Coastal Processes and Anthropogenic Factors Influencing the Geomorphic Evolution of
Weedon Island, Florida

by

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Coastal Processes and Anthropogenic Factors Influencing the Geomorphic Evolution of Weedon Island, Florida

Jeanne Lambert

ABSTRACT

Weedon Island, a peninsula located on the western inner shoreline of Tampa Bay, Florida, is the location of a collaborative geological and archaeological project that aims to relate the present day geomorphology to natural processes and human occupational activity during the middle to late Holocene. The area is known for extensive archaeological sites, which were originally investigated in the 1920s, although they have received relatively little scientific attention during most of the last century. We hypothesize that activities associated with pre-historic human occupation of Weedon Island at various times during the last ca. 5,000 years influenced the geomorphic evolution of the peninsula. An interdisciplinary approach, including geomorphic mapping, sediment-coring, and archaeological survey and excavation, is being used to test our hypothesis and is expected to reveal the extent to which natural processes and human activities interacted to shape the present-day configuration of the peninsula.

A total of 41 vibra-cores have been recovered from Weedon Island in a series of transects from Riviera Bay, an inland body of water connected by tidal channel to Tampa Bay, across multiple dune ridges, depressions, freshwater wetlands, and forested uplands, to the pre-development eastern shoreline position. Coring has revealed multiple buried
surfaces and archaeological midden deposits, which allow us to reconstruct the vertical
aggradation of coastal and inland sediments. Initial radiocarbon dating on charcoal
provides an age estimate of 1450 ± 40 $^{14}$C yr B.P. for the upper midden horizon. Wood
fragments from a sand layer at the base of the core give a pre-occupation age of 3370 ± 50
$^{14}$C yr B.P. These dates and stratigraphic evaluations of sediment reveal possible
paleoenvironmental shifts associated with mid to late Holocene sea-level rise,
paleoclimatic shifts, and pre-historic human activity.

More recent human impacts on the peninsula have impeded our efforts in some
areas. During the twentieth century, dredging, mosquito ditching, and road construction,
have disturbed the surface and portions of the upper sediment record in many locations.
Sediments below obvious disturbances or in unimpacted areas of the peninsula, along with
radiocarbon dating, have helped reconstruct the mid to late Holocene paleoenvironments
and paleolandscape of Weedon Island.
Introduction

Weedon Island, a peninsula on Florida’s West coast, protrudes into the estuary of Tampa Bay. Weedon Island is of geological and archaeological interest due to its moderately well preserved (legendary) archaeological site and its placement in inner Tampa Bay. The outer barrier island chain and shelf area at the opening of Tampa Bay have been extensively researched (Davis, 2003), yet many regions within the bay have received less attention. The post-glacial inundation history of Tampa Bay itself is still somewhat in question, though a better understanding of the region has recently been summarized by Donahue et al. (2003), suggesting a sunken fresh water depression that was inundated by marine waters around 5,000 BP. Surveys on the inner bay may help clarify times and patterns of sea level fluctuation and major events that may have occurred within of Tampa Bay since marine inundation.

The area is also known for its variety of archaeological sites, which have characterized a civilization of western Florida. Though the culture of the Weeden (sic) Island peoples (Note: known as such due to a misspelling in 1920s archaeological literature) has been established through artifacts from limited Weedon Island archaeological excavations and excavations elsewhere, there was very little known about the prehistoric people of the actual Weedon Island site (Milanich, 2002). Reconnaissance archaeological surveys done in collaboration with our geomorphologic studies have located and recorded a range of previously undocumented potential sites on Weedon
Island and revealed aboriginal technologies and occupational periods (Weisman et al., 2005). Further knowledge of the area has been established through our geological survey in which we reconstruct the geomorphic evolution of the peninsula during the late Holocene to help understand the paleoenvironmental relationships pertaining to the settlement patterns and timing of occupation events.

The purpose of this investigation is to reconstruct the geologic and paleoenvironmental evolution of the Weedon Island peninsula as a context for the ancient civilization’s movements on the peninsula itself.

Research Hypothesis: Prehistoric activities and cultural occupation and paleoclimatic changes influenced the geomorphic evolution of Weedon Islands.

Supporting Research Questions:

1. How did changes in sea level affect the geomorphology and sedimentation processes of Weedon Island?

2. What is the relationship between human manipulation of the landscape and the natural sedimentation processes in the geomorphic evolution of Weedon Island?

3. What additional research will be required to assess the anthropogenic and paleoclimate effects on the island’s geomorphology.

Data from this investigation, through sediment core collection, demonstrate a transition from a freshwater environment to a shallow brackish environment along the paleoshoreline. This is evident in the mud and peat layers that rapidly transition to
shallow beach-face sands. In inland cores we saw evidence of transitions from upland environments to more (saline/fresh) moist environments as well as transitions from arid dunal environments to more vegetated soil types as the water table and sea level rose.
Background

Site Location

Present day Weedon Island (Figure 1) consists of a 3,700 acre preserve owned by Pinellas County, the State of Florida, and Progress Energy Corp. The land has been jointly managed by all three entities since 1992. The preserve holds a vast variety of environments corresponding to upland, scrubland, and marsh ecosystems. Elevation plays a key factor in the location of these ecosystems in the preserve. Dune complexes surround Riviera Bay along its northern and eastern shores, Master’s Bayou on its southern shore, and once flanked the paleoshoreline of western Tampa Bay. The rise of these dunes from 2.5m to 6.5 m above sea level results in drastic differences in vegetation and soils. Mangrove marshes and tidal flats comprise most of the southern portion of the peninsula. Multiple springs and fresh to brackish lakes are located on the peninsula and its bordering islands. The northeastern portion of the peninsula has extensive alterations from the construction of the Florida Power electricity generating facility.

The island has undergone other historical changes due to fill activities, mosquito ditches, and additional human alterations during the past century. Much of the area was cleared of vegetation to harvest pine trees, build roads and an airport runway, and construct houses and businesses during the late 19th and early 20th centuries. Portions of the area were also utilized for agricultural development. Weedon Island residents, including Dr. Weedon himself, planted citrus groves over much of the northern and
eastern-midden capped dune ridges, which altered the upper sediment layers. During the 1950s and 1960s extensive mosquito ditches were dug on the southern and northern portions of the peninsula to “improve health”. The ditches drastically altered the ecology and hydrology of the area, allowing marine waters and mangrove invasion into a once upland environment in the northern portion, and a former mud flats ecosystem in the south. There has also been significant looting of the archaeological sites throughout the last century. Large conspicuous looting ditches can still be identified, especially along the large northeastern midden complex excavated by Fewkes in 1924. All of these historic and recent alterations have hampered our ability to reconstruct the past environments of Weedon Island.

**Geologic Background**

Weedon Island is really not an island at all, as can be seen in Figure 1. It is a peninsula located on the inner western edge of Tampa Bay. Tampa Bay is Florida’s largest estuary, with a surface area of 1032 km$^2$, and an average depth of less than 4 meters is located on the extensive Neogene carbonate Florida Platform (Duncan et al., 2003; Donahue et al., 2003).
The Florida platform, which developed since the Eocene period, is a tectonically stable environment created mainly from cycles of carbonate and siliclastic sedimentation (Smith and Lord, 1997). The Florida Platform lies between two provinces of sediment: the North Gulf sedimentary province and the Florida Peninsula sedimentary province.
During the Holocene, sedimentary deposits consisted mainly of siliclastic, carbonate, and organic sediments (Scott, 1997).

Throughout history, the Florida platform has been continually shaped and reshaped by the inundation and retreat of the oceans (Hine, 1997). The gently sloping platform, with a maximum elevation of 104 meters, allows for small sea level rises to have great impacts on the environment of the region (Hine, 1997). Freshwater lakes turn quickly into marine environments with the onslaught of rising sea levels, and when seas subside, areas become exposed dry land (Beck, 1984). The rate at which the sea level rises plays a crucial role in the development of coastal morphology (Schmidt, 1997).

