

# Design Guidelines for County required Littoral Shelf Planting Area (LSPA)

## STEP 1: Consult Regulations

The requirements for design, maintenance and alteration of littoral shelf planting areas (LSPAs) can be found in the Collier County Land Development Code [Chapter 3, Section 3.05.10](#).

For information about prohibited aquatic plants refer [Rule 5B-64.011, F.A.C.](#)

## STEP 2: Determine the Hydroperiod

A hydroperiod can be defined as the number of days per year that an area of land is dry or the length of time that there is standing water at a location (Gaff et al. 2000). Hydroperiod is one of the biggest factors affecting littoral plants within a stormwater lake or pond. It should be considered whenever designing a Littoral Shelf Planting Area (LSPA).

Hydroperiod and planting elevation in a stormwater lake are interconnected. The tolerance level of different wetland plants varies. Some plants can survive in deeper water with year-round flooding. Other plants cannot survive deep water but still need some flooding. Once the hydroperiod of a lake is approximated, each plant's maximum water depth and flooding duration must be considered before determining its planting elevation.

[Table 1](#) lists the approximate hydroperiod ranges for some typical native wetland plants. The plants have been divided into 4 planting zones (Figure 1). These planting zones were determined based on the plants maximum water depth (the maximum water depth under which a plant can survive) and the flooding duration (the amount of time a plant can survive under water).

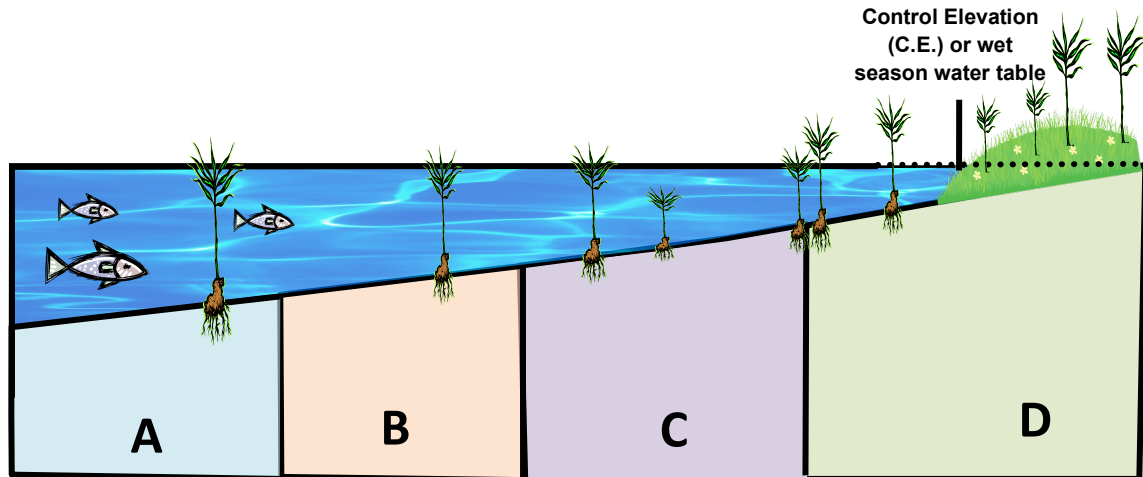


Figure 1. Planting Zones

(A) **Deep** – These plants need at least 9 –11 months of flooding per year and can survive in water that is 3 feet deep or greater.

(B) **Mid** – These plants need at least 3.5 – 8.5 months of flooding per year and can survive in water that is 2 to 3 feet deep.

(C) **Shallow** – These plants typically grow in water that is 1 to 2 feet deep and are inundated by water for at least 2.5 months annually.

(D) **Transitional** – These plants can survive in water that is 0 to 1 foot deep and do not need to be completely flooded, others just require wet or soggy soils.

### Step 3: Determine Planting Elevation

Most stormwater lakes in Collier County fluctuate between the wet and dry season. Each elevation along a shoreline will have a different hydroperiod and is based on the yearly fluctuation between the **Dry Season Water Table (DSWT)** and the **Control Elevation (C.E.)**. The DSWT should be the average water elevation during the driest time of the year – typically the months of April and May. The C.E. (wet season water table) should be the average water elevation during the wettest time of the year – typically the months of September and October. Some lakes may only fluctuate by 1 foot; others may fluctuate by as much as 6 feet.

In lakes with a fluctuation of 5' or greater, plant survival can be a challenge. It is advised that only the hardiest of plant species be chosen in lakes with this type of fluctuation. This will increase the likelihood of vegetative success and higher potential for propagation. Hardy species might include: spikerush, soft rush, bulrush, alligator flag and sand cord grass.

