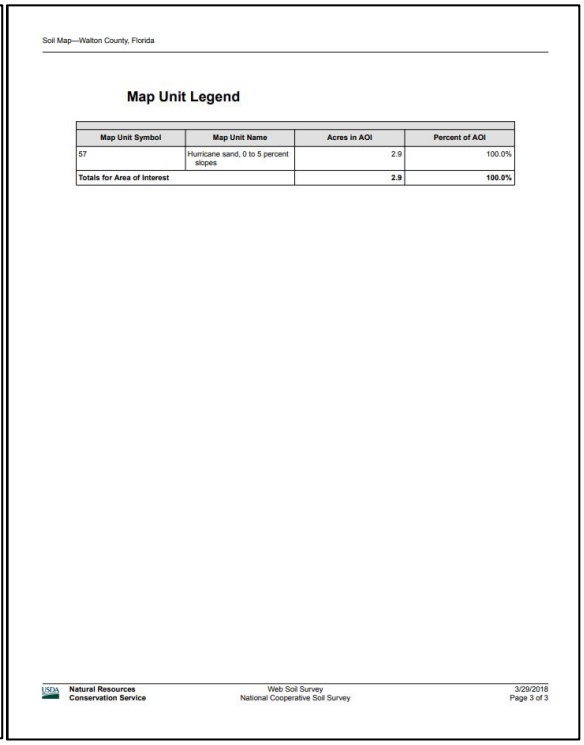


2. Use the top menu bar to zoom to your site, and then use the “AOI” (Area of Interest) buttons to delineate your site. Double click to close the polyline and execute the command.

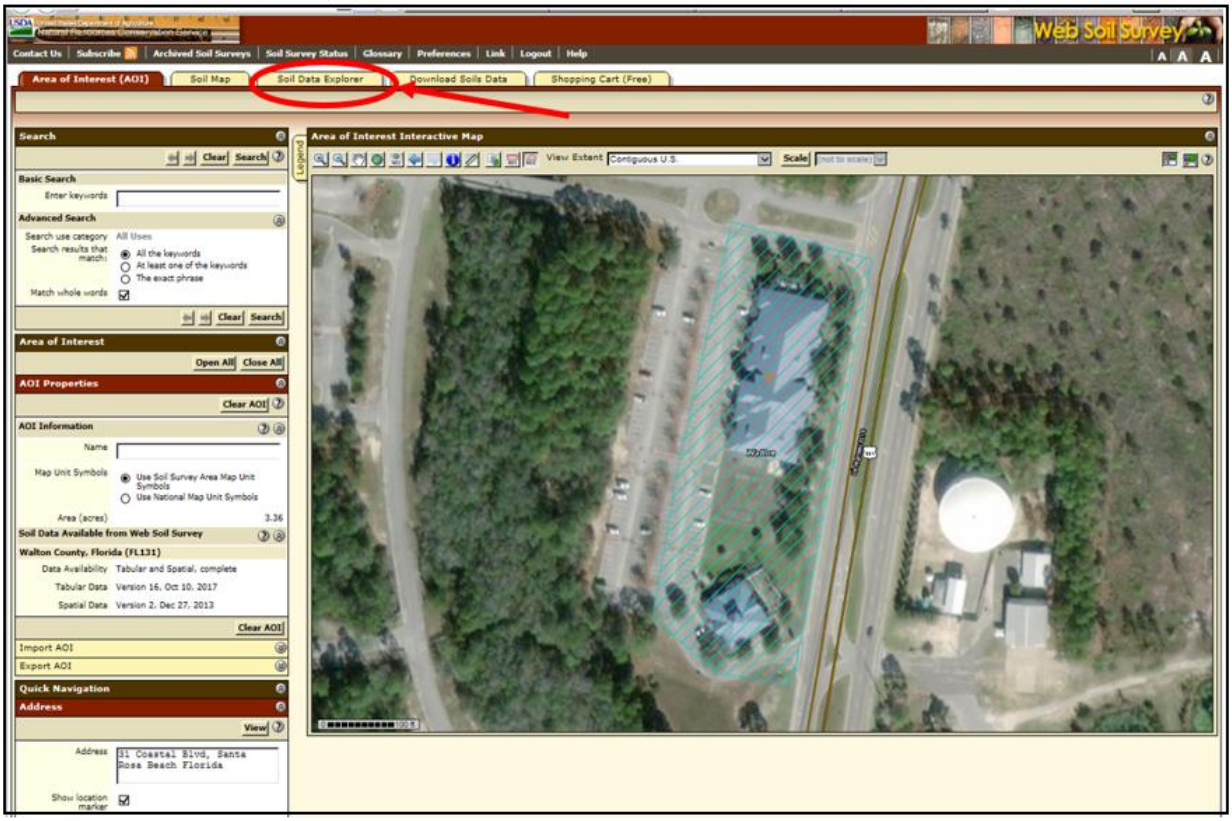


3. Go to the “Soil Map” tab and print the report for your record.

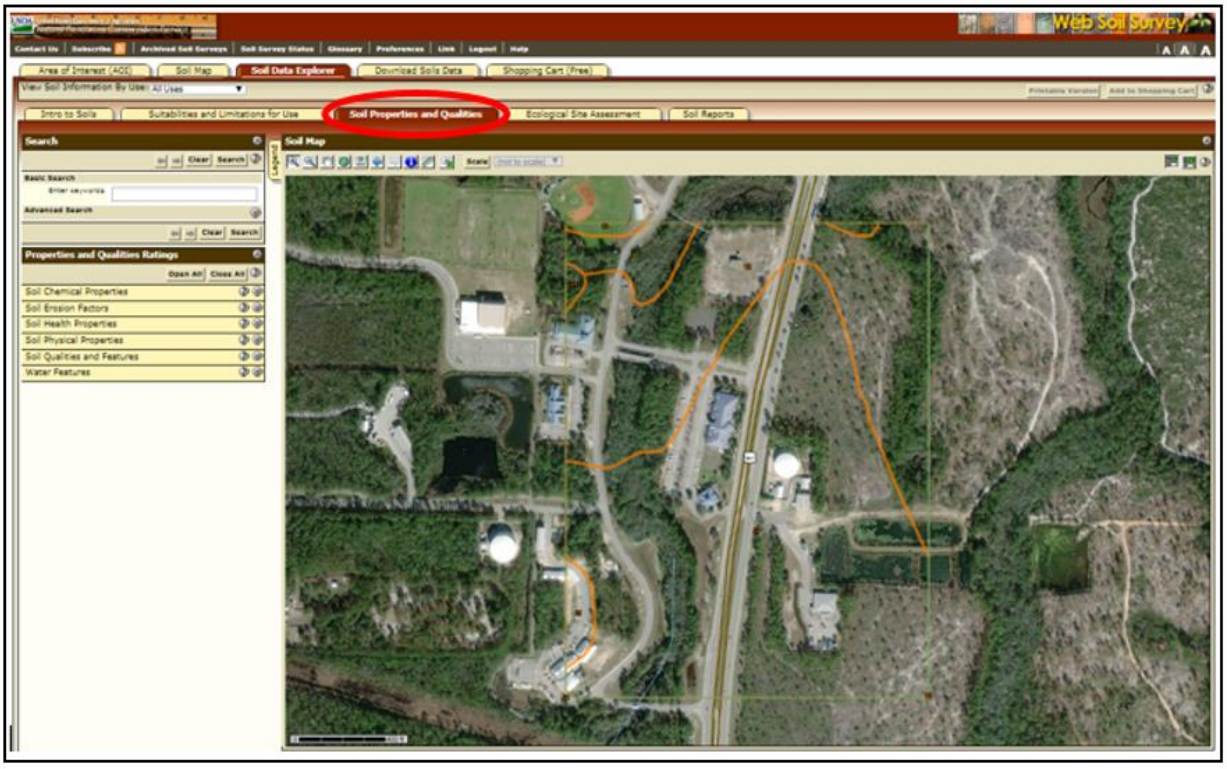
reminder Please print this report, as you will need to provide this with your application. The information on this report is key to your upcoming calculations/design.