The Tampa Bay region is a low energy sedimentation environment influenced mainly by tides. Though the tidal range for the area is less than one meter, Tampa Bay, because of its size, has an impressive tidal prism. These large prisms can greatly influence the geomorphology of the estuary’s tidal inlets (Hine, 1997). Other influences include impacts by tropical storms during the summer and frontal systems during the winter (Davis et al., 2003). Although infrequent, hurricanes along Florida’s Gulf Coast can play a major role in geomorphic changes of the area when they do occur (Davis et al., 2003).

There are four general theories for the formation of Tampa Bay. Stahl (1969) believed that the topography of the area may have had an impact on surface drainage patterns. These patterns may have influenced erosion of local features to create the Tampa Bay depression. Hebert (1985) believed the bay area was influenced more by karstification of the Miocene valley system, which has been recognized on the shelf. This caused the dissolution of limestone and the creation of depressions. Bathymetric
and seismic surveys on the coastal shelf help reveal the complex nature of this system, and the theory was later expanded upon by Hine (1997).

Hine (1997) hypothesized that during periods of lowered sea levels and increased water flow through the Tampa Bay system, the rates of dissolution of limestone may have increased on the shelf-valley systems. This may have caused a receding shelf-valley system and helped to create the present day Tampa Bay (Hine 1997). On the other hand, Donahue et al. (2003) suggest that there is no evidence of an estuarine or shelf retreat path. Instead they propose that the present Tampa Bay was a mid-platform depression that contained freshwater wetlands and acted as a drainage basin for much of the central peninsula. The freshwater depression system was quickly inundated by marine transgression which flooded the area during the late Holocene.

**Sea Level History**

The rise and fall of sea level and the rate at which it occurs remains the central issue to the theories for the formation of Tampa Bay described above. During glacial periods a significant amount of water is stored in glaciers and snow cover in the higher latitudes. In response, ocean levels decline, less precipitation falls in the subtropics, causing the land to dry, and cooler ocean temperatures cause a reduction in evaporation rates. The last major ice age maximum was around 20,000 years B.P., at which time sea-level was as much as 140 m below present level. Since the ice sheets began retreating about 15,000 years ago, sea-level has steadily risen, although with periods of minor reversals and fluctuating rates documented in the geologic record.
Fairbridge’s (1974) sea-level curve, which is based on radiocarbon data and geomorphologic evidence from around the world, shows a eustatic sea level height similar to the present by about 6,000 years B.P. (Gleason, 1984). The actual height of the oceans has changed very little in the last 3,500 years, oscillating a few feet since then, but the volume has recently begun to increase (Dorsey, 1997). Robbin’s (1984) study in the Florida Keys shows evidence of slow-fast-slow trend in the rates of rise. He suggests a rate of rise of 0.3 mm/yr from 14,000 to 7,000 yrs B.P., 1.2 mm/yr from 7,000 to 2,000 yrs B.P. and 0.3 mm/yr from 2,000 yrs B.P to the present (Robbin, 1984). Scholl’s 1969 curve, based on radiocarbon-dated samples of peat from South Florida also shows a constant overall sea level rise, but with varying rates (Gleason, 1984). Gleason (1984) found a similar continuous sea level rise through his study of the Florida Keys. Some investigations have suggested, mainly utilizing evidence from shell midden sites and dune scarps, that there was a higher-than-present sea-level stand during the mid to late Holocene (Blum et al. 2001; Morton et al., 2000; Stapor et al., 1991). In Gleason’s study of the Keys, there was no evidence to suggest a higher than present sea level during the Holocene. Closer to our study area, no higher than present mid-Holocene sea level stand was found along the Suwannee River coastline, but varying rates of rise for the area were estimated (Wright et al. 2005). Figure 2 is a compilation of data from several studies reconstructing changes in sea-level during the past 5,000 years.
Figure 2. Sea-level studies are represented by different colored lines and data points within the graph taken from Balsillie and Donoghue (2004). The data points and lines have been graphed to represent researched data for sea-level heights from present day to 5,000 yrs B.P.

Wright and others (2005), from their extensive study of the Suwannee River region, established rates of sea-level rise for the stable northern Gulf Coast of Florida. Using marsh deposits Wright and others identified a rate of rise for the area of 0.16 cm/yr between 7,500 and 5,500 cal yr BP. The rise slowed to 0.07 cm/yr between 5,500 and 2,500 cal yr BP, and slowed even further to 0.05 cm/yr between 2,500 cal yr BP and 750 cal BP. Wanless (1994) also amassed information from a variety of sources to establish a general sea level rate of rise curve for the coast of Florida. Figure 3 shows an overview of his curve estimating sea level rate of rise for the West Coast of Florida over the Holocene (Wanless, 1994).
Figure 3. The Holocene sea level rate of rise curve was compiled by Wanless et al. (1994), and illustrates the variations in the rate at which the sea is rising in South Florida. This graph was created using stratigraphic studies from throughout South Florida.
One of the most recent compilation efforts was done by the State of Florida Environmental Protection Agency and the Florida Geological Survey. Balsillie and Donoghue (2003) compiled 23 data sets from what are presently on shore and marine locations. They then compared these two separate reconstructions with a global (eustatic) sea-level curve. Figure 4 illustrates their findings for the middle to late Holocene.

![Comparison of the Gulf of Mexico younger data set compiled by Balsillie and Donoghue (2003) with the Siddall et al. (2003) eustatic sea-level curve. The Younger data set A is a compilation of data from presently marine positions from 23 sources. The Younger data set B is a compilation of presently onshore data from 23 sources.](image)

The variations in sea level and rates of change play a major role in the geomorphic evolution of the coastline. All of the above research suggests that sea-level has changed throughout the Holocene and that the rate at which it has changed has also fluctuated. Donahue et al. (2003) postulated a model for the development of Tampa Bay as sea level has fluctuated over the Holocene. The model shows Tampa Bay as a sunken fresh water depression from 11,000 yr B.P. to around 5,000 yr B.P., when the depression was quickly inundated by marine water. This created a shallow protected estuarine
environment suitable for mangrove and sea grass development. The rate of sea level rise was more rapid (around 10m/1000yrs) until 3,000 yr B.P., when it slowed as it reached a level near the present position, which correlates well with both Wanless (1994) and Wright (2005) curves. The slow rate of rise allowed for sediment accumulation and development of coastline features such as barrier islands and extensive mangrove systems, which are seen along Florida’s west coast (Donahue, 2003). Thus far there is very little information on how the sea level oscillations and rates of change have affected the inner portion of Tampa Bay where Weedon Island is situated.

**Paleoclimate**

Present climatic conditions in the Tampa Bay area are representative of a subtropical climate. The average summer and winter temperatures are 32°C and 17°C degrees Celsius, respectfully, and the area has an average rainfall (exclusive of hurricanes) of about 1170mm (NOAA Climate Data Center, 2006). More than half of the precipitation occurs during the wet season which runs from June through September and overlaps with the hurricane season (June-November). Precipitation in the region is highly influenced by regional climatic factors such as El Nino, the location of the Intertropical Convergence Zone (Cane, 2005), and the position of the Bermuda High (Stahle and Cleveland, 1992).

Throughout the Holocene, changes in Florida’s climate have been influenced by changes in the regional climatic features listed above. These features may themselves be influenced by a variety of events following the last glaciation such as the Earth’s orbital parameters (Milankovitch Cycles), and effects of deglaciation meltwaters flushing into
the Gulf of Mexico and the Northern Atlantic (Poore et al., 2003; Oglesby et al., 1998; Curtis and Hodell, 1993). The lack of high resolution studies has impeded reconstruction of a precise paleoclimate history for Florida during the Holocene (Otvos, 2005).

Previous studies have focused on lake sediment analysis and tree ring studies, such as those at Camel Lake, Lake Tulane, and Little Salt Springs. The early Holocene is characterized by drier and cooler conditions until around 8,500 yr B.P. (Poore et al., 2003; Watts, 1980). A study at Little Salt Spring study indicates drier than present conditions from between 9,300 and 5,900 yr B.P., a wet period beginning about 5,000 yr B.P. until around 2,800 yr B.P., semi-arid conditions peaked between 2,700 and 1,900 yr B.P., and precipitation once again increased, peaking at 1,000 yr B.P. (Alvarez et al., 2005). The sediment record at Little Salt Spring is low resolution with considerable uncertainty in the age estimates. But wetter conditions beginning at 5,000 yr B.P. do correspond well with the increasing El Nino intensity beginning around the same time (Cane, 2005).

