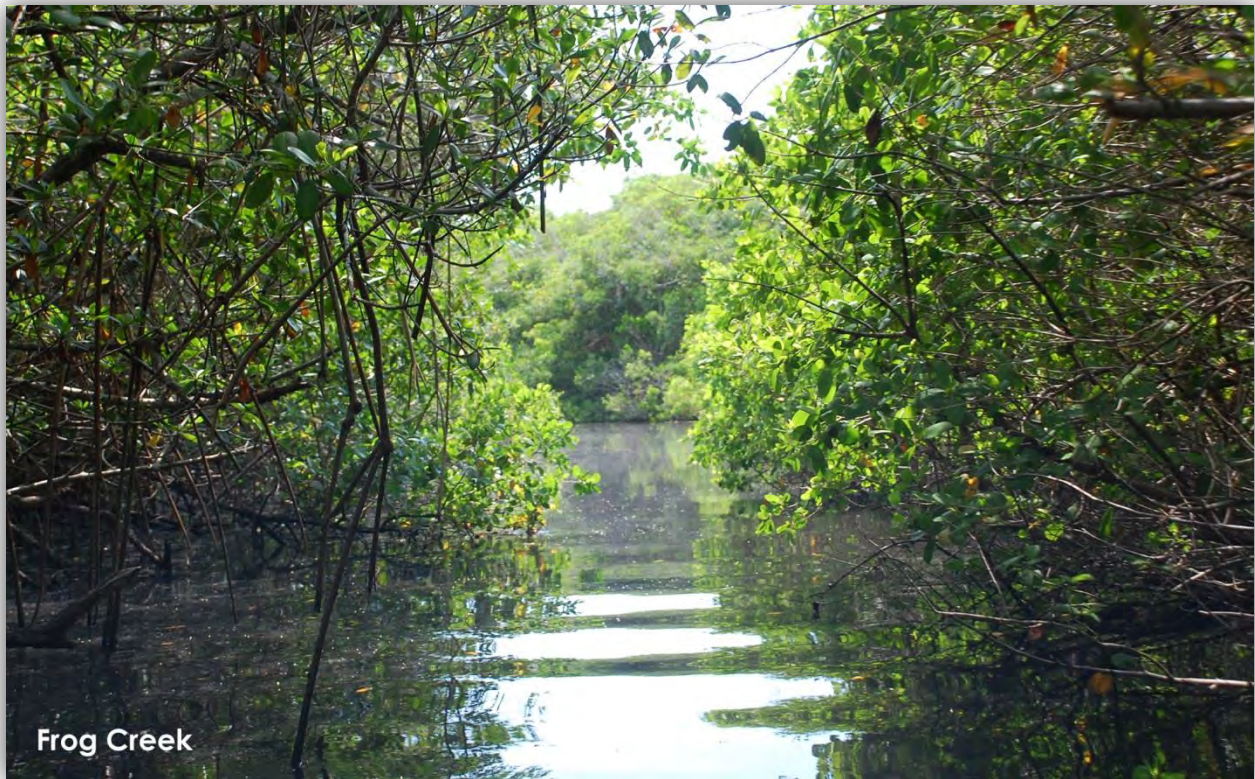


West-Central Florida Tidal Stream Assessment Study

Prepared for the Sarasota Bay Estuary Program by the Florida Center for
Community Design and Research at the University of South Florida

December 10, 2013



Primary Investigator and report author: David Eilers, USF-FCCDR

Research Intern: Kris Caldwell



Florida Center for Community Design & Research
School of Architecture and Community Design
College of The Arts
University of South Florida
4202 East Fowler Avenue, HMS 301
Tampa, Florida 33620
<http://fccdr.usf.edu/>

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Acknowledgments

Authors

David Eilers, University of South Florida/FCCDR

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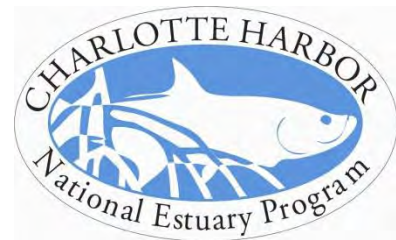
Dr. Jim Griffin, Project Manager

Dr. Bridgette Froeschke, Principal Investigator

For questions or comments concerning the Sarasota Bay Estuary Program Tidal Creeks Study please contact Dr. Jay Leverone at jay@sarasotabay.org.



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Project Overview

Background

In the summer of 2013 the Florida Center for Community Design and Research (FCCDR) was selected by the Sarasota Bay Estuary Program to conduct preliminary assessments of sixteen tidal streams along the west coast of Florida from the northern extent of Tampa Bay to the southern extent of Charlotte Harbor. The study was part of a larger effort that was funded by a grant from the US EPA Wetland Development Program (USEPA Wetland Development Grant number 00D01212a). Also participating in the study was Janicki Environmental Inc. (primary contractor), MOTE Marine Laboratory, Tampa Bay Estuary Program, Sarasota Bay Estuary Program, Charlotte Harbor National Estuary Program and associated county governments. The primary focus of the project was to characterize the nutrient regimes along the tidal portion of coastal creeks as they relate to Numeric Nutrient Criteria (NNC) for impairment.

Methods

The FCCDR tasks included bathymetric mapping, vegetation surveys and habitat assessment. These datasets will serve as the basis for sample site selection for the remaining project tasks including: water quality sampling, benthic invertebrate sampling, benthic chlorophyll sampling and fish sampling. Because of the need to finish this first phase of the overall project in a relatively short time, the assessments needed to be completed in a single day effort per creek. This was accomplished by extensive pre-field planning, the use of recording bathymetry equipment, and employing small boats to facilitate access to creek sites.

Vegetation Survey

Vegetation survey data was collected in approximately 200-meter regions, measured from the centerline of the creek beginning at the downstream extent and continuing to the upstream extent. Regions were defined using ArcGIS prior to field data collection and the resulting data was uploaded to a GPS unit for field use. In each region, presence and absence of vegetation species were recorded, with unknown species being either collected or photographed extensively for subsequent laboratory identification. Where possible, each region was assigned a dominant species or co-dominant species, as well as an approximate percent coverage of the shoreline for both the right and left banks as the boat traveled upstream. The goal of the vegetation assessment was to delineate the creek into three sections; tidal/salt, mixing, and freshwater dominant.

Habitat Assessment

Habitat assessment data was collected concurrently with the vegetation survey data and includes presence of oysters, seagrass, seawalls and rip-rap, and fallen woody debris. A side-scanning sonar system (Lowrance HDS 5 Gen2 HD Fish-finding Sonar & Mapping GPS system) and the sea bottom mapping software [DrDepth](#) was utilized to create a mosaic of side-scanned sonar images that then received further classification and analysis in ArcGIS. This software was also used to create a relative bottom hardness map indicating areas of “harder” and “softer” bottom composition. This relative bottom hardness should be used for comparison within a single creek and may not be applicable for comparisons between creeks.

Bathymetry

Bathymetric data was collected using a 12' johnboat equipped with a small outboard motor and a commercially available bottom finder with side-scanning sonar (Lowrance HDS 5 Gen2 HD Fish-finding Sonar and Mapping GPS system). Data collection was begun at the mouth of the tidal stream and continued upstream as far as necessary. Serpentine transects were conducted, with the distance between transects adjusted to compensate for the width of the stream. The resulting data was post-processed in ArcGIS to create three strata of bottom depths (0m to -0.5m, -0.5m to -1.0m, and deeper than -1.0m) for future use by other project teams to find suitable sampling areas for the acquisition of water quality data, fish sampling data, benthic macroinvertebrate data and benthic chlorophyll data. In addition, 1-foot bathymetric contours were generated from this data.

Stream Assessments

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Mullet Creek Stream Assessment

Study Area

Mullet Creek flows into Old Tampa Bay. The watershed of Mullet Creek is urbanized containing both residential and commercial land uses resulting in a watershed Landscape Development Intensity (LDI) value of 7.0. Mullet Creek flows from through storm water ponds before finally discharging into a creek with natural vegetation buffers near its tidal reaches. Mullet Creek has a buffer LDI score of 6.5. There is a rated flow gauge located just above tidal influence which is also the site of a fixed water quality sampling station routinely sampled by Pinellas County.



Figure 1. Overview of the Mullet Creek Study Area

Vegetation Survey

The Mullet Creek vegetation assessment encompassed four vegetation regions from the mouth in Old Tampa Bay as shown in Figure 2. In these regions, 70 species of vegetation were identified. Regions 1 and 2 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia geminans*) with few other salt tolerant species present. The most upstream mangrove was *Rhizophora mangle* was in Region 4. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 1. Needle Rush (*Juncus roemerianus*) was first observed in Region 2.



Figure 2. Overview of Mullet Creek Vegetation Assessment Regions

Figure 3 shows the vegetation transition zone of Mullet Creek indicating the most upstream Red Mangrove and Leather Fern as well as the most downstream *Distichlis* and *Juncus*. Based on the vegetation assessment data for Mullet Creek, regions 1 through 2 would comprise the highest salinity and tidal influence zone, Region 3 would comprise the “mixing” zone and Region 4 and above would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 1.

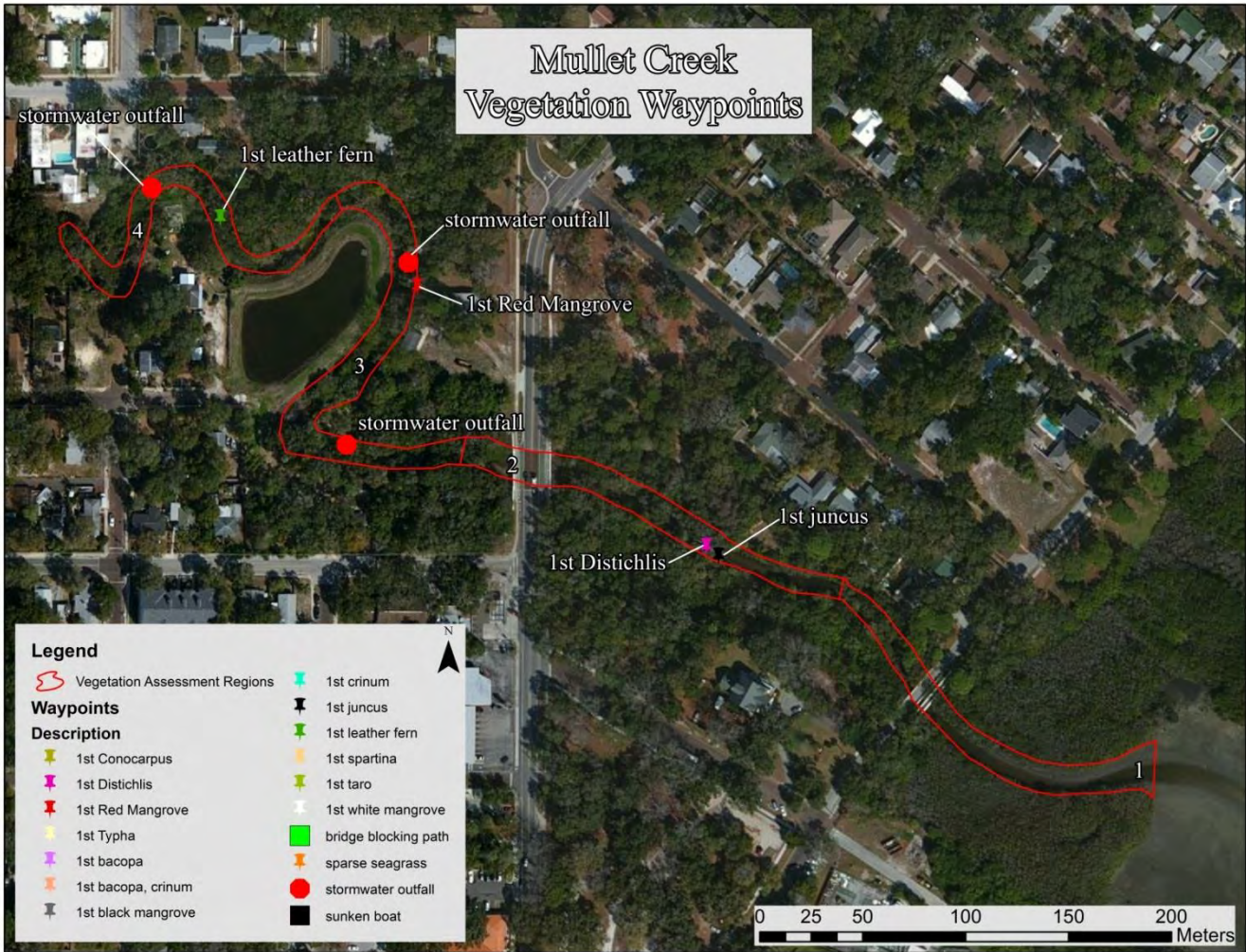


Figure 3. Mullet Creek Vegetation Waypoints

Table 1. Mullet Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region				Regions Found
		1	2	3	4	
<i>Acrostichum danaeifolium</i>	Leather Fern	1	1	1	1	4
<i>Dioscorea bulbifera</i>	Air Potato	1	1	1	1	4
<i>Quercus laurifolia</i>	Laurel oak	1	1	1	1	4
<i>Quercus virginiana</i>	Virginia Live Oak	1	1	1	1	4
<i>Sabal palmetto</i>	Sabal Palm	1	1	1	1	4
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	C	1	1	4
<i>Vitis rotundifolia</i>	Muscadine Grape	1	1	1	1	4
<i>Avicennia germinans</i>	Black Mangrove	1	1	1		3
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush		1	1	1	3
<i>Cinnamomum camphora</i>	Camphor-tree		1	1	1	3
<i>Laguncularia racemosa</i>	White Mangrove	C	C	1		3
<i>Myrica cerifera</i>	Wax Myrtle		1	1	1	3
<i>Panicum maximum</i>	Guneagrass		1	1	1	3
<i>Parthenocissus quinquefolia</i>	Woodbine		1	1	1	3
<i>Serenoa repens</i>	Saw palmetto	1	C	1		3
<i>Abrus precatorius</i>	Rosary Pea		1	1		2
<i>Alternanthera philoxeroides</i>	Alligator Weed			1	1	2
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace		1	1		2
<i>Bidens alba</i>	White Beggar Ticks			1	1	2
<i>Campsis radicans</i>	Trumpet Creeper			1	1	2
<i>Crinum americanum</i>	Swamp lily			1	1	2
<i>Cupaniopsis anacardioides</i>	Carrotwood			1	1	2
<i>Cyperus ligularis</i>	Flat Sedge		1	1		2
<i>Eupatorium capillifolium</i>	Dog Fennel			1	1	2
<i>Ludwigia peruviana</i>	Peruvian Primrosewillow			1	1	2
<i>Lygodium japonicum</i>	Japanese Climbing Fern			1	1	2
<i>Melia azedarach</i>	Chinaberry Tree			1	1	2
<i>Nephrolepis spp.</i>	Sword Fern		1	1		2
<i>Rhizophora mangle</i>	Red Mangrove	C	C			2
<i>Ricinus communis</i>	Castorbean			1	1	2
<i>Rumex verticillatus</i>	Swamp Dock			1	1	2
<i>Sambucus canadensis</i>	Elderberry			1	1	2
<i>Sesbania herbacea</i>	Danglepod Sesban			1	1	2
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye			1	1	2
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen			1	1	2
<i>Acer rubrum var. trilobum</i>	Southern Red Maple				1	1
<i>Amaranthus australis</i>	Southern Amaranth				1	1
<i>Ambrosia artemisiifolia</i>	Common Ragweed				1	1
<i>Bambusa spp.</i>	Bamboo				1	1
<i>Callicarpa americana</i>	American Beauty Berry			1		1
<i>Carya aquatica</i>	Water Hickory		1			1
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam			1		1
<i>Cyperus involucratus</i>	Umbrella flat sedge			1		1
<i>Cyperus odoratus</i>	Fragrant Flat Sedge			1		1
<i>Cyperus surinamensis</i>	Flat Sedge			1		1
<i>Distichlis spicata</i>	Salt Grass		1			1
<i>Echinochloa walteri</i>	Coast Cockspur Grass (hairy)				1	1
<i>Eclipta alba (prostrata)</i>	False Daisy, Yerba De Tajo			1		1
<i>Erechtites hieracifolia</i>	Fireweed				1	1
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort			1		1
<i>Hygrophila polysperma</i>	East Indian Hygophila				1	1
<i>Hypericum tetrapetalum</i>	Fourpetal St. John's-Wort			1		1
<i>Juncus roemerianus</i>	Needle Rush, Black Rush		1			1
<i>Lantana spp.</i>	Lantana				1	1
<i>Leucaena leucocephala</i>	White leadtree		1			1
<i>Liquidambar styraciflua</i>	Sweetgum			1		1
<i>Musa spp.</i>	Banana Tree				1	1
<i>Nerium oleander</i>	Oleander				1	1
<i>Panicum repens</i>	Torpedo Grass				1	1
<i>Phragmites australis</i>	Common Reed				1	1
<i>Pinus spp.</i>	Pine	1				1
<i>Pluchea rosea</i>	Rosy Camphorweed			1		1
<i>Quercus nigra</i>	Water Oak			1		1
<i>Ruellia simplex</i>	Britton's Wild Petunia			1		1
<i>Sanseveria hyacinthoides</i>	Bowstring Hemp				1	1
<i>Solidago sempervirens</i>	Goldenrod	1				1
<i>Spartina bakerii</i>	Cordgrass			1		1
<i>Thelypteris denata</i>	Shield Fern				1	1
<i>Urena lobata</i>	Caesar's Weed				1	1
<i>Urochloa mutica</i>	Para Grass			1		1
<i>Ximenia americana</i>	Tallow Wood, Hog Plum		1			1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Mullet Creek. Figure 4 shows the bottom hardness raster for Mullet Creek. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 4. Mullet Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Mullet Creek had a mean depth of 2.14 feet and a maximum depth of 5.44 feet. A total of 2 acres of creek was mapped during the assessment. At the time of assessment, Mullet Creek contained an estimated 795,253 gallons of water in the study area. Figure 5 details the bathymetric mapping for Mullet Creek showing the three depth stratum.



Figure 5. Mullet Creek Bathymetric Stratum Map

Bishop Creek Stream Assessment

Study Area

Bishop Creek is located in northern Pinellas County where it flows into Old Tampa Bay. Bishop Creek's watershed is highly urbanized having a watershed LDI value of 7.0 and is comprised of residential and commercial land uses. The creek is split into two upstream branches both of which flow through residential areas with some vegetation along the creek. The upstream portion of the creek has been altered and has steep ditch like banks. The lower portion of Bishop Creek, after the two branches converge, becomes more natural before it flows into Old Tampa Bay. The area immediately adjacent to the creek has a buffer LDI value of 5.6.



Figure 6. Bishop Creek Study Area

Vegetation Survey

The Bishop Creek vegetation assessment encompassed 5 vegetation regions from the mouth in Old Tampa Bay to upstream from Philippe Parkway as shown in Figure 7. In these regions, 65 species of vegetation were identified. Region 1 and Region 2 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The most upstream mangrove was *Rhizophora mangle* in Region 5. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 2. Needle Rush (*Juncus roemerianus*) was first observed in Region 1 with the last occurrence in Region 3. Above Region 3 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 7. Overview of Bishop Creek Vegetation Assessment Regions

Figure 8 shows the vegetation transition zone of Bishop Creek indicating the most upstream Red Mangrove and Black Mangrove as well as the most downstream Leather Fern and *Juncus*. Based on the vegetation assessment data for Bishop Creek, regions 1 through 2 would comprise the highest salinity and tidal influence zone, Region 3 would comprise the “mixing” zone and regions 4 and 5 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 2.

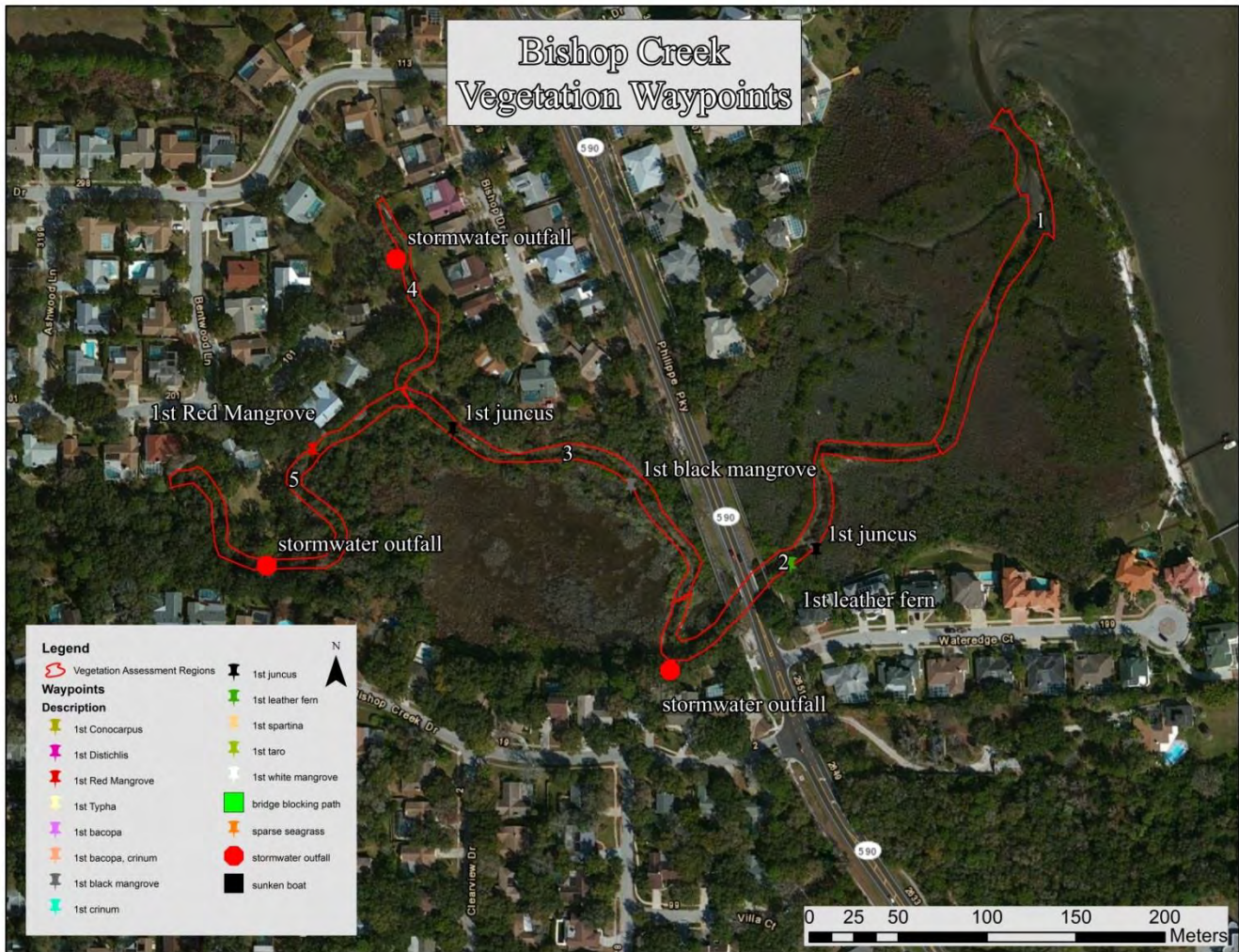


Figure 8. Bishop Creek Vegetation Waypoints

Table 2. Bishop Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region					Regions Found
		1	2	3	4	5	
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	1	1	5
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	1	1	5
<i>Acrostichum danaeifolium</i>	Leather Fern		1	1	1	1	4
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace		1	1	1	1	4
<i>Dioscorea bulbifera</i>	Air Potato		1	1	1	1	4
<i>Myrica cerifera</i>	Wax Myrtle		1	1	1	1	4
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	C	1		4
<i>Vitis rotundifolia</i>	Muscadine Grape		1	1	1	1	4
<i>Alternanthera philoxeroides</i>	Alligator Weed			1	1	1	3
<i>Ampelopsis arborea</i>	Peppervine			1	1	1	3
<i>Avicennia germinans</i>	Black Mangrove	1	1	1			3
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush			1	1	1	3
<i>Hydrilla verticillata</i>	Hydrilla, water thyme			1	1	1	3
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort			1	1	1	3
<i>Juncus roemerianus</i>	Needle Rush, Black Rush	1	1	1			3
<i>Lemna spp</i>	Duckweeds		1	1	1		3
<i>Nephrolepis spp.</i>	Sword Fern		1		1	1	3
<i>Pluchea rosea</i>	Rosy Camphorweed			1	1	1	3
<i>Quercus laurifolia</i>	Laurel oak			1	1	1	3
<i>Quercus virginiana</i>	Virginia Live Oak			1	1	1	3
<i>Ruellia simplex</i>	Britton's Wild Petunia			1	1	1	3
<i>Sabal palmetto</i>	Sabal Palm			1	1	1	3
<i>Serenoa repens</i>	Saw palmetto			1	1	1	3
<i>Solidago sempervirens</i>	Goldenrod		1	1		1	3
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye			1	1	1	3
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed		1			1	2
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam				1	1	2
<i>Cyperus involucratus</i>	Umbrella flat sedge				1	1	2
<i>Distichlis spicata</i>	Salt Grass		1	1			2
<i>Erechtites hieracifolia</i>	Fireweed				1	1	2
<i>Iva frutescens</i>	Marsh Elder		1	1			2
<i>Kalamchoe pinnata</i>	Life Plant			1		1	2
<i>Panicum repens</i>	Torpedo Grass			1	1		2
<i>Rumex verticillatus</i>	Swamp Dock			1	1		2
<i>Sambucus canadensis</i>	Elderberry				1	1	2
<i>Sapium sebiferum</i>	Popcorn Tree, Chinese Tallow Tree			1	1		2
<i>Spartina alterniflora</i>	Salt Marsh Grass	1		1			2
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen				1	1	2
<i>Taxodium distichum</i>	Bald Cypress				1	1	2
<i>Abrus precatorius</i>	Rosary Pea					1	1
<i>Acer rubrum var. trilobum</i>	Southern Red Maple				1		1
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle				1		1
<i>Callicarpa americana</i>	American Beauty Berry					1	1
<i>Canna flaccida</i>	Golden Canna, Bandana-Of-The-Everglades				1		1
<i>Cinnamomum camphora</i>	Camphor-tree					1	1
<i>Crinum americanum</i>	Swamp lily			1			1
<i>Cupaniopsis anacardioides</i>	Carrotwood				1		1
<i>Dicanthelium commutatum</i>	Variable Witch Grass					1	1
<i>Ludwigia peruviana</i>	Peruvian Primrosewillow					1	1
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia					1	1
<i>Lygodium japonicum</i>	Japanese Climbing Fern					1	1
<i>Musa spp.</i>	Banana Tree				1		1
<i>Osmunda regalis</i>	Royal Fern				1		1
<i>Parthenocissus quinquefolia</i>	Woodbine					1	1
<i>Paspalum spp</i>	Paspalum					1	1
<i>Phragmites australis</i>	Common Reed				1		1
<i>Polygonum hydropiperoides</i>	Swamp Smartweed					1	1
<i>Quercus nigra</i>	Water Oak					1	1
<i>Ricinus communis</i>	Castorbean					1	1
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow					1	1
<i>Sesbania herbacea</i>	Danglepod Sesban	1					1
<i>Seteria corrugata</i>	Coastal Bristlegrass				1		1
<i>Sesuvium portulacastrum</i>	Shoreline Seapurslane		1				1
<i>Thelypteris hispida</i>	Maiden Fern					1	1
<i>Woodwardia areolata</i>	Dimorphic Chain Fern					1	1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Bishop Creek. Figure 9 shows the bottom hardness raster for Bishop Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling. The higher the hardness value, the harder the bottom substrate.



Figure 9. Bishop Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Bishop Creek had a mean depth of 1.94 feet and a maximum depth of 4.16 feet. A total of 0.19 acres of creek was mapped during the assessment. At the time of assessment, Bishop Creek contained an estimated 597,298 gallons of water in the study area. Figure 10 details the bathymetric mapping for Bishop Creek showing the three depth stratum.



Figure 10. Bishop Creek Bathymetric Stratum Map

Double Branch Creek Stream Assessment

Study Area

Double Branch Creek is located on the west side of Hillsborough County and flows into Old Tampa Bay. Double Branch Creek’s watershed is a mix of medium density urban land use and natural areas giving it a watershed LDI value of 4.2. The creek banks are naturally sloping and have not been heavily altered. Double Branch Creek also has natural vegetation adjacent to it resulting in a creek buffer LDI value of 5.6. The creek flows through a natural area of mangroves and marshes before reaching Old Tampa Bay.

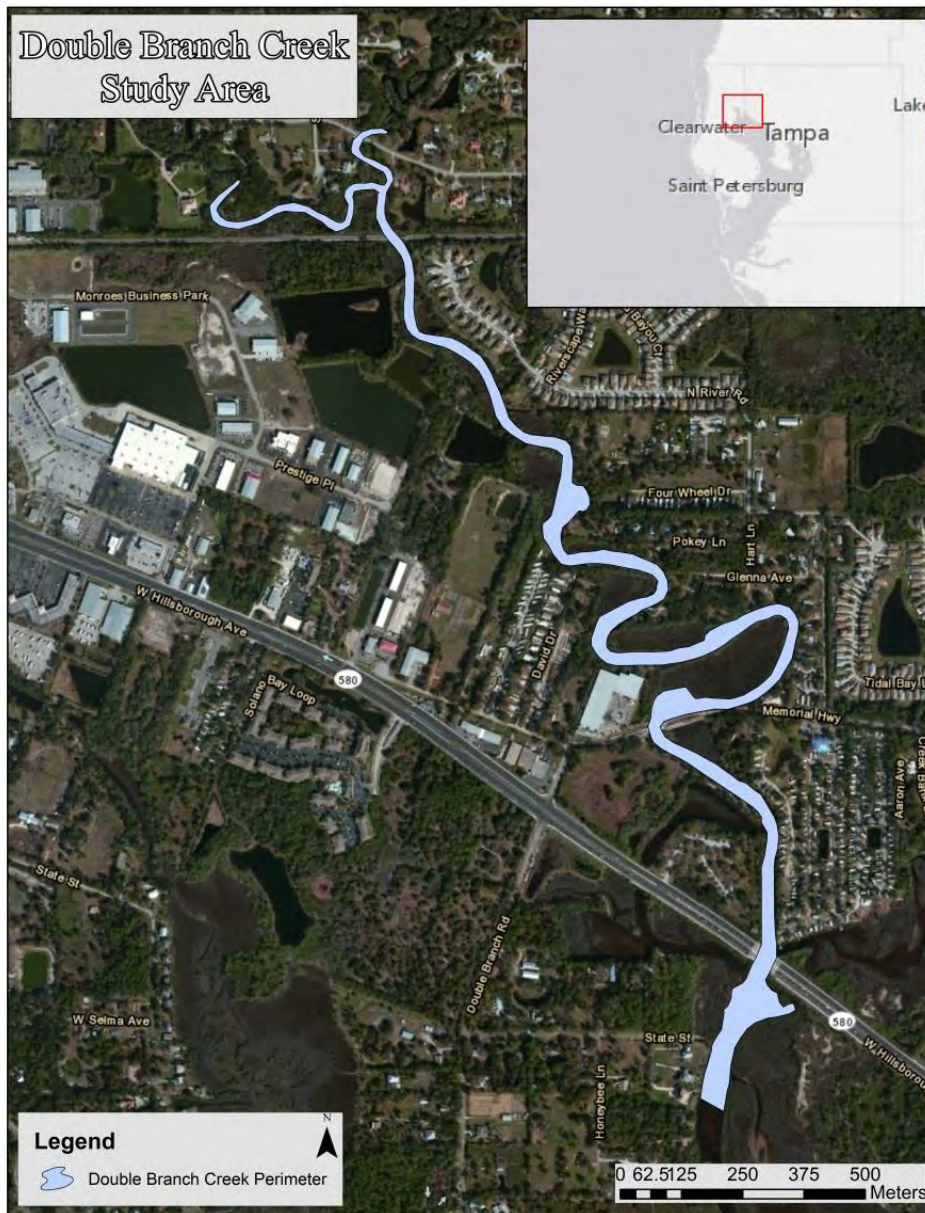


Figure 11. Overview of the Double Branch Creek Study Area

Vegetation Survey

The Double Branch Creek vegetation assessment encompassed 19 vegetation regions from the mouth in Old Tampa Bay to the Twin Branch Acres Road as shown in Figure 12. In these regions, 47 species of vegetation were identified. Regions 1 through 8 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 8. Needle Rush (*Juncus roemerianus*) was first observed in Region 3, becoming dominant in regions 5 and 9 through 17. Above Region 14 the vegetation communities are more frequently dominated by Brazilian Pepper (*Schinus terebinthifolius*) and Live Oak (*Quercus virginiana*).