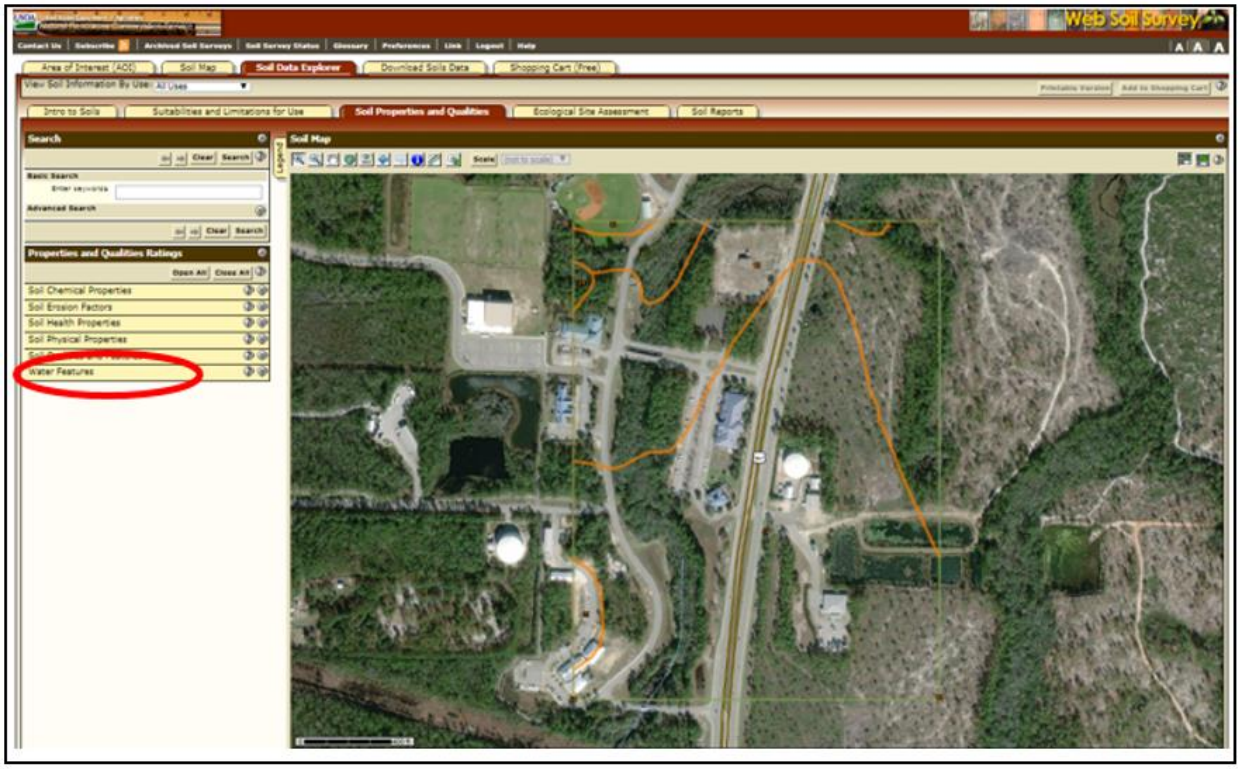
4. Next Click on “Soil Data Explorer” located on the top of the screen.



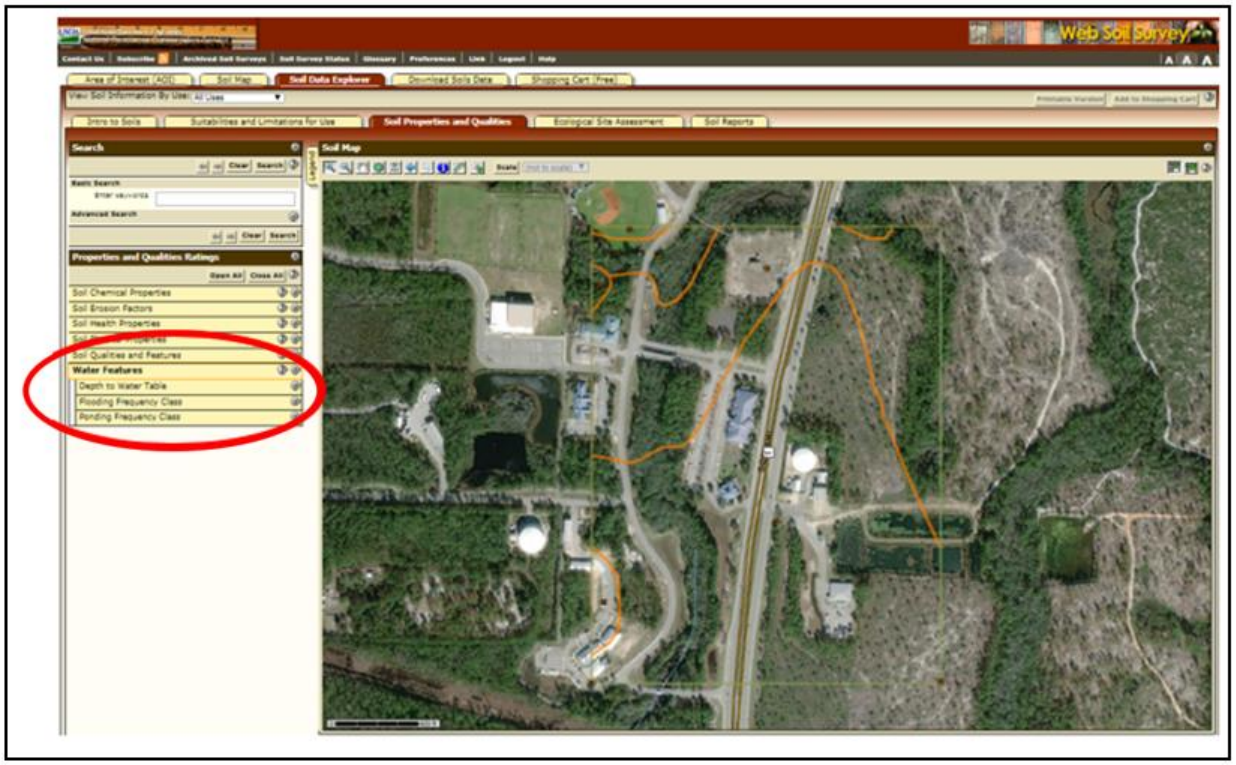
5. The subsurface drainage characteristics for your property can be accessed in the web soil survey under the “Soils Properties and Qualities” tab.