Table 2 is an estimate of the planting elevations for the groups of plants from Table 1, according to average water level fluctuation.

**Table 2. Estimated Planting Elevations Based on Hydroperiod Fluctuation**

Zone	2' or less fluctuation
(A) & (B)	2' or greater below C.E.
(C) & (D)	0' - 2' below C.E.

Zone	3' or greater fluctuation
(A)	3' or greater below C.E.
(B)	2'- 3' below C.E.
(C)	1'- 2' below C.E.
(D)	0' to 1' below C.E.

This is a simplified table. When designing a LSPA, keep in mind that many plants and trees may fit multiple categories. Some (A) plants may survive at (B), (C), and (D) plant levels; some (B) plants may survive at (C) and (D) plant levels, and so on. Just remember that almost all of these plants will be underwater at some point during an average rainfall year.

#### Step 4: Select Design

If you are modifying an existing lake to meet current code or are excavating a new lake, the current littoral planting code is intended to concentrate the littoral plantings in one area of the lake – a Littoral Shelf Planting Area (Figure 2). **Keep in mind that the design figures below are examples and only original plans specific to each unique site will be accepted as part of the permit submittal.**

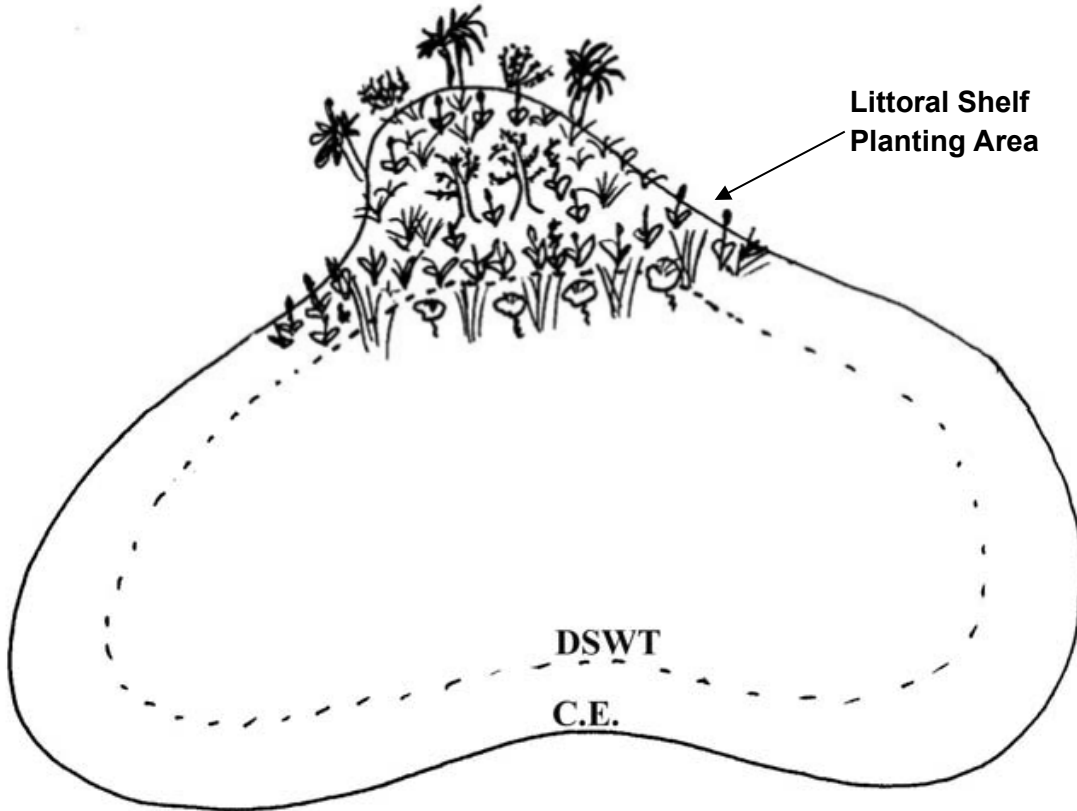


Figure 2

Each lake is different and designs can vary. Figures 3 – 8 represent possible LSPA design cross-sections. These are only suggested guides and the LSPA design should not be based solely on these figures.