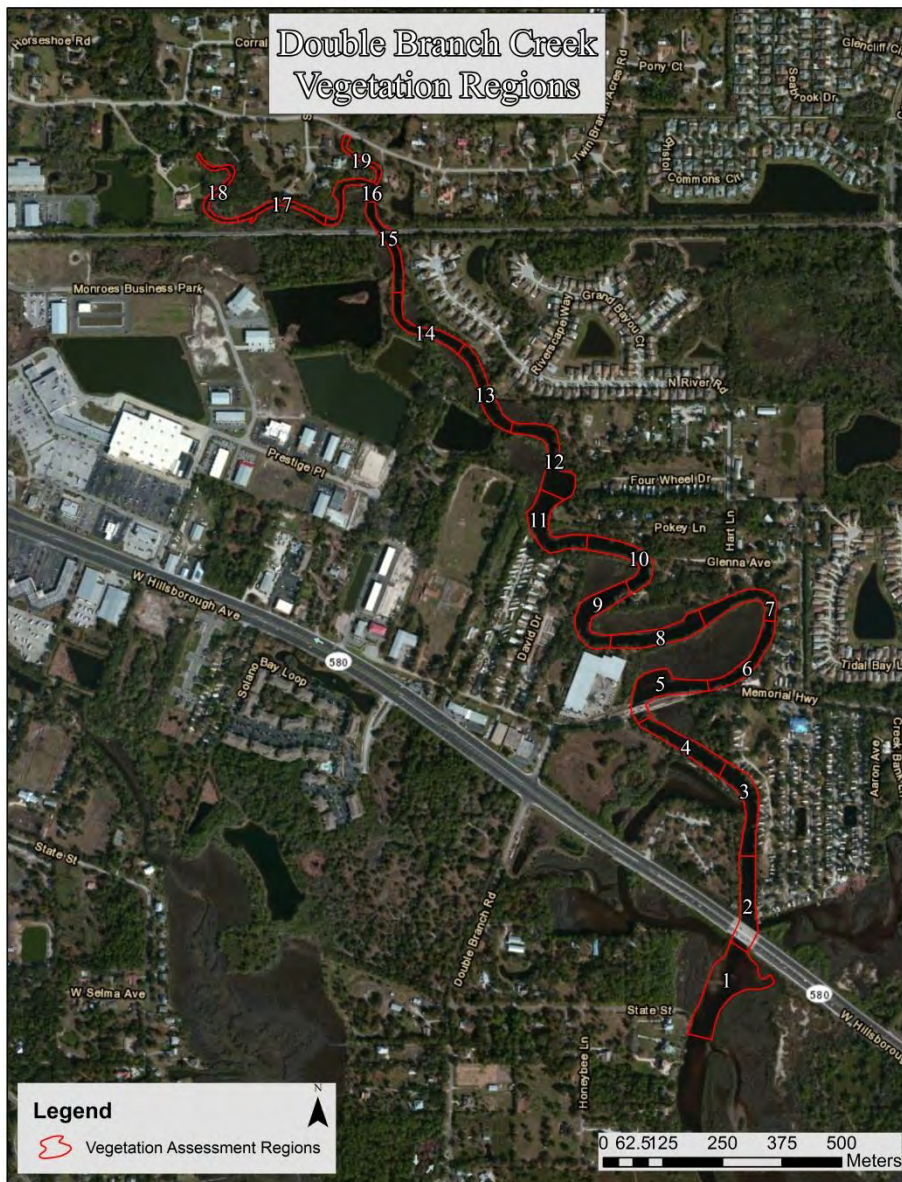


Figure 12. Overview of Double Branch Creek Vegetation Assessment Regions

Figure 13 shows the vegetation transition zone of Double Branch Creek indicating the most downstream Leather Fern, *Bacopa*, *Crinum* and *Typha*. Based on the vegetation assessment data for Double Branch Creek, regions 1 through 8 would comprise the highest salinity and tidal influence zone, regions 9 through 14 would comprise the “mixing” zone and regions 15 through 19 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 3.



Figure 13. Double Branch Creek Vegetation Waypoints

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Double Branch Creek. Figure 14 shows the bottom hardness raster for Double Branch Creek. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

Table 3. Double Branch Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																			Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1	C	1	C	C	1	1	C	C	1	C	C	C	C	C	19	
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	1	1	1	1	1	C	18	
<i>Quercus virginiana</i>	Virginia Live Oak		1	C	C	1	C	C	C	1	C	1	1	1	C	C	1	C	C	18	
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	
<i>Juncus roemerianus</i>	Needle Rush, Black Rush			1	1	C	C	1	1	C	C	C	C	C	C	C	C	1	1	16	
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	
<i>Vitis rotundifolia</i>	Muscadine Grape				1			1	1	1	1	1	1	1	1	1	1	1	1	14	
<i>Pinus spp.</i>	Pine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12	
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush		1	1	1	1	1		1						1	1	1	1	1	11	
<i>Serenoa repens</i>	Saw palmetto							1	C		1	1			1	1	1	1	1	10	
<i>Acrostichum danaeifolium</i>	Leather Fern								1	1	1	1		1		1	1	1	1	9	
<i>Myrica cerifera</i>	Wax Myrtle								1	1	1		1	1	1	1	1		1	8	
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar						1	1	1	1	1			1	1				1	8	
<i>Spartina alterniflora</i>	Salt Marsh Grass							1							1	1	1	1	1	7	
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace														1	1	1	1	1	6	
<i>Leucaena leucocephala</i>	White leadtree		1	1		1				1					1				1	6	
<i>Quercus laurifolia</i>	Laurel oak										1					1	1	1	1	6	
<i>Symphotrichum subulatum</i>	Salt Marsh Aster														1	1	1	1	1	6	
<i>Typha spp.</i>	Cattails													1	1	1	C	1	1	6	
<i>Sabal palmetto</i>	Sabal Palm	1			1	1							1	1						5	
<i>Alternanthera philoxeroides</i>	Alligator Weed														1	1	1		1	4	
<i>Callicarpa americana</i>	American Beauty Berry												1	1			1			4	
<i>Casuarina equisetifolia</i>	Australian Pine								1	1			C	C					1	4	
<i>Eupatorium capillifolium</i>	Dog Fennel			1		1		1									1			4	
<i>Pluchea rosea</i>	Rosy Camphorweed														1	1	1		1	4	
<i>Dioscorea bulbifera</i>	Air Potato				1			1										1		3	
<i>Symphotrichum carolinianum</i>	Climbing Aster															1	1	1		3	
<i>Distichlis spicata</i>	Salt Grass	1			1															2	
<i>Ipomoea sagittata</i>	Saltmarsh morning Glory																	1	1	2	
<i>Iva frutescens</i>	Marsh Elder			1								1								2	
<i>Lemna spp</i>	Duckweed													1					1	2	
<i>Solidago sempervirens</i>	Goldenrod															1			1	2	
<i>Andropogon virginicus var. glaucus</i>	Broom grass								1											1	
<i>Bidens alba</i>	White Beggar Ticks					1														1	
<i>Broussonetia papyrifera</i>	Paper Mulberry				1															1	
<i>Cladium jamaicense</i>	Jamaica Swamp Saw Grass												1							1	
<i>Crinum americanum</i>	Swamp lily																	1		1	
<i>Dalbergia sissoo</i>	Indian Rosewood		1																	1	
<i>Hypericum fasciculatum</i>	Sandweed, Peelbark St. John's-wort																		1	1	
<i>Juniper virginiana</i>	Red Cedar		1																	1	
<i>Paederia foetida</i>	Skunk Vine																		1	1	
<i>Parthenocissus quinquefolia</i>	Woodbine																		1	1	
<i>Rumex verticillatus</i>	Swamp Dock															1				1	
<i>Salvinia minima</i>	Water Spangles, Water Fern																		1	1	
<i>Spartina bakerii</i>	Cordgrass								1											1	
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye				1															1	
<i>Urochloa mutica</i>	Para Grass																		1	1	

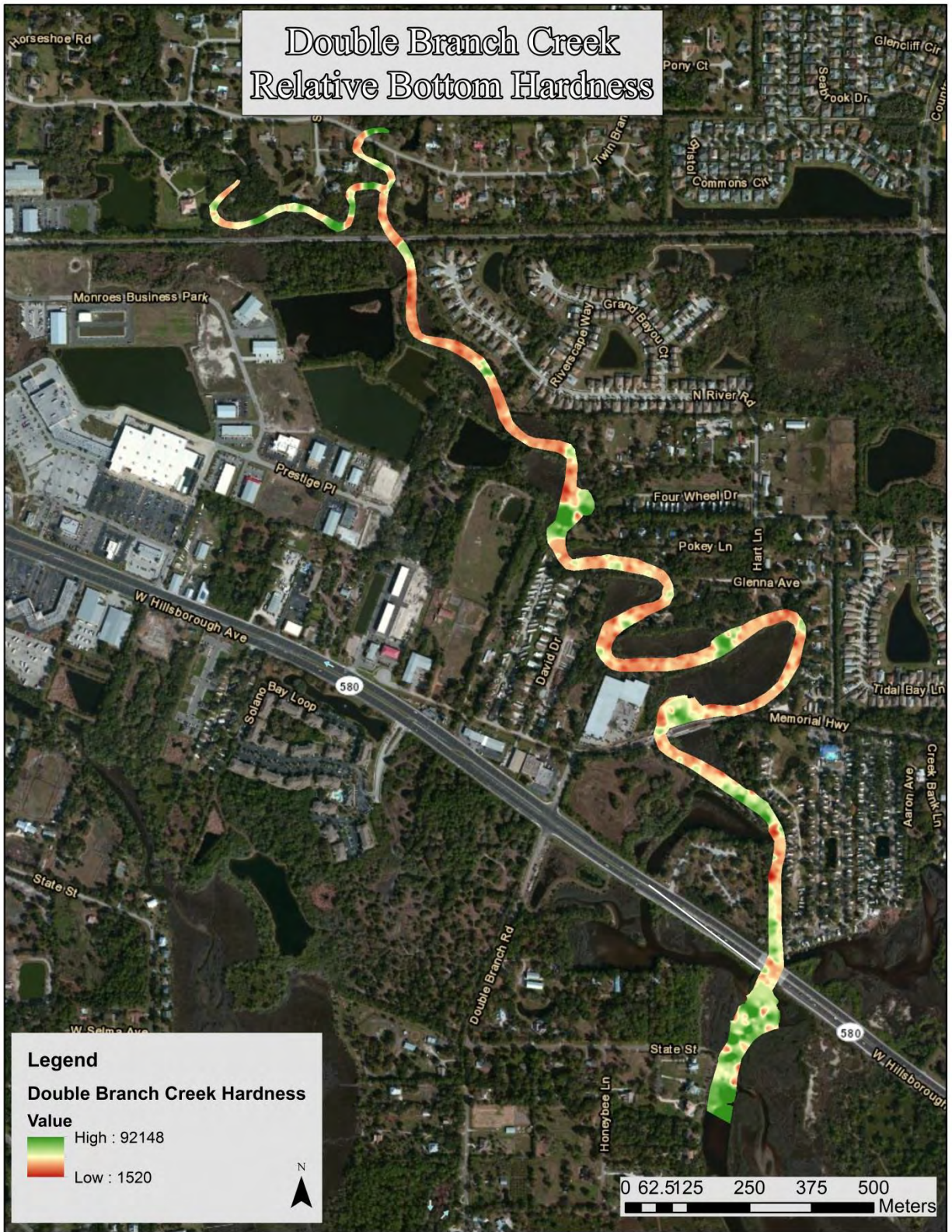


Figure 14. Double Branch Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Double Branch Creek had a mean depth of 3.43 feet and a maximum depth of 12.53 feet. A total of 25.64 acres of creek was mapped during the assessment. At the time of assessment, Double Branch Creek contained an estimated 15,610,182 gallons of water in the study area. Figure 15 and Figure 16 detail the bathymetric mapping for Double Branch Creek showing the three depth stratum.



Figure 15. Double Branch Creek Bathymetric Stratum Map (1 of 2)

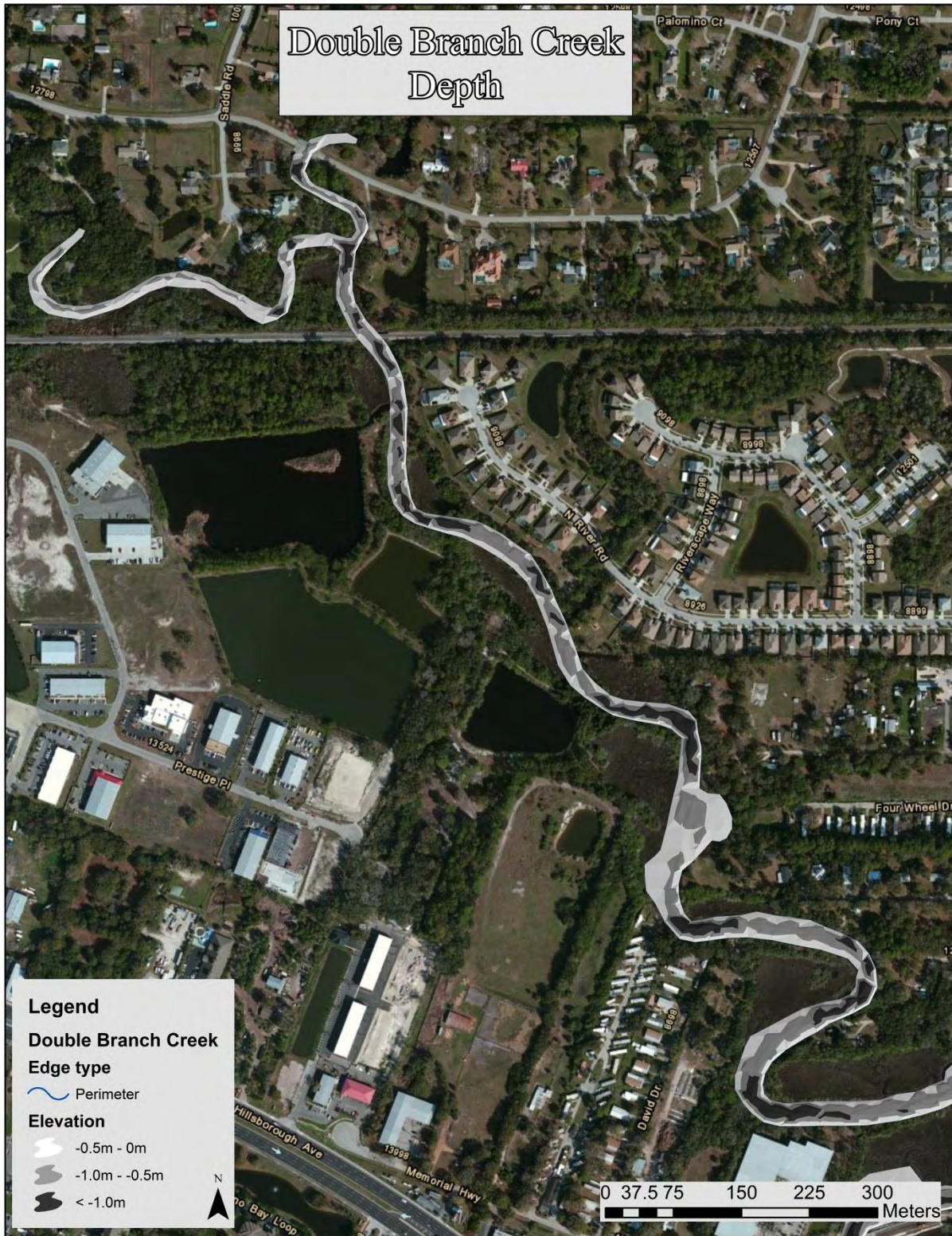


Figure 16. Double Branch Creek Bathymetric Stratum Map (2 of 2)

Sweetwater Creek Stream Assessment

Study Area

Sweetwater Creek has a highly urbanized watershed with residential, industrial, and commercial land use. This creek is located in Hillsborough County where Tampa and Town 'n' Country meet. The upstream portion of the Sweetwater Creek is highly ditched with steep banks and little vegetation buffering the creek. As you move down the creek the creek becomes more natural with less sloping banks and more natural vegetation. As Sweetwater Creek passes under Memorial Highway the natural banks become sea walled and the creek becomes deeper until it forms into a channel.

The watershed for Sweetwater Creek has a LDI value of 7.2 from the urbanization in the surrounding areas. Sweetwater Creek flows into the northeast corner of Old Tampa Bay on the backwater side of the Courtney Campbell Causeway. Sweetwater creek is a highly urbanized system and has one of the highest buffer LDI values of the creeks selected at 6.7.



Figure 17. Overview of the Sweetwater Creek Study Area

Vegetation Survey

The Sweetwater Creek vegetation assessment encompassed 16 vegetation regions from the mouth in Old Tampa Bay to below SR 580 as shown in Figure 18. In these regions, 48 species of vegetation were identified. Regions 1 through 11 were dominated by mangroves (*Rhizophora mangle* and *Laguncularia racemosa*) with few other salt tolerant species present. The most upstream mangrove was *Laguncularia racemosa* in Region 16. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 11, becoming dominant in Region 14. Needle Rush (*Juncus roemerianus*) was first observed in Region 2 with the last occurrence in Region 16. Above Region 15 the vegetation communities are populated by many species indicative of dominating freshwater influence, predominantly Brazilian Pepper.

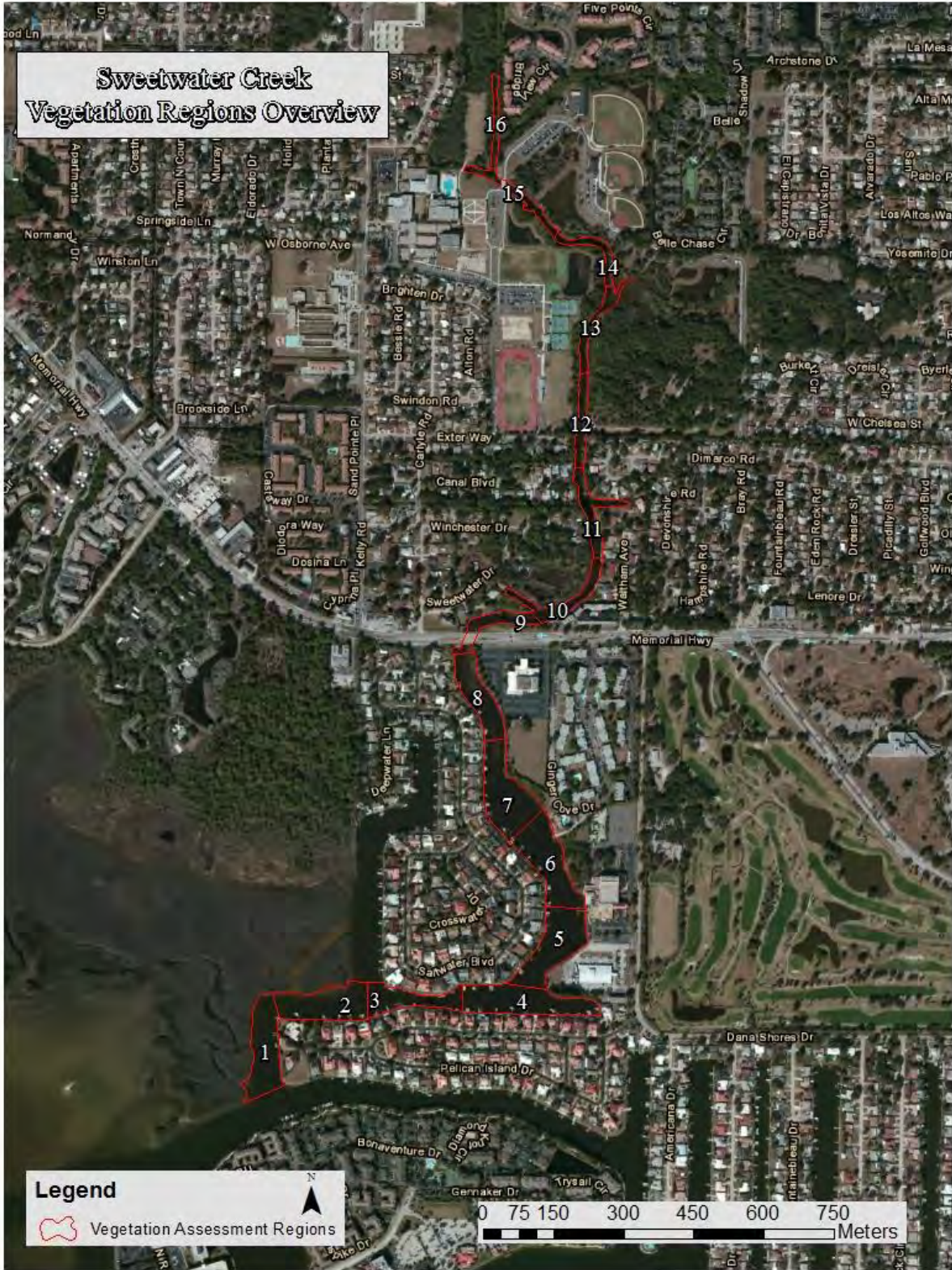


Figure 18. Overview of Sweetwater Creek Vegetation Assessment Regions

Figure 19 shows the vegetation transition zone of Sweetwater Creek indicating the most upstream Red Mangrove and Black Mangrove as well as the most downstream Leather Fern and *Juncus*. Based on the vegetation assessment data for Sweetwater Creek, regions 1 through 9 would comprise the highest salinity and tidal influence zone, regions 10 through 14 would comprise the “mixing” zone and regions 15 and 16 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 4.

Table 4. Sweetwater Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
<i>Laguncularia racemosa</i>	White Mangrove	C	C														1	15
<i>Schinus terebinthifolius</i>	Brazilian Pepper				1	1	1	C	1	C	C	D	C	C	C	C		12
<i>Avicennia germinans</i>	Black Mangrove	1	1			1	1	1	1	1	1			1				11
<i>Rhizophora mangle</i>	Red Mangrove	C	C		1	C	C	C	C	C	1	1	1					11
<i>Juncus roemerianus</i>	Needle Rush, Black Rush		1				1		1	C	1	1	C	C	1	1		10
<i>Sabal palmetto</i>	Sabal Palm					1	1		1	1	1	1	1	1	1	1	1	10
<i>Quercus laurifolia</i>	Laurel oak					1				1	1	1	1	1	1	1	1	8
<i>Quercus geminata</i>	Sand Live Oak									1	1	1	1	1	C	C		7
<i>Vitis rotundifolia</i>	Muscadine Grape									1	1	1	1	1	1	1	1	7
<i>Acrostichum danaeifolium</i>	Leather Fern										1	1	1	C	1	1		6
<i>Abrus precatorius</i>	Rosary Pea									1	1				1	1	1	5
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace											1	1	1	1	1	1	5
<i>Iva frutescens</i>	Marsh Elder				1					1		1		1	1	1		5
<i>Solidago sempervirens</i>	Goldenrod											1	1	1	1	1	1	5
<i>Callicarpa americana</i>	American Beauty Berry									1	1	1			1			4
<i>Conocarpus erecta</i>	Buttonwood				1	1						1	1					4
<i>Dioscorea bulbifera</i>	Air Potato											1		1	1	1	1	4
<i>Myrica cerifera</i>	Wax Myrtle												1	1	1	1	1	4
<i>Panicum repens</i>	Torpedo Grass												1	1	1	1	1	4
<i>Serenoa repens</i>	Saw palmetto											1	1	1	1	1		4
<i>Sesbania herbacea</i>	Danglepod Sesban												1	1	1	1	1	4
<i>Symphyotrichum subulatum</i>	Salt Marsh Aster												1	1	1	1	1	4
<i>Alternanthera philoxeroides</i>	Alligator Weed												1		1	1	1	3
<i>Casuarina equisetifolia</i>	Australian Pine				C	1					1							3
<i>Leucaena leucocephala</i>	White leadtree					1								1	1			3
<i>Pinus elliottii</i>	Slash Pine											1	1	1				3
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush											1	1					2
<i>Bidens alba</i>	White Beggar Ticks												1				1	2
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed	1					1											2
<i>Parthenocissus quinquefolia</i>	Woodbine				1							1						2
<i>Pluchea rosea</i>	Rosy Camphorweed														1	1		2
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye					1						1						2
<i>Typha spp.</i>	Cattails														1	1		2
<i>Eustachys glauca</i>	Saltmarsh Fingergrass														1	1		2
<i>Andropogon virginicus var. glaucus</i>	Broom grass																1	1
<i>Coccoloba uvifera</i>	Seagrape						1											1
<i>Cyperus ligularis</i>	Flat Sedge													1				1
<i>Desmodium incanum</i>	Creeping Beggarweed													1				1
<i>Echinochloa walteri</i>	Coast Cockspur Grass (hairy)															1		1
<i>Eupatorium capillifolium</i>	Dog Fennel																1	1
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort																1	1
<i>Koelreuteria elegans</i>	Golden Rain Tree										1							1
<i>Lantana spp.</i>	Lantana													1				1
<i>Ludwigia peruviana</i>	Peruvian Primrosewillow																1	1
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar																1	1
<i>Urena lobata</i>	Caesar's Weed																1	1
<i>Urochloa mutica</i>	Para Grass															1		1
<i>Amaranthus australis</i>	Southern Amaranth															1		1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Sweetwater Creek. Figure 20 shows the bottom hardness raster for Sweetwater Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

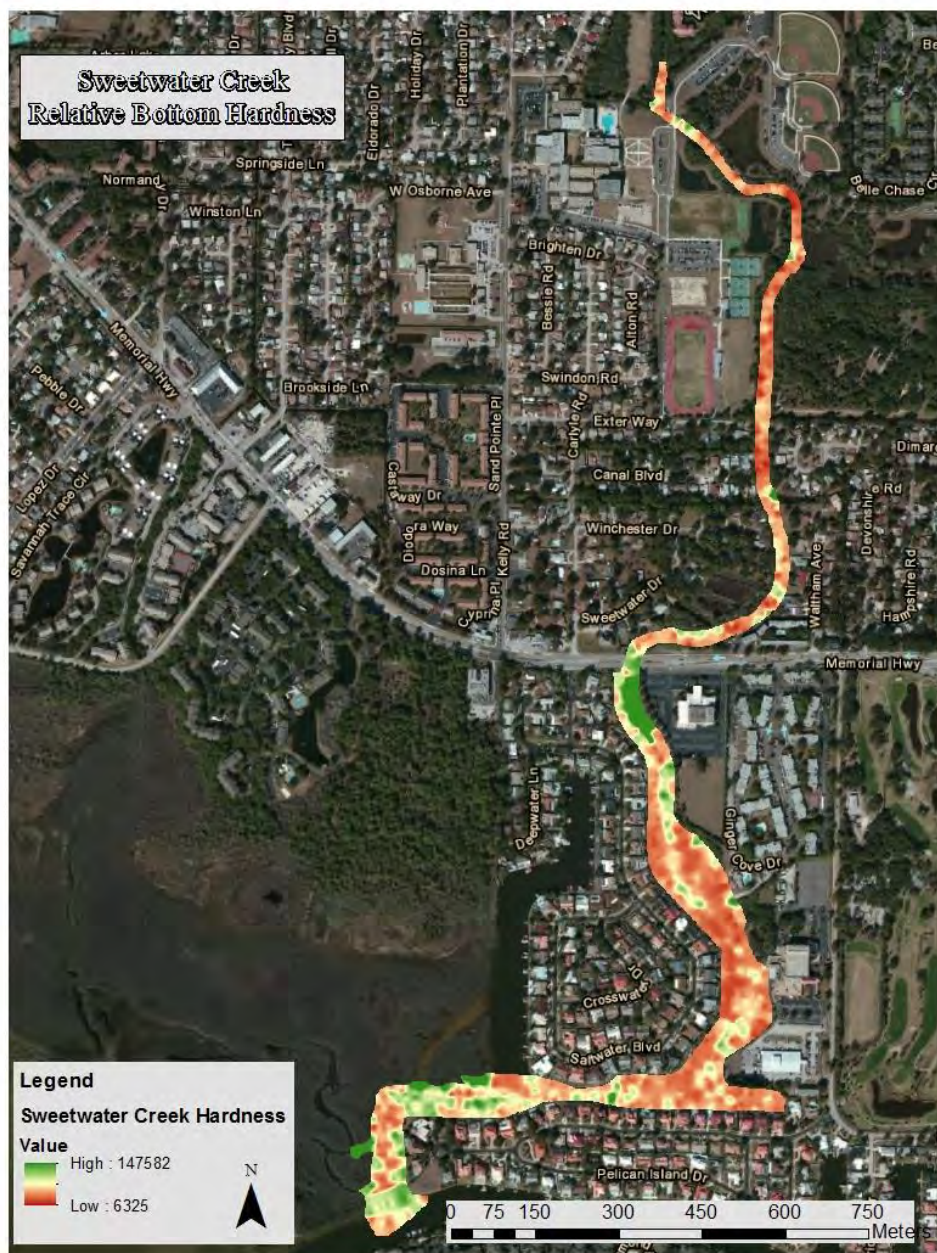


Figure 20. Sweetwater Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Sweetwater Creek had a mean depth of 5.16 feet and a maximum depth of 14.01 feet. A total of 34.72 acres of creek was mapped during the assessment. At the time of assessment, Sweetwater Creek contained an estimated 49,613,510 gallons of water in the study area. Figure 21 and Figure 22 detail the bathymetric mapping for Sweetwater Creek showing the three depth stratum.



Figure 21. Sweetwater Creek Bathymetric Stratum Map (1 of 2)



Figure 22. Sweetwater Creek Bathymetric Stratum Map (2 of 2)

Wildcat Creek Stream Assessment

Study Area

Wildcat Creek is a tributary to the Little Manatee River with a watershed that is largely made up of agricultural and natural land use switching to urban only on the one side of the creek in downstream portion. The watershed of Wildcat Creek is a more “natural” system with few obvious hydrologic changes with a LDI value of 3.8. The banks of the creek are not ditched and are gradually sloping with a large buffer of natural vegetation. Wildcat creek’s urbanized land use is to the north downstream consists of medium density residential and a golf course. Wildcat Creek flows through 20 acres of marsh in Hillsborough County into the Little Manatee River approximately 4.5 miles upstream from Middle Tampa Bay. This system is one of the only creeks with a watershed that is dominated by agriculture. Wildcat creek also has one of the lowest buffer LDI values at 1.5.



Figure 23. Overview of the Wildcat Creek Study Area

Vegetation Survey

The Wildcat Creek vegetation assessment encompassed 10 vegetation regions from the mouth in Hayes Bayou as shown in Figure 24. In these regions, 43 species of vegetation were identified. Regions 1 through 9 were dominated by Needle Rush (*Juncus roemerianus*) with few other salt tolerant species present. The most upstream mangrove was Red Mangrove (*Rhizophora mangle*) in Region 8. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 1, becoming dominant in regions 7-10. Above Region 8 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 24. Overview of Wildcat Creek Vegetation Assessment Regions



Figure 25. Wildcat Creek Vegetation Waypoints

Figure 25 shows the vegetation transition zone of Wildcat Creek indicating the most upstream Red Mangrove. Based on the vegetation assessment data for Wildcat Creek, regions 1 through 5 would comprise the highest salinity and tidal influence zone, regions 6 through 9 would comprise the “mixing” zone and above Region 9 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 5.