A recent paleoclimate study in Florida, and the first one involving speleothem isotopic analysis, confirms the tree ring precipitation models for the SE U.S. from 1,000 yr B.P. to the present (Soto, 2005). The speleothem record extends the tree ring record, giving high resolution data on precipitation back to 4,200 years B.P. (Soto, 2005). Soto (2005) found that the Atlantic Multidecadal Oscillation, with a cyclicity of about 60 years, appears to have the greatest impact on precipitation in Florida. Their study also correlates well with the lake sediment studies listed above and estimated precipitation variations as well as Cane’s (2005) study of El Nino events during the Holocene. Figure
5 is a graph of Soto (2005) speleothem isotopic data indicating the wetter and drier periods.

Figure 5. Oxygen Isotope data from Soto (2005) indicates periods of wetter and drier than average conditions in Florida as seen in two separate speleothems from two separate caves. The top graph shows the oxygen isotope data for speleothem labeled BRC03-02 from cave Brooksville Ridge Cave (BRC) in Hernando County Florida. The lower graph shows the oxygen isotope data for speleothem BRIARS03-02 from Briar cave in Marion County Florida.

As shown in Figure 5, periods of drier than average conditions occurred at 3.5 ka BP, 2.75 ka BP, 1.75 ka BP and from 0.8 ka to the present. Wetter than average conditions are noted with peaks at 1.8 ka BP, 1.3 ka BP, and 0.9 ka BP. These dates are
associated with larger peaks, but there are also many small oscillations, especially within the more detailed BRIAR cave record. All but the drier period around 0.9 ka BP appear to correlate well with the previous paleoclimate records described from Lake Tulane and Camel Lake.

**Archeology of Weedon Island**

It has been estimated that humans arrived in Florida between 14,000 and 12,000 years B.P. (Milanich, 2002). Their impacts along the coast have been studied at many locations. It is important to understand the role these ancient humans may have played in the creation of Weedon Island as it exists today because of their possible impact on the geomorphology of the area. A greater understanding of the archaeology of the area will assist in the determination of occupational periods, which may correspond with particular wet/dry periods and may have been influenced by sea level fluctuations.

The Weeden Island periods I and II are generally defined by their pottery types and chronologically come after the Santa Rosa and Swift Creek Periods (Willey, 1949). The two periods show general dates from A.D. 200/300 to 750 and A.D. 750 to 900-1000 (Milanich, 2002). The extent of the culture reaches down the Gulf Coast to Manatee and Sarasota counties, northward to the coastal plains of southern Georgia and Alabama, east to the Okefenokee swamp region, and west to Mobile Bay (Milanich, 2002). The sites themselves generally were small in extent with typical diameters of less than 100 meters (Willey, 1949). These sites were concentrated around sheltered brackish and salt water environments, including coves, bays, lagoons, sounds, and estuaries (Milanich, 2002). The socioeconomic structure was centered around the natural resources provided by the
coastal marshes and tidal streams such as mollusks and oysters, which are the predominant shells found in middens (Milanich, 2002).

Weedon Island archaeology was explored and partially excavated in 1923-24, and was reported by Fewkes (1924). His study found three basic different types of shell mounds, which he labeled as burial mounds, rubbish mounds, and possibly domiciliary mounds; but there is no direct evidence associated with the third type of mound as having buildings on it. Fewkes (1924) postulated that the mounds themselves may have been dunes previously, but evidence points towards artificial construction (Willey, 1949). Most of the ceramics Fewkes found in the shell middens were plain ware. Therefore, he did not associate the people who built the burial mounds and used Weeden Island pottery, with those who lived in the village and used the plain pottery (Milanich, 2002).

Within the few excavation areas, it was determined by Stirling, who worked with Fewkes on the excavation, that there are three distinct layers of deposition (Willey, 1949). These include a top layer about 4 inches in depth presumed to be deposited since occupation, and 2 layers containing skeletal remains which show very different burial techniques. Stirling believed the bottom layer to have been the original ground surface where depositions of burials as well as pottery and non-ceramics were more depicting of the Glades culture than the Weeden Island culture (Willey, 1949). The upper layer collection of burials, pottery, and non-ceramics were more typical of the Weeden Island II culture. The collection as a whole was incomplete, lacking information on any Weeden Island I culture, and many artifacts are missing. There were not any numerical ages determined, and therefore the time periods are only generalized (Willey, 1949).
These findings lead some archeologists to wonder whether or not Weedon Island itself can be considered an actual “true” Weeden Island I site (Milanich, 2002).

A recent comprehensive cultural resource survey of the Weedon Island Preserve by Weisman and others (2005), done in collaboration with this project, revealed a number of possible human interactions with Weedon Island. They found the site to be of great significance because, despite many disturbances, a substantial area of the site is still preserved. These preserved deposits allow archaeologists to determine Late Manasota-Weedon Island subsistence, technology, social organization, and political economy. A great diversity of pottery in terms of style, temper, and potform were found on the site leading to questions concerning pottery production and uses. Various tools were also found amongst the sand layers. A significant reduction sequence not yet described elsewhere in literature was worked out for a columella tool found on the site (Weisman et al., 2005). Figure 6 shows some of these unique tools made from shells found on Weedon Island by the cultural survey.
Figure 6. Shell tools were found on Weedon Island during the cultural survey. The smaller ones had not been identified in previous literature and a reduction sequence for the tools’ creation was discovered and documented by Jonathan Dean. Figure from Weisman et al. (2005).

Archaeological artifacts, including tools and evidence of tool production and culinary activities, found within yellow and white sand layers, suggest two separate
occupational periods. Both the Late Archaic groups and the latter Manasota-Weedon Island people lived on or adapted to a dunal setting. Those occurring within the yellow sand layer have been associated with the Middle to Late Archaic Period occurring around 5,000 years ago. The white sand layer overlaying the yellow sand contains artifacts indicating that people (Manasota-Weedon Island) were inhabiting the dune ridges during and after deposition. Shell scatters within white sand layers may have occurred prior to midden deposition, which occur predominantly above the white sand layer (Dean, personal communications, 2006). Figure 7 shows locations of shovel pit sites explored during the survey.
Figure 7. Yellow dots represent locations where shovel tests were taken during the archaeological investigation of Weedon Island. Along with these shovel tests soil probes and transects were also done in conjunction with this study. For further information on the archaeological findings on Weedon Island refer to Weisman et al. (2005).
Methods

Field Methods

In order to reconstruct the geomorphic evolution and give a general overview of environmental sedimentation for Weedon Island peninsula, multiple transects were selected for sediment core collection. Transects extend from what is interpreted as the paleoshoreline of Tampa Bay on the eastern and northern edges of the peninsula, across the upland environments and lowlands that encompass the peninsula south and westward to Riviera Bay (Figure 8). Within these transects cores were taken depending topography and accessibility. Forty-one sediment cores were collected using the basic vibracoring technique described by Lanesky et al (1979). 10 cm Aluminum core tubes were vibrated into the ground at previously selected locations and extracted using a coring tripod and winch. Excess core tube was trimmed using a pipe cutter, and core tubes were capped. Once transported to the lab, cores were cut into approximately one meter sections using a pipe cutter and then split lengthwise using a blade saw and stored in plastic sleeves for further analysis. Figure 8 shows the locations of the core sites within the five transects; cores 04WI2, 04WI4, 04WI6, 04WI8, 04WI10, 04WI12, 04WI14, 04WI15, and 04WI17 are duplicates, and cores 04WI11, 04WI13, 05WI18, 05WI31, 05WI32, and 05WI39 are outside of any transect. Table 1 lists core collected, their locations, lengths, and topographic position.
Table 1. All cores collected in the course of this study are listed with their identification number, date collected, North and East UTM coordinates, total sediment recovered in centimeters, compaction in centimeters, fence diagram in which the transect is represented, and description of the environment/landform where the core was taken. Cores represented by NA for their transect are either duplicates or are outside of any transect. Cores duplicates include 04WI2, 04WI4, 04WI6, 04WI8, 04WI10, 04WI12, 04WI14, 04WI15, and 04WI17. Cores outside of transects include cores 04WI11, 04WI13, 05WI18, 05WI31, 05WI32, and 05WI39.