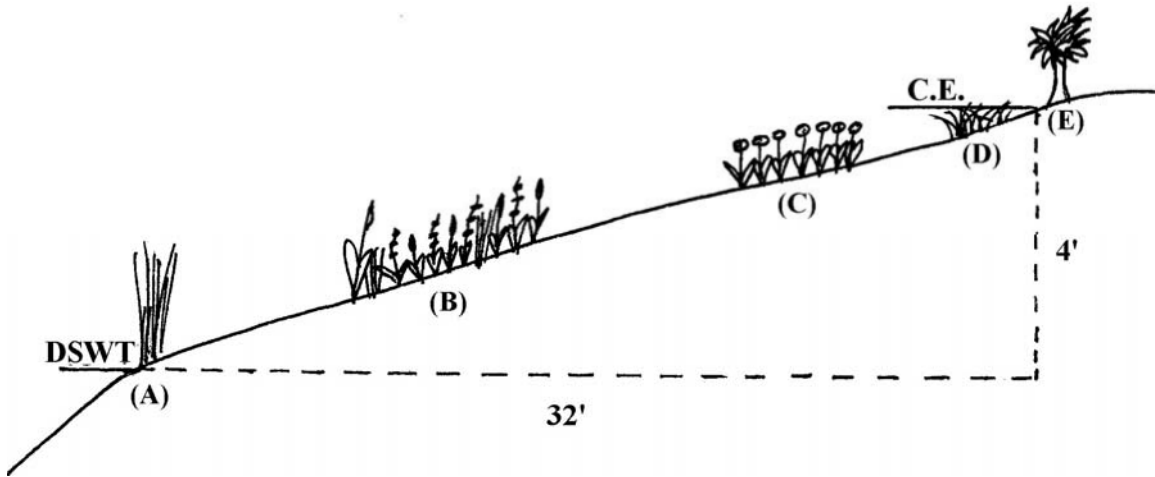


Figure 3

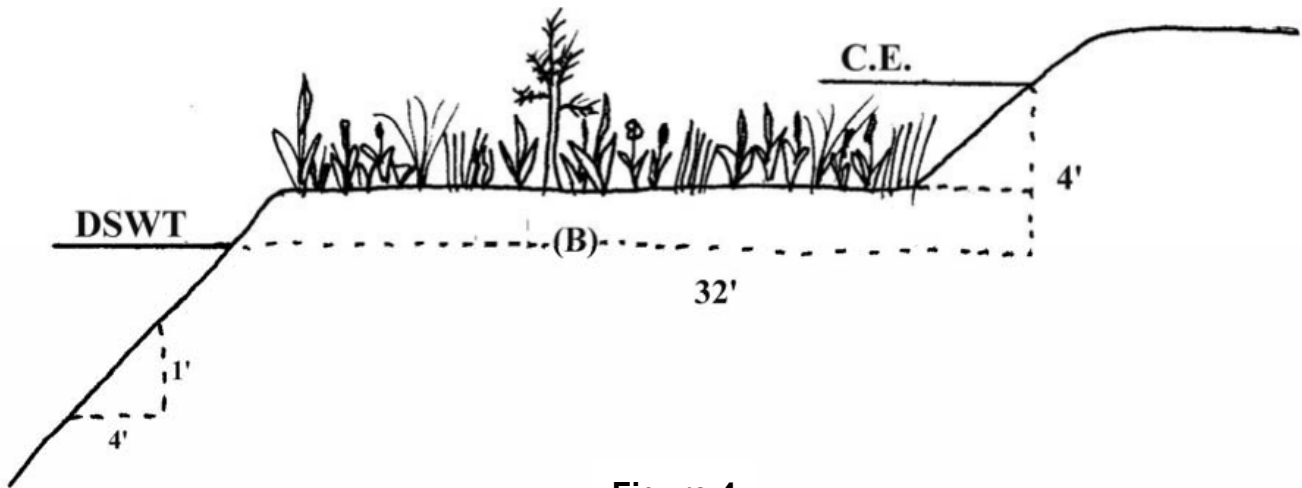


Figure 4

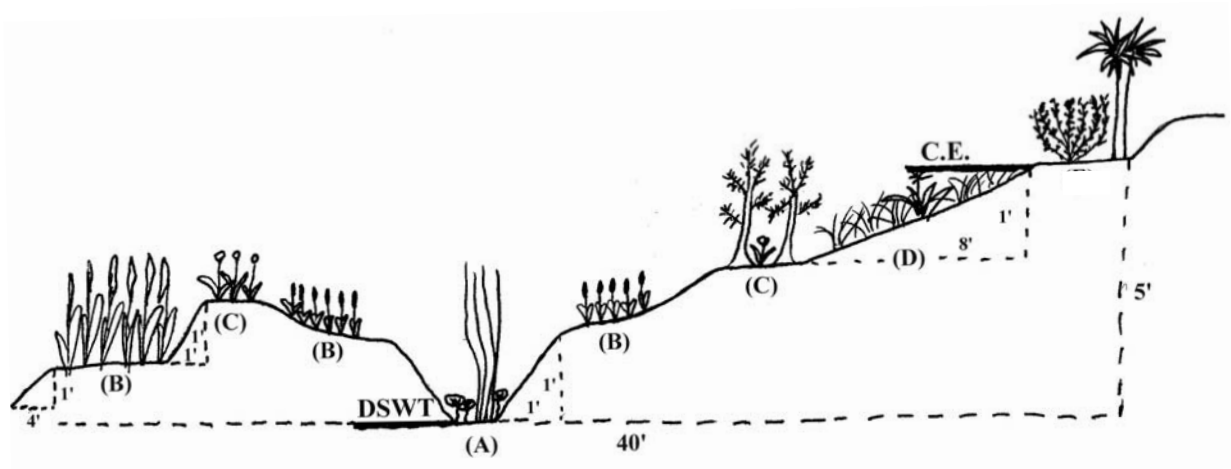


Figure 5

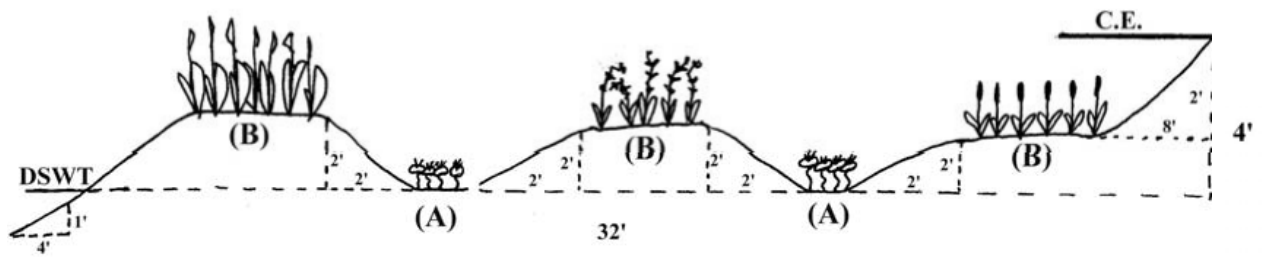


Figure 6

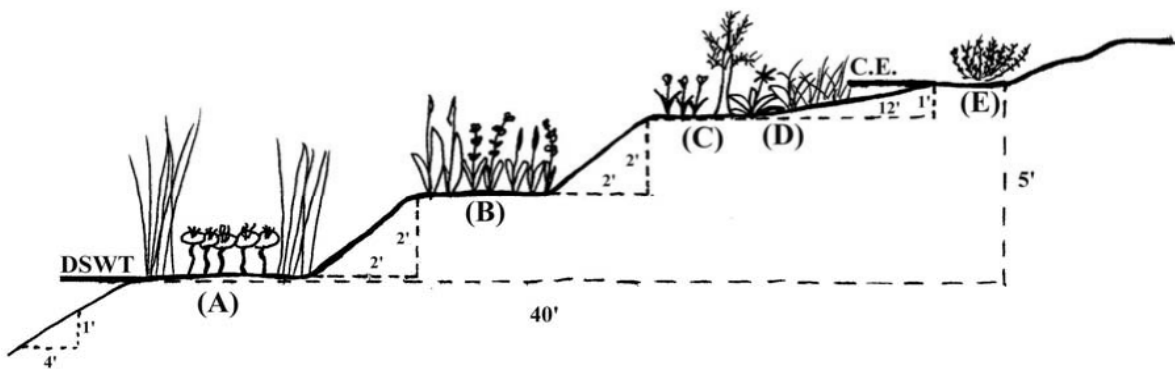


Figure 7

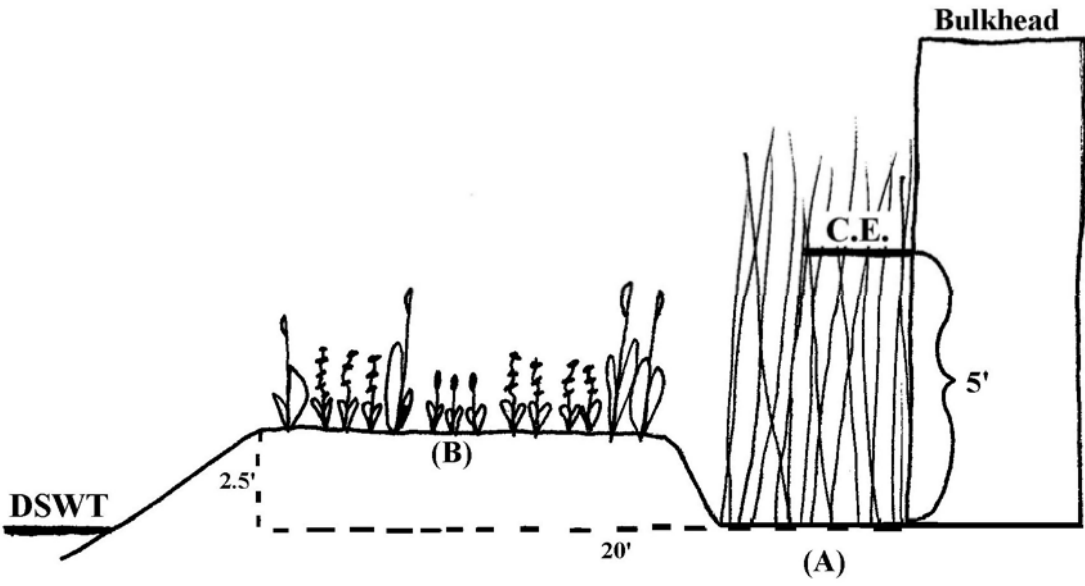


Figure 8

For retrofitting older lakes, refer to Collier County Land Development Code Chapter 3, Section 3.05.10 section C, specifically outlines the requirements for existing lakes.

Historically, littoral shelves within Collier County have been planted on stormwater lake shorelines graded at a 4:1 slope (Figure 9). If your lake was in existence before 2001, you most likely have a 4:1 slope. This steep slope will limit the planting design to a thin strip of vegetation that lines the shore (Figure 10).