Table 5. Wildcat Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region										Regions Found
		1	2	3	4	5	6	7	8	9	10	
<i>Acrostichum danaeifolium</i>	Leather Fern	1	1	1	1	1	1	C	C	C	C	10
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush	1	1	1	1	1	1	1	1	1	1	10
<i>Juncus roemerianus</i>	Needle Rush, Black Rush	C	D	C	D	C	C	C	C	C	1	10
<i>Quercus virginiana</i>	Virginia Live Oak	1	1	1	1	1	1	1	1	1	1	10
<i>Schinus terebinthifolius</i>	Brazilian Pepper	C	1	C	1	C	C	C	C	C	C	10
<i>Myrica cerifera</i>	Wax Myrtle	1	1		1	1	1	1	1	1	C	9
<i>Rhizophora mangle</i>	Red Mangrove	1	1	C	1	1	1	1	1			8
<i>Crinum americanum</i>	Swamp lily	1			1		1	1	1	1	1	7
<i>Pinus spp</i>	Pine	1	1	1		1	1	1	1			7
<i>Vitis rotundifolia</i>	Muscadine Grape			1	1		1	1	1	1	1	7
<i>Laguncularia racemosa</i>	White Mangrove	1	1	C		1	1	1				6
<i>Baccharis augustifolia</i>	False Willow					1	1	1	1	1		5
<i>Pluchea rosea</i>	Rosy Camphorweed						1	1	1	1	1	5
<i>Typha spp.</i>	Cattails						1	1	1	1	1	5
<i>Blechnum serrulatum</i>	Swamp Fern	1					1			1	1	4
<i>Alternanthera philoxeroides</i>	Alligator Weed								1	1	1	3
<i>Quercus laurifolia</i>	Laurel oak						1			1	1	3
<i>Serenoa repens</i>	Saw palmetto						1	1		1		3
<i>Solidago sempervirens</i>	Goldenrod							1		1	1	3
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye			1			1	1				3
<i>Symphotrichum subulatum</i>	Salt Marsh Aster							1	1	1		3
<i>Ximenia americana</i>	Tallow Wood, Hog Plum			1	1					1		3
<i>Amaranthus australis</i>	Southern Amaranth						1	1				2
<i>Cladium jamaicense</i>	Jamaica Swamp Saw Grass						1			1		2
<i>Lemna spp</i>	Duckweed									1	1	2
<i>Spirodela polyrhiza</i>	Duckweed									1	1	2
<i>Gordonia lasianthus</i>	Loblolly Bay		1	1								2
<i>Ipomoea sagittata</i>	Saltmarsh Morning Glory								1	1		2
<i>Parthenocissus quinquefolia</i>	Woodbine									1	1	2
<i>Persea palustris</i>	Swampbay		1							1		2
<i>Sabal palmetto</i>	Sabal Palm		1					1				2
<i>Spartina alterniflora</i>	Salt Marsh Grass					1					1	2
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed							1				1
<i>Distichlis spicata</i>	Salt Grass	1										1
<i>Eustachys glauca</i>	Saltmarsh Fingergrass							1				1
<i>Juniperus virginiana</i>	Red Cedar								1			1
<i>Magnolia virginiana</i>	Sweetbay Magnolia										1	1
<i>Musa spp.</i>	Banana Tree							1				1
<i>Osmunda cinnamomea</i>	Cinnamon Fern									1		1
<i>Panicum repens</i>	Torpedo Grass				1							1
<i>Sabatia spp.</i>	Rosegentian									1		1
<i>Schoenoplectus robustus</i>	Saltmarsh Bulrush							1				1
<i>Thelypteris denata</i>	Shield Fern										1	1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Wildcat Creek. Figure 26 shows the bottom hardness raster for Wildcat Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

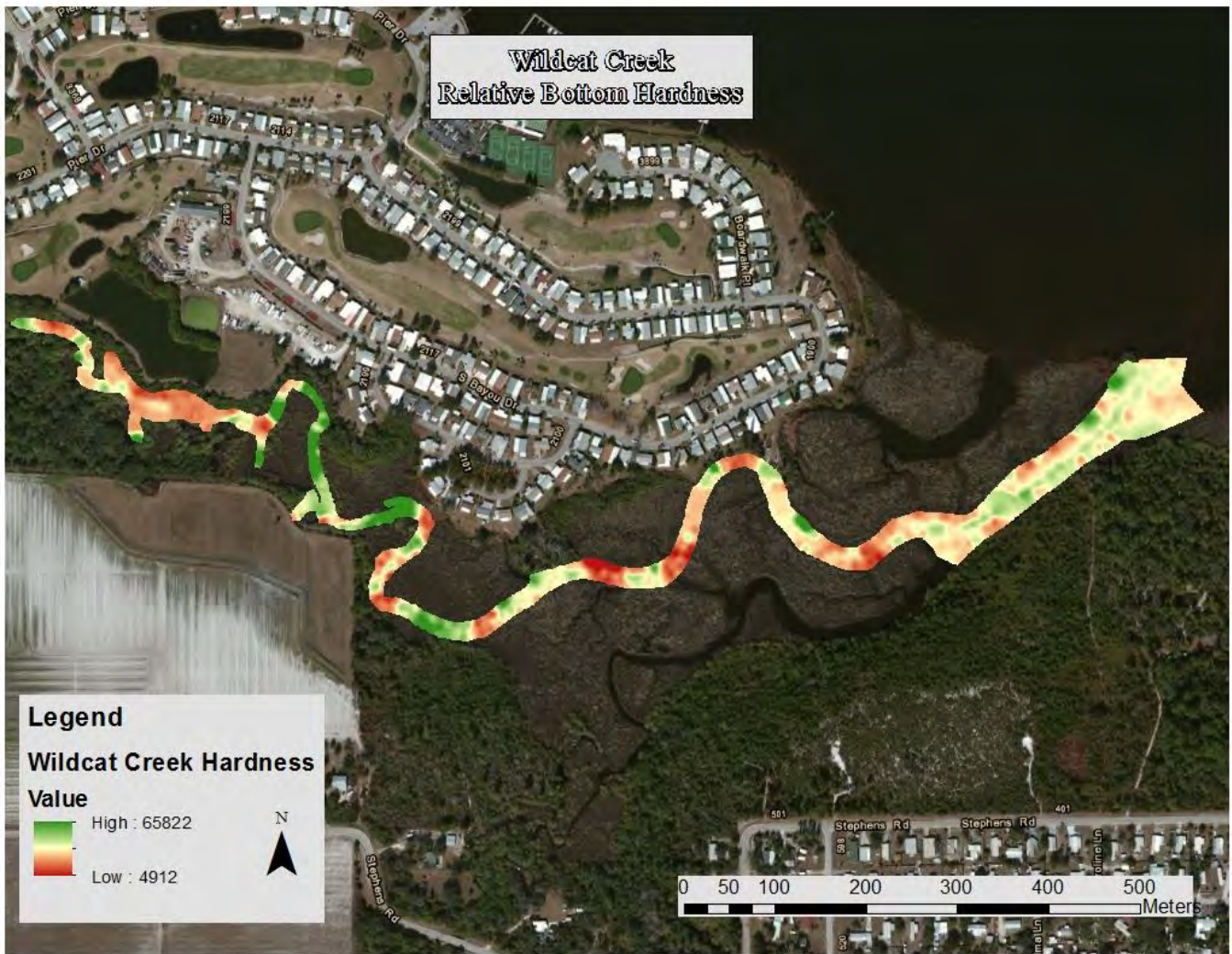


Figure 26. Wildcat Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Wildcat Creek had a mean depth of 2.37 feet and a maximum depth of 7.72 feet. A total of 12.06 acres of creek was mapped during the assessment. At the time of assessment, Wildcat Creek contained an estimated 6,913,642 gallons of water in the study area. Figure 27 details the bathymetric mapping for Wildcat Creek showing the three depth stratum.



Figure 27. Wildcat Creek Bathymetric Stratum Map

Frog Creek Stream Assessment

Study Area

Frog Creek is located in the Lower Tampa Bay Watershed in northern Manatee County with its head waters in Cedar Drain and its mouth in Terra Ceia Bay as shown in Figure 28. Frog Creek has a watershed that is split into two distinct types; the upstream developed portion and the lower natural portion. The upstream part of the water shed consists of a mix of high and medium density residential as well as some agricultural area. The lower natural portion is made up of mangrove forests and marshes as well as upland forested areas. The watershed of Frog Creek has a LDI value of 3.6 while the creek has less development immediately surrounding it giving it a buffer LDI value of 3.0. Frog Creek's banks have little development and are naturally sloping until the creek is above US41 where it becomes more ditched and less vegetated.

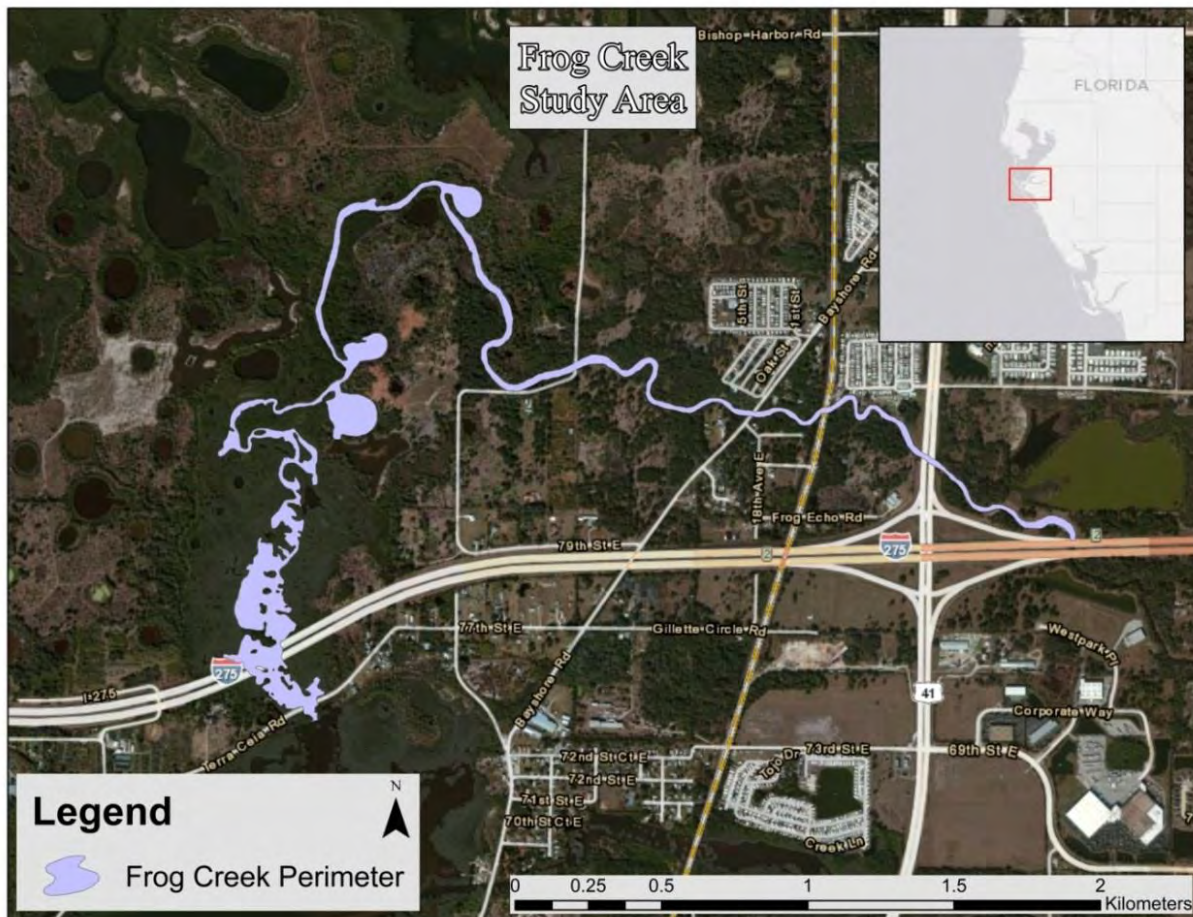


Figure 28. Overview of the Frog Creek Study Area

Vegetation Survey

The Frog Creek vegetation assessment encompassed 33 vegetation regions from the mouth in Terra Ceia Bay to the overpass at Interstate 275 as shown in Figure 29 through Figure 31. In these regions, 96 species of vegetation were identified. Regions 1 through 18 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The most upstream mangrove was *Avicennia germinans* in Region 19. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 15, becoming dominant in regions 17-22 and 24. Needle Rush (*Juncus roemerianus*) was first observed in Region 12 with the last occurrence in Region 17. Above Region 19 the vegetation communities are populated by many species indicative of dominating freshwater influence.

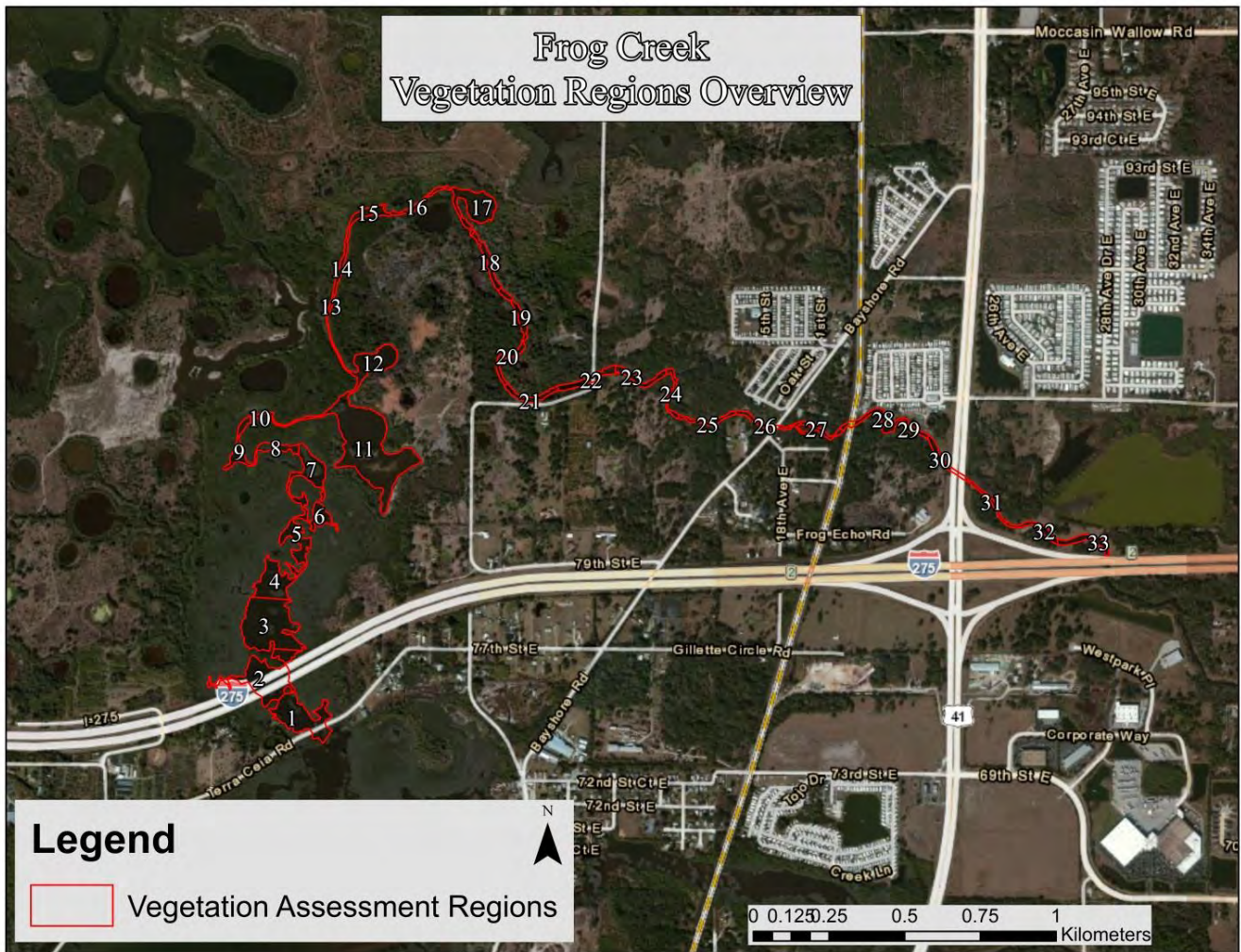


Figure 29. Overview of Frog Creek Vegetation Assessment Regions



Figure 30. Frog Creek Vegetation Assessment Regions 1-20



Figure 31. Frog Creek Vegetation Assessment Regions 21-34

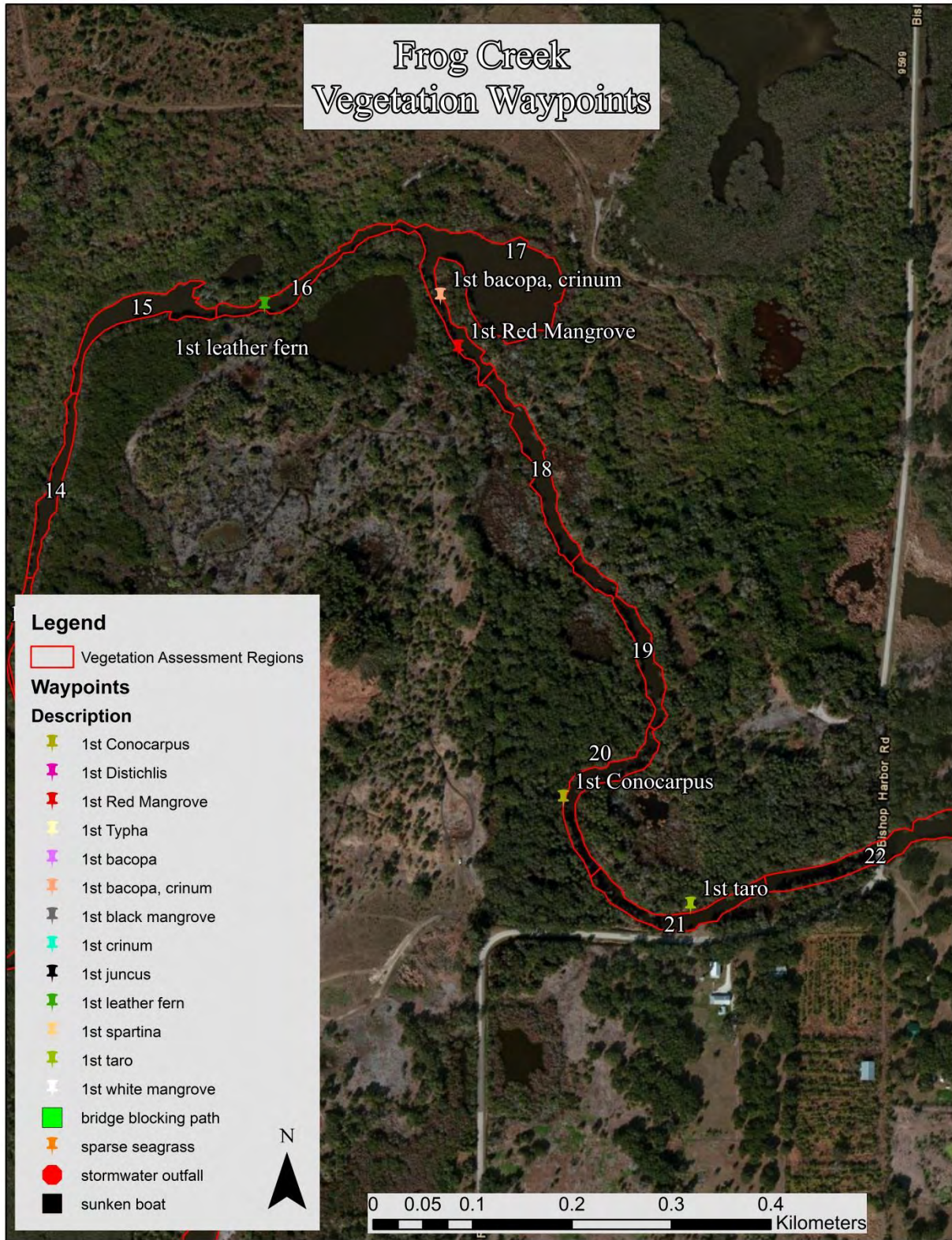


Figure 32. Frog Creek Vegetation Waypoints

Figure 32 shows the vegetation transition zone of Frog Creek indicating the most upstream Red Mangrove and *Conocarpus* as well as the most downstream Leather Fern, *Bacopa*, *Crinum* and Taro. Based on the vegetation assessment data for Frog Creek, regions 1 through 15 would comprise the highest salinity and tidal influence zone, regions 16 through 21 would comprise the “mixing” zone and regions 22 through 33 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 6 through Table 8.

Table 6. Frog Creek Vegetation Assessment List (Part 1)

Plant Species	Common Name	Sample Region																																	Regions Found			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33				
<i>Schinus terebinthifolius</i>	Brazilian Pepper								1	1		1	1	1	1		1	1	1	C	C		C	1	1	1	1	1	1	1	1	C	1			22		
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																19		
<i>Panicum maximum</i>	Guneagrass	1									1				1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19			
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	C	C	C	C	C	C	C	C	C	C	C	C																		18		
<i>Alternanthera philoxeroides</i>	Alligator Weed																1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17		
<i>Quercus virginiana</i>	Virginia Live Oak										1								1	1	1	C	C	1	1	C	C	1	1	1	1	1	1	1	1	17		
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	D	C	C	C	C	C	C	C	C	C	C	C																			17		
<i>Acrostichum danaeifolium</i>	Leather Fern														1	1	C	C	C	C	C	C	C	1	C	1	1	1	1			1			1	16		
<i>Commelina diffusa</i>	Dayflower																		1	1	1	1	C	C	C	C	C	1	1	C	1	1	1	1	1	15		
<i>Sabal palmetto</i>	Sabal Palm										1	1			1		1		1	1	1	1	1	1	1	1			1	1			1	1	1	15		
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush										1	1		1	1	1	1	C	C	C	1	1	1													12		
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam																						1	1	1	1	C	1	1	1	1	1	1	1	1	1	12	
<i>Ruellia simplex</i>	Britton's Wild Petunia																			1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	12	
<i>Dioscorea bulbifera</i>	Air Potato																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	11	
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye																																				11	
<i>Conocarpus erecta</i>	Buttonwood										1	1	1	1	1	1	1	1	C	1	1																10	
<i>Ludwigia peruviana</i>	Peruvian Primrosewillow																			1					1	1	1	1	1	1	1	1	1	1	1	1	1	10
<i>Panicum repens</i>	Torpedo Grass																			1	1	1	1	1	1	1			1		1	1				10		
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace																			1	1			1	1	1						1	1		1	1	9	
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle																				1			1			1	1	1	1	1	1			1	1	9	
<i>Crinum americanum</i>	Swamp lily																			1	1	1	1	1	1					1				1	1	9		
<i>Parthenocissus quinquefolia</i>	Woodbine											1											1	1		1	1		1					1	1	1	9	
<i>Juniperus virginiana</i>	Red Cedar											1				1		1		1	1					1	1	1									8	
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen																										1	1	1	1	1	1	1		1	1	8	
<i>Ulmus americana</i>	American Elm																																		1	1	8	
<i>Urena lobata</i>	Caesar's Weed																																		1	1	8	
<i>Vitis rotundifolia</i>	Muscadine Grape																																			1	8	
<i>Bidens alba</i>	White Beggar Ticks																																			1	7	

Table 7. Frog Creek Vegetation Assessment List (Part 2)

Plant Species	Common Name	Sample Region																																	Regions Found			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33				
<i>Carya aquatica</i>	Water Hickory																									1	1		1	1	1		1	1		7		
<i>Erythrina herbacea</i>	Coralbeans																			1									1	1	1		1	1	1	7		
<i>Melothria pendula</i>	Creeping Cucumber																							1	1	1			1	1			1	1		7		
<i>Ambrosia artemisiifolia</i>	Common Ragweed																													1	1			1	1	1	6	
<i>Callicarpa americana</i>	American Beauty Berry																				1		1	1	1								1	1		6		
<i>Echinochloa crusgalii</i>	Barn Yard Grass																												1	1	1	1			1	1	6	
<i>Eupatorium capillifolium</i>	Dog Fennel																			1		1	1		1									1	1	6		
<i>Ludwigia leptocarpa</i>	Anglestem Primrosewillow																												1	1			1	1	1	1	6	
<i>Pluchea rosea</i>	Rosy Camphorweed																			1	1	1	1	1	1											6		
<i>Schoenoplectus tabernaemontani</i>	Softstem Bulrush																				1	1		1	1	1								1		6		
<i>Serenoa repens</i>	Saw palmetto																					1	1	1	C		1	1								6		
<i>Iva frutescens</i>	Marsh Elder													1	1		1	1	1																	5		
<i>Campsis radicans</i>	Trumpet Vine																			1					1		1			1						4		
<i>Echinochloa walteri</i>	Coast Cockspur Grass (hairy)																					1		1			1							1		4		
<i>Hygrophila polysperma</i>	East Indian Hygophila																																1		1	1	1	4
<i>Juncus roemerianus</i>	Needle Rush, Black Rush																				1	1			1	1										4		
<i>Leucaena leucocephala</i>	White leadtree	1																									1		1					1		4		
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow																																		1		4	
<i>Symphotrichum subulatum</i>	Salt Marsh Aster																																	1	1		1	4
<i>Seteria corrugata</i>	Coastal Bristlegrass																																		1		1	4
<i>Amaranthus australis</i>	Southern Amaranth																																				3	
<i>Ampelopsis arborea</i>	Peppervine																																		1	1	1	3
<i>Dalbergia ecastaphyllum</i>	Coin Vine																																				3	
<i>Eichhornia crassipes</i>	Water Hyacinth																																				3	
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort																																				3	
<i>Polygonum hydropiperoides</i>	Swamp Smartweed																																				1	3
<i>Suaeda linearis</i>	Sea Blite																																					3
<i>Ricinus communis</i>	Castorbean																																				1	3

Table 8. Frog Creek Vegetation Assessment List (Part 3)

Plant Species	Common Name	Sample Region																																	Regions Found					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33						
<i>Typha spp.</i>	Cattails																		1						1								1			3				
<i>Urochloa mutica</i>	Para Grass																									1								1	1	3				
<i>Bambusa spp.</i>	Bamboo																										1	1								2				
<i>Fraxinus caroliniana</i>	Pop Ash																																1	1		2				
<i>Hydrilla verticillata</i>	Hydrilla, water thyme																																1	1		2				
<i>Ilex vomitoria</i>	Yaupon																																1			2				
<i>Ipomoea cairica</i>	Mile-A-Minute Vine																		1														1			2				
<i>Mikania scandens</i>	Climbing Hempvine																										1							1			2			
<i>Musa spp.</i>	Banana Tree																						1					1									2			
<i>Polygonum densiflorum</i>	Denseflower Smartweed																																	1	1		2			
<i>Rumex</i>	Swamp Dock																																		1		2			
<i>Sambucus canadensis</i>	Elderberry																																	1			2			
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar																																	1	1		2			
<i>Spartina alterniflora</i>	Salt Marsh Grass										1	1																									2			
<i>Spartina bakerii</i>	Cordgrass									1																												2		
<i>Taxodium distichum</i>	Bald Cypress																																					2		
<i>Thelypteris denata</i>	Shield Fern																																		1	1		2		
<i>Enterolobium contortisiquum</i>	Earpod Tree																																			1	1		2	
<i>Abrus precatorius</i>	Rosary Pea																																					1		
<i>Andropogon glomeratus</i>	Bushy bluestem									1																												1		
<i>Baccharis augustifolia</i>	Flase Willow																																			1		1		
<i>Batis maritima</i>	Saltwort											1																										1		
<i>Borricia frutescens</i>	Sea Oxeye																1																					1		
<i>Canna flaccida</i>	Golden Canna, Bandana-Of-The-Everglades																																			1		1		
<i>Cephalanthus occidentalis</i>	Common Buttonbush																																			1		1		
<i>Cinnamomum camphora</i>	Camphor-tree																																			1		1		
<i>Cupaniopsis anacardioides</i>	Carrotwood																																			1		1		
<i>Cyperus leonti</i>	Sedge																																			1		1		
<i>Cyperus surinamensis</i>	Flat Sedge																																			1		1		
<i>Erechtites hieracifolia</i>	Fireweed																																					1		
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia																																			1		1		
<i>Micranthemum glomeratum</i>	Manatee Mudflower, Baby's Tears																																			1		1		
<i>Myriophyllum aquaticum</i>	Parrot Feather																																			1		1		
<i>Opuntia humifusa</i>	Pricklypear Cactus																																			1		1		
<i>Paspalum urvillei</i>	Vasey Grass																																				1		1	
<i>Phyla nodiflora</i>	Frog-fruit, Carpetweed, Turkey Tangle Fogfruit																																				1		1	
<i>Pinus elliottii</i>	Slash Pine																																				1		1	
<i>Sesbania herbacea</i>	Danglepod Sesban																																				1		1	
<i>Woodwardia areolata</i>	Dimorphic Chain Fern																																				1		1	
<i>Ximenia americana</i>	Tallow Wood, Hog Plum																																					1		1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Frog Creek. Figure 33 shows the bottom hardness raster for Frog Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

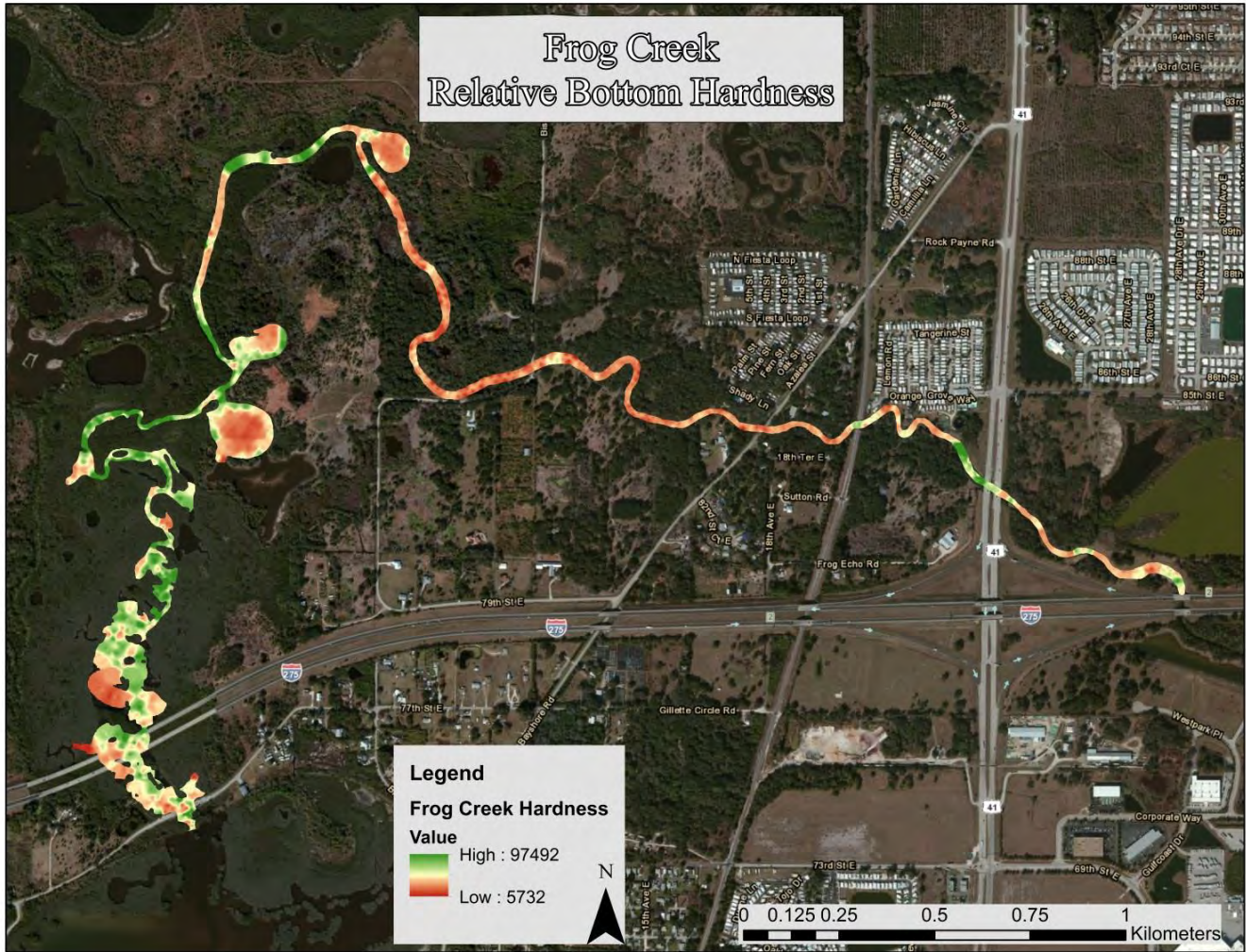


Figure 33. Frog Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Frog Creek had a mean depth of 2.71 feet and a maximum depth of 8.60 feet. A total of 57.5 acres of creek was mapped during the assessment. At the time of assessment, Frog Creek contained an estimated 27,860,668 gallons of water in the study area. Figure 34 and Figure 35 detail the bathymetric mapping for Frog Creek showing the three depth stratum.



Figure 34. Frog Creek Bathymetric Stratum Map (1 of 2)



Figure 35. Frog Creek Bathymetric Stratum Map (2 of 2)

Sugarhouse Creek Stream Assessment

Study Area

Sugarhouse Creek is located in Manatee County converges from two creek branches with different landscapes before converging and flowing into the estuary. The western branch of Sugarhouse Creek has steep banks and is highly ditched and runs through agricultural lands and a high density residential area. The southern branch of Sugarhouse Creek has a natural upland forest buffer which has banks that naturally sloped and receives water from a upstream medium density residential area. The downstream portion of Sugarhouse Creek is impacted on either side by a high density mobile home park and a golf course to the north where it flows into the Braden River. The Braden River is a natural area with marsh and mangrove habitats and a medium to low saline water. The Braden River eventually flows into Lower Tampa Bay through the Manatee River. This creek is impacted by both agriculture and a high density urban environment with a receiving water body that has natural habitat and a low salinity. The watershed and buffer area immediately surrounding Sugarhouse Creek are very similar and results in both having a LDI value of 6.0.