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(Table 1 continued next page)
Table 1. (continued from p. 23)

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</tbody>
</table>

Lab Methods

A trowel was used to scrape excess sediment from the cores, and one half of each core was then wrapped in plastic to serve as an undisturbed archive. All cores were photographed prior to further analysis. Visual stratigraphic and lithologic descriptions of sediment size, composition, structure, Munsell color, and organic content were then constructed for all cores. Core logs are presented in Appendix A.

Three radiocarbon samples were taken from cores 04-WI-1 and 04-WI-3. A few small pieces (few mm) of charcoal were extracted at 51cm below ground surface (BGS) from the shelly midden layer of core 04-WI-1. Fibrous rootlets, with no obvious surface connections, were collected [in core 04-WI-3] from a bedding plane in finely laminated, carbonate mud at a depth of 81 cm BGS. Finally, wood fragments were collected from a sand layer at the base of core 04-WI-3, at 268cm BGS. These were assumed to pre-date the thick homogeneous carbonate clay bed above. The radiocarbon samples were collected to target two events: 1) age of the midden deposits in an inland, upland core,
and 2) bracketing ages for the unusual carbonate mud beds within a core interpreted to be from a nearshore paleoenvironment.

Selected core descriptions and photographs have been applied along with the three radiocarbon age estimates to reconstruct lithologic and geomorphologic changes for the transects. Fence diagrams were created to correlate selected cores and stratigraphic units across the transects.

Maps and aerial photographs were also used to determine recent historical changes that have occurred on Weedon Island. This was essential in determining an approximate historical shoreline of the peninsula prior to the extensive mosquito ditching activities and artificial fill associated with power plant construction on the northeast portion of the island. These aerial photos and maps were obtained from various county and state sources and orthorectified (if not already in the proper format). They were then processed and analyzed using ArcGIS® software. A map of present geomorphic settings was created for comparison with possible previous sedimentation environments.

Digital elevation models and USGS topographic maps from Pinellas County, Florida were also employed for estimation of elevations of core sites and topographic features in the study area. The 10 meter DEM, in Appendix B, was enhanced and corrected in ArcScene® prior to the addition of core locations and an aerial photo overlay.
Results

Cores:

Photos and descriptions of each core are contained in Appendix A. Cores representing five transects across selected landforms and environments were assembled into fence diagrams. Figure 8 shows the locations of each core transect as well as the cores used for each fence diagram. Table 1 lists all cores collected in the course of this study.
Figure 8. The red dots indicate locations where cores were taken on Weedon Island. The lettered boxes indicate groups of cores that are represented in fence diagrams A through E (Figures 9-13). Some cores were not represented within fence diagrams due to their locations or because they are duplicates of others used in the fence diagrams.

Transects were selected based on topographic position, targeted landforms, archaeological relevance, and accessibility. Transect A extends across a midden-capped dune ridge and is located just south of Master’s Boyou. Numerous archaeological artifact
sites are scattered throughout this transect area. Four cores were taken to represent
transect A. One core was taken on the top of the dune ridge, one on both the northern
and southern slopes, and one on the northern slope west of the other three locations. The
fourth core was taken to determine the distribution of midden material. Transect B
contains six cores and runs from northeast to the southwest across midden capped dune
ridges containing artifacts, low lying freshwater wetlands, to the western dunes lining
Riviera Bay. The northeastern most core (04-WI-13) in this transect is positioned on
what we have interpreted as the paleoshoreline. Transect C is situated near Old Weedon
Island drive, which lies atop a high dune ridge running along the northern edge of Riviera
Bay and is close to archaeological test sites. Transect D extends northeast to southwest
past a small lake, to the dune ridge along the eastern edge of Riviera Bay. The transect
was selected in order to try and determine the extend of the wetland, presently known as
Boy Scout Lake, in the past. Transect E begins in Riviera Bay and extends in an irregular
pattern northeast across two dune ridges. Cores were taken in Riviera Bay in order to
determine whether a freshwater-marine transition could be identified in the sediment
record (cores 37-40). Additional cores (04WI11, 04WI12, 04WI13, and 04WI140) were
collected in the Northeastern most part of the study area, in the transitional zone, between
natural sediments and construction fill, in order to further delineate the paleo-shoreline.

Sediment types were categorized and symbols for each facies were assigned.
Descriptions of each core facies are found in Table 2.
Table 2. List of facies identified in Weedon Island Cores. Symbols correspond to those used stratigraphic columns in figures 9-13.

<table>
<thead>
<tr>
<th>Facies Name</th>
<th>Description</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeological shell midden</td>
<td>Characteristic of a layer containing many, approximately 80%, large and small mollusk shells. Bones, charcoal, and other organic material may also be present. The boundaries are generally distinct. These layers have been identified during the archaeological reconnaissance survey as being anthropogenic created midden layers containing artifacts.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Brown sand</td>
<td>Characteristic of a layer containing dark brown very fine grained sand with medium amount of organic content. Very similar to the very pale brown sand layer, but sand is considerably darker in color.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Brown highly mottled sand</td>
<td>Characteristic of a layer containing pale brown to brown highly mottled with yellow, white, and brown sand. Organic content is generally moderate to high, approximately 50% or more. The layer often appears marbled and differs from the mottled white and brown sand layer with the high organic, mostly root, content.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Brown highly mottled sand with shell fragments</td>
<td>Characteristic of a layer containing pale brown to gray, highly mottled, very fine sand. Organic content consists of few to medium amounts of shell fragments.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Brown sand with shell fragments</td>
<td>Characteristic of a layer containing pale brown to brown highly compacted fine grained sand. Many, approximately 70%, tiny well mixed shell fragments are found within this type of layer. Boundaries are relatively distinct.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Coarse sand and gravel</td>
<td>Characteristic of a layer containing white to gray very fine sand with many, approximately 80% or more, solid white to very pale brown chunks. Tiny pieces of crushed shells are typically the only organic content present.</td>
<td><img src="image" alt="Symbol" /></td>
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<tr>
<td>Dark yellow reddish-brown sand</td>
<td>Characteristic of a dark brown to yellowish brown very fine sand. Generally the layer is darker in color near the top and gradually becomes lighter. Organic material is found in small amounts, generally consisting of a few tap roots. The sand has a rusty metallic glimmer that is characteristic of sands containing maganese.</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Grayish brown sand</td>
<td>Characteristic of a layer containing grayish brown very fine sand with few, about 20% or less, organic materials. This layer generally occurs below a layer with high organic content, but tends to be comprised mainly of sand itself.</td>
<td></td>
</tr>
<tr>
<td>Carbonate mud</td>
<td>Characteristic of a layer containing high, approximately 90% or more, calcium carbonate clay sized sediment. The color of the clay ranges from a white (5Y8/1) to a dark bluish gray (5PB4/1) and is often finely laminated. The boundaries are abrupt and very distinct.</td>
<td></td>
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<tr>
<td>Light gray sand and detritus</td>
<td>Characteristic of light gray, very fine grained sand containing medium to high, 30-70%, amounts of detritus material. This layer is located at the top of most cores, which corresponds well with its interpretation as top soil.</td>
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<tr>
<td>Light gray sandy clay</td>
<td>Characteristic of a layer containing light gray to very pale brown sand with a medium carbonate content. The sand appears cemented when dry.</td>
<td></td>
</tr>
<tr>
<td>Mottled white and brown sand</td>
<td>Characteristic of a mottled mixture of white and light brown very fine sand, giving a marbled appearance. Organic content is moderate to few, approximately 20%, and consists of mainly roots.</td>
<td></td>
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<tr>
<td>Organic-rich mud</td>
<td>Characteristic of dark brown to black organic rich layer. The sand content is low, approximately 10-20%, and there is a noticeable organic smell.</td>
<td></td>
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<tr>
<td>Organic-rich sandy mud</td>
<td>Characteristic of a layer containing grayish brown to dark brown compressed fine grained sand. Many flaky roots are present up to, about 70%, but the layer contains a higher content of fine grained sand than the 'mud' or 'peat' layers.</td>
<td></td>
</tr>
<tr>
<td>Peat</td>
<td>Characteristic of a layer containing a high percentage, approximately 70% or more, of densely compressed flakey roots. The sediment is generally dark brown with approximately 30% or less being fine grained sand.</td>
<td></td>
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<tr>
<td>Very pale brown sand</td>
<td>Characteristic of very pale brown very fine grained sand. These layers generally contain well mixed sand with some bioturbation mainly from plants. Organic material generally consists of a few to medium amount of tap roots.</td>
<td></td>
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<tr>
<td>White sand</td>
<td>Characteristic of a layer containing white (10YR8/1 or 10YR7/1) very fine single grained sand. The layer generally contains few, about 20% or less, organic content and is typically homogenous throughout. Organic content present usually consists of tap roots. Few to medium amount of tiny black phosphate flecks are also seen in this type of layer.</td>
<td></td>
</tr>
</tbody>
</table>
yellow sand

Characteristic of a layer containing homogenous yellow (10YR8/6) very fine sand with few, about 20% or less, organic material. The organic content present typically consists of a few long tap roots.