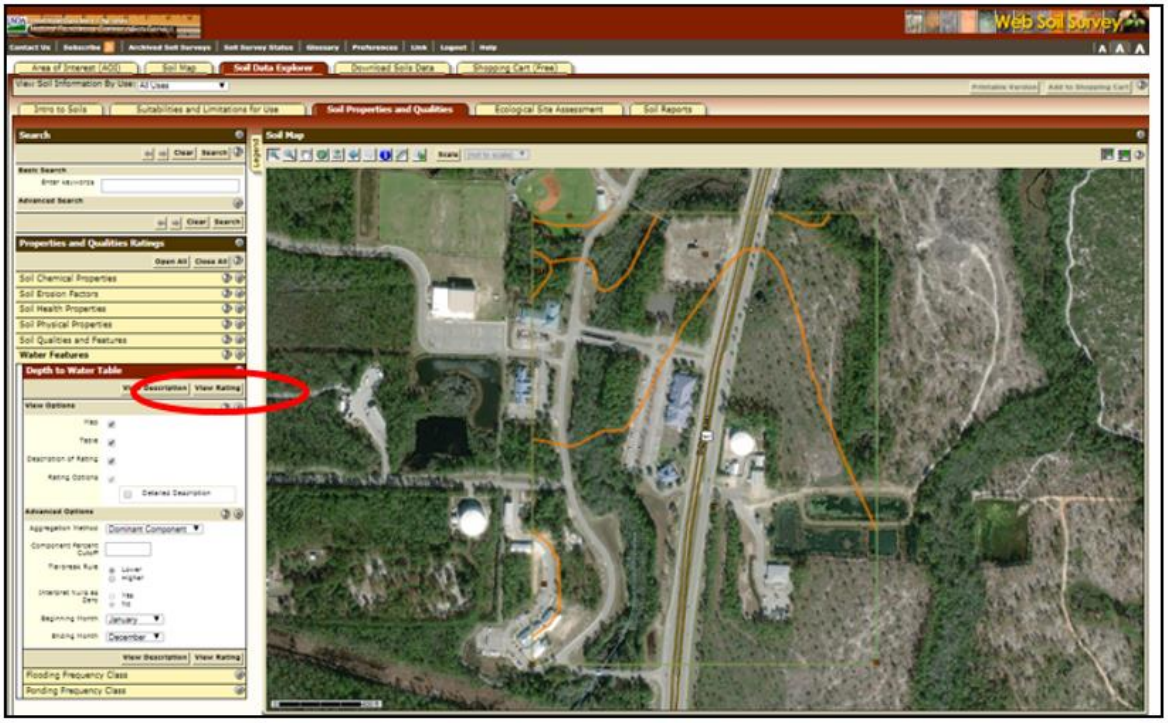
6. Expand the “Water Features” drop down menu located on the left hand side of the screen.



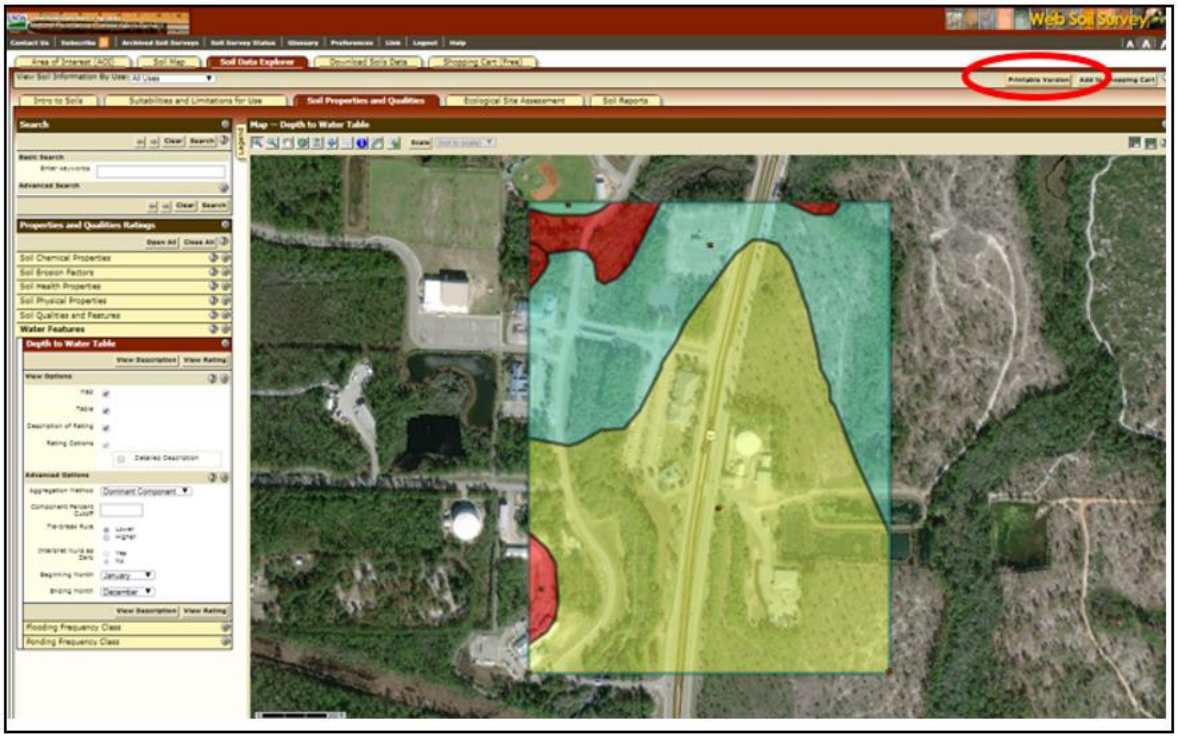
7. Expand the “Depth to Water Table” tab.