Figure 36. Overview of the Sugarhouse Creek Study Area

Vegetation Survey

The Sugarhouse Creek vegetation assessment encompassed 9 vegetation regions from the mouth in the Braden River to the footbridge on the south branch and the agricultural field on the west branch as shown in Figure 37. In these regions, 46 species of vegetation were identified. Regions 1 through 5 and Region 9 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The most upstream mangrove was *Laguncularia racemosa* in Region 6. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 3, becoming dominant in regions 5 through 7. Needle Rush (*Juncus roemerianus*) was first observed in Region 2 with the last occurrence in regions 3 and 9. Above Region 6 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 37. Overview of Sugarhouse Creek Vegetation Assessment Regions

Figure 38 shows the vegetation transition zone of Sugarhouse Creek indicating the most upstream Red Mangrove as well as the most downstream Leather Fern and *Juncus*. Based on the vegetation assessment data for Sugarhouse Creek, regions 1 through 4 and Region 9 would comprise the highest salinity and tidal influence zone, regions 5 and 6 would comprise the “mixing” zone and regions 7 and 8 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 9.

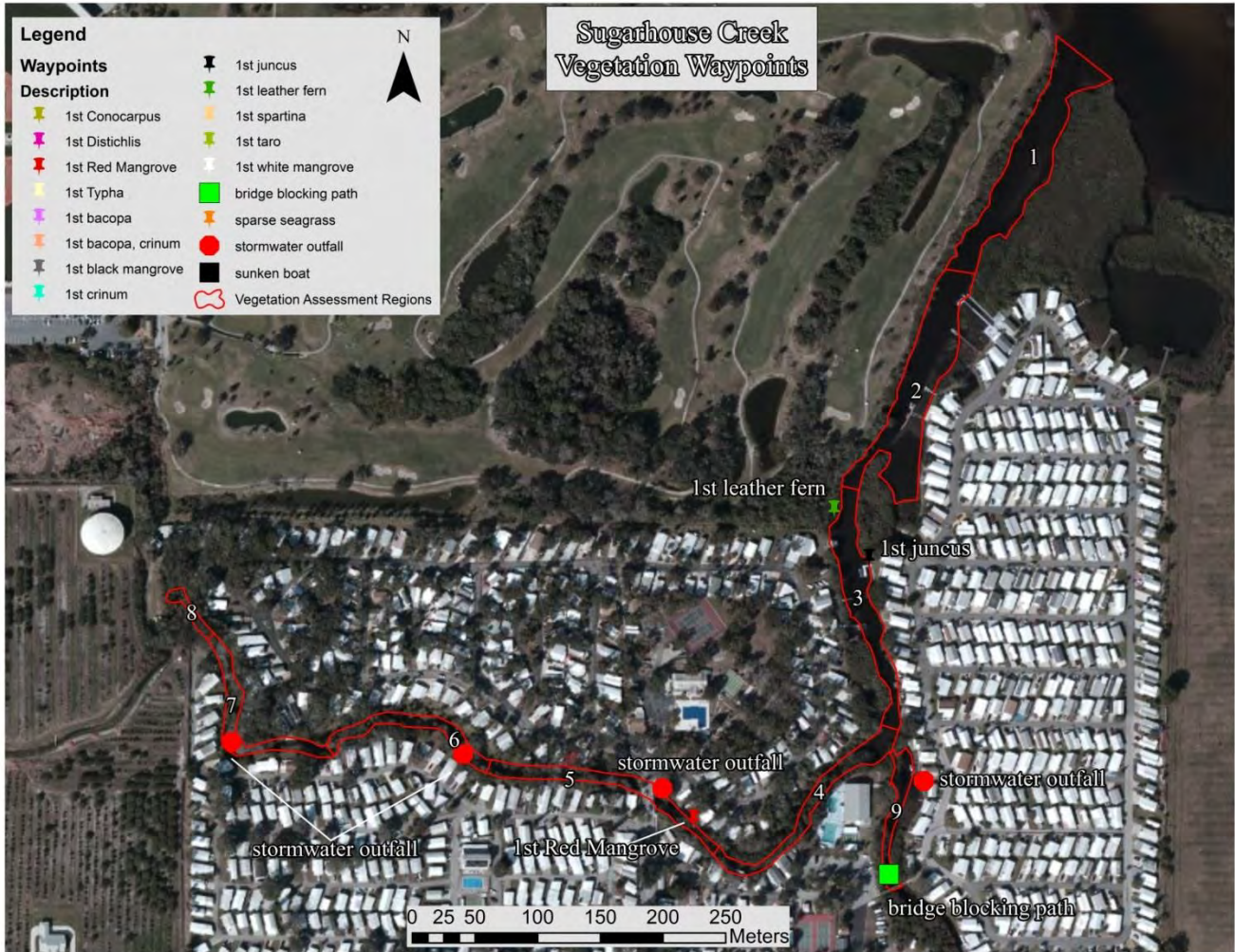


Figure 38. Sugarhouse Creek Vegetation Waypoints

Table 9. Sugarhouse Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region									Regions Found
		1	2	3	4	5	6	7	8	9	
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	C	C	1	1	1	1	9
<i>Alternanthera philoxeroides</i>	Alligator Weed	1	1	1	1	1	1	1	1	1	8
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	C	C	1			C	7
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye		1	1	1	1	1	1	1		7
<i>Acrostichum danaeifolium</i>	Leather Fern			1	1	C	C	C	1		6
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	C	1				C	6
<i>Vitis rotundifolia</i>	Muscadine Grape				1	1	1	1	1	1	6
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace				1	1	1	1	1		5
<i>Quercus virginiana</i>	Virginia Live Oak					1	1	1	1	1	5
<i>Sabal palmetto</i>	Sabal Palm				1	1	1	1	1		5
<i>Carya aquatica</i>	Water Hickory					1	1	1	1		4
<i>Dioscorea bulbifera</i>	Air Potato					1	1	1	1		4
<i>Xanthosoma sagittifolium</i>	Arrowleaf Elephant's Ear					1	1	1	1		4
<i>Panicum maximum</i>	Guneagrass					1	1	1	1		4
<i>Billbergia pyramidalis</i>	Foolproofplant					1	1	1	1		4
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen					1	1	1	1		4
<i>Erythrina herbacea</i>	Coralbeans						1	1	1		3
<i>Eupatorium capillifolium</i>	Dog Fennel		1		1	1					3
<i>Saccharum officinarum</i>	Sugarcane						1	1	1		3
<i>Quercus laurifolia</i>	Laurel oak						1	1	1		3
<i>Ruellia simplex</i>	Britton's Wild Petunia					1	1	1			3
<i>Avicennia germinans</i>	Black Mangrove	1	1								2
<i>Juncus roemerianus</i>	Needle Rush, Black Rush		C	1						1	3
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia							1	1		2
<i>Melia azedarach</i>	Chinaberry Tree							1	1		2
<i>Ricinus communis</i>	Castorbean							1	1		2
<i>Sansevieria hyacithoides</i>	Bowstring Hemp						1	1			2
<i>Abrus precatorius</i>	Rosary Pea							1			1
<i>Bidens alba</i>	White Beggar Ticks							1			1
<i>Casuarina equisetifolia</i>	Australian Pine			1							1
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam						1				1
<i>Crinum americanum</i>	Swamp lily							1			1
<i>Distichlis spicata</i>	Salt Grass		1								1
<i>Eclipta alba (prostrata)</i>	False Daisy, Yerba De Tajo				1						1
<i>Mikania scandens</i>	Climbing Hempvine							1			1
<i>Myrica cerifera</i>	Wax Myrtle									1	1
<i>Panicum repens</i>	Torpedo Grass						1				1
<i>Polygonum hydropiperoides</i>	Swamp Smartweed						1				1
<i>Pontederia cordata</i>	Pickerel Weed						1				1
<i>Senna spp</i>	Senna						1				1
<i>Rumex verticillatus</i>	Swamp Dock						1				1
<i>Spartina alterniflora</i>	Salt Marsh Grass									1	1
<i>Taxodium ascendens</i>	Pond Cypress						1				1
<i>Thelypteris interupta</i>	Tri-vented Fern							1			1
<i>Typha spp.</i>	Cattails						1				1
<i>Urochloa mutica</i>	Para Grass						1				1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Sugarhouse Creek. Figure 39 shows the bottom hardness raster for Sugarhouse Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 39. Sugarhouse Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Sugarhouse Creek had a mean depth of 2.06 feet and a maximum depth of 4.71 feet. A total of 7.26 acres of creek was mapped during the assessment. At the time of assessment, Sugarhouse Creek contained an estimated 3,302,061 gallons of water in the study area. Figure 40 details the bathymetric mapping for Sugarhouse Creek showing the three depth stratum.



Figure 40. Sugarhouse Creek Bathymetric Stratum Map

Phillippi Creek Stream Assessment

Study Area

Phillippi Creek is located within a highly urbanized watershed. The majority of Phillippi Creek’s watershed has a land use of either residential or commercial resulting in a watershed LDI value of 6.3. The banks of the creek are sloping and the majority of the creek is not seawalled. Phillippi Creek becomes wider and deeper as you move downstream and is navigable for over 1.5 miles from Roberts Bay. This creek has the highest buffer LDI value of all the creeks in the study at 6.9 and has little natural or undisturbed habitat adjacent to the creek except at the mouth.

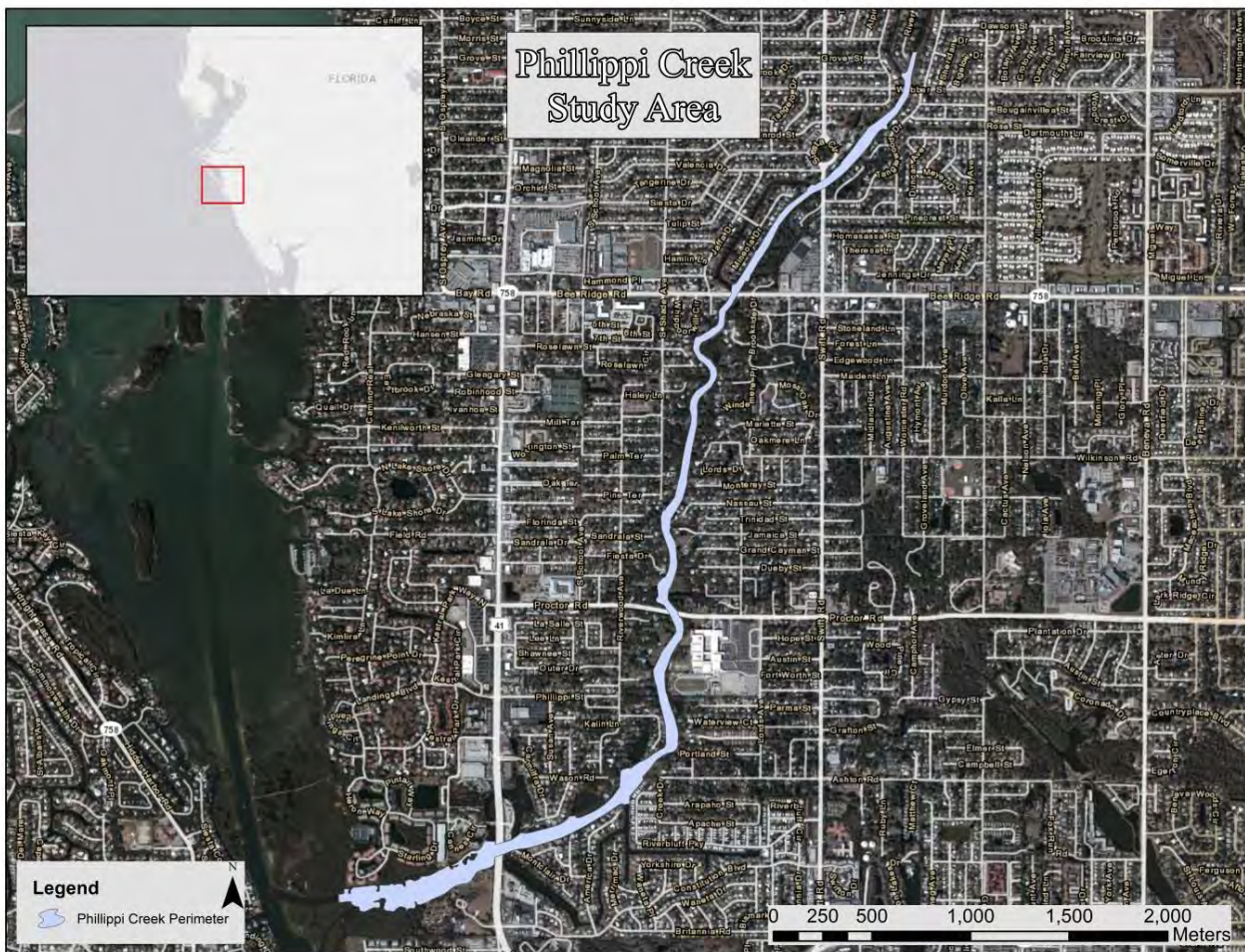


Figure 41. Overview of the Phillippi Creek Study Area

Vegetation Survey

The Phillippi Creek vegetation assessment encompassed 28 vegetation regions from the mouth in Roberts Bay to above Webber Street as shown in Figure 42. In these regions, 82 species of vegetation were identified. Regions 1 through 20 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The most upstream mangrove was *Laguncularia racemosa* in Region 26. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 11, becoming co-dominant in regions 24 and 26. Needle Rush (*Juncus roemerianus*) was first observed in Region 7 with the last occurrence in Region 17. Above Region 21 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 42. Overview of Phillippi Creek Vegetation Assessment Regions

Figure 43 shows the vegetation transition zone of Phillippi Creek indicating the most upstream Black Mangrove as well as the most downstream Leather Fern and *Spartina*. Based on the vegetation assessment data for Phillippi Creek, regions 1 through 16 would comprise the highest salinity and tidal influence zone, regions 17 through 22 would comprise the “mixing” zone and regions 23 through 28 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 10 through Table 12.

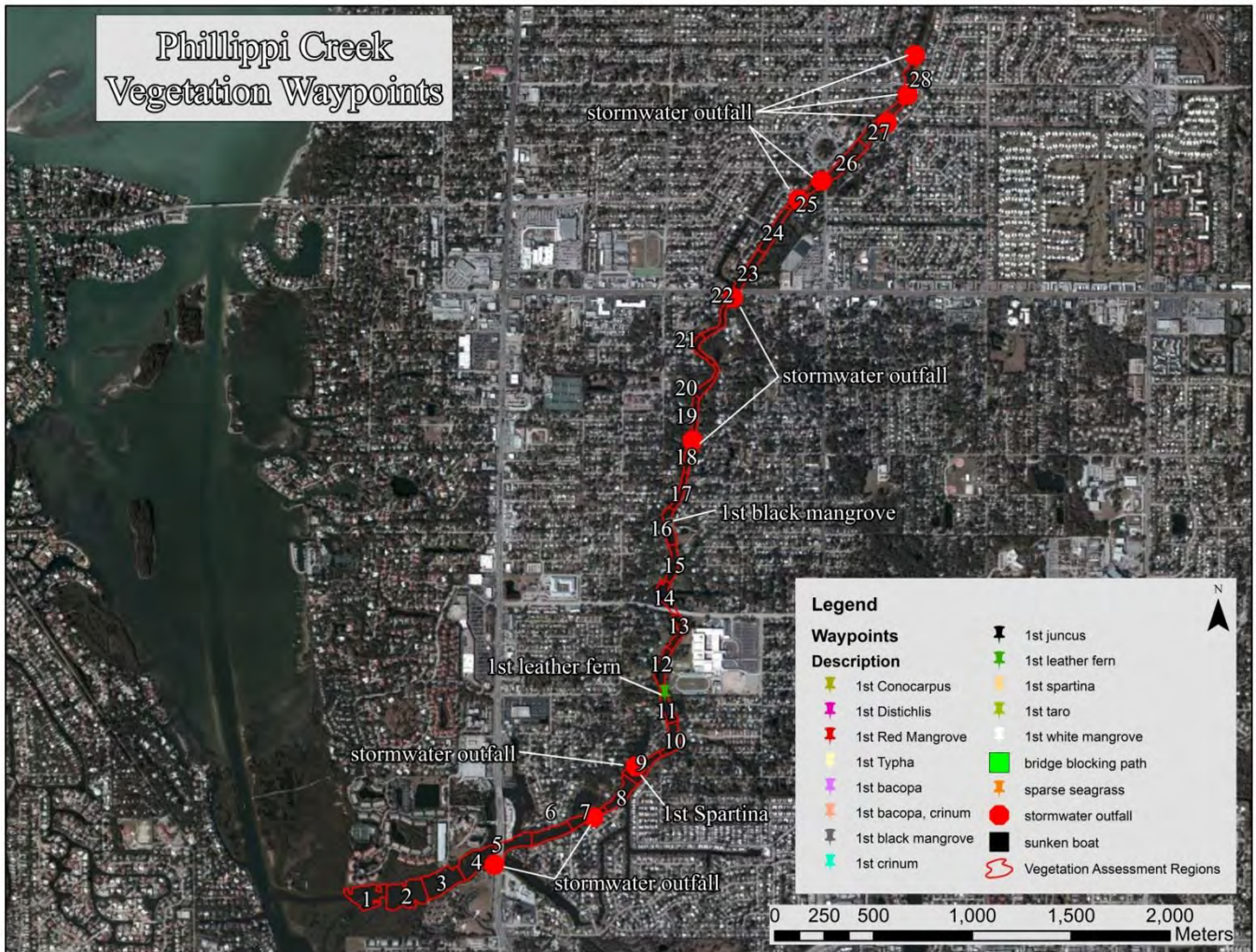


Figure 43. Phillippi Creek Vegetation Waypoints

Table 10. Phillippi Creek Vegetation Assessment List (Part 1)

Plant Species	Common Name	Sample Region																												Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
<i>Schinus terebinthifolius</i>	Brazilian Pepper			1	1	1	1	1	1	1	1	C	C	1	C	1	1	1	C	C	C	C	C	C	C	C	1	1	1	26
<i>Eichhornia crassipes</i>	Water Hyacinth	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25	
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	1	1	1	1	1	1	24		
<i>Quercus virginiana</i>	Virginia Live Oak				C	1	1	1	C	1	1	1	C	C	1	C	C	C	1	1	1	C	C	C	1	1	1	25		
<i>Alternanthera philoxeroides</i>	Alligator Weed			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21		
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21			
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20			
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	1	1	1	1	1	1	20			
<i>Acrostichum danaeifolium</i>	Leather Fern											1	1	1	1	1	1	1	1	1	1	1	1	1	C	1	18			
<i>Vitis rotundifolia</i>	Muscadine Grape			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18			
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15				
<i>Cupaniopsis anacardioides</i>	Carrotwood									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14				
<i>Iva frutescens</i>	Marsh Elder				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14				
<i>Sabal palmetto</i>	Sabal Palm		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14				
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12				
<i>Crinum americanum</i>	Swamp lily														1	1	1	1	1	1	1	1	1	1	12					
<i>Dioscorea bulbifera</i>	Air Potato			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12					
<i>Panicum repens</i>	Torpedo Grass							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	11					
<i>Myriophyllum aquaticum</i>	Parrot Feather							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10					
<i>Spartina alterniflora</i>	Salt Marsh Grass							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10					
<i>Coccoloba uvifera</i>	Seagrape				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9					
<i>Enterolobium contortisiliquum</i>	Earpod Tree									1	1	1	1	1	1	1	1	1	1	1	1	1	1	9						
<i>Parthenocissus quinquefolia</i>	Woodbine				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9						
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace															1	1	1	1	1	1	1	1	8						
<i>Dalbergia ecastaphyllum</i>	Coin Vine			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8						
<i>Juncus roemerianus</i>	Needle Rush, Black Rush						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8						
<i>Typha spp.</i>	Cattails												1	1	1	1	1	1	1	1	1	1	1	8						
<i>Amaranthus australis</i>	Southern Aramanth														1	1	1	1	1	1	1	1	1	6						
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen															1	1	1	1	1	1	1	1	6						
<i>Casuarina equisetifolia</i>	Australian Pine										1	1	1	1	1	1	1	1	1	1	1	1	1	5						
<i>Cyperus involucratus</i>	Umbrella flat sedge																	1	1	1	1	1	1	5						
<i>Distichlis spicata</i>	Salt Grass						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5						
<i>Juniperus virginiana</i>	Red Cedar			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5						

Table 11. Phillippi Creek Vegetation Assessment List (Part 2)

Plant Species	Common Name	Sample Region																												Regions Found	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca													1	1											1	1	1			5
<i>Pluchea rosea</i>	Rosy Camphorweed															1	1									1			1	1	5
<i>Abrus precatorius</i>	Rosary Pea										1														1	1		1		4	
<i>Bambusa spp.</i>	Bamboo																		1					1				1		4	
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed														1		1	1										1		4	
<i>Koelreuteria elegans</i>	Golden Rain Tree									1	1						1											1		4	
<i>Melia azedarach</i>	Chinaberry Tree																				1	1			1			1		4	
<i>Phyla nodiflora</i>	Frog-fruit, Carpetweed, Turkey Tangle Fogfruit																1			1					1				1	4	
<i>Schoenoplectus tabernaemontani</i>	Softstem Bulrush																						1				1	1	1	4	
<i>Urochloa mutica</i>	Para Grass																						1			1		1	1	4	
<i>Borrichia frutescens</i>	Sea Oxeye				1	1				1																				3	
<i>Carya aquatica</i>	Water Hickory																								1	1	1			3	
<i>Eupatorium capillifolium</i>	Dog Fennel																						1				1	1		3	
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia											1		1					1											3	
<i>Ludwigia polypoides</i>	Water Primroses, Primrosewillow												1							1	1									3	
<i>Taxodium ascendens</i>	Pond Cypress																					1							1	3	
<i>Ampelopsis arborea</i>	Peppervine																										1		1	2	
<i>Bauhinia variegata</i>	Orchid Tree																											1	1	2	
<i>Cinnamomum camphora</i>	Camphor-tree																				1	1								2	
<i>Ficus aurea</i>	Strangler Fig																				1							1		2	
<i>Hydrilla verticillata</i>	Hydrilla, water thyme																										1		1	2	
<i>Leucaena leucocephala</i>	White leadtree																							1	1					2	
<i>Mikania scandens</i>	Climbing Hempvine																									1			1	2	
<i>Quercus geminata</i>	Sand Live Oak																					1	1							2	
<i>Quercus laurifolia</i>	Laurel oak																					1			1					2	
<i>Quercus nigra</i>	Water Oak																	1						1						2	
<i>Ricinus communis</i>	Castorbean																								1			1		2	
<i>Syzygium cumini</i>	Java Plum							1			1																			2	
<i>Aeschynomene indica</i>	Indian Joint Vetch				1																									1	

Table 12. Phillippi Creek Vegetation Assessment List (Part 3)

Plant Species	Common Name	Sample Region																												Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
<i>Bidens alba</i>	White Beggar Ticks						1																							1
<i>Commelina diffusa</i>	Dayflower																												1	1
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort																												1	1
<i>Ludwigia peruviana</i>	Peruvian Primrosewillow																												1	1
<i>Musa spp.</i>	Banana Tree						1																							1
<i>Myrica cerifera</i>	Wax Myrtle																												1	1
<i>Nephrolepis spp.</i>	Sword Fern																						1							1
<i>Grevillea robusta</i>	Silk Oak									1																				1
<i>Paederia foetida</i>	Skunk Vine																					1								1
<i>Paspalum repens</i>	Water Paspalum																									1				1
<i>Pistia stratoides</i>	Water Lettuce																												1	1
<i>Polygonum hydropiperoides</i>	Swamp Smartweed																												1	1
<i>Ruellia simplex</i>	Britton's Wild Petunia																												1	1
<i>Rumex verticillatus</i>	Swamp Dock																												1	1
<i>Sambucus canadensis</i>	Elderberry																												1	1
<i>Sapium sebiferum</i>	Popcorn Tree, Chinese Tallow Tree															1														1
<i>Senna spp</i>	Senna																						1							1
<i>Serenoa repens</i>	Saw palmetto																	1												1
<i>Sesbania herbacea</i>	Danglepod Sesban																												1	1
<i>Spartina bakerii</i>	Cordgrass																						1							1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Phillippi Creek. Figure 44 shows the bottom hardness raster for Phillippi Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

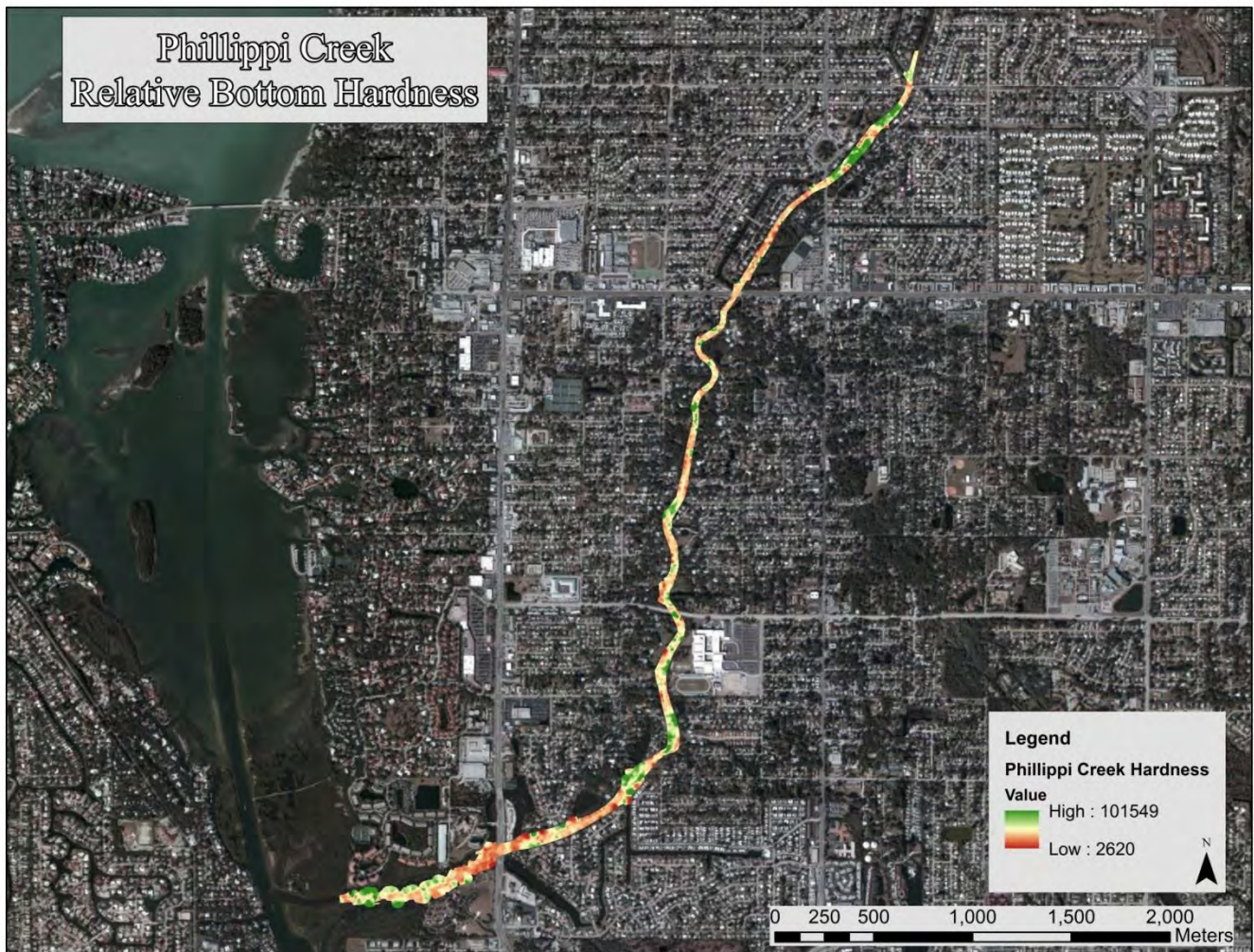


Figure 44. Phillippi Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Phillippi Creek had a mean depth of 3.50 feet and a maximum depth of 11.75 feet. A total of 78.62 acres of creek was mapped during the assessment. At the time of assessment, Phillippi Creek contained an estimated 62,075,018 gallons of water in the study area. Figure 45 and Figure 46 detail the bathymetric mapping for Phillippi Creek showing the three depth stratum.



Figure 45. Phillippi Creek Bathymetric Stratum Map (1 of 2)



Figure 46. Phillippi Creek Bathymetric Stratum Map (2 of 2)

South Creek Stream Assessment

Study Area

South Creek has a watershed that is largely within Oscar Scherer State Park making for a relatively unaltered and natural hydrologic system. The upstream portion of South Creek is comprised of both forested and non-forested uplands. The majority of development is at the mouth of South Creek beyond US-41 this is also where there are minimal seawalls present. South Creek is one of the more natural watersheds in the study with a watershed LDI value of 4.6 and a creek LDI value of 2.0.

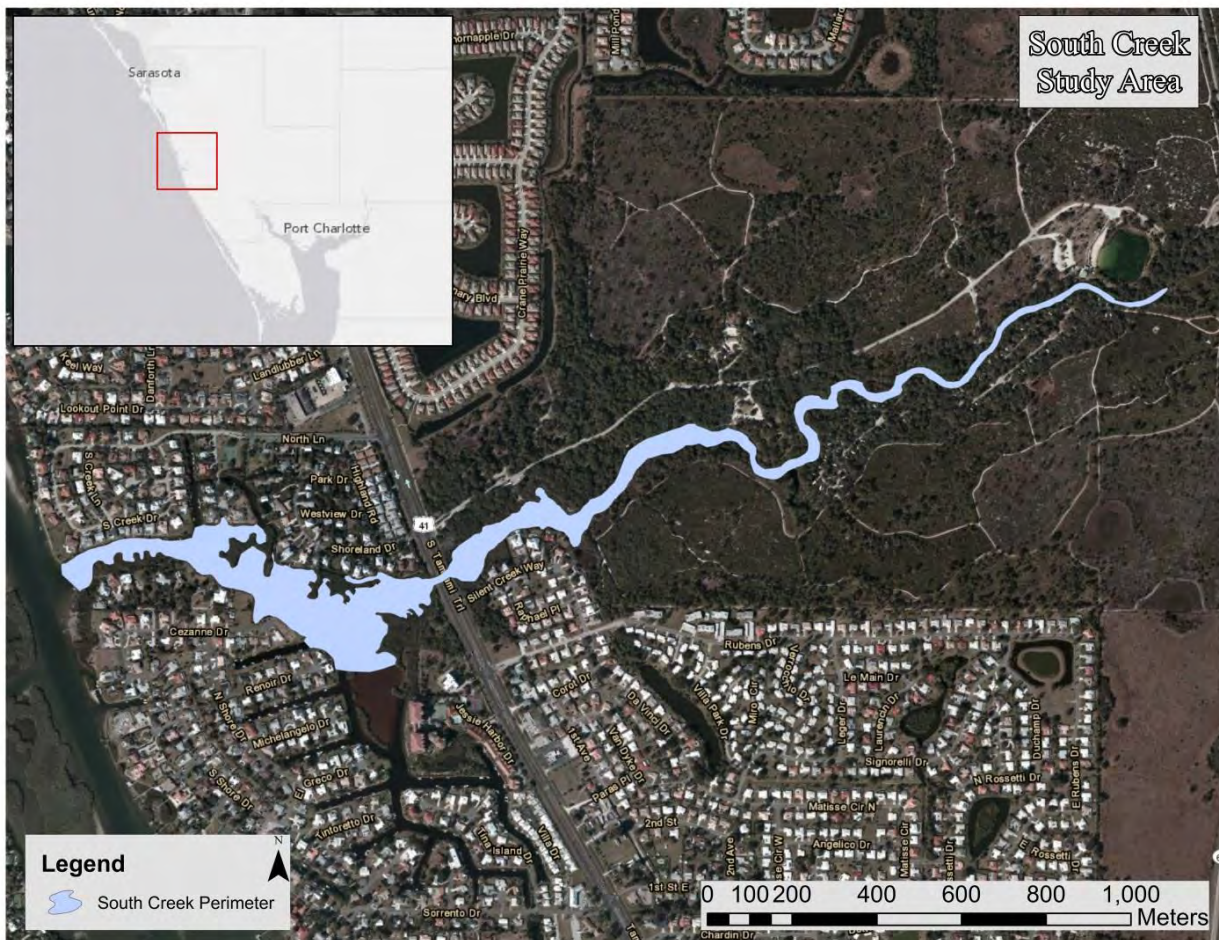


Figure 47. Overview of the South Creek Study Area

Vegetation Survey

The South Creek vegetation assessment encompassed 16 vegetation regions from the mouth in Blackburn Bay to upstream in Oscar Scherer State Park as shown in Figure 48. In these regions, 46 species of vegetation were identified. Regions 1 through 12 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia geminans*) with few other salt tolerant species present. The most upstream mangrove was *Avicennia geminans* in Region 15. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 6. Needle Rush (*Juncus roemerianus*) was first observed in Region 6 with the last occurrence in Region 14. Above Region 13 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 48. Overview of South Creek Vegetation Assessment Regions

Figure 49 shows the vegetation transition zone of South Creek indicating the most upstream *Juncus* as well as the most downstream Leather Fern, *Juncus* and *Spartina*. Based on the vegetation assessment data for South Creek, regions 1 through 4 would comprise the highest salinity and tidal influence zone, regions 5 through 12 would comprise the “mixing” zone and regions 13 through 16 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 13.