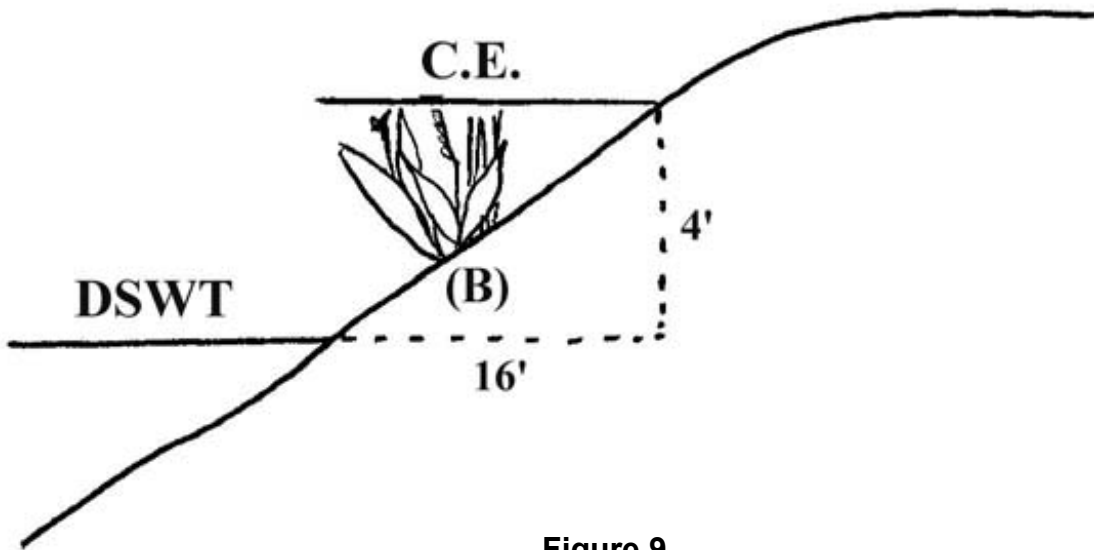


Figure 9

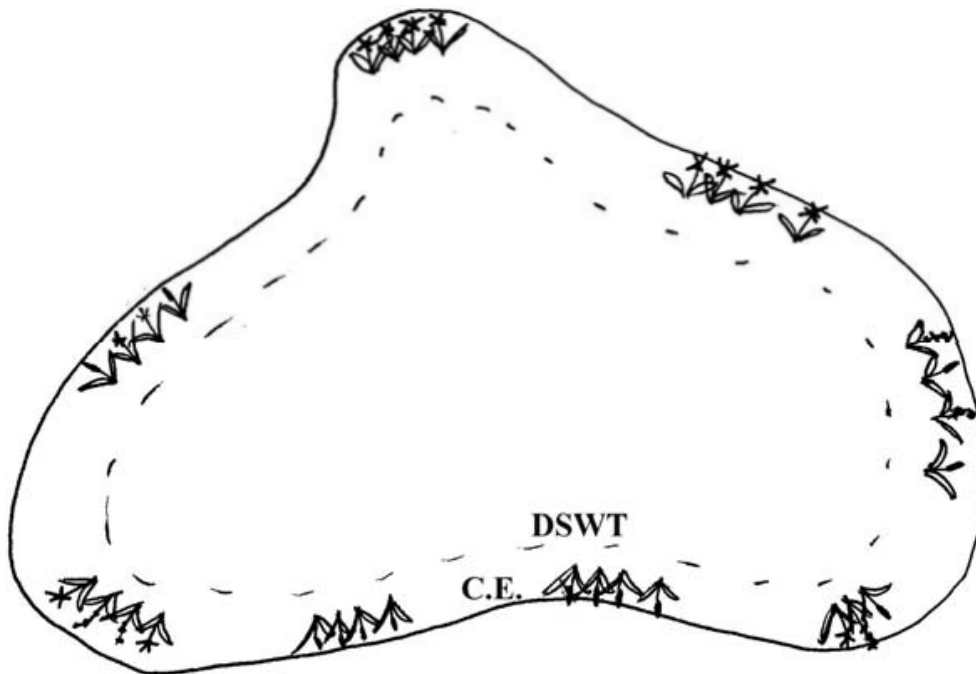


Figure 10

### Current LSPA Design Requirements and Other Suggestions

- The LSPA must have an average slope of 8:1. Terraced step-downs in elevation can have a larger slope as long as flatter areas are present to create an average slope of 8:1.
- Only the surface where the LSPA is planted is required to be at an 8:1 slope. The remaining shoreline can be sloped with a maximum 4:1 slope.
- If you have steeper (4:1 slope) shoreline outside the LSPA, common [Bacopa](#) is a good ground cover that will follow the water line. Bacopa will help with erosion control on steeply sloped shorelines.
- Grass carp and LSPA's Do Not Mix. [Grass carp](#) will eat aquatic plants. If you already have grass carp, you may need to exclude them from the LSPA's to prevent plant damage. Consult FL Fish and Wildlife for additional information FWC local office (239) 229-5403.





**Table 1: Suggested Plants for a Littoral Shelf Planting Area (LSPA) in a Stormwater Lake or Pond in Collier County**



Proposed Elevation Below C.E. (feet)	Planting Zone	Plant type	Common Name	Scientific Name <i>spp. = multiple species within that genus</i>	Comments	Flooding Duration at Proposed Elevation (months)	Size/height requirement	Plant Spacing maximum
0-1'	Transition (D)	Woody-tree	Paurotis Palm	<a href="#">Acoelorrhaphe wrightii</a>	multi-stemmed small palm. prone to manganese deficiency	0-2	3gallon/ 4' min	20'
0 - 1'	Transition (D)	Herbaceous	Salt grass / spike grass	<a href="#">Distichlis spicata</a>	freshwater or brackish	0 - 2	12" min	36" on center
0-1'	Transition (D)	Woody-tree	Dahoon holly	<a href="#">Ilex cassine</a>	evergreen	0-2	3gallon/ 4' min	20'