8. Click on “View Rating”



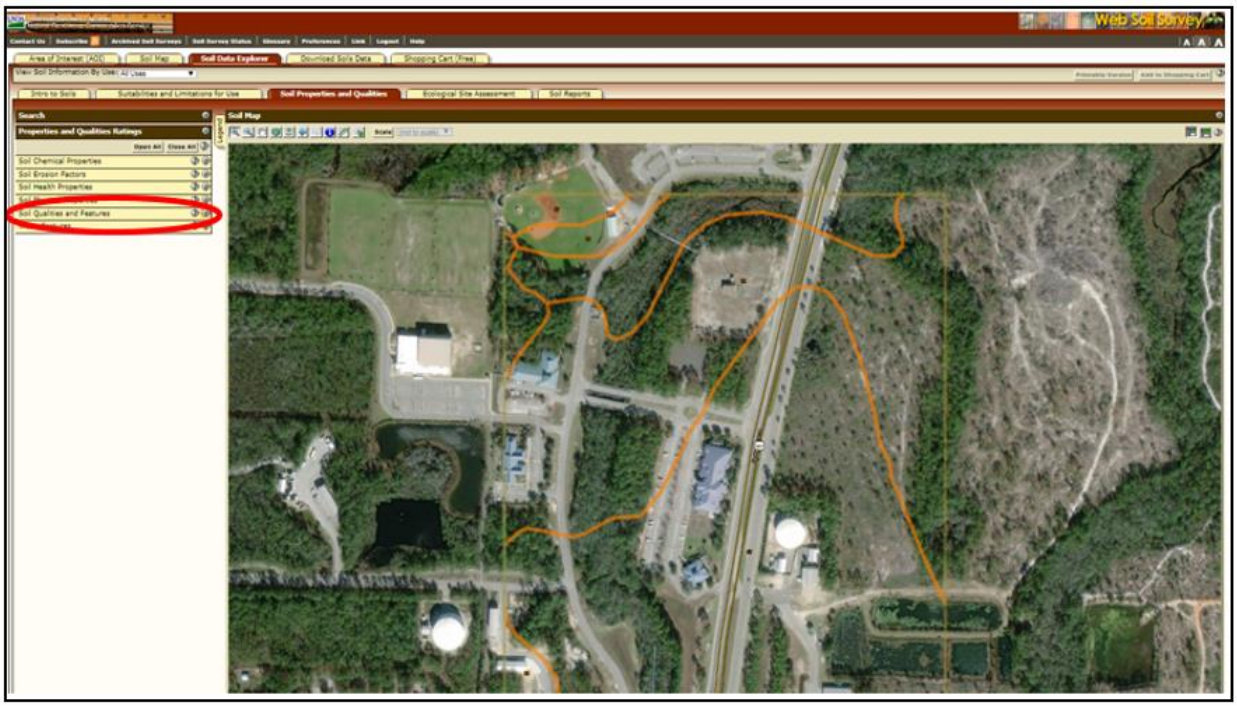
9. Print out the map to include in the application packet by clicking on the “Printable Version” on the top right corner.



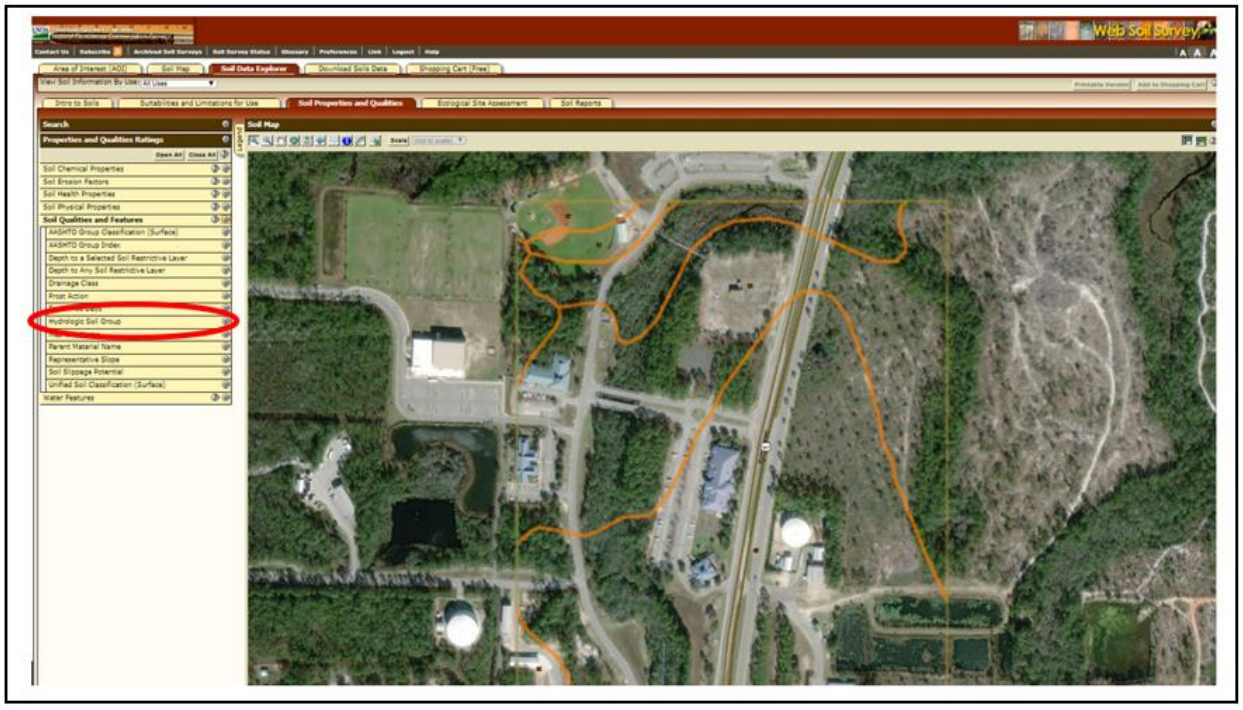
reminder Please print this report, as you will need to provide this with your application.

Next, you will determine the HSG that is associated with your property. The HSG will provide information associated with how fast water will drain (permeability / infiltration) from the LID SWMF that you choose to implement.