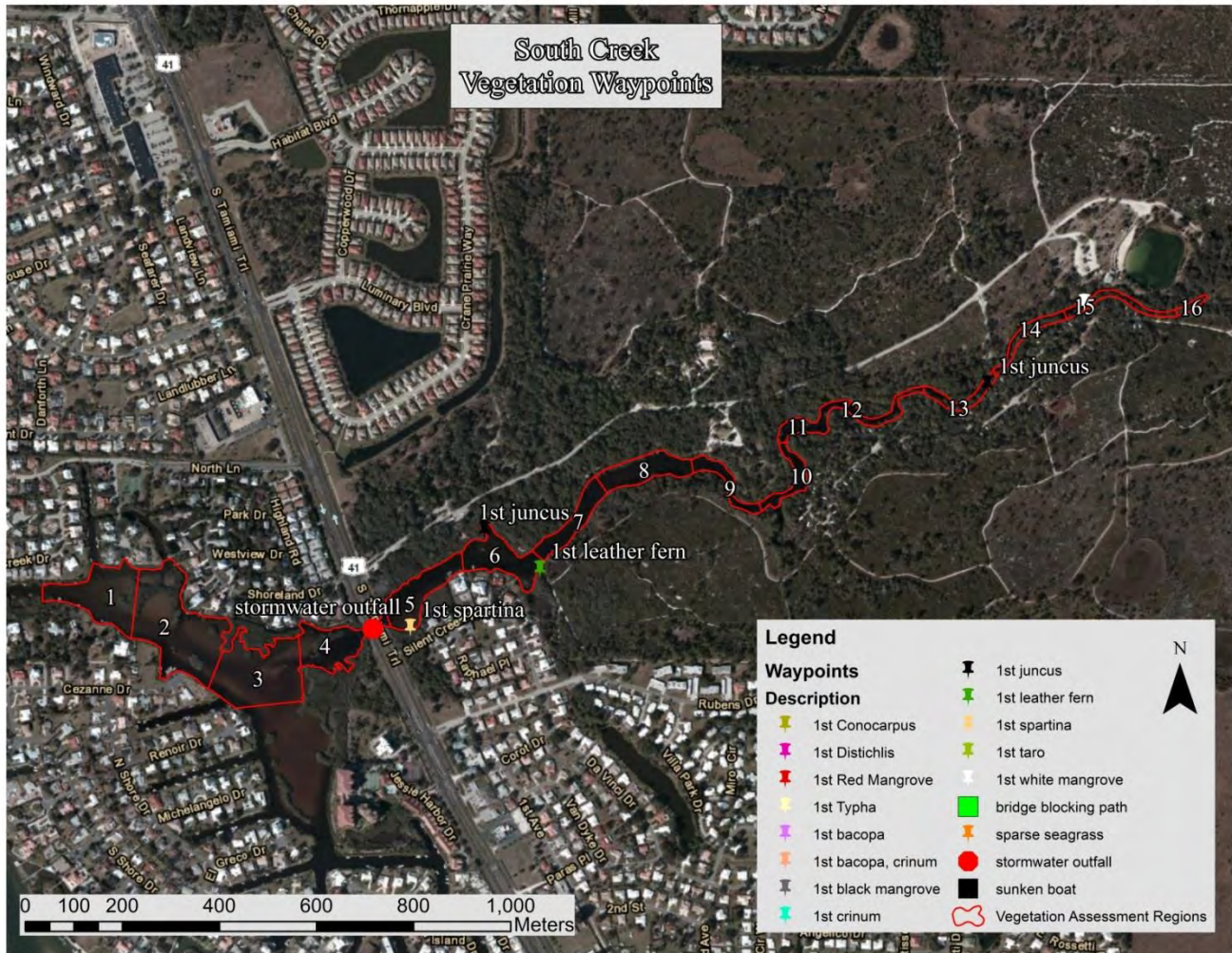


Figure 49. South Creek Vegetation Waypoints

Table 13. South Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
<i>Quercus virginiana</i>	Virginia Live Oak	1	1	1	1	C	C	C	C	C	C	C	1	C	C	C	16	
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	C	C	C	C	C	C	C	1	1	1		15	
<i>Sabal palmetto</i>	Sabal Palm	1	1	1	1	1	1	1	1	1	1	1	1	1	1		15	
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1	1	1	1	1	1	1	1	1	1	1		13	
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	C	C	C	C	C	1	1	1				12	
<i>Serenoa repens</i>	Saw palmetto					1	1	1	C	C	C	C	1	C	C	C	12	
<i>Acrostichum danaeifolium</i>	Leather Fern					1	1	1	1	1	1	1	1	1	1	1	11	
<i>Conocarpus erecta</i>	Buttonwood	1	1	1	1	1	1	1	1	1	1	1					11	
<i>Pinus spp</i>	Pine					1	1	1	1	1	1	1	1	1	1	1	11	
<i>Vitis rotundifolia</i>	Muscadine Grape					1	1	1	1	1	1	1	1		1	1	11	
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush		1		1	1	1	1	1	1	1	1					10	
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1							9	
<i>Juncus roemerianus</i>	Needle Rush, Black Rush					1	1	1	1	1	1	1	1	1			8	
<i>Myrica cerifera</i>	Wax Myrtle								1	1	1	1	1	1		1	7	
<i>Quercus laurifolia</i>	Laurel oak										1	1	1	1	1	1	6	
<i>Callicarpa americana</i>	American Beauty Berry								1			1	1	1		1	5	
<i>Juniperus virginiana</i>	Red Cedar	1				1	1	1	1								5	
<i>Iva frutescens</i>	Marsh Elder	1			1	1	1	1									4	
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace													1	1	1	3	
<i>Cyperus ligularis</i>	Flat Sedge				1	1								1			3	
<i>Parthenocissus quinquefolia</i>	Woodbine	1				1	1										3	
<i>Smilax auriculata</i>	Earleaf Greenbriar								1		1		1				3	
<i>Borrhchia frutescens</i>	Sea Oxeye				1					1	1						3	
<i>Ampelopsis arborea</i>	Peppervine				1											1	2	
<i>Eupatorium capillifolium</i>	Dog Fennel													1		1	2	
<i>Spartina alterniflora</i>	Salt Marsh Grass				1	1											2	
<i>Thelypteris denata</i>	Shield Fern													1	1		2	
<i>Abrus precatorius</i>	Rosary Pea				1												1	
<i>Andropogon glomeratus</i>	Bushy bluestem															1	1	
<i>Blechnum serrulatum</i>	Swamp Fern															1	1	
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle													1			1	
<i>Casuarina equisetifolia</i>	Australian Pine		1														1	
<i>Cephalanthus occidentalis</i>	Common Buttonbush															1	1	
<i>Distichlis spicata</i>	Salt Grass				1												1	
<i>Ipomoea pes-caprae</i>	Railroad Vine		1														1	
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca			1													1	
<i>Paspalum repens</i>	Water Paspalum															1	1	
<i>Pluchea rosea</i>	Rosy Camphorweed											1					1	
<i>Quercus nigra</i>	Water Oak															1	1	
<i>Rapanea punctata</i>	Myrsine									1							1	
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow														1		1	
<i>Spartina bakerii</i>	Cordgrass									1							1	
<i>Typha spp.</i>	Cattails					1											1	
<i>Urochloa mutica</i>	Para Grass															1	1	
<i>Ximenia americana</i>	Tallow Wood, Hog Plum										1						1	
<i>Schefflera actinophylla</i>	Australian Umbrella Tree	1															1	

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for South Creek. Figure 50 shows the bottom hardness raster for South Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 50. South Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, South Creek had a mean depth of 2.7 feet and a maximum depth of 8.4 feet. A total of 39.5 acres of creek was mapped during the assessment. At the time of assessment, South Creek contained an estimated 25,269,730 gallons of water in the study area. Figure 51 details the bathymetric mapping for South Creek showing the three depth stratum.



Figure 51. South Creek Bathymetric Stratum Map

Forked Creek Stream Assessment

Study Area

Forked Creek has a mostly urban watershed. The watershed becomes less urban above US-41 where there is a mix of agriculture and natural lands which results in a watershed LDI value of 3.6. The majority of Forked Creek is channelized and navigable via boat. Forked Creek's banks have been either developed to have rip-rap or to seawalls. There are some areas of mangroves on downstream portion of the creek where there are also some shallower areas which have not been dredged. The urbanized and non-natural areas immediately surrounding Forked Creek gives it a buffer LDI value of 6.0.



Figure 52. Overview of the Forked Creek Study Area

Vegetation Survey

The Forked Creek vegetation assessment encompassed 18 vegetation regions from the mouth in Lemon Bay to the near Keyway Road as shown in Figure 53. In these regions, 36 species of vegetation were identified. Most of the regions were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present until Region 18 which was dominated by a variety of freshwater and upland species. The majority of the Forked Creek study area was lined by seawall which is reflected in the lack of a dominant species in Regions 5, 6, 9, 10, 14 and 15. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 17. Needle Rush (*Juncus roemerianus*) was first observed in Region 1 with the last occurrence in Region 10. Above region 17 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 53. Overview of Forked Creek Vegetation Assessment Regions

Figure 54 shows the vegetation transition zone of Forked Creek indicating the first occurrence of *Juncus* and *Spartina* in Region 1 as well as the first occurrences of Leather Fern in Regions 13 and 17. Based on the available vegetation assessment data Regions 1 through 9 would comprise the highest salinity and tidal influence zone, Regions 10 through 12 and Regions 14 through 16 would comprise the “mixing” zone and Regions 13 and 17 through 18 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 14.



Figure 54. Forked Creek Vegetation Waypoints

Table 14. Forked Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																		Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	1	1	D	D	1	1	C	C	C	1		C	D	1	17
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	16
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1		1	1	1		1	C	C	C			C	1	1	13
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1				1					1			1	1	1	9
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye			1	1		1	1					1	1			1	1	1	9
<i>Pinus spp</i>	Pine	1	1	1		1	1											1	1	7
<i>Quercus virginiana</i>	Virginia Live Oak	1	1	1	1				1			1	1							7
<i>Coccoloba uvifera</i>	Seagrape			1	1		1	1				1	1							6
<i>Vitis rotundifolia</i>	Muscadine Grape			1	1								1	1				1	1	6
<i>Juncus roemerianus</i>	Needle Rush, Black Rush	1	1	1					1		1									5
<i>Spartina alterniflora</i>	Salt Marsh Grass	1	1	1	1												1			5
<i>Conocarpus erecta</i>	Buttonwood	1	1	1	1															4
<i>Sabal palmetto</i>	Sabal Palm	1	1	1	1															4
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush												1				1	1		3
<i>Distichlis spicata</i>	Salt Grass			1		1		1												3
<i>Myrica cerifera</i>	Wax Myrtle	1																1	1	3
<i>Acrostichum danaeifolium</i>	Leather Fern													1				1	1	3
<i>Callicarpa americana</i>	American Beauty Berry													1				1		2
<i>Cyperus ligularis</i>	Flat Sedge					1			1											2
<i>Iva frutescens</i>	Marsh Elder	1			1															2
<i>Parthenocissus quinquefolia</i>	Woodbine				1		1													2
<i>Quercus laurifolia</i>	Laurel oak																	1	1	2
<i>Ampelopsis arborea</i>	Peppervine											1								1
<i>Casuarina equisetifolia</i>	Australian Pine												1							1
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam																		1	1
<i>Cupaniopsis anacardioides</i>	Carrotwood													1						1
<i>Cyperus involucratus</i>	Umbrella flat sedge												1							1
<i>Dioscorea bulbifera</i>	Air Potato																		1	1
<i>Eupatorium capillifolium</i>	Dog Fennel				1															1
<i>Halodule wrightii</i>	Shoal-grass	1																		1
<i>Ipomoea pes-caprae</i>	Railroad Vine				1															1
<i>Juncus scirpoides</i>	Needlepod Rush																	1		1
<i>Lygodium japonicum</i>	Japanese Climbing Fern								1											1
<i>Nephrolepis spp.</i>	Sword Fern																		1	1
<i>Opuntina humifusa</i>	Pricklypear Cactus				1															1
<i>Ruppia martima</i>	Widgeon-grass	1																		1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Forked Creek. Figure 55 shows the bottom hardness raster for Forked Creek. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 55. Forked Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Forked Creek had a mean depth of 3.33 feet and a maximum depth of 8.37 feet. A total of 47.8 acres of creek was mapped during the assessment. At the time of assessment, Forked Creek contained an estimated 45,924,792 gallons of water in the study area. Figure 56 details the bathymetric mapping for Forked Creek showing the three depth stratum.



Figure 56. Forked Creek Bathymetric Stratum Map

Buck Creek Stream Assessment

Study Area

Buck Creek is located in a relatively unimpaired watershed. Most of the creek is bordered by mangroves. A small area of medium density residential property borders a portion of the downstream area of Buck Creek. A golf course that is buffered by mangroves is located within the downstream portion of the creek. Buck Creek’s watershed has a LDI value of 3.8 and the area immediately surrounding the creek with a buffer LDI value of 1.2.



Figure 57. Overview of the Buck Creek Study Area

Vegetation Survey

The Buck Creek vegetation assessment encompassed 12 vegetation regions from the mouth in Lemon Bay to the Boundary Road crossing as shown in Figure 58. In these regions, 21 species of vegetation were identified. Regions 1 through 12 were dominated by mangroves (*Rhizophora mangle* and *Laguncularia racemosa*) with few other salt tolerant species present. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 11. Needle Rush (*Juncus roemerianus*) was first observed in Region 7, becoming dominant in Regions 11 and 12. Buck Creek showed a vegetation community influenced by salinity and tides throughout the study area.

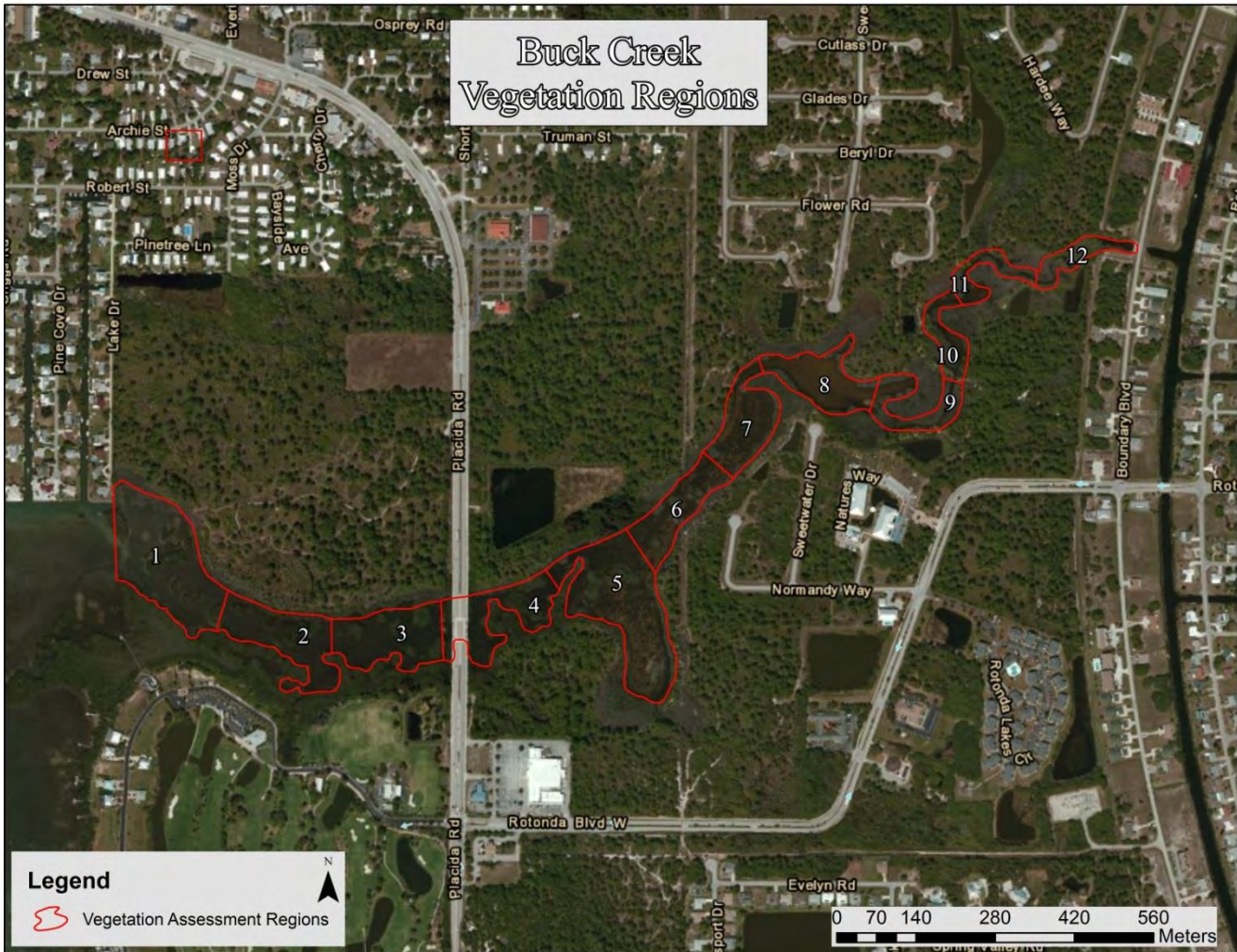


Figure 58. Overview of Buck Creek Vegetation Assessment Region

Figure 59 shows the vegetation transition zone of Buck Creek indicating the most downstream Leather Fern and *Juncus* as well as the upstream extent of seagrass. Based on the vegetation assessment data for Buck Creek, Regions 1 through 7 would comprise the highest salinity and tidal influence zone, Regions 8 through 11 would comprise the “mixing” zone and Region 12 would comprise the least salinity dominant zone. The vegetation assessment species lists are shown in Table 15.

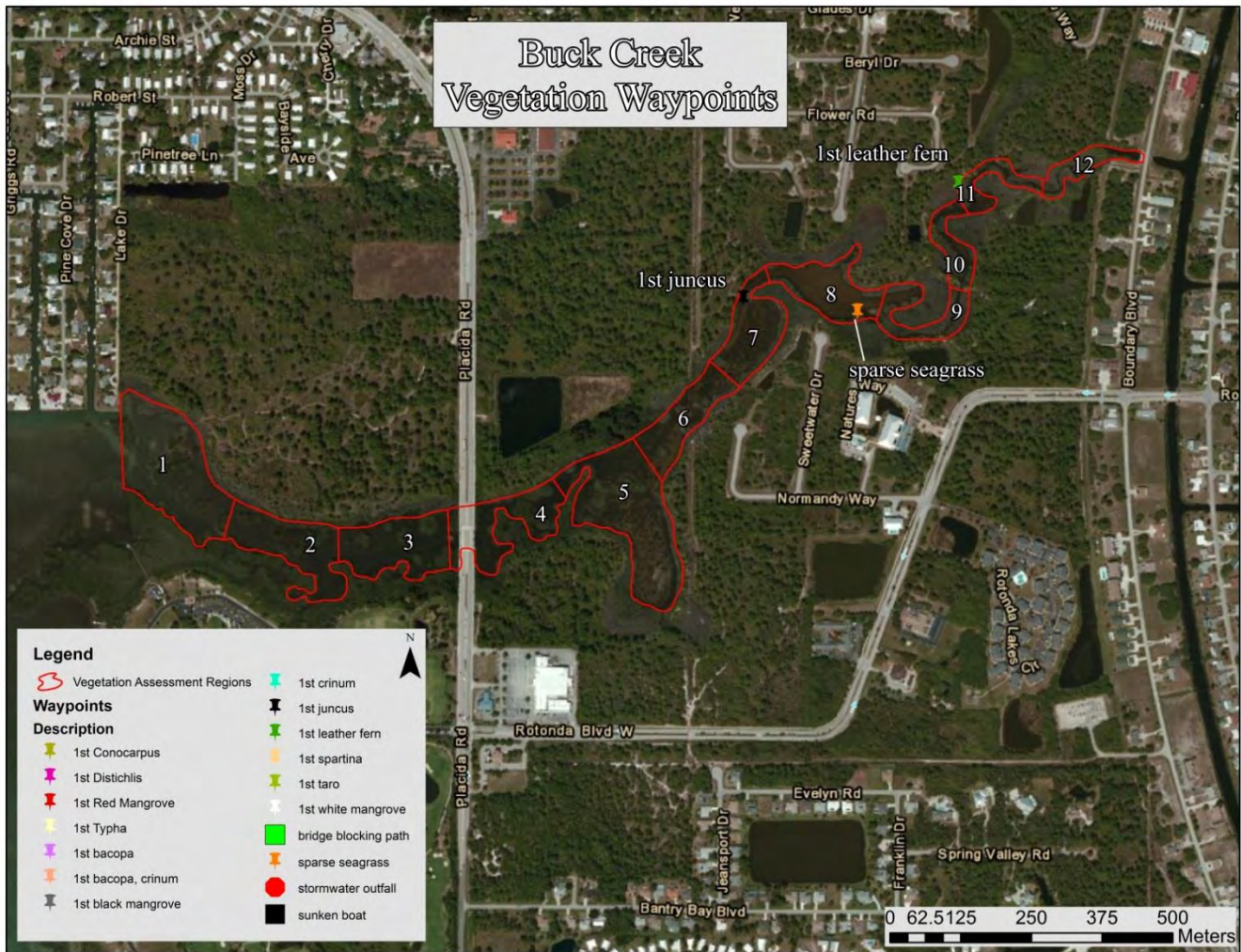


Figure 59. Buck Creek Vegetation Waypoint Map

Table 15. Buck Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region												Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	12
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	C	C	C	C	C		1	1
<i>Pinus spp</i>	Pine	1	1	1	1	1	1	1	1	1	1	1	1	12
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	D	D	D	D	D	D	C	C	12
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1	1	1	1	1	1	1	1	1	12
<i>Quercus virginiana</i>	Virginia Live Oak	1		1	1	1	1	1	1	1	1	1	1	11
<i>Sabal palmetto</i>	Sabal Palm	1	1	1		1	1	1	1	1	1	1		10
<i>Halodule wrightii</i>	Shoal-grass	1	1	1	1	1	1	1	1					8
<i>Conocarpus erecta</i>	Buttonwood					1	1			1	1	1	1	6
<i>Juncus roemerianus</i>	Needle Rush, Black Rush							1			1	C	C	4
<i>Myrica cerifera</i>	Wax Myrtle							1			1	1		3
<i>Serenoa repens</i>	Saw palmetto									1	1	1		3
<i>Acrostichum danaeifolium</i>	Leather Fern											1	1	2
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush							1			1			2
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace											1	1	2
<i>Casuarina equisetifolia</i>	Australian Pine					1	1							2
<i>Batis maritima</i>	Saltwort	1												1
<i>Distichlis spicata</i>	Salt Grass							1						1
<i>Iva frutescens</i>	Marsh Elder	1												1
<i>Spartina alterniflora</i>	Salt Marsh Grass							1						1
<i>Vitis rotundifolia</i>	Muscadine Grape										1			1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Buck Creek. Figure 60 shows the bottom hardness raster for Buck Creek. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 60. Buck Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Buck Creek had a mean depth of 1.73 feet and a maximum depth of 5.35 feet. A total of 36.94 acres of creek was mapped during the assessment. At the time of assessment, Buck Creek contained an estimated 14,652,632 gallons of water in the study area. Figure 61 details the bathymetric mapping for Buck Creek showing the three depth stratum.



Figure 61. Buck Creek Bathymetric Stratum Map

Whidden Creek Stream Assessment

Study Area

Whidden Creek is the most natural unaltered creek of the creeks selected for sampling. Located at the southern portion of Cape Haze in Charlotte County, it is highly tidally influenced creek with little fresh water input. Whidden Creek’s watershed is mostly comprised of mangroves, marsh lands, and other natural features and has a watershed LDI value of 2.2. The only development near Whidden Creek is to northwest and is a residential area with no structures on it. The buffer LDI score for Whidden Creek is the lowest of all creeks in the study with a value of 1.

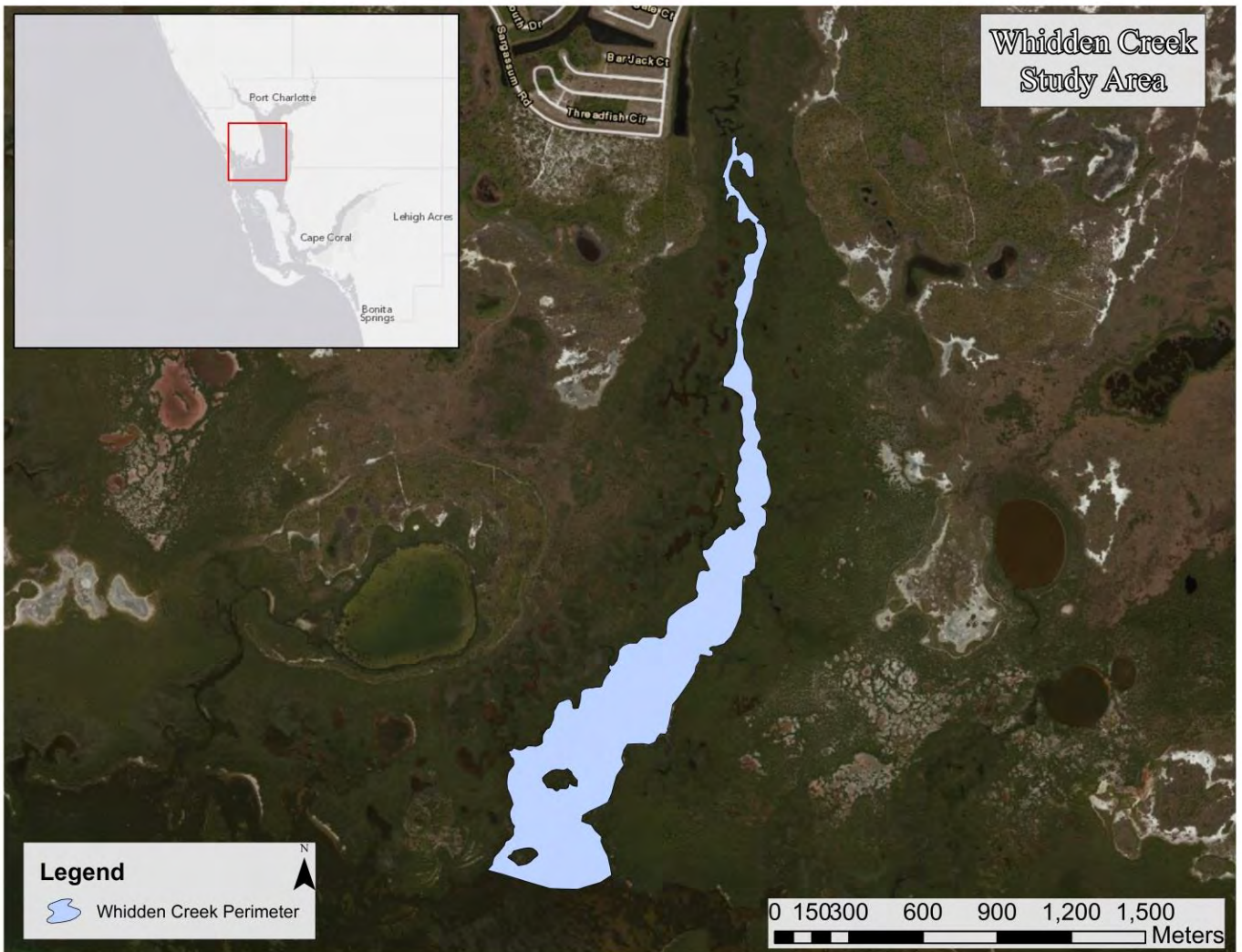


Figure 62. Overview of the Whidden Creek Study Area

Vegetation Survey

The Whidden Creek vegetation assessment encompassed 18 vegetation regions from the mouth in Cape Haze as shown in Figure 63. In these regions, 5 species of vegetation were identified. Regions 1 through 18 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*). The only observed vegetation gradient in the study area was a change in species of seagrasses. Turtle Grass (*Thalassia testudinum*) was present in regions 1 through 3. Widgeon Grass (*Ruppia maritima*) was present in regions 1 through 14. Above Region 14 there was no more submerged vegetation observed.



Figure 63. Overview of Whidden Creek Vegetation Assessment Regions

Figure 64 shows the vegetation transition zone of Whidden Creek indicating the most upstream seagrass. Based on the vegetation assessment data for Whidden Creek, regions 1 through 3 would comprise the highest salinity and tidal influence zone due to the presence of Turtle Grass, regions 4 through 14 would comprise the “mixing” zone due to the presence of Widgeon Grass and regions 15 through 18 would comprise the least saltwater dominant zone. The vegetation assessment species list is shown in Table 16.