Radiocarbon Dating

Radiocarbon samples were measured by University of Arizona NSF-AMS lab. Radiocarbon age estimates were calibrated using the Cologne Radiocarbon Calibration software, CalPal (www.calpal.de). An age estimate of 1453 ± 36 $^{14}$C yr B.P., determined on charcoal from the 04WI1 core midden layer, is comparable to radiocarbon ages determined on archaeological materials associated with aboriginal occupation in the area (Weisman et al., 2005). Ages acquired for the 04WI3 core indicate that the calcium carbonate sediment layers formed between 3369 ± 45 and 456 ± 36 $^{14}$C yr B.P. Table 3 lists radiocarbon samples measured and their calibrated results.

Table 3. Radiocarbon age estimates determined through this study. 14C ages were calibrated using the Cologne Radiocarbon Calibration software (www.calpal.de).

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<th>Calendric Age calAD/BC</th>
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<td>512±15BP</td>
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<td>wood</td>
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<td>1663±60BC</td>
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Stratigraphic columns arranged in fence diagrams (Figures 9-13) indicate the different facies within each core and correlations between cores across transects shown in figure 8. Core elevations are estimates based on topographic maps and field notes. The elevation differences are not accurate; they are generalizations to show relative differences in topographic position within each transect. Detailed core descriptions and photographs are compiled in Appendix A.
Figure 9. This figure represents transect A, cores 05WI34-37. These cores transect the northern-most midden-capped dune ridge.
Figure 10. Transect B extends northeastward from the intersection of Weedon Island Drive and Progress Energy Road, across the midden-capped dune ridge, to the paleoshoreline. The transect encompasses present day upland, midland, and lowland environments.
Figure 11. Transect C, which includes cores 05WI40, 05WI23, 05WI24, 05WI27, 05WI26, and 05WI25, extends eastward along the dune ridge on the northern edge of Riviera Bay. Core 05WI40 was taken about 100 meters offshore in the northern portion of Riviera Bay; the rest of the cores were onshore just north of core 05WI40.
Figure 12. The figure represents Transect D, with cores 04WI9, 05WI29, 05WI33, and 05WI30. This irregular transect extends from the eastern shore of Riviera Bay, east, then south across a dune ridge, ending northeast of Boy Scout Lake.
Figure 13. Transect E contains cores 05WI38, 05WI21, 05WI22, 05WI28, 05WI19, and 05WI20, which crosses the dune ridge beginning at the northwest end of Riviera Bay. The cores make a northeasterly transect from core 05WI38, which was taken about 100 meters offshore, across an east-west trending dune ridge to an upland area north of Weedon Island Drive.
Aerial Photographs

As seen in Figures 14 and 15, the paleoshoreline and paleodune ridge can be viewed on the rectified 1943 aerial photograph. This photo provides a geomorphic perspective prior to large-scale alteration of the natural shoreline and topography through the construction of the Progress Energy power plant in the northeastern part of the study area. The locations of core sites are shown in relation to the natural shoreline position. It is also notable to recognize that the paleoduneridges and paleoshoreline are not the same location. There was a low lying possibly tidal flat or marsh area in between the dunes and the beach zone.
Figure 14. A 1943 aerial photo, from Pinellas County Florida, was georectified and utilized to digitize the paleodune ridge as well as the paleoshoreline prior to power plant construction. The cores that are closest to the paleoshoreline and paleodune ridge near the fill area have been labeled.
Figures 15. The digitized lines created from the 1943 photograph were overlayed directly onto the most recent aerial photo from Pinellas County Florida.
Discussion

Fence Diagrams Descriptions

Fence diagrams were created for the core transects (Figures 9-13) in order to determine the geomorphic changes that occurred on Weedon Island and how humans may have impacted the evolving geomorphology of Weedon Island.

Fence diagram A (Figure 9):

The base of core 36 contains dark brown metallic sand possibly due to higher amounts of manganese, colored and organically enriched probably by an adjacent spring or standing freshwater. The pale brown and yellow sand in cores 34, 35, 36, and 37 correspond with a drier period of vegetated upland landscape. The darker sand layer in core 37 correlates with these layers, but its proximity to the inlet resulted in wetter conditions and greater organic matter accumulation and preservation. White eolian (dune) sand layers in core 36 correlate with the gray sand layers in cores 34, 35, and 37, which were darkened due to leaching of organics from the overlying archaeological shell-midden layers. No midden material is identified in core 36, possibly due to its position farther from the shoreline or proximity to a former fresh water source. Organic rich mud above the midden horizon in core 37 is indicative of inundation either by freshwater or migration of the nearby tidal inlet, or could represent highly compacted saw palmetto and other vegetation root matter. The vegetation environment, midland containing concentrations of palm trees and saw palmettos, near core 37 suggests that the second explanation for the organic rich mud horizon may be more acceptable. A yellow sand layer separates two midden horizons in core 35. The two distinct midden horizons may represent two separate periods of habitation or may simply indicate reworking during
20th century human activities. Further dating of the shell material is needed in order to confirm the possible explanations.

**Fence Diagram B (Figure 10):**

The base of core 3, located at the paleoshoreline, contains two separate layers of peat formed within a moist environment, directly above a layer of pale brown sand that is radiocarbon dated to $3,369 \pm 45 \text{^{14}C yr B.P.}$. The lower pale brown sand layer does not contain shells, and most likely represents a vegetated dry land environment prior to marine inundation. Above the peat layers in core 3 is an abrupt transition into a homogeneous, finely laminated, carbonate clay, possibly created in a zero-energy lacustrine or lagoonal environment by whiting events. Above the carbonate layer, highly fragmented shelly sand, representing a beach face environment, indicates a paleoshoreline position. A coarse sand and gravel layer lies above the shelly sand, separated by a sharp, horizontal boundary. We interpret the coarse layer to be a storm deposit, which extends across the transect into core 1. Above the storm deposit in core 3, the beach environment continues briefly, then abruptly transitions into an upper bed of finely laminated clays. This might indicate a transition from a back lagoonal area to an open water environment and then back to a lagoonal environment before becoming an open water area again prior to the construction of the power plant. Organics compressed between laminae are dated to $456 \pm 36 \text{^{14}C yr B.P.}$. Core 1 contains two separate archaeological shell-midden deposits, which may correlate to the time period in which pale brown sand accumulated in cores 16, 5, and 7. Midden material in core 1 was deposited on dune sand, which correlates with the white eolian sand layers in the lower
part of core 16, 5, and upper layer of 18. Below the layers of white sand there is a layer of organic mud or sandy organic mud in both cores 18 and 16. These organic layers would be associated with wetland environments. The mottled facies in core 7 may either indicate high bioturbation within the pale brown sand layer or human disturbance. When viewing the 1943 aerial photo, it becomes apparent that core 7 is located at or near the former location of Weedon Island Drive. The yellow sand layer in core 18 indicates a vegetated upland or midland environment. It is likely that this layer occurs in other core locations, but we did not penetrate to that layer. All cores in this diagram contain a light gray layer at the top indicative of top soil.