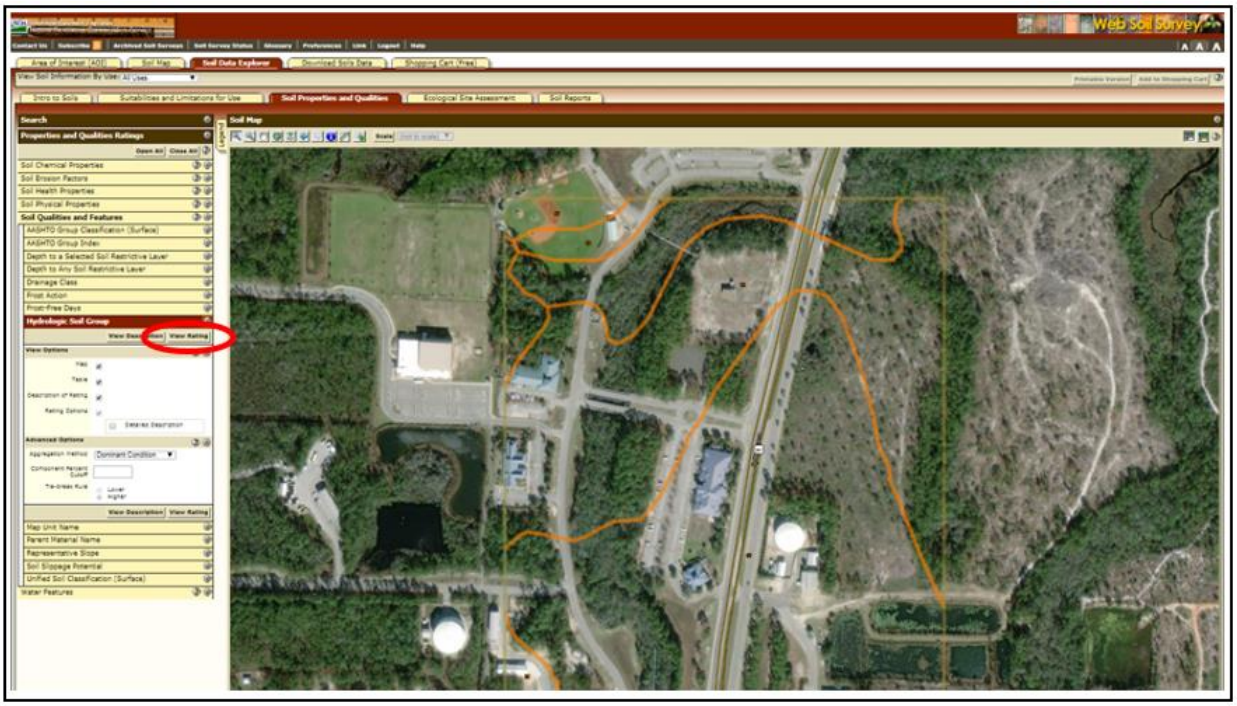
10. Click on “Soil Qualities and Features” located on the left side of the screen to expand the drop down menu.



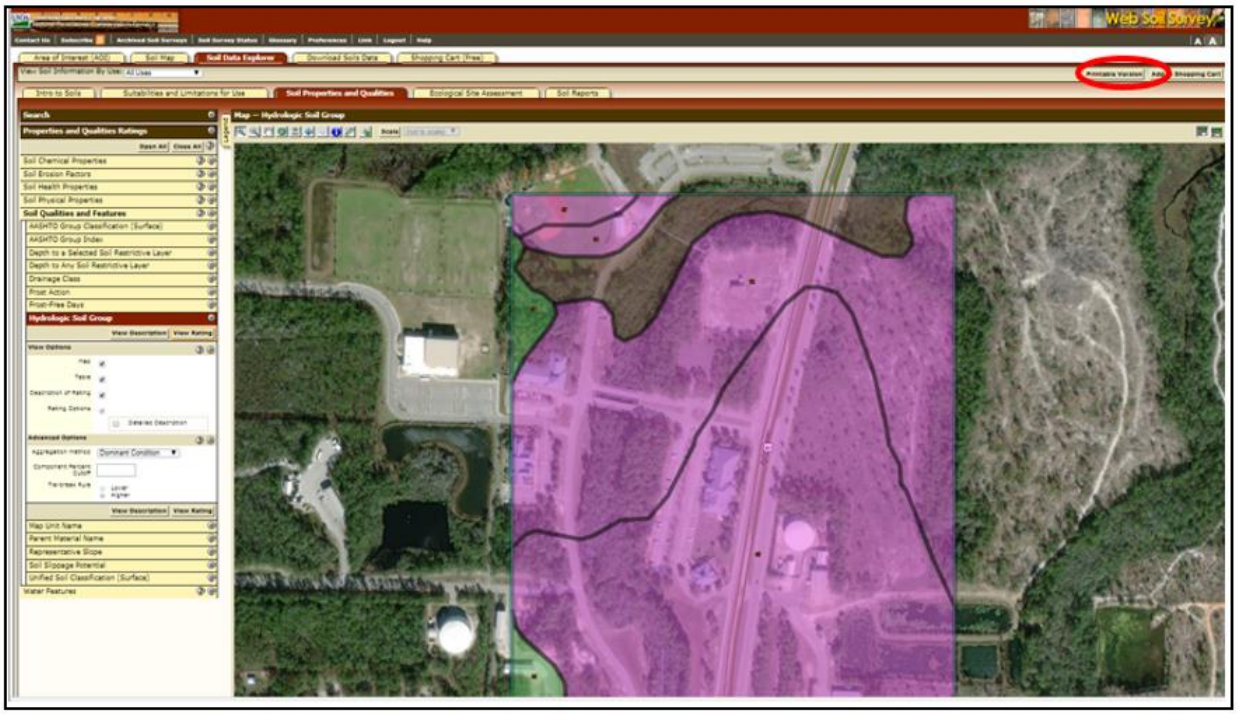
11. Click on “Hydrologic Soil Group” located on the left side of the screen.



12. Once this expands, click on “View Rating”.



The map should depict the hydrologic soils group. Next click on printable version and include it in the application. You will use this information in Section 2.4.3 to help you determine how fast your LID SWMF will drain (recovery rate).



reminder Please print this report, as you will need to provide this with your application.

Find the Soil Map Unit Number(s) on your report to determine the soil types at the location of the SWMF. Once you have identified the permeability of your soil you can determine how long it will take the chosen LID SWMF to drain; this is known as the recovery rate or recovery time. **Table 3** provides permeability rates associated with the different soil types identified in Walton County.

All LID SWMFs will not function the same way and most are highly dependent on the type of soil and the depth to groundwater. The permeability of soil determines how fast water will be absorbed into the ground. Soil permeability rates may dictate which LID approach will work the best for your project. If you have any questions regarding the applicability of one LID SWMF over another, please contact the Walton County Planning Department for assistance.