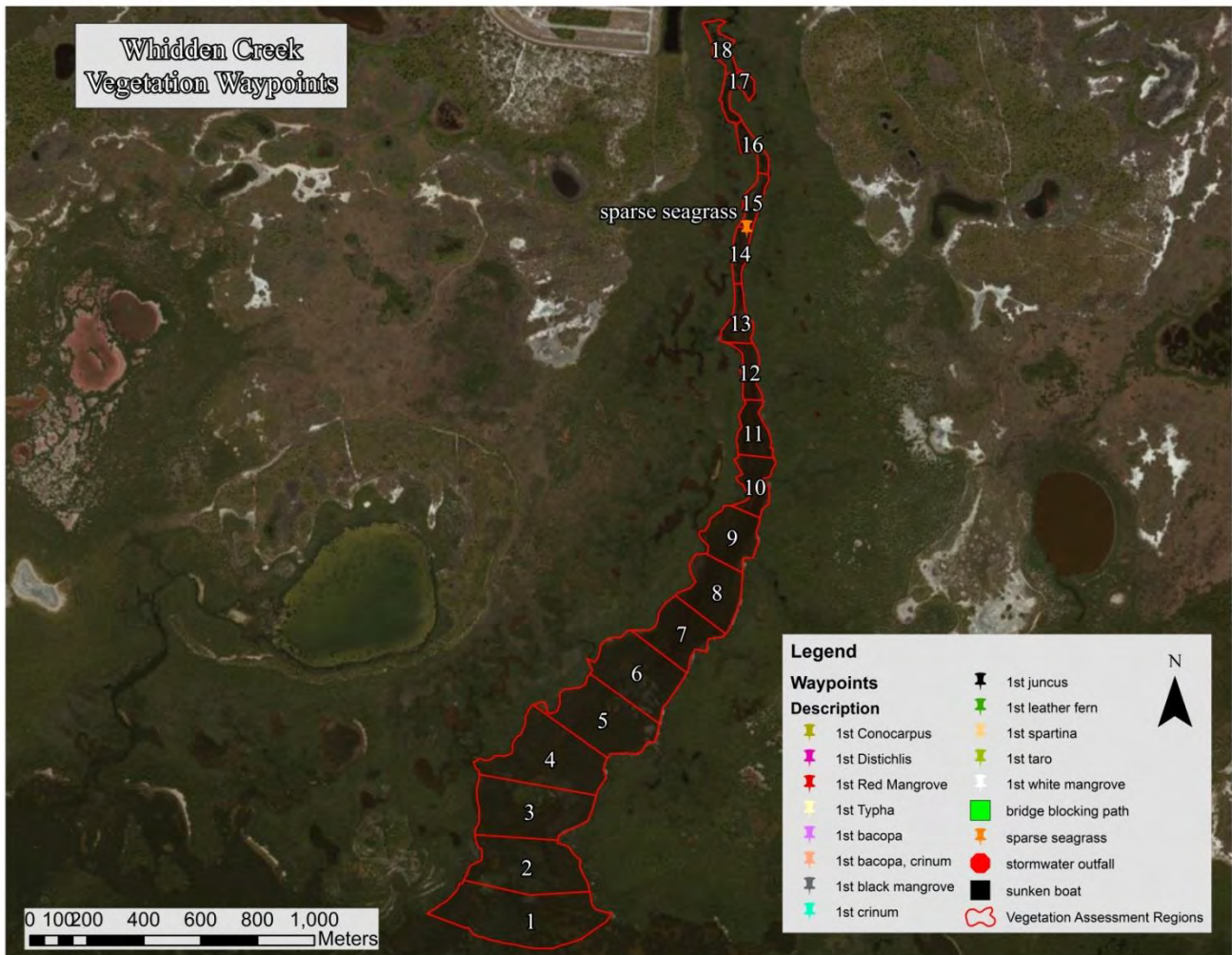


Figure 64. Whidden Creek Vegetation Waypoints

Table 16. Whidden Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																	Regions Found	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	18
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	18
<i>Ruppia maritima</i>	Widgeon Grass	1	1	1	1	1	1	1	1	1	1	1	1	1						14
<i>Thalassia testudinum</i>	Turtle-grass	1	1	1																3

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Whidden Creek. Figure 65 shows the bottom hardness raster for Whidden Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

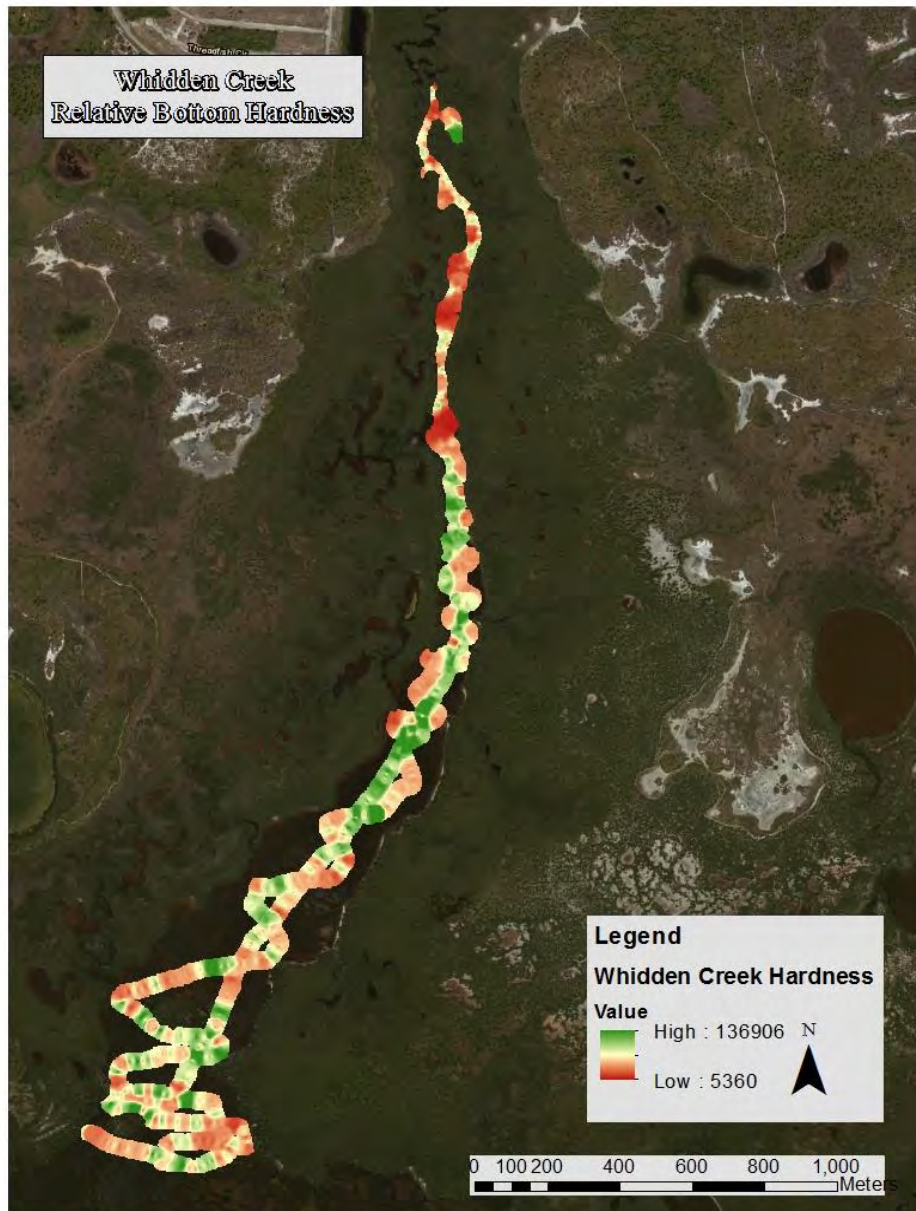


Figure 65. Whidden Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Whidden Creek had a mean depth of 1.35 feet and a maximum depth of 5.19 feet. A total of 144.95 acres of creek was mapped during the assessment. At the time of assessment, Whidden Creek contained an estimated 39,793,034 gallons of water in the study area. Figure 66 details the bathymetric mapping for Whidden Creek showing the three depth stratum.



Figure 66. Whidden Creek Bathymetric Stratum Map

Little Alligator Creek Stream Assessment

Study Area

Little Alligator Creek is located at the northern portion of Charlotte Harbor in Charlotte County. The watershed of Little Alligator Creek is highly urbanized with very little natural land upstream and has a watershed LDI value of 5.6. The hydrology has been altered to include weirs (the purple squares in the figure 1 below) and the system has been dredged and channelized. The lower portion of the creek is the most “unaltered” part of the system it includes natural banks, mangroves, marshes, and shallow water areas. The area immediately surrounding Little Alligator Creek contains natural wetland features resulting in a buffer LDI value of 3.3.

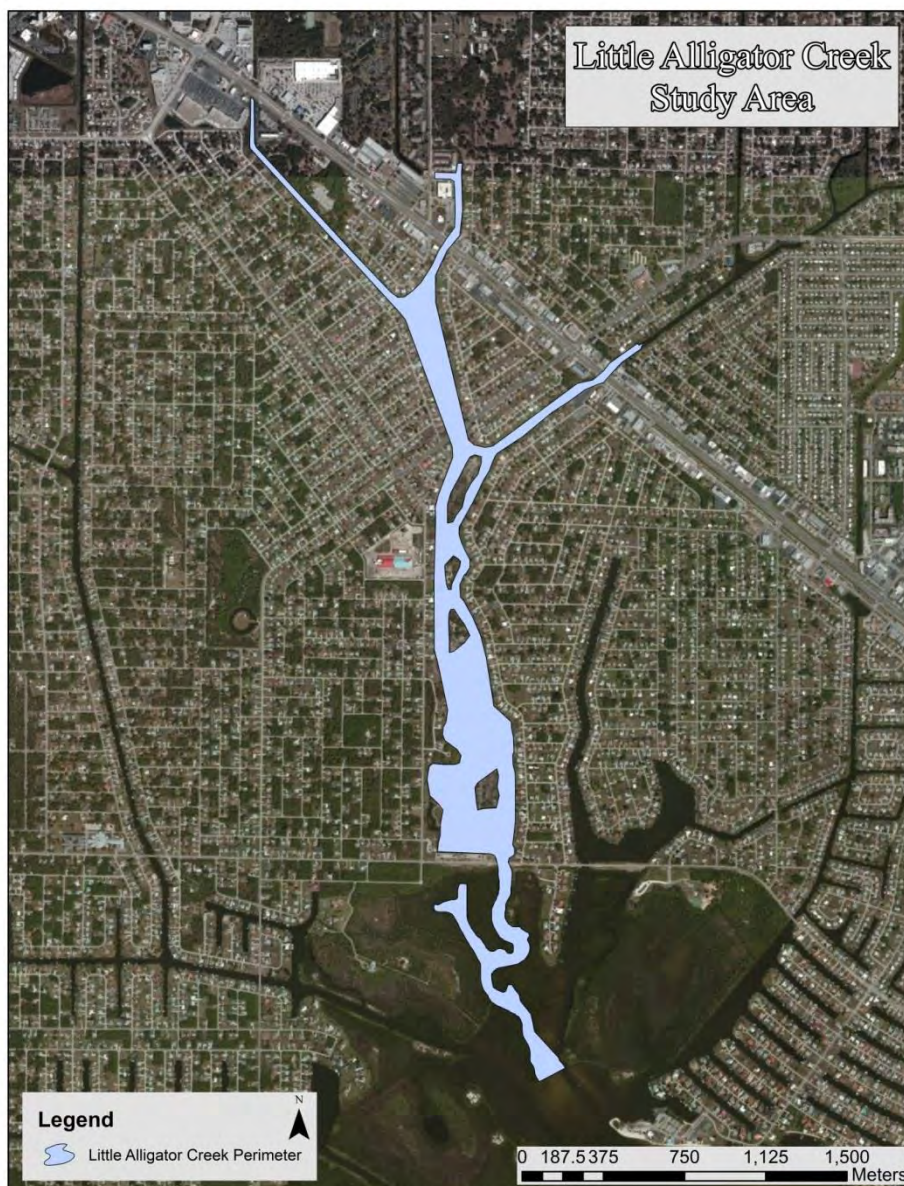


Figure 67. Overview of the Little Alligator Creek Study Area

Vegetation Survey

The Little Alligator Creek vegetation assessment encompassed 33 vegetation regions from the mouth in Charlotte Harbor to the weirs above US Highway 41 as shown in Figure 68. In these regions, 56 species of vegetation were identified. Regions 1 through 7 comprise the “natural” portion of this stream where it is dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia geminans*) with few other salt tolerant species present. Upstream from Region 7 the stream is heavily modified both physically by seawalls and hydraulically with weirs. This altered region has few remaining areas with vegetation. The most upstream mangrove was *Rhizophora mangle* in Region 31. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 20, becoming dominant in regions 20, 26, 27, 31, 32 and 33. Needle Rush (*Juncus roemerianus*) was first observed in Region 3 with the last occurrence in Region 21.

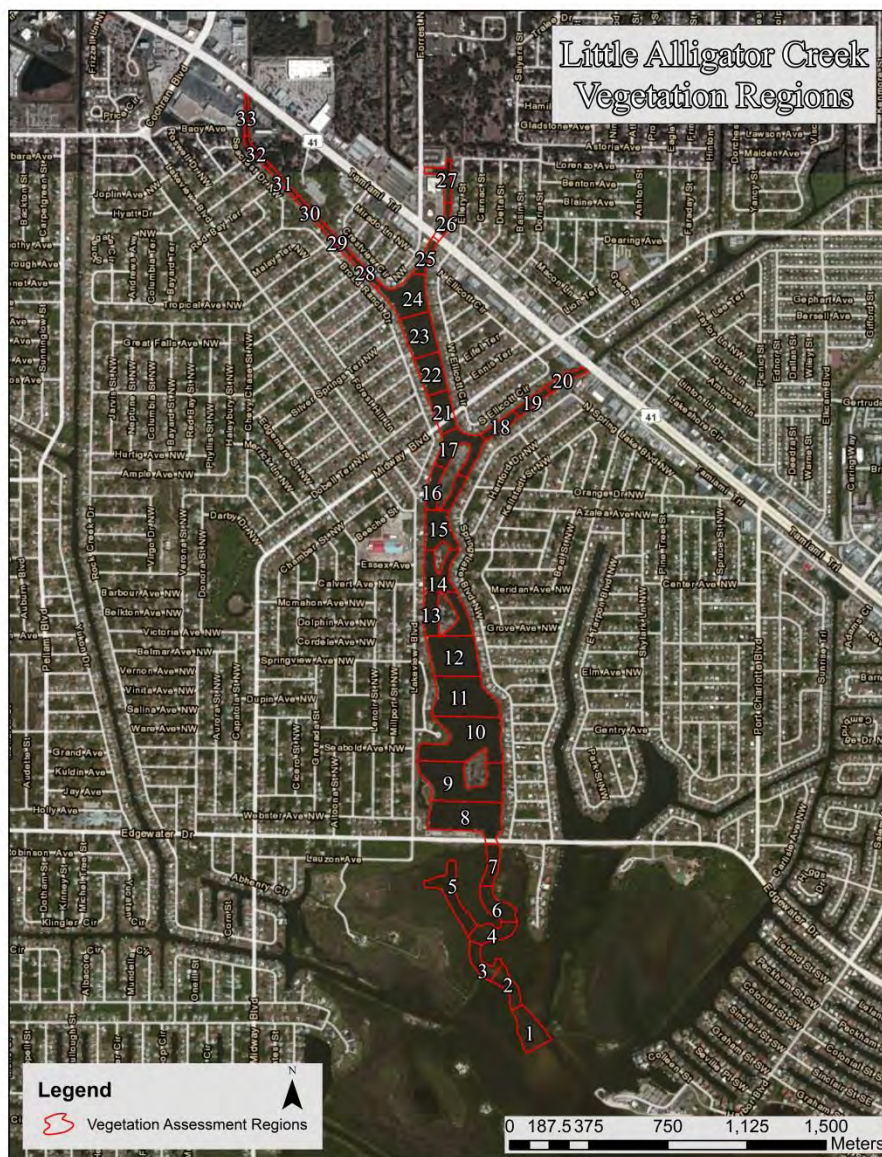


Figure 68. Overview of Little Alligator Creek Vegetation Assessment Regions

Figure 69 shows the vegetation transition zone of Little Alligator Creek indicating the most upstream Red Mangrove as well as the most downstream Leather Fern, *Typha*, *Crinum* and *Juncus*. Based on the vegetation assessment data for Little Alligator Creek, regions 1 through 8 would comprise the highest salinity and tidal influence zone, regions 9 through 17 would comprise the “mixing” zone and regions 18 through 33 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 17.

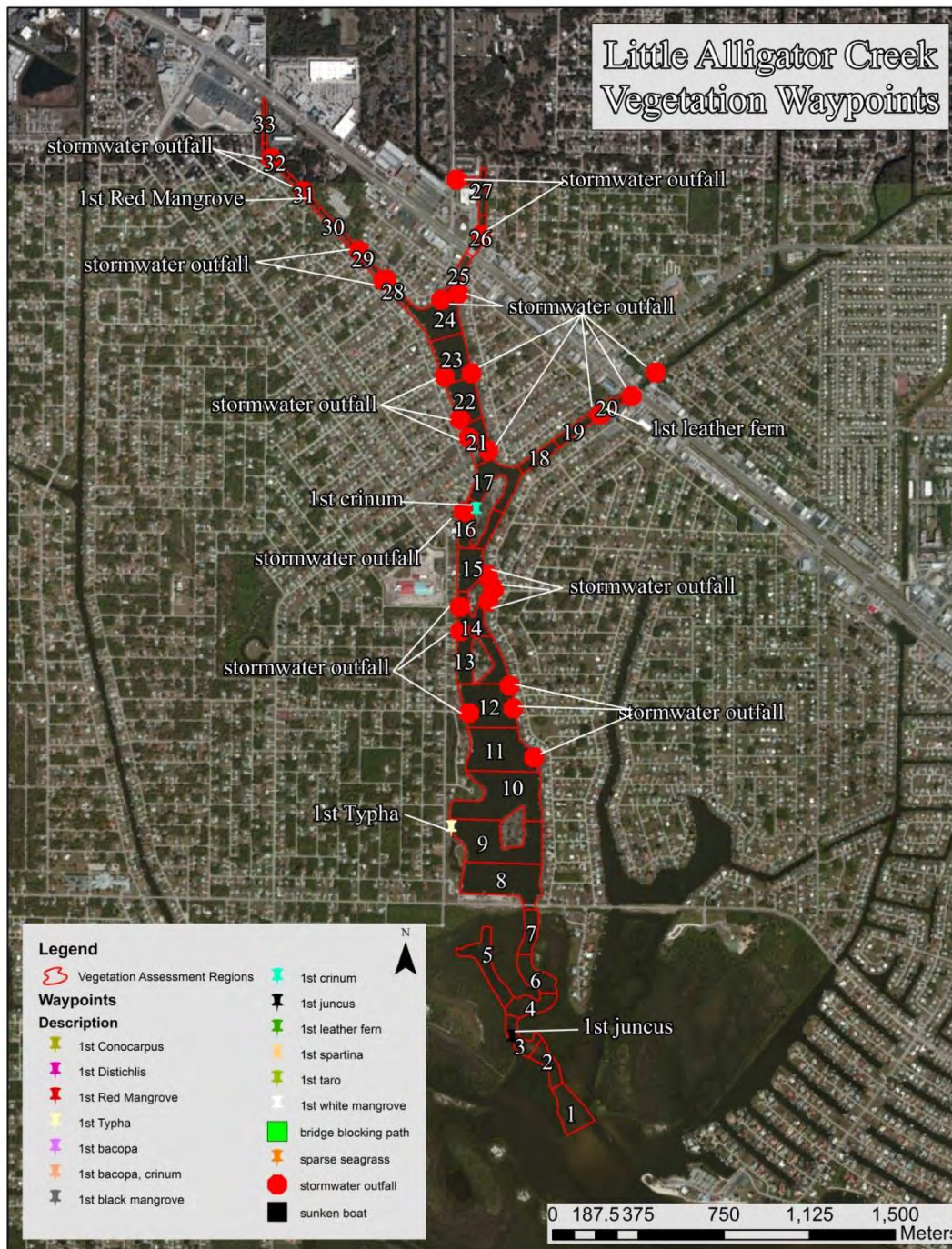


Figure 69. Little Alligator Creek Vegetation Waypoints

Table 17. Little Alligator Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																																Regions Found	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		33
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	D	D	D	C	C	C	1	C	1	1	C	D	1	1		1	1	1	1	C	1	1	1	1	1	1	1	1	1	30
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1			1	1	1	C	C	C	D	C	1	1	C	1	D	1	1	D		D	1	C	C	C	1	1	D	C	C	C	30
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
<i>Sabal palmetto</i>	Sabal Palm	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
<i>Typha spp.</i>	Cattails								1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	13	
<i>Vitis rotundifolia</i>	Muscadine Grape								1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	13	
<i>Quercus virginiana</i>	Virginia Live Oak							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12	
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush			1					1	1			1				1					1					1	1		1	1		10		
<i>Acrostichum danaeifolium</i>	Leather Fern																					D					C	C	1	1	1	C	C	C	9
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1																								9	
<i>Juncus roemerianus</i>	Needle Rush, Black Rush			1					1	1			1	1		1	1	1					1											9	
<i>Conocarpus erecta</i>	Buttonwood			1		1	1	1	1	C	1																							8	
<i>Crinum americanum</i>	Swamp lily																	1				1	1					1		1	1	1		7	
<i>Myrica cerifera</i>	Wax Myrtle								1				1															1		1		1	1	7	
<i>Panicum repens</i>	Torpedo Grass								1			1	1			1						1						1	1					7	
<i>Dalbergia ecastaphyllum</i>	Coin Vine	1						1	1	1		1	1																					6	
<i>Pinus spp</i>	Pine							1				1	1				1		1													1		6	
<i>Cupaniopsis anacardioides</i>	Carrotwood												1	1	1		1					1						1						5	
<i>Distichlis spicata</i>	Salt Grass			1				1	1		1				1																			5	
<i>Leucaena leucocephala</i>	White leadtree								1	1						1																		5	
<i>Ampelopsis arborea</i>	Peppervine												1		1	1	1	1																4	
<i>Coccoloba uvifera</i>	Seagrape	1		1					1																									4	
<i>Cyperus involucratus</i>	Umbrella flat sedge											1	1															1	1					4	
<i>Alternanthera philoxeroides</i>	Alligator Weed																						1				1							3	
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed															1		1	1															3	
<i>Cyperus spp.</i>	Sedge											1	1	1																				3	
<i>Quercus laurifolia</i>	Laurel oak																											1		1		1		3	
<i>Blechnum serrulatum</i>	Swamp Fern								1			1																						2	
<i>Cyperus ligularis</i>	Flat Sedge											1				1																		2	
<i>Rhabdadenia biflora</i>	Mangrove Rubber Vine			1				1																										2	
<i>Schoenoplectus tabernaemontani</i>	Softstem Bulrush												1															1						2	
<i>Serenoa repens</i>	Saw palmetto														1		1																	2	
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar												1				1																	2	
<i>Spartina alterniflora</i>	Salt Marsh Grass								1	1																								2	
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye																						1											2	
<i>Taxodium ascendens</i>	Pond Cypress																											1	1					2	
<i>Ambrosia artemisiifolia</i>	Common Ragweed																	1																1	
<i>Andropogon virginicus var. glaucus</i>	Broom grass																1																	1	
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle																	1																1	
<i>Dioscorea bulbifera</i>	Air Potato																																	1	
<i>Eupatorium capillifolium</i>	Dog Fennel																																	1	
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort																																	1	
<i>Ipomoea pes-caprae</i>	Railroad Vine												1																					1	
<i>Iva frutescens</i>	Marsh Elder												1																					1	
<i>Juniperus virginiana</i>	Red Cedar																												1					1	
<i>Ludwigia octovalvis</i>	Mexican Primrosewillow, Long-stalked Ludwigia																																	1	
<i>Parthenocissus quinquefolia</i>	Woodbine																																	1	
<i>Pistia stratioides</i>	Water Lettuce																											1						1	
<i>Pluchea rosea</i>	Rosy Camphorweed									1																								1	
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow																																1	1	
<i>Sambucus canadensis</i>	Elderberry																												1					1	
<i>Sesuvium portulacastrum</i>	Shoreline Seapurslane								1																									1	
<i>Sapium sebiferum</i>	Popcorn Tree, Chinese Tallow Tree																																	1	
<i>Sarcostemma clausum</i>	White-vine																																	1	
<i>Spartina bakerii</i>	Cordgrass																																	1	
<i>Taxodium distichum</i>	Bald Cypress																																		1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Little Alligator Creek. Figure 70 shows the bottom hardness raster for Little Alligator Creek. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

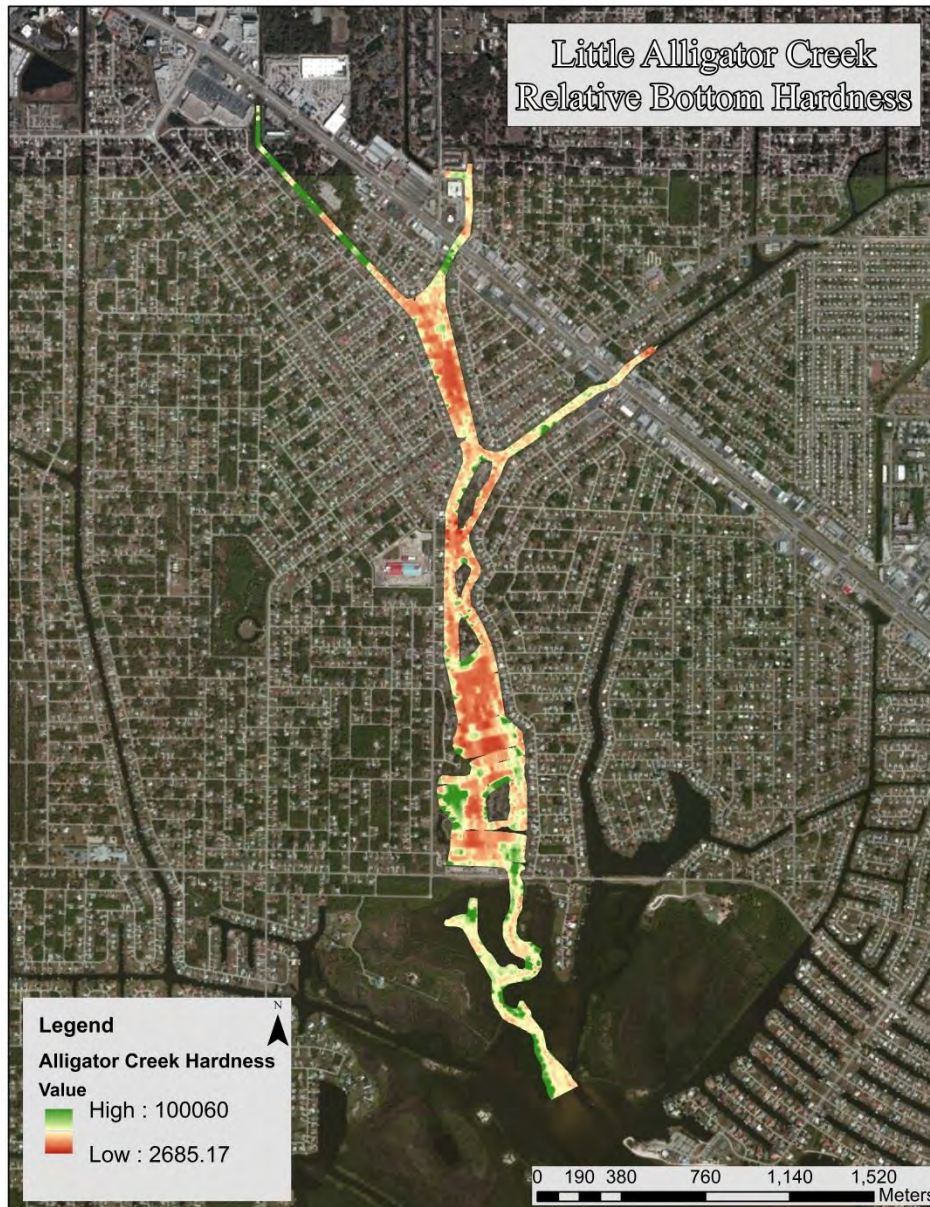


Figure 70. Little Alligator Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Little Alligator Creek had a mean depth of 3.99 feet and a maximum depth of 11.79 feet. A total of 168 acres of creek was mapped during the assessment. At the time of assessment, Little Alligator Creek contained an estimated 222,887,978 gallons of water in the study area. Figure 71 details the bathymetric mapping for Little Alligator Creek showing the three depth stratum.

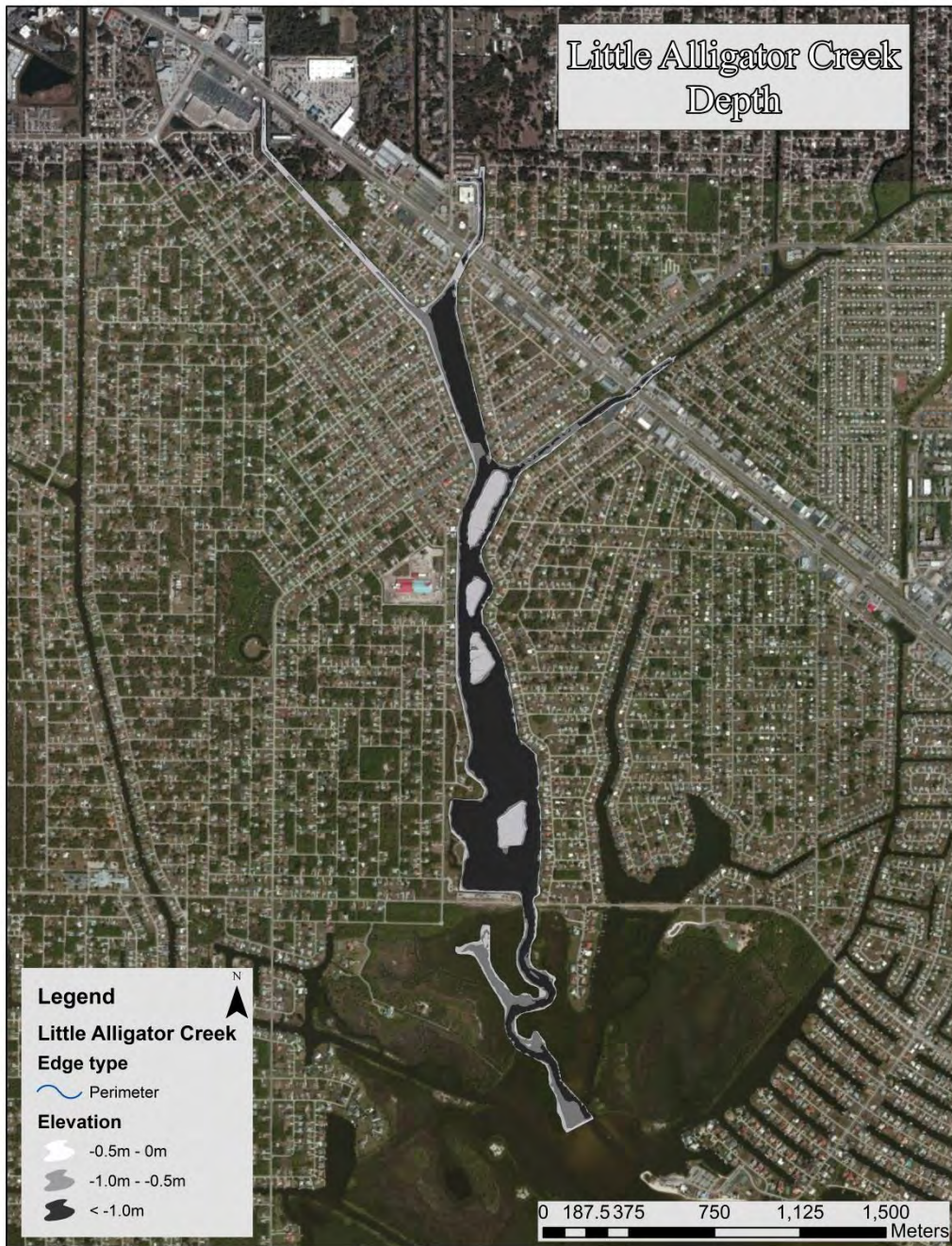


Figure 71. Little Alligator Creek Bathymetric Stratum Map

Powell Creek Stream Assessment

Study Area

Powell Creek is a tributary to the Caloosahatchee River, is located a mile and a half upstream the Caloosahatchee River from Hancock Creek in Lee County. The watershed of Powell Creek has natural areas and mixed residential land uses with an LDI value of 5.7. The downstream portion of the creek is channelized and is navigable by boat having one side urbanized and the other being natural. The eastern branch of the upstream portion remains more naturally sloping but has a flood control structure on it. The western branch turns into a roadside drainage ditch for the N. Tamiami Trail. The immediate buffer area surrounding Powell creek is slightly more impacted than the watershed as a whole with an LDI value of 6.0.

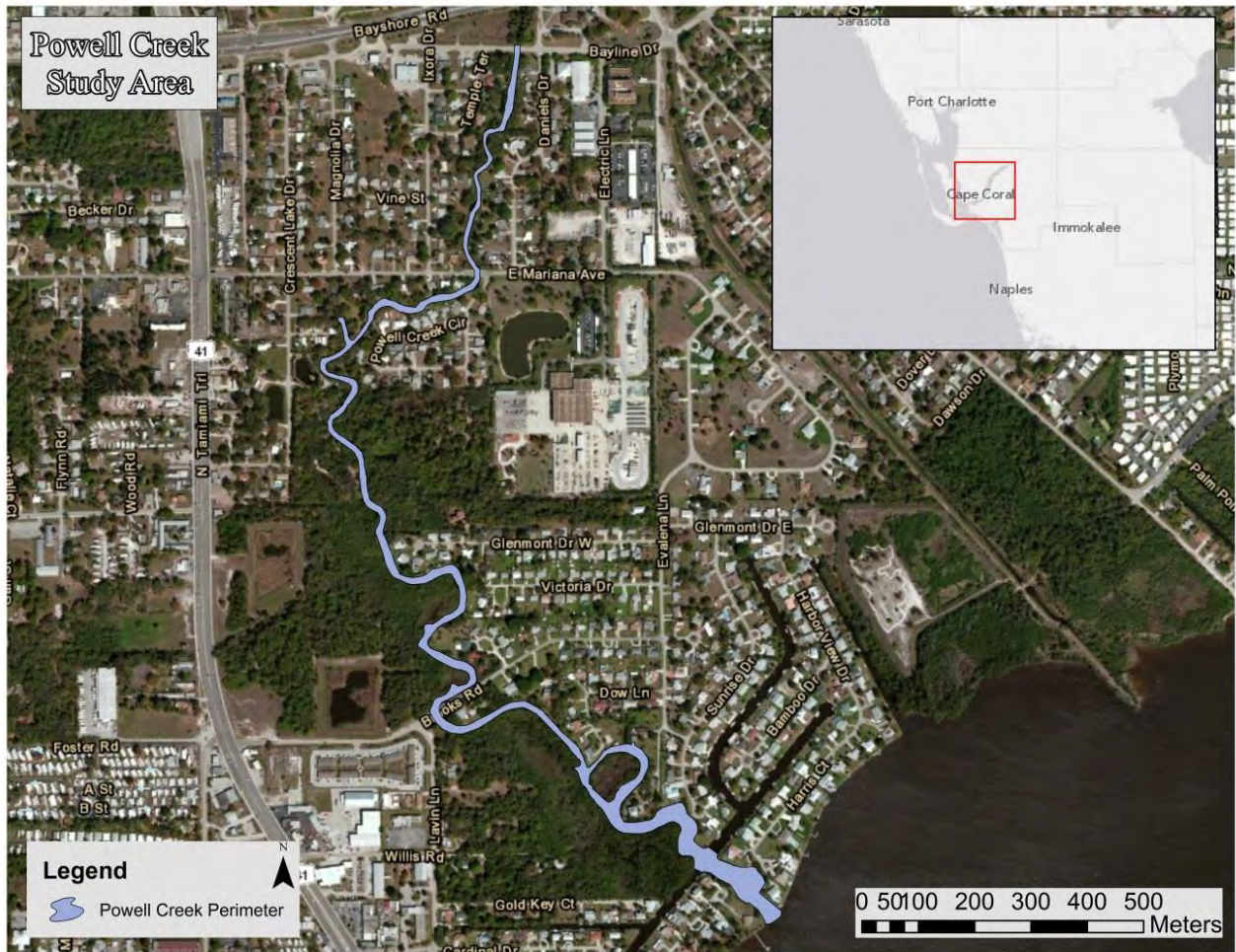


Figure 72. Overview of the Powell Creek Study Area

Vegetation Survey

The Powell Creek vegetation assessment encompassed 13 vegetation regions from the mouth in the tidal Caloosahatchee River to the overpass at Bayshore Road as shown in Figure 73. In these regions, 60 species of vegetation were identified. Regions 1 through 7 were dominated by mangroves (*Rhizophora mangle* and *Laguncularia racemosa*) with few other salt tolerant species present. The most upstream mangrove was *Rhizophora mangle* in Region 9. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 2, becoming dominant in regions 2 through 8.. Above Region 9 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 73. Overview of Powell Creek Vegetation Assessment Regions

Figure 74 shows the vegetation transition zone of Powell Creek indicating the most upstream Red Mangrove as well as the most downstream Leather Fern. Based on the vegetation assessment data for Powell Creek, regions 1 through 4 would comprise the highest salinity and tidal influence zone, regions 5 through 9 would comprise the “mixing” zone and regions 10 through 13 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 18.