Fence Diagram C (Figure 11):

The lower part of cores 23, 24, and 27 are dominantly dark yellow reddish-brown metallic sand, similar to that found in core 36, which we interpret to represent a westward migrating spring outlet adjacent to this transect. Pale brown sand in cores 25 and 26 correlates with the metallic sands in cores 23, 24, and 27. We conclude that the pale brown sand represent the same sediment accumulation period as the metallic sand. Organic muds in core 23 indicate an adjacent water source – possibly a spring - and corresponding wetland environment. At that same time, a dune ridge was forming across the sites of cores 24-27. As the spring discharge point migrated westward, away from the site of core 23, sand accumulated in the low lying area. Core 24 does not have the light brown sand layer identified at similar levels in cores 23 and 27, possibly due to excavation during road construction. In the upper part of core 23, which lies closest to Riviera Bay, is a muddy organic layer overlying the light brown sand, representing water
inundation and possibly mangrove expansion. The uppermost bed of light gray-brown sand in core 23 represents eolian accumulation following a drop in water levels or fill associated with nearby mosquito ditch excavation. The first two layers in core 26 may also represent human disturbance due to road construction in the early nineteenth century. The mottled white and brown sand in 26, though indicative of bioturbation, contain little or no organic material, which supports our conclusion of human disturbance rather than bioturbation. Core 40, taken about 100 meters from shore in the northern portion of Riviera Bay, shows no apparent correlation with the cores taken on land. We conclude that the cores taken from the bay may not be deep enough to determine past environments, and the sediments may have been affected by local dredging of the Bay.

**Fence Diagram D (Figure 12):**

The brown highly mottled sand near the base of cores 9, 29, and 33 suggest a period of vegetation and higher bioturbation. This probably occurred during the period of sediment accumulation, but tap roots may have extended downwards from above layers during the later periods as well. The grayish brown sand found in cores 29 and 33 may have been whiter eolian sand like that found in core 30. The once white sands in core 33, possibly more so than core 29 due to its location on the edge of Boy Scout Lake, may have been altered due to leaching from the above layers, causing it to become a grayish brown. The yellow sand, possibly indicating a vegetated semiarid or upland environment, in core 9 may have accumulated during the same period as the white and grayish brown sands in cores 29, 33, and 30. Due to its location on the opposite side of the dune ridge, sediments accumulated at the position of core 9 may have, depending on
wind direction, had a different source and been more protected than the other core locations in Transect D. A protected environment may have allowed for more vegetation growth, which is suggested by the higher abundance of roots. The peat and organic rich sandy mud layers, as well as the dark yellow brown layers below, found in cores 33 and 30, may indicate higher water levels in Boy Scout Lake. These higher water levels could have enriched the soils with manganese, accounting for the metallic luster of the dark yellow-brown sands. Higher water may have allowed more vegetation growth around the lake’s edge, creating the peat and organic-rich sandy-mud layers. The yellow sand seen at the bottom of cores 9 and 30 represent a vegetative environment that would have been drier than the preceding environment that created the darker, more organic rich sediments. All cores within diagram D contain a light gray layer at the top indicative of top soil.

**Fence Diagram E (Figure 13):**

The white and grayish brown sand layers in cores 38, 22, and 20 are interpreted as eolian dune sand, which may represent a drier period. Due to the locations of cores 19 and 20 in a lower lying area near wetlands, more sediment may have accumulated during that time period. The light brown sand layers in cores 28 and 21 may have also accumulated at that time, but due to their locations on the opposite side of the dune ridge north of Riviera Bay, there may have been more vegetation growth or less sand accumulation. Another possible explanation for the lack of eolian whitish sand in cores 21 and 28 is that they may have been removed during the construction of Weedon Island Drive. Below these layers of white, grayish-brown, or pale-brown sands, there are
layers of organic-rich sandy mud in cores 21, 22, 19, and 20. All four cores are in relatively lower lying areas presently adjacent to wetland areas containing mangroves and other wetland indicator vegetation. Core 22 may have been even lower lying during this period of accumulation than core 21. As the wetland area dried or shifted, location 22 may have been filled in with sediment before the location around core 21. A yellow sand layer generally lies below both the white sand and organic rich mud. We interpret this layer to be indicative of a vegetated semi-arid location. This layer may also indicate a drier period proceeded by a wetter period which created the organic layers overlaying the yellow sand. Cores 19 and 20 appear to have reversed layers. The dark yellow-brown metallic sand is interpreted to have been altered through spring-water flow. The spring outlet or pooling location may have migrated from the location of core 20 to the position of core 19. The area around core 20 was then filled in by pale brown sediment prior to the layers of white and grayish brown sand. Below the dark yellow-brown sand layer in core 19, there is a pale-brown sand layer. It is unknown whether core 20 would have penetrated into this layer, had the core been longer, or if this layer is not present at the location of core 20. Core 38 does show some correlation with the landward cores in the transect, but due to its location about 100 meters offshore from the northern edge of Riviera Bay, it is unclear whether these are legitimate correlations or simply represent recent resedimentation associated with channel dredging. If the lower layers are undisturbed it would appear that this northern area of Riviera Bay was either once dry land during periods of eolian sand movement, or sediment layers accumulated relatively rapidly in a nearshore marine embayment. The layer containing sand partially cemented with calcium carbonate suggests a dry environment where secondary CaCO₃ was
precipitated in the shallow subsoil. Therefore, the area would have either been wet then
dry and then wet again, or it contained water the whole period, but accumulated sediment
rapidly, wind blown or erosion driven, at a fast enough pace not to be too bioturbated.
All cores accept for 38 have either light gray or brown highly mottled sand indicating a
top soil layer.

**Clay Bed Interpretations**

Clay sized sediment, concentrated in distinct found within cores 04WI3, 04WI4,
04WI11, and 04WI12 is almost entirely calcium carbonate, with only minor traces of
siliclastic grains. This would not have been a source for clay used in the creation of
pottery and other clay artifacts found within archaeological deposits on Weedon Island.
Possible explanations for the carbonate clay deposits include whiting events like those
described by Glenn et al. (1995). Conditions for whiting events in the past may have
been more suitable due to past climatic changes including wetter and possibly warmer
more tropical conditions as seen in the Soto (2005) and Lake Tulane (Cross et al., 2004;
Grimm et al., 1993) studies.

Another possible explanation is that the area where the carbonate clays formed
and accumulated was formerly seaward of the paleoshoreline within a back-barrier
microtidal carbonate lagoonal environment, as described by Nichols (1999). Figure 14
illustrates the location of cores compared with the shoreline prior to power plant
construction in the area, which indicates the possibility of a lagoonal paleoenvironment.
That type of environment would have been associated with hypersaline, calm conditions
deterring bioturbation and restricting coarse siliclastic inputs. The barrier islands in
that scenario, examples of which are present offshore of Weedon Island today, may have originated as oyster bars with mangroves colonizing the banks. Mangroves’ associated fauna are known to create calcium carbonate waste that could be oxidized creating the light gray color (Brinkman, personal communication, 2006). These back barrier conditions could have also been ideal environments for whittings to occur. The laminations within the carbonate clays are more suggestive of repeated whiting events, rather than semi-continuous sedimentation that would be expected under the mangrove model.

It is likely that the paleoenvironments adjacent to Weedon Island were formerly analogous to that described by Donahue and others (2003). According to Donahue’s model, the marine inundation of Tampa Bay began around 5,000 yr B.P., and a shallow protected estuarine environment replaced what was previously once a freshwater depression. Our cores along the paleoshoreline may preserve a record of the initial encroachment of rising sea-level to a position just high enough to inundate the region of Tampa Bay where Weedon Island is situated. Prior to the creation of the carbonate clay layers peat layers indicate a wetland environment, although the absence of fossils precludes a freshwater vs. marine interpretation. Radiocarbon ages for the basal sand layer, around 3,600 $^{14}$C yr B.P. fall at the end of a period of higher rate of sea-level rise, according to Donahue and others (2003). Donahue et al. (2003) and Wanless (1994) interpret a reduction of the rate of sea-level rise around 3,000 yr B.P., although sea-level has gradually continued to rise since that time. Wright and others (2005) interpreted a slightly lower rate of rise during that period, but all agree that sometime between about 3,000 and 2,500 yr B.P., the rate of sea-level rise decreased considerably compared with
the period prior to 5,000 yr B.P.. This slowing in sea level rise allows for mangrove and oyster beds to colonize surfaces and keep up with the rate of vertical aggradation, resulting in the formation of sand bars and islands in the newly inundated tidal regions. We interpret the 3,600 $^{14}$C yr B.P. paleoshoreline of Weedon Island to have been approaching a similar position to that observed in the 1943 aerial image (Figure 14). While it would have been approximately 0-2m meters below present, it would have reached the inner Tampa Bay region. Coastal environments would have been stabilizing, allowing for more long-term human occupation of the coastal zone. These environments allowed for human occupation of the area as the sea level continued to slowly rise and the climate shifted from wetter to drier conditions.