0 - 1'	Transition (D)	Herbaceous	Muhly grass	<a href="#">Muhlenbergia capillaris</a>	freshwater or brackish	0 - 2	12" min	36" on center
0 - 1'	Transition (D)	Herbaceous	Seashore paspalum	<a href="#">Paspalum vaginatum</a>	freshwater or brackish	0 - 2	12" min	36" on center
0 - 1'	Transition (D)	Herbaceous	Sand Cord grass	<a href="#">Spartina spp</a>	Species: <i>patens</i> , <i>alterniflora</i> , <i>spartinae</i> , <i>bakeri</i> . some spp tolerant of salt water	0 - 2	12" min	36" on center
0 - 1'	Transition (D)	Herbaceous	Fakahatchee grass	<a href="#">Tripsacum dactyloides</a>	grass can grow very tall. butterfly larval host plant	0 - 2	12" min	36" on center
0-1'	Transition (D)	Herbaceous	Florida Gamagrass	<a href="#">Tripsacum floridanum</a>	doesn't grow as tall as <i>dactyloides</i>	0 - 2	12" min	36" on center
1-2'	Shallow ( C)	Woody-tree	Paurotis Palm	<a href="#">Acoelorrhaphe wrightii</a>	multi-stemmed small palm, prone to manganese deficiency	1 - 3	3gallon/ 4' min	20'
1 - 2'	Shallow ( C)	Herbaceous	Blue maidencane	<a href="#">Amphicarpum muhlenbergianum</a>		1 - 3	12" min	36" on center
1 - 2'	Shallow ( C)	Herbaceous	Canna lily	<a href="#">Canna flaccida</a>	perennial accent plant	1 - 3	12" min	36" on center
1 - 2'	Shallow ( C)	Woody-shrub	Buttonbush	<a href="#">Cephalanthus occidentalis</a>		1 - 3	1gallon	5'
1 - 2'	Shallow ( C)	Woody-tree	Buttonwood	<a href="#">Conocarpus erectus</a>	evergreen	1 - 3	3gallon/ 4' min	20'
1 - 2'	Shallow ( C)	Herbaceous	Swamp lily	<a href="#">Crinum americanum</a>	accent plant blooming in summer. mix with other herbaceous plants since it spreads slowly	1 - 3	12" min	36" on center