Figure 74. Powell Creek Vegetation Waypoints

Table 18. Powell Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region													Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Acrostichum danaeifolium</i>	Leather Fern		C	C	C	C	C	C	1	1	1	1	1	1	12
<i>Quercus laurifolia</i>	Laurel oak		1	1		1	1	1	1	1	1	1	1	1	11
<i>Crinum americanum</i>	Swamp lily			1	1	1	1		1	1	1	1	1	1	10
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1	C	1	C	1					1	10
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye			1	1	1	1		1	1	1	1	1	1	10
<i>Ficus aurea</i>	Strangler Fig						1	1	1	1	1	1	1	1	8
<i>Panicum repens</i>	Torpedo Grass		1	1	1	1		1	1		1	1			8
<i>Rhizophora mangle</i>	Red Mangrove	D	C	C	C	C	C	C	1						8
<i>Alternanthera philoxeroides</i>	Alligator Weed						1	1	1	1	1	1	1	1	7
<i>Senna spp</i>	Senna						1	1	1	1	1		1	1	7
<i>Colocasia esculenta</i>	Wild Taro, Dasheen, Coco Yam						1	1	1	1	D	D	1		7
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush					1		1	1	1	1		1		6
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle							1	1	1	1	1	1	1	6
<i>Dioscorea bulbifera</i>	Air Potato							1	1	1	1	1	1	1	6
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia							1	1	1	1	1	1	1	6
<i>Ulmus americana</i>	American Elm			1	1	1				1	1	1			6
<i>Annona glabra</i>	Pond Apple		1			C	C	1	1						5
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace			1							1	1	1	1	5
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1			1	1							5
<i>Ruellia simplex</i>	Britton's Wild Petunia								1	1	1	1	1	1	5
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen								1	1	1	1	1	1	5
<i>Thespesia populnea</i>	Seaside Mahoe					1	1	C	1	1					5
<i>Schoenoplectus californicus</i>	Giant Bulrush					1				1	1	1			4
<i>Taxodium distichum</i>	Bald Cypress							1	1	1				1	4
<i>Mikania scandens</i>	Climbing Hempvine							1	1	1					3
<i>Persea palustris</i>	Swampbay							1	1	1					3
<i>Pistia stratioides</i>	Water Lettuce		1						1	1					3
<i>Sambucus canadensis</i>	Elderberry								1			1		1	3
<i>Symphytotrichum carolinianum</i>	Climbing Aster								1	1	1				3
<i>Urochloa mutica</i>	Para Grass										1	1	1		3
<i>Bidens alba</i>	White Beggar Ticks								1					1	2
<i>Casuarina equisetifolia</i>	Australian Pine	1												1	2
<i>Dalbergia ecastaphyllum</i>	Coin Vine	1		1											2
<i>Fraxinus caroliniana</i>	Pop Ash												1	1	2
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort								1	1					2
<i>Ludwigia leptocarpa</i>	Anglestem Primrosewillow										1		1		2
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca					1	1								2
<i>Myrica cerifera</i>	Wax Myrtle					1	1								2
<i>Pluchea rosea</i>	Rosy Camphorweed										1		1		2
<i>Schoenoplectus robustus</i>	Saltmarsh Bulrush			1		1									2
<i>Algal Spp.</i>	Algal Mats, Floating				1										1
<i>Ampelopsis arborea</i>	Peppervine		1												1
<i>Andropogon virginicus var. glaucus</i>	Broom grass							1							1
<i>Broussonetia papyrifera</i>	Paper Mulberry								1						1
<i>Ceratopteris thalictroides</i>	Water Sprite										1				1
<i>Cinnamomum camphora</i>	Camphor-tree				1										1
<i>Coccoloba uvifera</i>	Seagrape		1												1
<i>Cyperus involucreatus</i>	Umbrella flat sedge				1										1
<i>Eustachys glauca</i>	Saltmarsh Fingergrass					1									1
<i>Leucaena leucocephala</i>	White leadtree								1						1
<i>Ludwigia octovalvis</i>	Mexican Primrosewillow, Long-stalked Ludwigia									1					1
<i>Ludwigia polypoides</i>	Water Primroses, Primrosewillow									1					1
<i>Polygonum hydropiperoides</i>	Swamp Smartweed										1				1
<i>Rumex verticillatus</i>	Swamp Dock									1					1
<i>Sabal palmetto</i>	Sabal Palm			1											1
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow					1									1
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar					1									1
<i>Taxodium ascendens</i>	Pond Cypress									1					1
<i>Vitis rotundifolia</i>	Muscadine Grape					1									1
<i>Ximenia americana</i>	Tallow Wood, Hog Plum								1						1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Powell Creek. Figure 75 shows the bottom hardness raster for Powell Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 75. Powell Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Powell Creek had a mean depth of 3.66 feet and a maximum depth of 7.92 feet. A total of 10.16 acres of creek was mapped during the assessment. At the time of assessment, Powell Creek contained an estimated 8,606,125 gallons of water in the study area. Figure 76 and Figure 77 detail the bathymetric mapping for Powell Creek showing the three depth stratum.



Figure 76. Powell Creek Bathymetric Stratum Map



Figure 77. Powell Creek Bathymetric Stratum Map

Bear Branch Stream Assessment

Study Area

Bear Branch is located in the Charlotte Harbor Watershed in southern Charlotte County with its head waters in and unnamed canal at the end of Harborside Blvd and its mouth in Charlotte Harbor as shown in Figure 78. Bear Branch is also known as Key Point Canal which is located within a relatively unimpaired watershed. The downstream portion of Bear Branch is surrounded by mangroves. The upstream portion of Bear Branch is surrounded by a combination of open land and low density residential property. Bear Branch’s watershed has a LDI value of 2.7 and the area immediately surrounding the creek with a buffer LDI value of 2.1.



Figure 78. Overview of the Bear Branch Study Area

Vegetation Survey

The Bear Branch vegetation assessment encompassed 12 vegetation regions from the mouth in Charlotte Harbor to the culvert above Cape Horn Road as shown in Figure 79. In these regions, 48 species of vegetation were identified. Regions 1 through 10 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The most upstream mangrove was *Laguncularia racemosa* in Region 10. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 7, becoming co-dominant in regions 10 and 11. Needle Rush (*Juncus roemerianus*) was first observed in Region 9. Above the Cape Horn Road bridge in Region 10 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 79. Overview of Bear Branch Vegetation Assessment Regions

Figure 80 shows the vegetation transition zone of Bear Branch indicating the most upstream White Mangrove (*Laguncularia racemosa*) as well as the most downstream Leather Fern (*Acrostichum danaeifolium*), Waterhyssop (*Bacopa monnieri*), and Needle Rush (*Juncus roemerianus*). The locations of stormwater outfalls are also indicated on the map. Based on the vegetation assessment data for Bear Branch, regions 1 through 7 would comprise the highest salinity and tidal influence zone, regions 8 through 10 would comprise the “mixing” zone and regions 11 and 12 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 19.



Figure 80. Bear Branch Vegetation Waypoints

Table 19. Bear Branch Vegetation Assessment List

Plant Species	Common Name	Sample Region												Sites Found
		1	2	3	4	5	6	7	8	9	10	11	12	
<i>Sabal palmetto</i>	Sabal Palm	1	1	1	1	1	1	1	1	1	1	1	1	12
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	10
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	1	1			10
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	C	C	D	D	D	C			10
<i>Schinus terebinthifolius</i>	Brazilian Pepper				1	C	C	1	1	1	1	1	1	9
<i>Coccoloba uvifera</i>	Seagrape	1	1	1	1	1	1	1			1			8
<i>Dalbergia ecastaphyllum</i>	Coin Vine	1	1	1	1			1	1	1	1			8
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush				1	1	1	1	1	1	1	1	1	7
<i>Bidens alba</i>	White Beggar Ticks			1			1	1	1	1	1		1	7
<i>Conocarpus erectus</i>	Buttonwood	1	1	1	1	1	1	1						7
<i>Abrus precatorius</i>	Rosary Pea						1	1	1	1	1	1	1	6
<i>Acrostichum danaeifolium</i>	Leather Fern						1	1	1	C	C	1		6
<i>Alternanthera philoxeroides</i>	Alligator Weed				1			1	1	1	1	1	1	6
<i>Vitis rotundifolia</i>	Muscadine Grape						1	1	1	1	1	1	1	6
<i>Pinus elliotii</i>	Slash Pine							1	1	1	1	1	1	5
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace								1	1	1	1	1	4
<i>Myrica cerifera</i>	Wax Myrtle						1			1	1	1	1	4
<i>Quercus virginiana</i>	Virginia Live Oak						1	1	1	1				4
<i>Solidago sempervirens</i>	Goldenrod						1	1	1	1				4
<i>Andropogon virginicus var. glaucus</i>	Broom grass						1	1		1				3
<i>Caesalpinia bonduc</i>	Gray Nicker	1	1	1										3
<i>Callicarpa americana</i>	American Beauty Berry						1		1		1			3
<i>Eustachys glauca</i>	Saltmarsh Fingergrass			1					1	1				3
<i>Leucaena leucocephala</i>	White leadtree				1		1						1	3
<i>Micranthemum umbrosum</i>	Shade Mudflower, Baby's Tears									1	1	1		3
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye	1								1		1		3
<i>Urochloa mutica</i>	Para Grass									1	1	1		3
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed	1	1											2
<i>Cyperus ligularis</i>	Flat Sedge				1						1			2
<i>Distichlis spicata</i>	Salt Grass		1				1							2
<i>Panicum repens</i>	Torpedo Grass	1								1				2
<i>Parthenocissus quinquefolia</i>	Woodbine											1	1	2
<i>Quercus laurifolia</i>	Laurel oak											1	1	2
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar								1	1				2
<i>Thespesia populnea</i>	Seaside Mahoe				1		1							2
<i>Blechnum serrulatum</i>	Swamp Fern											1		1
<i>Casuarina equisetifolia</i>	Australian Pine					1								1
<i>Dichromena colorata</i>	White-Top Sedge									1				1
<i>Dioscorea bulbifera</i>	Air Potato												1	1
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort												1	1
<i>Juncus roemerianus</i>	Needle Rush, Black Rush								1					1
<i>Ludwigia leptocarpa</i>	Anglestem Primrosewillow												1	1
<i>Ludwigia spp.</i>	Water Primroses, Primrosewillow												1	1
<i>Mikania scandens</i>	Climbing Hempvine												1	1
<i>Salix caroliniana</i>	Carolina Willow; Coastalplain Willow												1	1
<i>Schoenoplectus tabernaemontani</i>	Softstem Bulrush									1				1
<i>Typha spp.</i>	Cattails												1	1
<i>Urena lobata</i>	Caesar's Weed												1	1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Bear Branch. Figure 81 shows the bottom hardness raster for Bear Branch. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling. The higher the hardness values the harder the substrate.

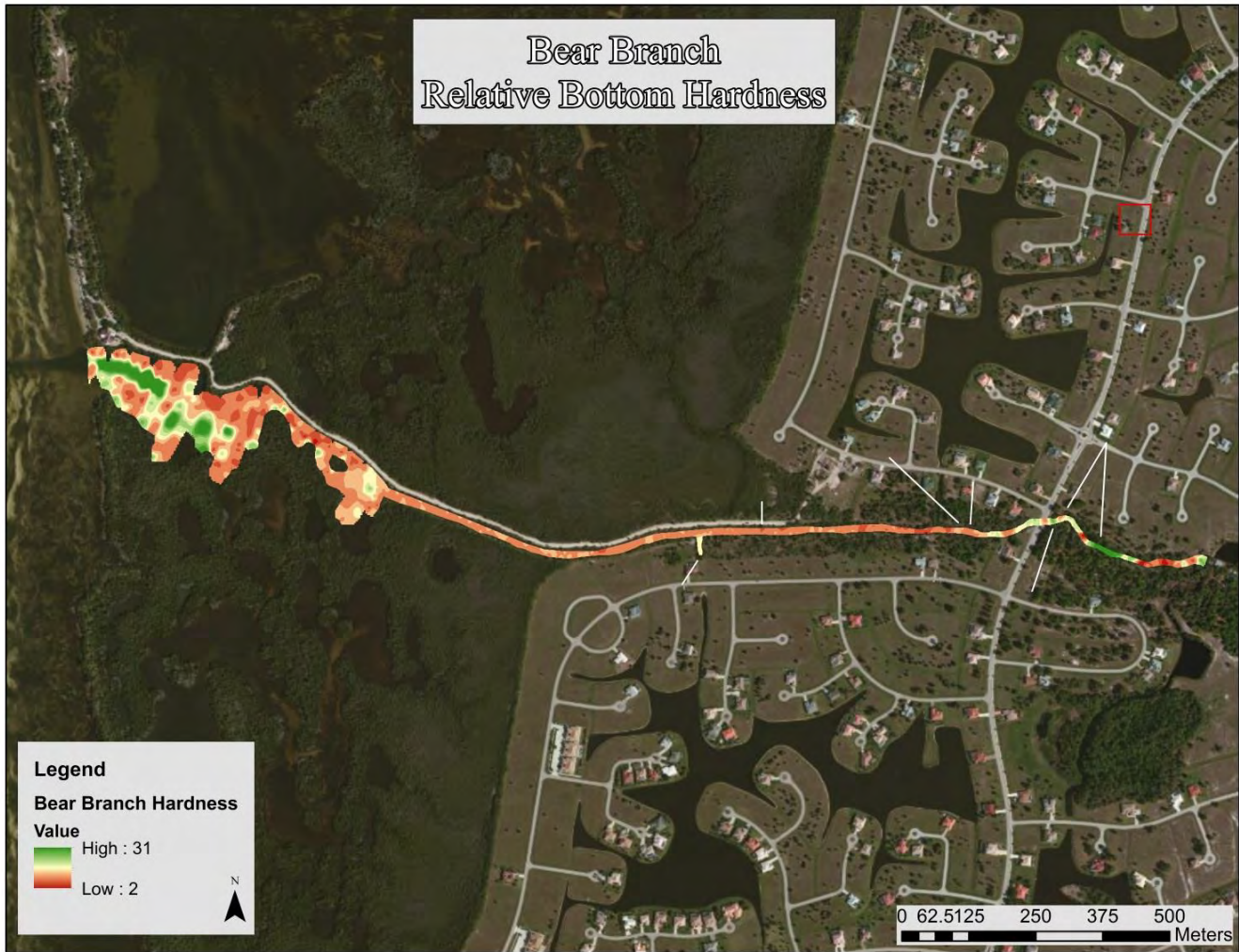


Figure 81. Bear Branch Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Bear Branch had a mean depth of 3.28 feet and a maximum depth of 10.22 feet. A total of 21.19 acres of creek was mapped during the assessment. At the time of assessment, Bear Branch contained an estimated 18,600,604 gallons of water in the study area. Figure 82 and Figure 83 detail the bathymetric mapping for Bear Branch showing the three depth stratum.



Figure 82. Bear Branch Bathymetric Stratum Map (1 of 2)



Figure 83. Bear Branch Bathymetric Stratum Map (2 of 2)

Yucca Pen Creek Stream Assessment

Study Area

Yucca Pen Creek is located in the Charlotte Harbor Watershed in Northern Lee County with its head waters in a swamp east of Burnt Store Road and its mouth in Charlotte Harbor as shown in Figure 84. The watershed of Yucca Pen Creek has a LDI value of 2.4 while the creek has less development immediately surrounding it giving it a buffer LDI value of 1.8.

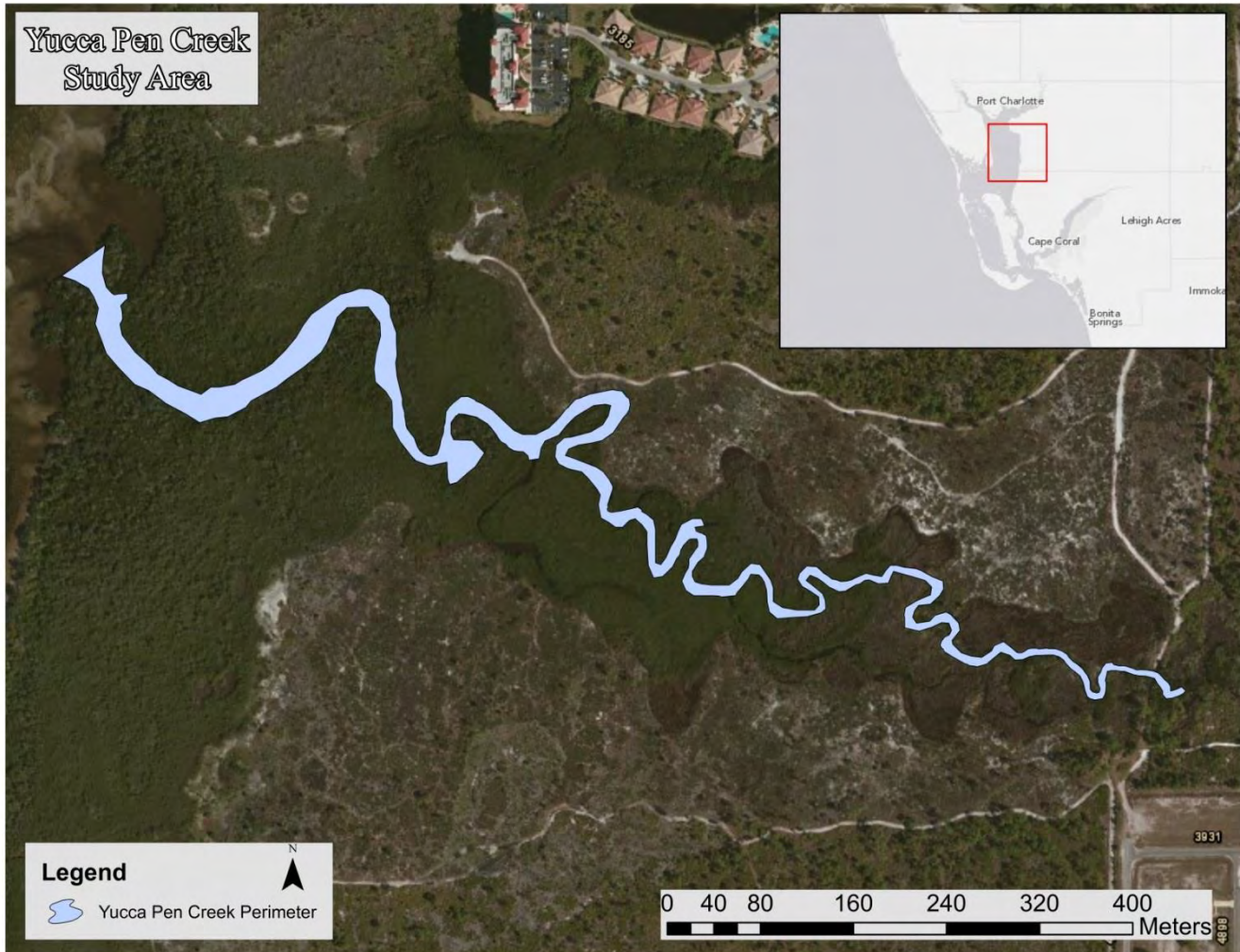


Figure 84. Overview of the Yucca Pen Creek Study Area

Vegetation Survey

The Yucca Pen Creek vegetation assessment encompassed 8 vegetation regions from the mouth in Charlotte Harbor to Old Burnt Store Road as shown in Figure 85. In these regions, 20 species of vegetation were identified. Regions 1 through 8 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 6, becoming dominant in Region 7. Needle Rush (*Juncus roemerianus*) was first observed in Region 4. Throughout the study area they vegetation indicated influence of salinity.



Figure 85. Overview of Yucca Pen Creek Vegetation Assessment Regions

Figure 86 shows the vegetation transition zone of Yucca Pen Creek indicating the downstream extent of Leather Fern and *Juncus*. Based on the vegetation assessment data for Yucca Pen Creek, regions 1 through 6 would comprise the highest salinity and tidal influence zone, regions 7 through 8 would comprise the “mixing” zone. The vegetation assessment species list is shown in Table 20.

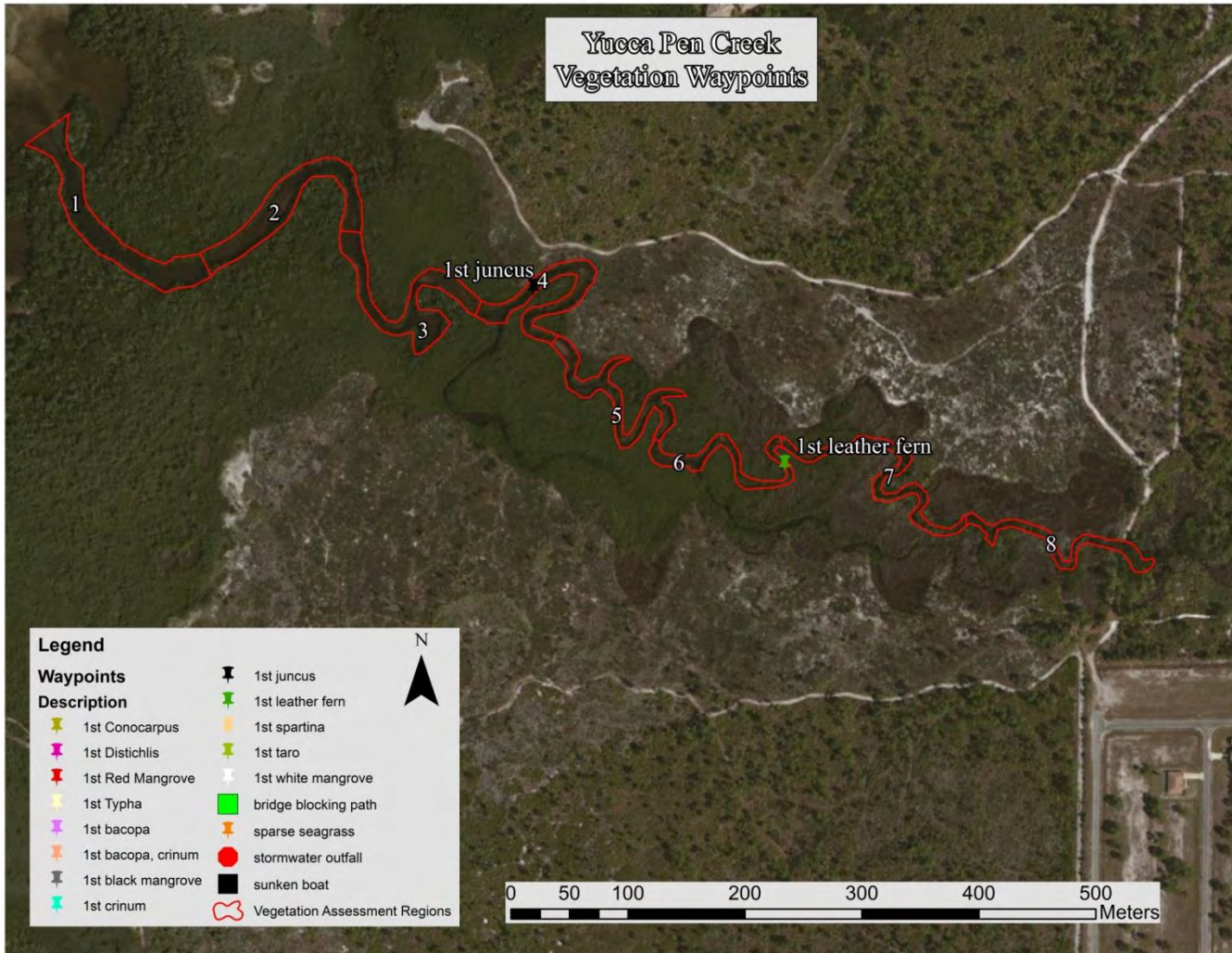


Figure 86. Yucca Pen Creek Vegetation Assessment Waypoints

Table 20. Yucca Pen Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region								Regions Found
		1	2	3	4	5	6	7	8	
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	8
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	C	D	D	C	D	8
<i>Juncus roemerianus</i>	Needle Rush, Black Rush				1	1	1	1	1	5
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1					4
<i>Acrostichum danaeifolium</i>	Leather Fern						1	C	1	3
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush				1	1			1	3
<i>Conocarpus erecta</i>	Buttonwood				1			1	1	3
<i>Schinus terebinthifolius</i>	Brazilian Pepper				1			1	1	3
<i>Myrica cerifera</i>	Wax Myrtle				1	1				2
<i>Serenoa repens</i>	Saw palmetto				C	1				2
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace								1	1
<i>Eustachys glauca</i>	Saltmarsh Fingergrass				1					1
<i>Borrchia frutescens</i>	Sea Oxeye					1				1
<i>Dalbergia ecastaphyllum</i>	Coin Vine				1					1
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca								1	1
<i>Pinus spp</i>	Pine				1					1
<i>Quercus geminata</i>	Sand Live Oak							1		1
<i>Sabal palmetto</i>	Sabal Palm				1					1
<i>Spartina alterniflora</i>	Salt Marsh Grass	1								1
<i>Spartina bakerii</i>	Cordgrass				1					1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Yucca Pen Creek. Figure 87 shows the bottom hardness raster for Yucca Pen Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 87. Yucca Pen Creek Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Yucca Pen Creek had a mean depth of 3.49 feet and a maximum depth of 12.87 feet. A total of 5.12 acres of creek was mapped during the assessment. At the time of assessment, Yucca Pen Creek contained an estimated 3,051,932 gallons of water in the study area. Figure 88 details the bathymetric mapping for Yucca Pen Creek showing the three depth stratum.



Figure 88. Yucca Pen Creek Bathymetric Stratum Map

Estero River Stream Assessment

Study Area

Estero River is located in the middle of Estero Bay in Lee County. This system is surrounded by golf courses and residential areas but appears to be relatively hydrologically unaltered. To the west of US41 on the southern bank of the Estero River is Koreshan State Park which provides a natural undeveloped habitat in a relatively developed stream. Where Halfway Creek flows into the Estero River the system becomes surrounded by mangrove swamps and marshes until it reaches Estero Bay. This system’s watershed has a LDI value of 4.1 and the area adjacent to the creek has a buffer LDI value of 3.4.

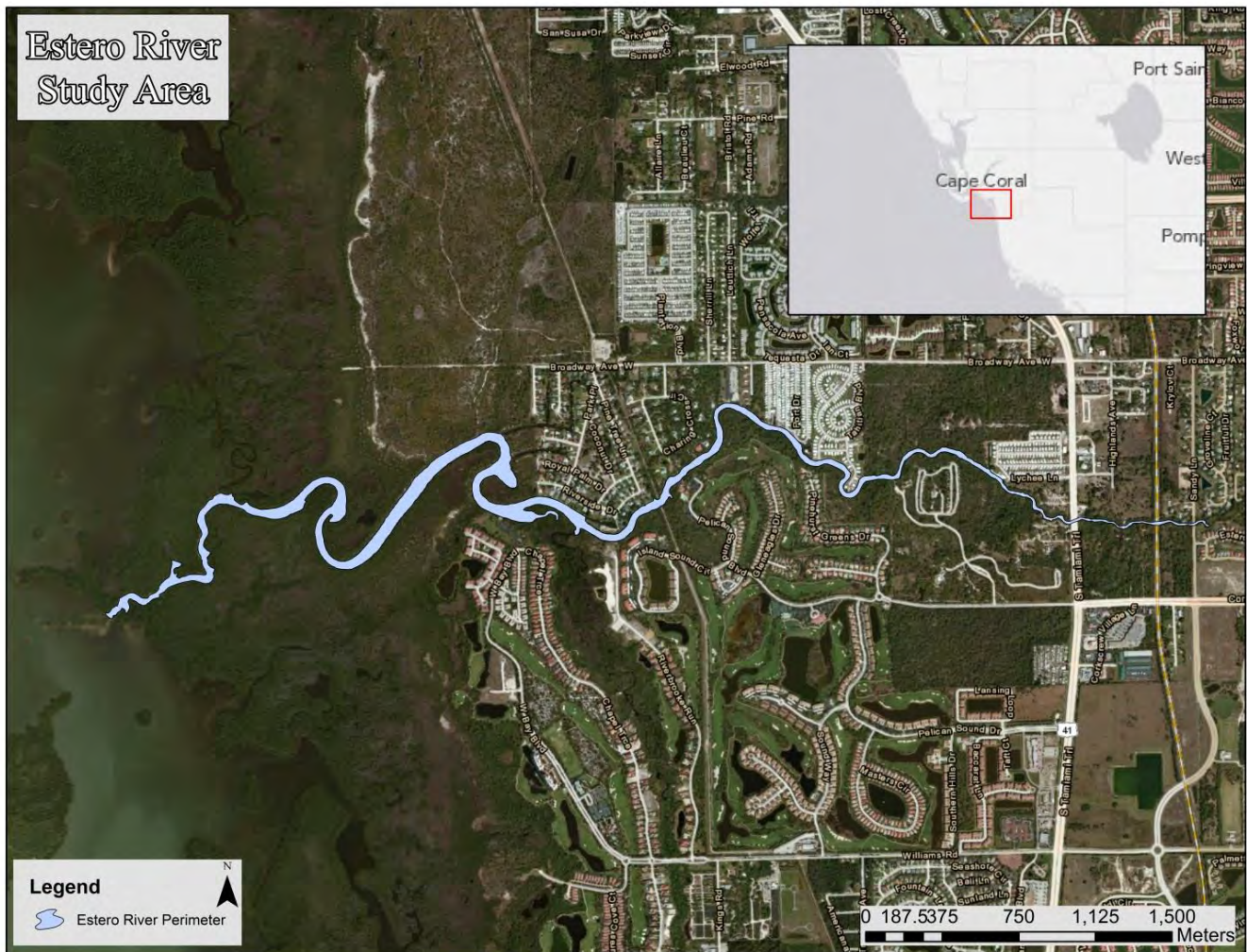


Figure 89. Overview of the Estero River Study Area

Vegetation Survey

The Estero River vegetation assessment encompassed 40 vegetation regions from the mouth in Estero Bay to above Sandy Lane as shown in Figure 90 through Figure 92. In these regions, 66 species of vegetation were identified. Regions 1 through 27 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia germinans*) with few other salt tolerant species present. Mangroves were present throughout the study area. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 15. Needle Rush (*Juncus roemerianus*) was first observed in Region 16 with the last occurrence in Region 30. Above Region 38 the vegetation communities are populated by many species indicative of dominating freshwater influence.