Table 3. NRCS Soil Data

Map Unit Symbol	Map Unit Name	HSG	Depth to SHGW	High Water Season	Permeability Rate (Ksat)
5	Chipley sand, 5 to 8 % slopes	A	-2 feet	Dec - Apr	6 in/hr
8	Dorovan-Pamlico association, frequently flooded	B/D	0 (at surface)	Jan – Dec	0.6 in/hr
12	Foxworth sand, 0 to 5 percent slopes	A	-3.5 feet	Jun – Oct	20 in/hr
16	Kureb sand, 0 to 8 percent slopes	A	-5 feet	----	6 in/hr
17	Lakeland sand, 0 to 5 percent slopes	A	-5 feet	----	6 in/hr
18	Lakeland sand, 5 to 12 percent slopes	A	-5 feet	----	6 in/hr
19	Lakeland sand, 12 to 30 percent slopes	A	-5 feet	----	6 in/hr
21	Leon sand, 0 to 2 percent slopes	A/D	0 (at surface)	Jun – Feb	0.6 in/hr
27	Rutlege fine sand, 0 to 2 percent slopes	A/D	0 (at surface)	Dec – May	6 in/hr
30	Tifton fine sandy loam, 5 to 8 percent slopes	B	-3.5 feet	Jan – Feb	0.6 in/hr
36	Pits	-	On-site test	On-site test	On-site test
45	Direго muck, frequently flooded	A/D	0 (at surface)	Jan – Dec	6 in/hr
49	Eglin sand, 0 to 5 percent slopes	A	-5 feet	----	6 in/hr
50	Mandarin sand, 0 to 2 percent slopes	A	-1.5 feet	Jun – Dec	0.6 in/hr
51	Bigbee loamy sand, 0 to 5 percent slopes, occasionally flooded	A	-3.5 feet	Jan – Mar	6 in/hr
53	Arents, 2 to 8 percent slopes	A	-5 feet	----	20 in/hr
54	Newhan-Corolla sands, rolling	A	-5 feet	----	20 in/hr
55	Beaches	-	0 (at surface)	----	0 in/hr
56	Kureb sand, hilly	A	-5 feet	----	6 in/hr
57	Hurricane sand, 0 to 5 percent slopes	A/D	-2 feet	Nov – Apr	6 in/hr
58	Duckston muck, frequently flooded	A/D	0 (at surface)	Jan – Dec	6 in/hr
62	Resota sand, 0 to 5 percent slopes	A	-3.5 feet	Dec – Apr	20 in/hr
63	Pickney sand, depressional	A/D	0 (at surface)	Nov – Apr	6 in/hr
64	Pamlico muck	A/D	0 (at surface)	Dec – May	0.6 in/hr
69	Florala loamy fine sand, 2 to 5 percent slopes	C	-1.5 feet	Dec – Mar	0.06 in/hr
99	Water	-	-	-	-
100	Waters of Gulf of Mexico	-	-	-	-

2.3.2 SHGW Elevation Verification (optional)

Since the elevation of the water table is such a crucial element of a good working SWMF, it is a good idea to double-check it with this simple process.

After a larger storm event dig a hole deep enough to observe groundwater, but no more than 5-feet. **Please secure the area, especially from small children and pets**. Observe, measure, and document the water level a few times a day for 3-days. Please discard any measurement that are significantly different from the majority of the measurements. Depending on the time of the year, the average of these remaining measurements will give you either the seasonal low, average, or high water table. **Table 3. *NRCS Soil Data*** provided in this section includes the months through which your measurements would be consider the seasonal high. If you are outside of the noted timeframe, simply add 1-foot to your measurement to convert it to the seasonal high.

If the SHGW elevation listed in **Table 3. *NRCS Soil Data*** and your calculated SHGW are significantly different, please contact our department for help, otherwise use the shallower depth.

2.3.3 Recovery Time Calculation

The entire storage volume of the chosen LID SWMF must recover in less than 72 hours. The calculation to determine the recovery time is as follows:

$$\textit{Recovery Time (hr)} = \frac{\textit{Depth of LID SWMF (in)}}{\textit{0.5*Permeability Rate (in/hr)}}$$

For example, if your site has soil identified as Foxworth (HSG A) than according to the information provided in **Table 3** the permeability rate will be 20 in/hr. The LDC requires a safety factor of 2 to be applied to permeability rates; therefore, you will divide the values found in **Table 3** by 2. For this example, the permeability rate used to determine the recovery time for your chosen LID would be as follows:

$$\frac{\textit{Permeability Rate Taken From Table}}{\textit{Safety Factor}} = \textit{Design Permeability Rate (in/hr)}$$

$$\frac{20\ in/hr}{2} = 10\ in/hr$$

If the proposed LID SWMF is 2 feet deep then the anticipated recovery time would be as follows:

Depth of SWMF / Design Permeability Rate (in/hr)	x	Conversion From ft to in	=	Recovery Time
$\frac{2\ ft}{10\ in/hr}$	x	$\frac{12\ in}{1\ ft}$	=	2.4 hr

If you have soil that drain slowly or have low permeability such as Dorovan Muck, which is frequently flooded, the permeability rate is 0.6 in/hr. If the same LID SWMF is placed in an area with this soil, the recovery rate would be:

Depth of SWMF / Factor of Safety * Permeability Rate (in/hr)	x	Conversion From ft to in	=	Recovery Time
$\frac{2\ ft}{0.5*0.6\ in/hr}$	X	$\frac{12\ in}{1\ ft}$	=	80 hr

As you can see, soil properties make a huge difference in the time that it will take for the stormwater to infiltrate into the native soils. We will use this equation again in **Section 5** and will refer to **Table 3** to apply the applicable infiltration rates for the soils on your property.

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3.0 Required Water Storage Calculations

Nitrogen and phosphorus are some of the major water quality pollutants that originate from rural and urban areas. When these pollutants enter natural waterways, they can lead to excess algae growth and depletion of dissolved oxygen. As a community, we can reduce the amount of nutrients leaving our properties by collecting it and reusing it or allowing it to be naturally filtered by plants and soil. Common pollutants and contributing sources are provided in the table below. [4]

Table 4. Common Pollutants and Their Sources

Pollutant	Contributing Source
Nitrogen and Phosphorus	Lawn fertilizers, soil erosion, animal waste, detergents, vehicle exhaust.
Sediment and Debris	Lawns, driveways, roads, drainage channel erosion, construction activities.
Pesticides and Herbicides	Residential lawns, gardens, commercial landscaped areas.
Organic Material	Residential lawns, gardens, commercial landscaped areas, animal waste.
Oil and Grease / Hydrocarbons	Roads, driveways, parking lots, gas stations.
Bacteria and Viruses	Septic systems, animal waste, sewer cross-connections, lift stations.
Metals	Vehicles, industrial areas, soil erosion, corroding surfaces.

https://www.epa.gov/sites/production/files/2015-10/documents/usw_b.pdf

3.1 Water Quality - Treatment Volume Calculation

LDC Chapter 5.06.00 ***Stormwater Management*** provides guidance associated with the minimum volume of stormwater to be retained on-site. According to the LDC, **large development projects** are required to collect and treat different volumes of water based on if the system is allowed to dry out in between storms or if it will always retain water.

It is the intent of the County to simplify the stormwater management criteria for small single-family residential lots. Improvement to small single-family residential lots don't exasperate stormwater issues individually, however if you consider the cumulative effects of multiple lots than stormwater issues become a compounding problem. This is why it is important for each residence to manage a small portion of stormwater on-site through LID SWMF. Single-family homes may not create a large difference individually, but as a whole the effects can be substantial.

[4] Environmental Protection Agency. Urban Stormwater Preliminary Data Summary. 2015. https://www.epa.gov/sites/production/files/2015-10/documents/usw_b.pdf

The criteria for stormwater quality management associated with single-family residential lots established with this manual is as follows:

a) if the LID SWMF completely dries out between storms - on-site storage and treatment of one-half inch of rainfall over the total disturbed area or runoff from one-inch over the total proposed impervious area associated with the parcel, whichever is greater;
b) if the LID SWMF is designed to retain water between storms - on-site storage and treatment of one-inch of rainfall over the total proposed impervious area associated with the parcel;

SWMF examples of impervious area include any type of pavement or structure that does not allow water to move through it and into the underlying soils. The following calculations provide an example on how to determine the criteria for your project.