1 - 2'	Shallow (C)	Herbaceous	Spikerush	<a href="#">Eleocharis spp</a>	species: <i>interstincta, cellulosa, flavescens, atropurpurea, baldwinii, or vivipara</i>	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Herbaceous	Horsetail	<a href="#">Equisetum hyemale</a>	food for waterfowl	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Herbaceous	Yellowtop	<a href="#">Flaveria linearis</a>	perennial accent plant. easily grown from seed	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Woody-shrub	St. John's-wort	<a href="#">Hypericum fasciculatum</a>	max growth 5'	1 - 3	1gallon/ 12" min	36" on center
1 - 2'	Shallow (C)	Woody-tree	Dahoon holly	<a href="#">Ilex cassine</a>	evergreen	1 - 3	3gallon/ 4' min	20'
1-2'	Shallow (C)	Herbaceous	Prairie Iris	<a href="#">Iris savannarum</a>	accent plant blooming in spring	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Woody-shrub	Christmas Berry	<a href="#">Lycium carolinianum</a>	freshwater or brackish	1 - 3	1gallon/ 12" min	36" on center
1 - 2'	Shallow (C)	Herbaceous	Muhly grass	<a href="#">Muhlenbergia capillaris</a>	colorful pink inflorescence, white variety too	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Herbaceous	Maidencane	<a href="#">Panicum hemitomon</a>	Can look similar to torpedo grass	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Woody-tree	Swamp bay	<a href="#">Persea palustris</a>		1 - 3	3gallon/ 4' min	20'
1 - 2'	Shallow (C)	Herbaceous	Pickernelweed	<a href="#">Pontedaria cordata</a>	accent plant blooming late summer	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Woody-tree	Royal palm	<a href="#">Roystonea regia</a>		1 - 3	3gallon/ 4' min	20'
1 - 2'	Shallow (C)	Herbaceous	Arrowhead	<a href="#">Sagittaria spp</a>	Species: <i>latifolia</i> and <i>lancifolia</i>	1 - 3	12" min	36" on center
1 - 2'	Shallow (C)	Herbaceous	Lizard's tail	<a href="#">Saururus cernuus</a>		1 - 3	12" min	36" on center
1-2'	Shallow (c)	Herbaceous	Sand Cord grass	<a href="#">Spartina spp</a>	Species: <i>patens, alterniflora, spartinae, bakeri</i> . some spp tolerant of salt water	1 - 3	12" min	1-2'
1-2'	Shallow (C)	Herbaceous	Fakahatchee grass	<a href="#">Tripsacum dactyloides</a>	grass can grow very tall, larval host	1 - 3	12" min	36" on center
1-2'	Shallow (C)	Herbaceous	Florida Gamagrass	<a href="#">Tripsacum floridanum</a>	doesn't grow as tall as <i>dactyloides</i>	1 - 3	12" min	36" on center