**Comparison With Paleoclimate Records**

Radiocarbon age estimates on samples taken from the cores appear to match well with both archaeological and paleoclimatic data. Charcoal dated 1453 ± 36 $^{14}$C yr B.P., collected from midden sediments within core 04WI1, corresponds well with archaeological findings previously reported in the region and recently identified through archaeological reconnaissance on Weedon Island (Weisman et al., 2005).

My interpretations suggest a correlation between three radiocarbon-dated sedimentary horizons with wetter and drier periods identified in the speleothem paleoclimate record of Soto (2005). Figure 16 shows the calibrated ages determined in my study compared with Soto (2005) speleothem data and interpreted Little Salt Springs (Alvarez et al., 2005) data compiled and graphed by Van Beynen (2006).
My dated samples were taken from a shell midden, a carbonate clay bed, and a sand layer underlying the carbonate clay bed. The oldest sample dated 3600 ± 60 cal yr B.P., within the sand layer below the carbonate clay, falls within a relatively wet phase.
According to our ages, the carbonate formed between 3600 ± 60 and 510 ± 15 cal yr B.P., which correspond to a relatively long wet period. An age of 1350 ± 30 cal yr B.P. determined on charcoal within the midden layer, corresponds with the end of a wet period that preceded a much drier period. Below all of the midden layers and within many of the other cores a layer of white eolian sand was found with very little organic material. This facies may correlate with the drier period around 1.3 ka BP.

The climate was drier during the period from about 1.75 to 1.3 ka B.P., with a sharp increase in precipitation around 0.9 ka BP, which may correlate with shell midden construction and human occupation. In cores 04WI1 and 05WI35 I identified potentially two distinct occupation horizons, represented by separate midden beds. With so few radiocarbon dated samples, it is difficult to interpret specific time periods of occupation. It is also possible that the double midden beds represent erosion and downslope redeposition, which could be revealed through additional radiocarbon dating. With the dates I have one possible explanation, if there are multiple events, which is that the layer of white sand occurring between the midden layers accumulated during the drier period around 1.75ka BP. A possible explanation for leaving the area at that time might be the lack of fresh water if the drier climate caused the fresh springs in the area to become less active.

Other facies within the cores also correlate with the speleothem data. Below the white sand layers within all of the cores, layers of either yellow sand or organic-rich sand/peat are observed. These facies are interpreted as forming under vegetation cover. According to the speleothem data, there was a drier period that I associated with the white sand facies. Without further age control, however, these are only speculations.
The cores along the paleoshoreline show no obvious indications that sea level was higher than present during the period studied, as suggested by Stapor et al. (1991). Instead, there appears to be evidence of a continual rise in sea level, as indicated by Wright et al. (2005). The sediment at the bottom of the paleoshore cores (04WI3) reflects a vegetated dryland environment much like the facies seen in other more upland cores. Separate layers of peat and intermixed sand, which may be interpreted as ephemeral wetlands or could be indicative of mangrove transgression and regression seen in the Ten Thousand Island area of Florida as the rate of sea level rise has fluctuated (Donahue et al., 2003). Finely laminated clay layers occur directly above these peat layers indicating a possible transition from a shallow shoreline environment to a slightly deeper back lagoonal environment. Sand with intermixed broken shells in the preceding layer, as well as gravel layers indicating a possible storm event, show a transition to a beach environment. That type of environment persisted until the construction of the power plant, and can be viewed in the 1943 aerial photo (Figure 14).
Conclusion

There appears to be some correlation within our cores and dates taken from our samples to the time periods found in both the paleoclimate as well as the archaeological records of the area. Sand layers below the midden layers indicate a drier phase in the climate and suggest that the ancient humans settled on existing dune structures in a region containing freshwater springs and an estuarine food source. According to Weisman et al. (2005), ancient humans occupied the area to some extent prior to deposition of the white eolian sand layers. The shell middens, which overlie the white sand, would have been created at the end of, or following formation of these dune ridges. We infer that the indigenous peoples created the middens after sea-level had reached near present elevation. The environment at the time would be that of an estuary ideal for oyster bed creation and other mollusk inhabitation, enabling the creation of shell middens. We did not find evidence of a higher than present sea level, but one that has continued to rise at varying rates.

In review of my hypothesis I asked three research questions. After analysis and further interpretation of my data I have made the following conclusions.

- How did changes in sea level affect the geomorphology and sedimentation processes of Weedon Island?
  - The paleoshoreline cores show a transition from vegetated soils to wetland environments, to marine environments.
What is the relationship between human manipulation of the landscape and the natural sedimentation processes in the geomorphic evolution?

- Humans appear to have settled on existing dune ridges and modified and enhanced the topography through the creation of midden piles.

What additional research will be required to assess the anthropogenic and paleoclimate affects on the island’s geomorphology?

- Future research is needed to understand the timing of formation of the natural and anthropogenic features on Weedon Island. Considerably more radiocarbon dating would assist in the effort to correlate facies across core transects, toward the ultimate goal of reconstructing relationships between sea-level rise, coastal geomorphology, paleoclimatology, and the archaeological record.
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Appendix A

Core digital Library
Site Name: Weedon Island  
Core length: 154cm  
Core Sections:2  
Core I.D.: 04WI1  
Number of Layers: 7  
Compaction: 115cm  
Date Taken: 3/22/04  
UTM Location: UTM-17-0341749E 3082722N

I. 0-20 10YR6/3 pale brown very fine single grained sand, medium to many detritus material, abrupt boundary.

II. 20-33cm 10YR6/3 pale brown very fine sand w/ very high whole shell and crushed shell content, about 70%, a bone and large root lay vertically near bottom of layer, abrupt boundary.

III. 33-45cm 10YR8/6 yellow sand pretty homogenous layer, some darker flecks and mottles, very few shell frags, little to no organics, abrupt boundary.

IV. 45-63cm 10YR5/1 gray very fine sand, 90% whole and crushed shells, high organic content in sand, abrupt boundary.

V. 63-87cm 10YR7/1 light gray clor gradually gets lighter to a 10YR8/1 white very fine single grained sand abrupt boundary.

VI. 87-110cm 10YR8/1 white sand w/ horizontal layers of solid 10YR8/2 very pale brown chunks, possibly reworked limestone or nodules, 3 main horizontal lines of chunks w/ smaller pieces throughout, abrupt boundary.

VII. 110-150cm 10YR8/1 white very fine single grained sand gradually turning 10YR8/2 very pale brown, homogenous layer, no organics.
Site Name: Weedon Island
Core length: 162cm
Core Sections: 2
Core I.D.: 04WI2
Number of Layers: 5
Compaction: 135cm
Date Taken: 3/22/04
UTM Location: UTM-17-0341749E 3082722N

I. 0-5cm 10YR2/2 very dark brown high organic detritus content, many tiny roots, distinct boundary.
II. 5-27cm 10YR4/1 dark gray very fine single grained sand, well mixed medium amount of broken shells and fragments, about 40%, abrupt boundary.
III. 27-62cm 10YR4/1 dark gray very fine sand very high large and broken/fragmented shells, highly compacted 90% shells, abrupt boundary.
IV. 62-115cm 10YR8/1 white very fine single grained sand, light gray at top gradually getting lighter, few 10YR7/1 white light brown chunks of either reworked limestone or nodules mixed throughout layer, not in distinct layers, semi-distinct boundary.
V. 115-162cm 10YR7/1 very pale brown very fine single grained sand, highly mottled at top of layer w/ 10YR6/3 pale brown sand, few mottles continue throughout layer, tiny organic fragments (possibly roots) at top of layer.
I. 0-20cm 10YR7/2 light gray very fine single grained sand, well mixed w/ tiny detritus frags, semi-abrupt boundary.