1. First calculate the volume to treat one half-inch of rainfall over the total project area by using the following equation:

Retention criteria = ½-inch rainfall x Total Project Area (ft^2)				
0.5 in x	$\frac{1\ ft}{12\ in}$	***x Total Project Area (ft^2)***	***=***	***Required 0.5-in Storage Volume (ft^3)***

2. Now calculate the volume to treat one-inch of rainfall over the total impervious area by using the following equation:

Retention criteria = 1-inch rainfall x Total Impervious Area (ft^2)				
1 in x	$\frac{1\ ft}{12\ in}$	***x Total Imp. Area (ft^2)***	***=***	***Required 1-in Storage Volume (ft^3)***

3. The required stormwater treatment capacity will be the larger of the two values from above.

4. Example: If your lot is 0.25 acres and you have a 2,000 ft^2 (footprint) house and a 500 ft^2 driveway the required 1/2-inch storage volume will be as follows:

   First, convert acres to square feet:

Acres	***** $\frac{43{,}560\ (ft^2)}{1\ acre}$	***=***	***Square Feet***
0.25 acres	$\frac{43{,}560\ ft^2}{1\ acre}$		*10,890 ft^2*

The required 1/2-inch storage volume will be as follows:

$$0.5\ in \times \frac{1\ ft}{12\ in} \times 10{,}890\ ft^2 = 453.75\ ft^3$$

Larger Value

The required 1-inch storage volume will be as follows:

$$1\ in \times \frac{1\ ft}{12\ in} \times (2{,}000\ ft^2 + 500\ ft^2) = 208.33\ ft^3$$

The storage volume associated with water treatment is 453.75 ft^3.

Refer to the Site Characteristics Calculation Sheet on page 26 for assistance in determining the required treatment volume for your property.

If you are interested in reducing the stormwater storage requirements for your lot consider installing pervious pavement for patios, sidewalks, and driveways instead of traditional concrete. Refer to **Section 5.8** for more information on how the installation of pervious pavement can result in less stormwater storage requirements, as well as, example calculations.

If you have any questions regarding how to calculate the stormwater requirements for your project, please contact the Walton County Planning Department for assistance.

Water Quantity – Flood Attenuation Calculation

A water budget is the application of conservation and takes into account the total quantity of water entering an area minus water leaving an area. For simplicity, we will only consider water leaving a SWMF through infiltration.

Attenuation is the reduction of post-development peak flow or runoff, back to pre-development peak flow (runoff). This is accomplished by storing the excess stormwater during a storm and slowly releasing it through infiltration over a longer duration than would normally occur after a site has been developed. The lowered rate of release re-establishes the natural hydrology of the parcel and connected hydraulic systems in the surrounding area.

The criteria for stormwater quantity management (attenuation) associated with single-family residential lots established with this manual is as follows:

a) The LID SWMF requires to provide water quantity management to a portion of the rainfall generated from a 10-year 24-hour storm event (unless your parcel is in ICPAL) over the total impervious area associated with the parcel. In Walton County this storm event is equivalent to 8.73-inches of rainfall and its intensity is 0.43 in/hr. (The anticipated rainfall for additional design storms is provided in **Appendix C**)

Design Storm	Rainfall Depth	Rainfall Intensity
10-year 24-hour	**8.73-inches**	**0.43 in/hr**
ICPAL; 100-year 24-hour	**14.70-inches**	**0.61 in/hr**

b) The portion of the rainfall required to be stored will depend on the soil type at the location of your LID SWMF and your proposed ISR. Refer to **Section 2.0** on how to determine the size of your property and the total impervious area. From this information, you will calculate the proposed ISR.

Example: your property is 0.25 acres (AC) and your proposed impervious area is 2,500 ft^2.

$$0.25\ AC \times \frac{43{,}560\ ft^2}{1\ AC} = 10{,}890\ ft^2$$

$$\frac{\text{Proposed Impervious Area } (ft^2)}{\text{Total Site Area } (ft^2)} = \text{Impervious Surface Ratio (ISR)}$$

$$\frac{2{,}500\ ft^2}{10{,}890\ ft^2} = 0.22 \text{ (or 22\%)}$$

c) From **Section 2.4**, **Table 3** obtain the permeability rate associated with the soil at the location of your proposed LID SWMF. Remember, we will apply a safety factor (SF) of 2 (divide the permeability rate by 2) to the permeability rate as required by standard practice. For example, if your site has soil identified as Foxworth (HSG A) than according to the information provided in **Table 3** the permeability rate will be 20 in/hr. After applying the SF equal to 2, the design permeability rate will be 10 in/hr.

d) The portion of the rainfall depth required to be stored is calculated by using the following equation:

$\frac{\textbf{Rainfall Intensity (in/hr)}}{\textbf{Design Permeability Rate (in/hr)}}$	x	Rainfall Depth (in)	=	Reduced Rainfall Depth (in)
$\frac{0.43\ in/hr}{10\ in/hr}$	x	8.73 in	=	0.37 in

e) The design rainfall depth is based on your proposed ISR.

Proposed ISR	Design Factor
Less than 40% (<0.4)	1.0
40% - 70% (0.4-0.7)	1.2
Greater than 70% (>0.7)	1.4

Reduced Rainfall Depth (in)	x	Design Factor	=	Design Rainfall Depth (in)
0.37 in	x	1.2 =		0.45 in

f) The design rainfall depth multiplied with the total impervious area of your site equals the required storage volume associated with flood attenuation.

Design Rainfall Depth (in)	x	$\frac{1\ ft}{12\ in}$	x	Total Impervious Area (ft^2)	=	Required Storage Volume (ft^3)
0.45 in	x	$\frac{1\ ft}{12\ in}$	x	2,500 ft^2	=	93.8 ft^3

The storage volume associated with flood attenuation is 94 ft^3.

a) If the soil at the site has a permeability rate of 0.6 in/hr the flood attenuation would be as follows:

$\frac{\textbf{Rainfall Intensity (in/hr)}}{\textbf{Design Permeability Rate (in/hr)}}$	x	Rainfall Depth (in)	=	Reduced Rainfall Depth (in)
$\frac{0.43\ in/hr}{0.5*0.6\ in/hr}$	x	8.73 in	=	12.51 in

b) The design rainfall depth is based on your proposed ISR.

Proposed ISR	Design Factor
Less than 40% (<0.4)	1.0
40% - 70% (0.4-0.7)	1.2
Greater than 70% (>0.7)	1.4

Reduced Rainfall Depth (in)	***x***	***Design Factor***	***=***	***Design Rainfall Depth (in)***
12.51 in	*x*	*1.2 =*		*15.01 in*

c) The design rainfall depth multiplied with the total impervious area of your site equals the required storage volume associated with flood attenuation.