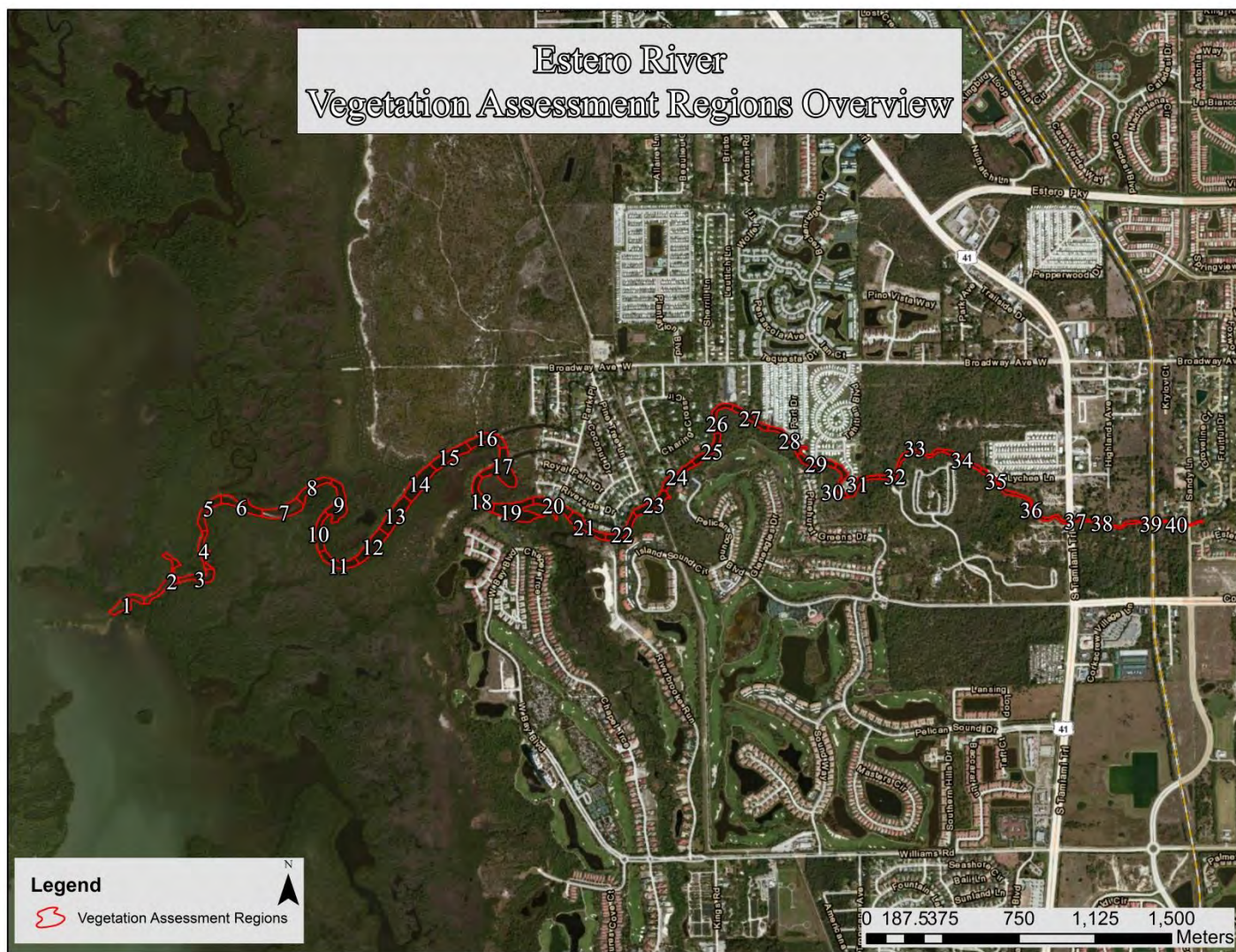


Figure 90. Overview of Estero River Vegetation Assessment Regions



Figure 91. Estero River Vegetation Assessment Regions 1-20



Figure 92. Estero River Vegetation Assessment Regions 21-40



Figure 93. Estero River Vegetation Waypoints

Figure 93 shows the vegetation transition zones of Estero River indicating the most upstream *Juncus* as well as the most downstream Leather Fern, *Juncus* and *Crinum*. Based on the vegetation assessment data for Estero River, regions 1 through 15 would comprise the highest salinity and tidal influence zone, regions 16 through 30 would comprise the “mixing” zone and regions 30 through 40 would comprise the freshwater dominant zone. The vegetation assessment species lists are shown in Table 21 through Table 22.

Table 21. Estero River Vegetation Assessment List Regions 1-20 (Part 1)

Plant Species	Common Name	Sample Region																				Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	39
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	38
<i>Conocarpus erecta</i>	Buttonwood	1	1	1	C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	35
<i>Schinus terebinthifolius</i>	Brazilian Pepper		1	1	1									1	1	1	1	1	1	1	1	31
<i>Dalbergia ecastaphyllum</i>	Coin Vine				1			1						1	1		1	1	1	1	1	27
<i>Quercus virginiana</i>	Virginia Live Oak															1	1	1	1	1		25
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
<i>Acrostichum danaeifolium</i>	Leather Fern															1	1	1	1	1	1	23
<i>Sabal palmetto</i>	Sabal Palm														1	1	1	1	1	1	1	23
<i>Vitis rotundifolia</i>	Muscadine Grape																1	1				21
<i>Eustachys glauca</i>	Saltmarsh Finger Grass		1	1	1	1	1							1	1	1	1	1		1		18
<i>Crinum americanum</i>	Swamp lily																					11
<i>Quercus geminata</i>	Sand Live Oak																					10
<i>Batis maritima</i>	Saltwort			1	1	1	1		1	1	1	1	1									9
<i>Borrchia frutescens</i>	Sea Oxeye			1							1		1	1	1	1		1	1			8
<i>Sansevieria hyacinthoides</i>	Bowstring Hemp																		1			8
<i>Serenoa repens</i>	Saw palmetto																1	1		1		8
<i>Cupaniopsis anacardioides</i>	Carrotwood																1	1	1	1		7
<i>Ficus aurea</i>	Strangler Fig																					7
<i>Myrica cerifera</i>	Wax Myrtle																		1			7
<i>Ximenia americana</i>	Tallow Wood, Hog Plum																	1				7
<i>Coccoloba uvifera</i>	Seagrape																			1	1	6
<i>Juncus roemerianus</i>	Needle Rush, Black Rush																1	1				6
<i>Leucaena leucocephala</i>	White leadtree																1					6
<i>Rhabdadenia biflora</i>	Mangrove Rubber Vine												1				1	1	1		1	6
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush		1	1													1		1	1		5
<i>Casuarina equisetifolia</i>	Australian Pine															1	1	1				5
<i>Cyperus ligularis</i>	Flat Sedge			1		1		1											1			5
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye																1					5
<i>Acacia auriculiformis</i>	Earleaf Acacia																	1				4
<i>Distichlis spicata</i>	Salt Grass										1				1	1	1					4
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace																					3
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle																					3
<i>Cyperus involucratus</i>	Umbrella flat sedge																					3
<i>Erythrina herbacea</i>	Coral Bean																					3
<i>Solidago sempervirens</i>	Goldenrod																					3
<i>Thespesia populnea</i>	Seaside Mahoe															1		1	1			3
<i>Typha spp.</i>	Cattails																					3

Table 22. Estero River Vegetation Assessment List Regions 1-20 (Part 2)

Plant Species	Common Name	Sample Region																				Regions Found
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
<i>Abrus precatorius</i>	Rosary Pea														1							2
<i>Andropogon virginicus var. glaucus</i>	Broom grass																					2
<i>Bauhinia variegata</i>	Orchid Tree																					2
<i>Blechnum serrulatum</i>	Swamp Fern																					2
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed				1											1						2
<i>Cyperus odoratus</i>	Fragrant Flatsedge																					2
<i>Dioscorea bulbifera</i>	Air Potato																					2
<i>Eupatorium capillifolium</i>	Dog Fennel															1						2
<i>Iva frutescens</i>	Marsh Elder											1	1									2
<i>Panicum repens</i>	Torpedo Grass																					2
<i>Albizia lebbek</i>	Woman's Tounge																					1
<i>Antigonon leptopus</i>	Coral Vine																					1
<i>Ardisia escallonioides</i>	Marlberry																					1
<i>Eclipta alba (prostrata)</i>	False Daisy, Yerba De Tajo																					1
<i>Ilex cassine</i>	Dahoon Holly																					1
<i>Ipomoea pes-caprae</i>	Railroad Vine																1					1
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia																					1
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca																				1	1
<i>Pluchea rosea</i>	Rosy Camphorweed																					1
<i>Quercus nigra</i>	Water Oak																			1		1
<i>Sagittaria lancifolia</i>	Bulltongue Arrowhead, Duck Potato																					1
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar																					1
<i>Spartina alterniflora</i>	Salt Marsh Grass																					1
<i>Spartina bakerii</i>	Cordgrass																					1
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen																					1
<i>Ulmus americana</i>	American Elm																					1
<i>Urena lobata</i>	Caesar's Weed																					1
<i>Urochloa mutica</i>	Para Grass																					1

Table 23. Estero River Vegetation Assessment List Regions 21-40 (Part 1)

Plant Species	Common Name	Sample Region																			Regions Found
		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
<i>Rhizophora mangle</i>	Red Mangrove	D	D	D	D	D	D	D	C	C	C	C	C	C	C	C	C	1	1		39
<i>Laguncularia racemosa</i>	White Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	38
<i>Conocarpus erecta</i>	Buttonwood	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					35
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	D	D	1	31
<i>Dalbergia ecastaphyllum</i>	Coin Vine	1	1	1	1	1	1	C	C	C	C	1	1	1	C	C					27
<i>Quercus virginiana</i>	Virginia Live Oak	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
<i>Avicennia germinans</i>	Black Mangrove	1	1			1		1		1											24
<i>Acrostichum danaeifolium</i>	Leather Fern		1		1		1	1	1	1	1	C	C	C	1	1	1	1	1	1	23
<i>Sabal palmetto</i>	Sabal Palm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					23
<i>Vitis rotundifolia</i>	Muscadine Grape		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
<i>Eustachys glauca</i>	Saltmarsh Finger Grass	1	1									1	1	1	1						18
<i>Crinum americanum</i>	Swamp lily							1			1	1	1	1	1	1	1	1	1		11
<i>Quercus geminata</i>	Sand Live Oak	1	1	1	1	1	1	1	1	1											10
<i>Batis maritima</i>	Saltwort																				9
<i>Borrchia frutescens</i>	Sea Oxeye																				8
<i>Sansevieria hyacinthoides</i>	Bowstring Hemp		1					1		1							1	1	1	1	8
<i>Serenoa repens</i>	Saw palmetto				1	1	1	1	1												8
<i>Cupaniopsis anacardioides</i>	Carrotwood	1	1	1																	7
<i>Ficus aurea</i>	Strangler Fig	1								1						1	1		1	1	7
<i>Myrica cerifera</i>	Wax Myrtle				1				1	1	1	1								1	7
<i>Ximenia americana</i>	Tallow Wood, Hog Plum													1	1	1	1			1	7
<i>Coccoloba uvifera</i>	Seagrape	1		1					1											1	6
<i>Juncus roemerianus</i>	Needle Rush, Black Rush			1	1	1				1											6
<i>Leucaena leucocephala</i>	White leadtree		1	1	1											1	1				6
<i>Rhabdadenia biflora</i>	Mangrove Rubber Vine	1																			6
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush																				5
<i>Casuarina equisetifolia</i>	Australian Pine													1	1						5
<i>Cyperus ligularis</i>	Flat Sedge				1																5
<i>Sphagneticola (Wedelia) trilobata</i>	Creeping Oxeye					1										1	1			1	5
<i>Acacia auriculiformis</i>	Earleaf Acacia			1			1	1													4
<i>Distichlis spicata</i>	Salt Grass																				4
<i>Bacopa monnieri</i>	Common Bacopa, Herb-Of-Grace		1							1										1	3
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle						1	1										1	1	1	3
<i>Cyperus involucratus</i>	Umbrella flat sedge															1			1	1	3
<i>Erythrina herbacea</i>	Coral Bean													1	1				1		3
<i>Solidago sempervirens</i>	Goldenrod				1					1	1										3
<i>Thespesia populnea</i>	Seaside Mahoe																				3
<i>Typha spp.</i>	Cattails					1	1				1										3

Table 24. Estero River Vegetation Assessment List Regions 21-40 (Part 2)

Plant Species	Common Name	Sample Region																			Regions Found	
		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		40
<i>Abrus precatorius</i>	Rosary Pea													1								2
<i>Andropogon virginicus var. glaucus</i>	Broom grass				1										1							2
<i>Bauhinia variegata</i>	Orchid Tree																		1	1		2
<i>Blechnum serrulatum</i>	Swamp Fern											1			1							2
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed																					2
<i>Cyperus odoratus</i>	Fragrant Flatsedge						1	1														2
<i>Dioscorea bulbifera</i>	Air Potato																			1	1	2
<i>Eupatorium capillifolium</i>	Dog Fennel	1																				2
<i>Iva frutescens</i>	Marsh Elder																					2
<i>Panicum repens</i>	Torpedo Grass											1									1	2
<i>Albizia lebbek</i>	Woman's Tounge																	1				1
<i>Antigonon leptopus</i>	Coral Vine														1							1
<i>Ardisia escallonioides</i>	Marlberry		1																			1
<i>Eclipta alba (prostrata)</i>	False Daisy, Yerba De Tajo																				1	1
<i>Ilex cassine</i>	Dahoon Holly			1																		1
<i>Ipomoea pes-caprae</i>	Railroad Vine																					1
<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia																1					1
<i>Melaleuca quinquenervia</i>	Punk Tree, Melaleuca																					1
<i>Pluchea rosea</i>	Rosy Camphorweed																				1	1
<i>Quercus nigra</i>	Water Oak																					1
<i>Sagittaria lancifolia</i>	Bulltongue Arrowhead, Duck Potato						1															1
<i>Smilax bona-nox</i>	Saw Greenbrier Cat Briar																				1	1
<i>Spartina alterniflora</i>	Salt Marsh Grass				1																	1
<i>Spartina bakerii</i>	Cordgrass														1							1
<i>Syngonium podophyllum</i>	Nephtis, American Evergreen																				1	1
<i>Ulmus americana</i>	American Elm																			1		1
<i>Urena lobata</i>	Caesar's Weed																				1	1
<i>Urochloa mutica</i>	Para Grass																				1	1

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Estero River. Figure 94 shows the bottom hardness raster for Estero River. In this raster, the higher the hardness value, the harder the bottom substrate. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.



Figure 94. Estero River Relative Bottom Hardness Map

Bathymetry Mapping

In the study area, Estero River had a mean depth of 3.99 feet and a maximum depth of 12.06 feet. A total of 73.78 acres of creek was mapped during the assessment. At the time of assessment, Estero River contained an estimated 69,288,066 gallons of water in the study area. Figure 95 and Figure 96 detail the bathymetric mapping for Estero River showing the three depth stratum.



Figure 95. Estero River Bathymetric Stratum Map (1 of 2)



Figure 96. Estero River Bathymetric Stratum Map (2 of 2)

Spring Creek Stream Assessment

Study Area

Spring Creek flows into Estero Bay and is located in the southern portion of Lee County. The watershed is impacted with a LDI value of 5.6 because of the urbanization on the upstream portion. The upstream portion of Spring Creek is also narrower than the downstream portion. Spring Creek widens and becomes more natural with as it moves downstream with mangroves and marsh areas along one of the banks. The creek buffer area is not highly altered with only some channelization at the mouth of the creek and a creek LDI value of 2.8.



Figure 97. Overview of the Spring Creek Study Area

Vegetation Survey

The Spring Creek vegetation assessment encompassed 34 vegetation regions from the mouth in Estero Bay to above Highway 41 as shown in Figure 98 through Figure 100. In these regions, 44 species of vegetation were identified. Regions 1 through 32 were dominated by mangroves (*Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia geminans*) with few other salt tolerant species present. The most upstream mangrove was *Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia geminans* in Region 34. The first occurrence of Leather Fern (*Acrostichum danaeifolium*) was in Region 12, becoming dominant in regions 31, 32 and 34. Needle Rush (*Juncus roemerianus*) was first observed in Region 13 with the last occurrence in Region 22. Above Region 32 the vegetation communities are populated by many species indicative of dominating freshwater influence.



Figure 98. Overview of Spring Creek Vegetation Assessment Regions

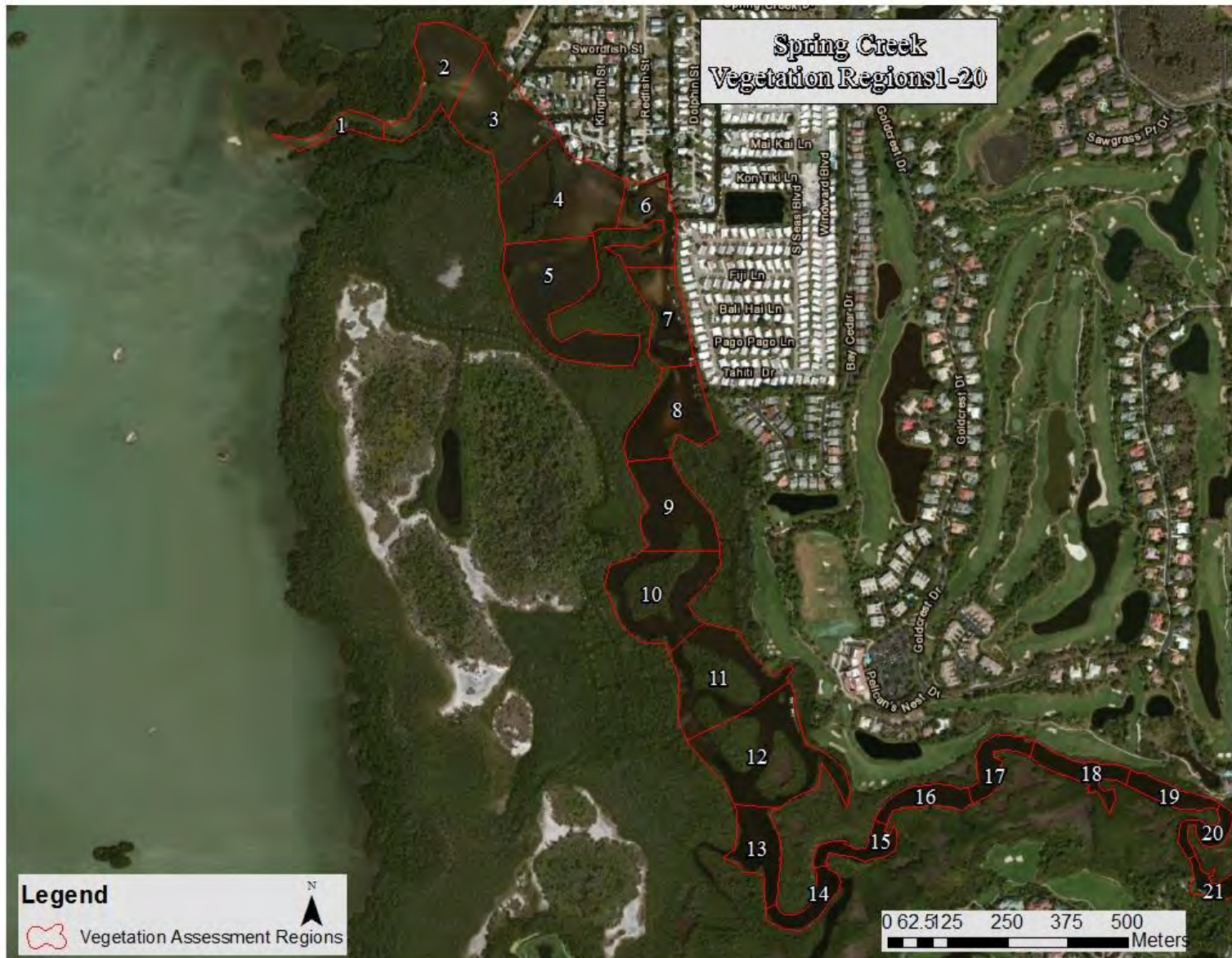


Figure 99. Spring Creek Vegetation Assessment Regions 1-20



Figure 100. Spring Creek Vegetation Assessment Regions 21-34

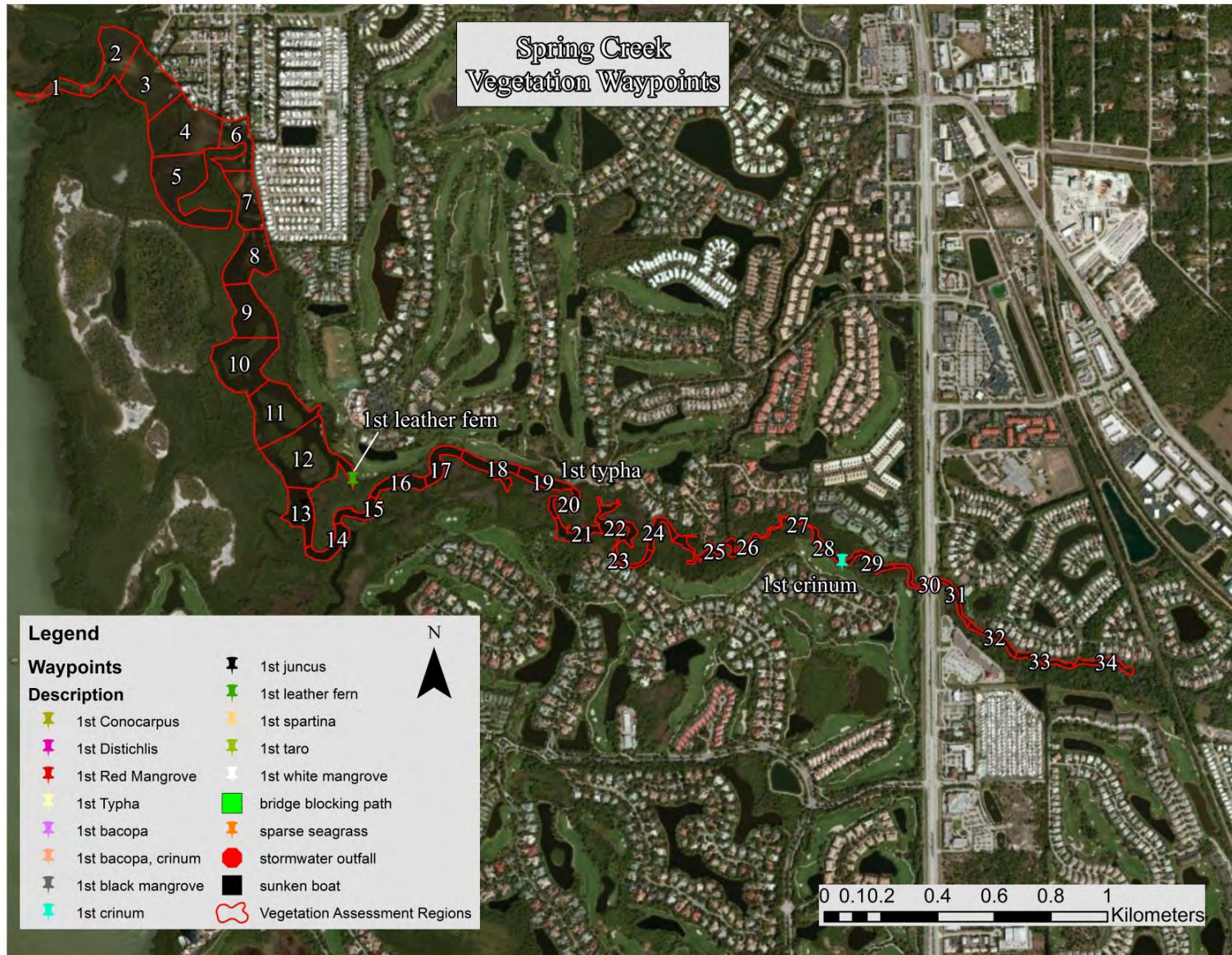


Figure 101. Spring Creek Vegetation Waypoints

Figure 101 shows the vegetation transition zone of Spring Creek indicating the most downstream Leather Fern, *Typha* and *Crinum*. Based on the vegetation assessment data for Spring Creek, regions 1 through 20 would comprise the highest salinity and tidal influence zone, regions 21 through 32 would comprise the “mixing” zone and regions 33 through 34 would comprise the freshwater dominant zone. The vegetation assessment species list is shown in Table 23.

Table 25. Spring Creek Vegetation Assessment List

Plant Species	Common Name	Sample Region																																Regions Found				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		33	34		
<i>Laguncularia racemosa</i>	White Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	1	1	34	
<i>Rhizophora mangle</i>	Red Mangrove	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	1	1	34	
<i>Conocarpus erecta</i>	Buttonwood		1	1		1	1	1	1	1	1	1	1	1	1	C	C	C	C	C	C	C	1	C	1	C	C	C	C	C	C	C	C	C	1	32		
<i>Acrostichum danaeifolium</i>	Leather Fern											1			1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C	C	1	C	20		
<i>Avicennia germinans</i>	Black Mangrove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															20		
<i>Schinus terebinthifolius</i>	Brazilian Pepper	1														1	1						1	1		1	1	C	1	1	C	1	1	C	1	15		
<i>Quercus virginiana</i>	Virginia Live Oak										1				1			1				1	1	1	1	1	1	1	1	1	1	1	C	1	1	14		
<i>Vitis rotundifolia</i>	Muscadine Grape										1							1				1		1			1	1	C	1	1	1	1	1	1	1	13	
<i>Sabal palmetto</i>	Sabal Palm										1	1					1	1								1			1	1	1	1	1	1	1	1	1	12
<i>Rhaddadenia biflora</i>	Mangrove Rubber Vine							1			1		1			1			1	1			1	1	1		1			1						11		
<i>Baccharis halimifolia</i>	Eastern False Willow, Saltbush																		1	1				1				1	1	1		1	1			1	9	
<i>Batis maritima</i>	Saltwort		1	1			1	1	1		1		1		1																						8	
<i>Myrica cerifera</i>	Wax Myrtle																					1	1					1	1	1				1	1	1	8	
<i>Casuarina equisetifolia</i>	Australian Pine	1			1	1			1	1	1	1																									7	
<i>Crinum americanum</i>	Swamp lily																												1	1	1	1	1	1	1	1	7	
<i>Annona glabra</i>	Pond Apple																												1				1	1	1	C	6	
<i>Blechnum serrulatum</i>	Swamp Fern				1				1	1																	1	1							1		6	
<i>Dalbergia ecastaphyllum</i>	Coin Vine								1	1	1					1		1							1												6	
<i>Pinus elliotii</i>	Slash Pine										1							1					1			1	1	1									6	
<i>Senna spp</i>	Senna																												1	1					1	1	5	
<i>Juncus roemerianus</i>	Needle Rush, Black Rush												1			1	1						1														4	
<i>Typha spp.</i>	Cattails																			1									1					1	1		4	
<i>Panicum repens</i>	Torpedo Grass																								1										1	1	3	
<i>Persea palustris</i>	Swampbay																																		1	1	1	3
<i>Quercus laurifolia</i>	Laurel oak																																		1	1	1	3
<i>Borrhchia frutescens</i>	Bushy seaside Oxeye				1			1															1														3	
<i>Ardisia elliptica</i>	Showbutton									1								1																				2
<i>Ardisia escallonioides</i>	Marlberry																						1													1		2
<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle																																1	1			2	
<i>Cladium jamaicense</i>	Jamaica Swamp Saw Grass																																1		1		2	
<i>Sambucus canadensis</i>	Elderberry															1		1																			2	
<i>Acer rubrum var. trilobum</i>	Southern Red Maple																																			1	1	
<i>Andropogon virginicus var. glaucus</i>	Broom grass																																	1			1	
<i>Baccharis glomeruliflora</i>	Groundsel Tree																																	1			1	
<i>Blutaparon vermiculare</i>	Silverhead, Saltweed										1																										1	
<i>Cephalanthus occidentalis</i>	Common Buttonbush																																		1		1	
<i>Cyperus haspan</i>	Jointed Flat Sedge																																	1			1	
<i>Cyperus ligularis</i>	Flat Sedge									1																											1	
<i>Eclipta alba (prostrata)</i>	False Daisy, Yerba De Tajo																																	1			1	
<i>Hydrocotyl umbellata</i>	Manyflower Marshpennywort, Water Pennywort																																	1			1	
<i>Pluchea rosea</i>	Rosy Camphorweed																																				1	
<i>Ruellia simplex</i>	Britton's Wild Petunia																																		1		1	
<i>Sagittaria lancifolia</i>	Bulltongue Arrowhead, Duck Potato																																				1	
<i>Taxodium ascendens</i>	Pond Cypress																																			1	1	

Habitat Assessment

Collected sonar data was processed through Dr. Depth software to analyze the strength of the return signal from the bottom to get an estimate of the relative bottom hardness for Spring Creek. Figure 102 shows the bottom hardness raster for Spring Creek. This map is meant to help identify locations of harder and softer bottoms for benthic invertebrate sampling, fish sampling and benthic chlorophyll sampling.

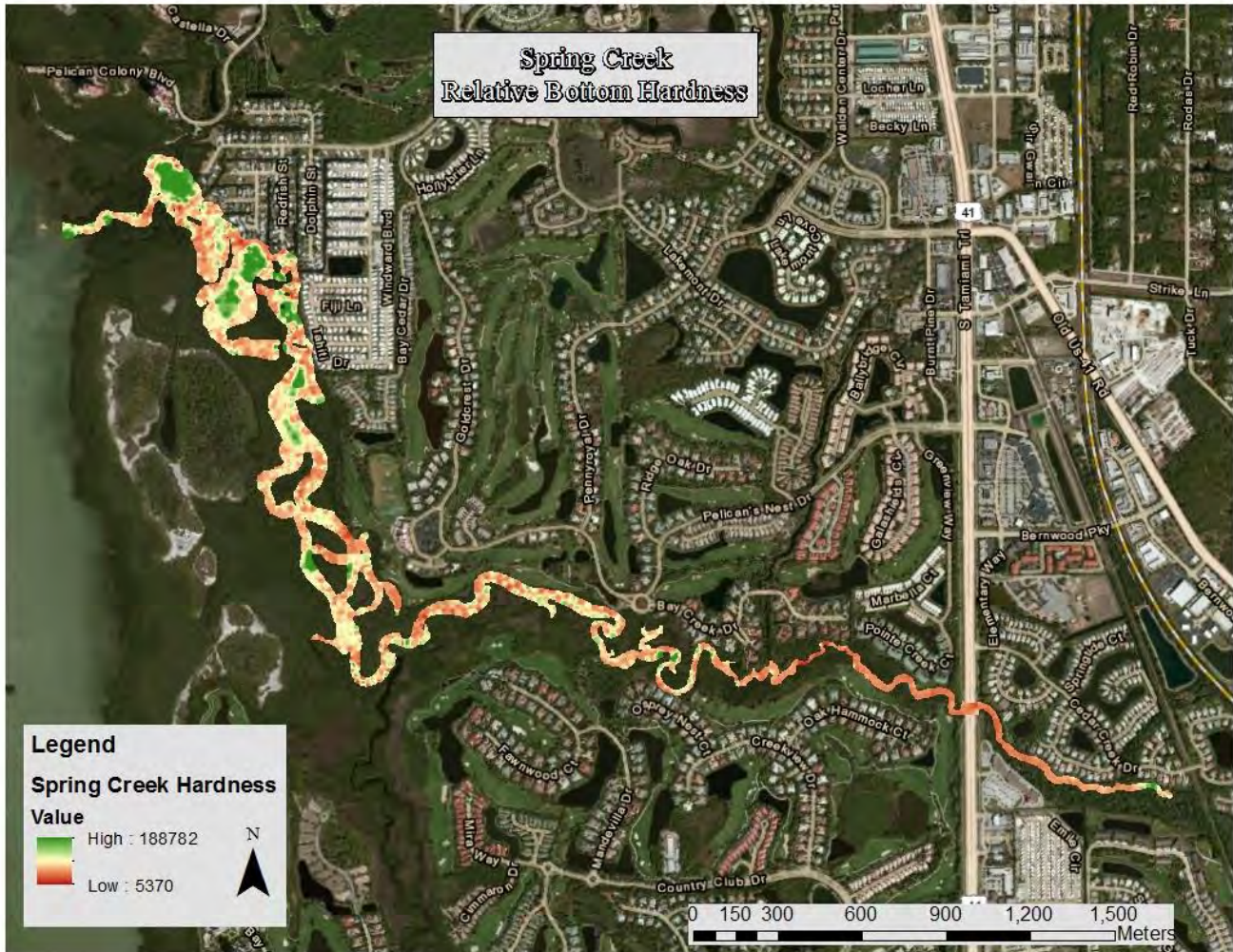


Figure 102. Spring Creek Relative Bottom Hardness Map



Figure 104. Spring Creek Bathymetric Stratum Map (2 of 2)