Proposed Elevation Below C.E. (feet)	Planting Zone	Plant type	Common Name	Scientific Name <i>spp. = multiple species within that genus</i>	Comments	Flooding Duration at Proposed Elevation (months)	Size/height requirement	Plant Spacing maximum
2 - 3'	Mid (B)	Woody-tree	Red (Swamp) maple	<a href="#">Acer rubrum</a>	deciduous	3 - 6	3gallon/ 4' min	20'
2 - 3'	Mid (B)	Herbaceous	Canna lily	<a href="#">Canna flaccida</a>	perennial accent plant	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Woody-tree	Buttonwood	<a href="#">Conocarpus erectus</a>		3 - 6	3gallon/ 4' min	20'
2 - 3'	Mid (B)	Herbaceous	Sawgrass	<a href="#">Cladium jamaicense</a>	freshwater or brackish. Serrated leaves install in areas with minimal maintenance needed.	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Herbaceous	Hibiscus	<a href="#">Hibiscus spp.</a>	freshwater and brackish. Can be sensitive to pests. hummingbird plant. species: <i>coccineus</i> and <i>grandifloras</i> )	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Herbaceous	Spikerush	<a href="#">Eleocharis spp.</a>	species: <i>interstincta</i> , <i>cellulosa</i> , <i>flavescens</i> , <i>atropurpurea</i> , <i>baldwinii</i> , or <i>vivipara</i>	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Herbaceous	Soft rush or Needle rush	<a href="#">Juncus spp.</a>	species: <i>effusus</i> , <i>megacephalus</i> , <i>roemerianus</i> , <i>marginatus</i>	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Woody- shrub	Fern (Royal or Cinnamon)	<a href="#">Osmunda spp.</a>	partial to full shade only	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Herbaceous	Lizard's tail	<a href="#">Saururus cernuus</a>		3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Herbaceous	Bulrush	<a href="#">Schoenoplectus spp.</a>	species: <i>pungens</i> , <i>californicus</i> and <i>tabernaemontani</i> . can grow tall and block views.	3 - 6	12" min	36" on center
2 - 3'	Mid (B)	Woody-tree	Pond Cypress or Bald Cypress	<a href="#">Taxodium spp.</a>	species: <i>ascendens</i> and <i>distichum</i>	3 - 6	3gallon/ 4' min	20'
3' - deeper	Deep (A)	Woody- shrub	Giant Leather fern	<a href="#">Acrostichum danaeifolium</a>		6 - 9	1gallon	5'
3' - deeper	Deep (A)	Woody-tree	Pond apple	<a href="#">Annona glabra</a>	semi-deciduous	6 - 9	3gallon/ 4' min	20'
3' - deeper	Deep (A)	Herbaceous	Sawgrass	<a href="#">Cladium jamaicense</a>	freshwater or brackish. serrated leaves install in areas with minimal maintenance needed.	6 - 9	12" min	36" on center
3' - deeper	Deep (A)	Woody-tree	Pop ash	<a href="#">Fraxinus caroliniana</a>		6 - 9	3gallon/ 4' min	20'
3' - deeper	Deep (A)	Herbaceous	Spatterdock	<a href="#">Nuphar advena</a>	small yellow flower	6 - 9	12"	N/A

3' - deeper	Deep (A)	Herbaceous	Water lily	<a href="#">Nymphaea spp.</a>	species: <i>odorata, elegans, lotus, mexicana</i> . showy aquatic flower.	6 - 9	N/A	N/A
3' - deeper	Deep (A)	Herbaceous	Bulrush	<a href="#">Schoenoplectus spp.</a>	species: <i>pungens, californicus and tabernaemontani</i> . can grow tall and block views.	6 - 9	12" min	36" on center
3' - deeper	Deep (A)	Herbaceous	Alligator flag	<a href="#">Thalia geniculata</a>		6 - 9	12" min	36" on center

## Valuable species that do not meet LSPA requirements

Proposed Elevation Below C.E. (feet)	Planting Zone	Plant type	Common Name	Scientific Name	comments	Flooding Duration at Proposed Elevation (months)	Size/height requirement	Plant Spacing maximum
0 - 1'	Transition (D)	Herbaceous	Coreopsis	<a href="#">Coreopsis leavenworthii</a>	self-seeds	0 - 2	n/a	36" on center
0 - 1'	Transition (D)	Herbaceous	Goldenrod	<a href="#">Solidago fistulosa</a>	showy yellow flower	0 - 2	n/a	36" on center
1 - 2'	Shallow ( C)	Herbaceous	Water hyssop	<a href="#">Bacopa monnieri</a>	excellent sprawling groundcover could be an alternative to turf	1 - 3	n/a	36" on center
1-2'	Shallow ( C)	Herbaceous	Lemon bacopa	<a href="#">Bacopa caroliniana</a>	excellent sprawling groundcover could be an alternative to turf	1 - 3	n/a	36" on center
3ft - deeper	Mid (B) or Deep (A)	Herbaceous	Tape-grass or eelgrass	<a href="#">Vallisneria americana</a>	growth rate dependent on water clarity. growth can become prolific	6 - 9	n/a	36" on center

updated June 2018

## Reference

Gaff, H., DeAngelis, D.L., Gross, L.J., Salinas, R., and M. Shorrash. 2000.  
*Ecological Modeling* 127:33-52.