Design Rainfall Depth (in)	***x***	$\frac{\textbf{1 ft}}{\textbf{12 in}}$	***x***	***Total Impervious Area (ft^2)***	***=***	***Required Storage Volume (ft^3)***
15.01 in	*x*	$\frac{1\ ft}{12\ in}$	*x*	*2,500 ft^2*	*=*	*3,128 ft^3*

3.2 Required Storage Volume

In Section 3.2 and 3.3 we calculated different volumes based on different requirements. You will need to design your LID SWMF to be able to hold the largest of these three volumes. In our case, we have the following:

The storage volume associated with water treatment is 453.75 ft^3.

The storage volume associated with flood attenuation is 94 ft^3.

Therefore the required storage volume is 453.75 ft^3 ~ 454 ft^3 (remember to always round up)

If the storage volume associated with flood attenuation (**Section 3.2**) is significantly larger than the storage volume associated with water treatment (**Section 3.1**) it is likely, because you have poor soil conditions. In this case, it might be beneficial to consult with a licensed civil engineer regarding the design of a smaller, but more complex optimized system.

3.3 ICPAL Volume Calculation

Due to the increased flooding potential for properties located in an ICPAL, the stormwater attenuation volume must be increased to the 100-year 24-hour storm. The methodology used to determine the required treatment and attenuation volume for the SWMF are the same calculations presented in **Section 3.1 and 3.2**; the only difference is that you will substitute the rainfall amount used in the attenuation calculations from 7.13 inches to 14.7 inches and the rainfall intensity will be adjusted to 0.61 in/hr (See **Appendix C**).

The calculations are as follows:

a) The portion of the rainfall depth required to be stored is calculated by using the following equation:

Rainfall Intensity (in/hr) / Design Permeability Rate (in/hr)	***x***	***Rainfall Depth (in)***	***=***	***Reduced Rainfall Depth (in)***
0.60 in/hr / 10 in/hr	*x*	*14.7 in*	*=*	*0.88 in*

b) The design rainfall depth is based on your proposed ISR.

Proposed ISR	Design Factor
Less than 40% (<0.4)	1.0
40% - 70% (0.4-0.7)	1.2
Greater than 70% (>0.7)	1.4

Reduced Rainfall Depth (in)	x	Design Factor	=	Design Rainfall Depth (in)
0.88 in	x	1.2 =		1.05 in

c) The design rainfall depth multiplied with the total impervious area of your site equals the required storage volume associated with flood attenuation.

Design Rainfall Depth (in)	x	$\frac{1\ ft}{12\ in}$	x	Total Impervious Area (ft^2)	=	Required Storage Volume (ft^3)
1.05 in	x	$\frac{1\ ft}{12\ in}$	x	2,500 ft^2	=	220.5 ft^3

The storage volume associated with flood attenuation is 221 ft^3.

a) If the soil at the site has a permeability rate of 0.6 in/hr the flood attenuation would be as follows:

$\frac{\text{Rainfall Intensity (in/hr)}}{\text{Design Permeability Rate (in/hr)}}$	x	Rainfall Depth (in)	=	Reduced Rainfall Depth (in)
$\frac{0.60\ in/hr}{0.5*0.6\ in/hr}$	x	14.7 in	=	29.4 in

b) The design rainfall depth is based on your proposed ISR.

Proposed ISR	Design Factor
Less than 40% (<0.4)	1.0
40% - 70% (0.4-0.7)	1.2
Greater than 70% (>0.7)	1.4

Reduced Rainfall Depth (in)	x	Design Factor	=	Design Rainfall Depth (in)
29.4 in	x	1.2 =		35.2 in

c) The design rainfall depth multiplied with the total impervious area of your site equals to the required storage volume associated with flood attenuation.

Design Rainfall Depth (in)		$\frac{1\ ft}{12\ in}$		***Total Impervious Area (ft^2)***		***Required Storage Volume (ft^3)***
35.2 in	x	$\frac{1\ ft}{12\ in}$	x	*2,500 ft^2*	=	*7,350 ft^3*

In this case it is highly recommended that the home owner contact an engineer for further assistance with the design of the SWMF.

3.4 Dune Lake Volume Calculation

Dune lakes are a valuable environmental asset for water quality and they must be protected. Areas within a dune lake buffer zone and dune lake tributary shall increase the stormwater retention volume by 150%. The methodology used to determine the required treatment and attenuation volume for the SWMF are the same calculations presented in in **Section 3.1 and 3.2.**; the only difference is that once you have determined the highest volume you will multiply the number by 1.5.

3.5 Mosquito Control Ditch Volume Calculation

If your property will release water into a Walton County mosquito control ditch the stormwater attenuation volume must be increased to the 24-hour 100-year storm, similar to areas in an ICPAL. The methodology used to determine the required treatment and attenuation volume for the SWMF are the same calculations presented in in **Section 3.1 and 3.2**. The only difference is that you will substitute the rainfall amount used in the attenuation calculations from 8 inches to 14.7 inches and the rainfall intensity will be adjusted to 0.61 in/hr (See **Appendix C**).

Attenuation Calculation Sheet

Site Characteristics

Total Disturbed Area		ft^2	Line 1
Impervious Area		ft^2	Line 2
Impervious Surface Ratio (ISR)			Line 3

Soil Characteristics

Soil Type - Refer to Section 2.4			Line 4
Rainfall Intensity	0.43	in/hr	Line 5
Infiltration Rate - Refer to Table 3		in/hr	Line 6
Design Infiltration Rate (Divide By 2)		in/hr	Line 7
Rainfall Depth	8.73	in	Line 8
Reduced Rainfall Depth		in	Line 9

Attenuation Calculation

Design Factor - Choose One Based On The ISR Calculated In Line 3			Line 10
ISR Less Than 0.4	1		
ISR Between 0.4 and 0.7	1.2		
ISR Greater Than 0.7	1.4		
Design Rainfall Depth		in	Line 11
Design Rainfall Depth (Conversion)		ft	Line 12
Required Storage Volume		ft^3	Line 13

Site Characteristics

Total Disturbed Area		ft^2	Line 1
Impervious Area		ft^2	Line 2
Impervious Surface Ratio (ISR)			Line 3

Soil Characteristics

Soil Type - Refer to Section 2.4			Line 4
Rainfall Intensity	0.61	in/hr	Line 5
Infiltration Rate - Refer to Table 3		in/hr	Line 6
Design Infiltration Rate (Divide By 2)		in/hr	Line 7
Rainfall Depth	14.7	in	Line 8
Reduced Rainfall Depth		in	Line 9

Attenuation Calculation

Design Factor - Choose One Based On The ISR Calculated In Line 3			Line 10
ISR Less Than 0.4	1		
ISR Between 0.4 and 0.7	1.2		
ISR Greater Than 0.7	1.4		
Design Rainfall Depth		in	Line 11
Design Rainfall Depth (Conversion)		ft	Line 12
Required Storage Volume		ft^3	Line 13