II. 20-72cm 10YR8/2 very pale brown very fine sand, very compacted, circular chunk of clay at 55cm, well mixed tiny shell frags throughout layer, pretty homogenous, very distinct boundary.

III. 72-90cm 5Y8/1 white clay w/ highly laminated layers of 5PB4/1 dark bluish gray and 2.5Y5/4 light olive brown, mainly finely laminated layers of white and bluish clay, very distinct boundary.

IV. 90-100cm 10YR8/2 very pale brown very fine sand very well mixed w/ tiny shell frags, abrupt boundary.

V. 100-104cm 10YR8/2 very pale brown sand, mainly 90% chunks, possibly reworked limestone or nodules, few shell frags intermixed, abrupt boundary.

VI. 104-140cm 10YR8/2 very pale brown highly compacted single grained sand, many tiny well mixed shell frags throughout layer, less at bottom of layer, very distinct boundary.

VII. 140-240cm 5Y8/1 white clay highly laminated at top of layer w/ 5PB4/1 dark bluish green clay, from 165-200cm pure white clay w/ very few bluish streaks, from 200-240 highly laminated w/ blue and 5Y7/2 light gray streaks.

VIII. 240-245cm 10YR2/1 black highly compacted muddy peat, very distinct boundary.

IX. 245-249cm 10YR7/2 light gray very fine single grained sand, no shell frags, homogenous sand, distinct boundary.

X. 249-253cm 10YR2/2 very dark brown
<table>
<thead>
<tr>
<th>Layer</th>
<th>Depth (cm)</th>
<th>Color Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XI</td>
<td>253-257</td>
<td>10YR7/2</td>
<td>Light gray very fine single grained sand, no shell frags homo. sand, distinct boundary.</td>
</tr>
<tr>
<td>XII</td>
<td>257-260</td>
<td>10YR2/2</td>
<td>Very dark brown highly compacted peat, iron stained near bottom of layer, distinct boundary.</td>
</tr>
<tr>
<td>XIII</td>
<td>260-269</td>
<td>10YR7/2</td>
<td>Light gray very fine sand w/ iron staining.</td>
</tr>
</tbody>
</table>
Site Name: Weedon Island  
Core I.D.: 04WI4  
Date Taken: 4/5/04

Core length: 121cm  
Core Sections: 3  
Number of Layers: 3  
Compaction: 181cm  
UTM Location: UTM-17-0341796E 3082627N

I. 0-20cm 10YR6/2 light brown very fine single grained sand, few well mixed organic and shell frags, distinct boundary.

II. 20-70cm 10YR8/2 very pale brown very fine highly compacted sand, medium amount of very tiny well mixed shell frags, tiny streak of clay at 62cm, very distinct boundary.

III. 70-82cm 5y8/1 white clay highly laminated w/ 5PB4/1 dark blueish gray and 2.5Y5/4 light olive green clay, very distinct boundary.

IV. 82-132cm 10YR8/2 very pale brown very fine highly compacted single grained sand, large and small chunks of reworked limstone or nodules throughout layer, very abrupt boundary.

V. 132-179cm 5Y8/1 white clay laminated throughout most of layer w/ 5PB4/1 dark bluish gray and 2.5Y5/4 light olive green clay, little to no laminations from 155-175cm, very abrupt boundary.

VI. 179-183cm 10YR2/2 very dark brown highly compacted muddy/peat, orange possible iron stained mottles, very abrupt boundary.

VII. 183-187cm 10YR8/2 very pale brown very fine single grained sand, little to no organics, very abrupt boundary.

VIII. 187-188cm 10YR2/2 very dark brown highly compacted muddy/peat
Site Name: Weedon Island

Core length: 260cm
Core Sections: 2
Core I.D.: 04WI5
Number of Layers: 4
Compaction: 152cm
Date Taken: 4/5/04
UTM Location: UTM-17-0341690E 3082437N

I. 0-35cm 10YR6/1 gray very fine single grained sand, high content of detritus at top of layer, well mixed leaf litter and organic matter, gets less towards bottom of layer, gradual boundary.

II. 35-112cm 10YR7/4 very pale brown very fine single grained sand, medium sized roots/sticks at top of layer, smaller roots at 60-80cm, organic matter decreases throughout layer 80-112cm pure sand, gradual boundary.

III. 112-140cm 10YR8/1 white very fine single grained sand, pure sand w/ medium amount of tiny black phosphate flecks, higher content of flecks from 115-125cm.
Site Name: Weedon Island  
Core length: 121cm  
Core Sections: 3
Core I.D.: 04WI6  
Number of Layers: 3  
Compaction: 247cm
Date Taken: 4/5/04  
UTM Location: UTM-17-0341690E 3082437N

I. 0-40cm 10YR6/1 gray very fine single grained sand, high content of detritus at top of layer, large root at 15-22cm, well mixed leaf litter and organic matter gets less toward bottom of layer, gradual boundary.

II. 40-110cm 10YR7/4 very pale brown very fine single grained sand, little to no organic matter, very few tiny roots near top of layer and at 65cm, gradual boundary.

III. 110-121cm 10YR8/1 white very fine single grained sand, pure sand w/ little to no organic matter, medium to few tiny black phosphate flecks.
Site Name: Weedon Island  
Core length: 260cm  
Core Sections: 2  
Core I.D.: 04WI7  
Number of Layers: 4  
Compaction: 106cm  
Date Taken: 4/5/04  
UTM Location: UTM-17-0341567E 3082229N

I. 0-20cm 10YR6/1 gray very fine single grained sand, very high detritus content, large roots and sticks at top, gradual boundary.

II. 20-148cm 10YR6/3 pale brown single grained sand, highly mottled w/ medium root content throughout, mottled w/ white, yellow, brown, black; roots mainly horizontal, looks marbled, semi-abrupt boundary.

III. 148-234cm 10YR8/4 very pale brown very fine single grained sand, very few roots/organic matter, one long root from 166-175cm, homogenous pure sand throughout gradually lightening to 10YR8/2 very pale brown, abrupt boundary.

IV. 234-260 10YR8/4 very pale brown very fine single grained sand, highly mottled w/ 10YR5/4 yellow brown sand, mottles gradually decrease near end of core.
Site Name: Weedon Island  
Core I.D.: 04WI8  
Date Taken: 4/5/04  
Core length: 241cm  
Core Sections: 3  
Number of Layers: 6  
Compaction: 126cm  
UTM Location: UTM-17-0341567E 3082229N

I. 0-35cm (loss of sed. from 0-15cm) 10YR7/1 light gray very fine single grained sand, high very small root and detritus content, roots decrease at layer boundary, gradual non-distinct boundary.

II. 35-80cm 10Yr6/1 gray very fine single grained sand, medium to few flaky root content, highly mottled w/ 10YR8/3 very pale brown, 10YR8/2 very pale brown, and 10YR5/1 gray sand, looks marbled, very distinct boundary.

III. 80-100cm 10YR5/3 brown very fine single grained sand, very few flaky roots throughout layer, few darker and lighter mottles of 10YR5/4 yellow brown and 10Yr7/4 very pale brown, distinct boundary.

IV. 100-153cm 10YR5/2 grayish brown very fine single grained sand, high content of medium sized (mangrove) roots and smaller roots, highly mottled and streaked w/ 10YR7/1 light gray, 10YR7/3 very pale brown, and 10YR3/3 dark brown sand, looks marbled, very distinct boundary.

V. 153-203cm 10YR7/4 very pale brown very fine single grained sand, dark streak of 10YR4/3 brown sand at 157-159, smaller streaks from 170-176, very few roots/organic matter, pretty homogenous pure sand layer w/ very few tiny flaky roots throughout, sand gradually gets lighter, gradual boundary.

VI. 203-241cm 10YR8/2 very pale brown gradually becoming 10YR8/1 white very fine single grained sand, very few small flaky roots throughout layer.
Site Name: Weedon Island  Core length: 250cm  Core Sections: 3
Core I.D.: 04WI9  Number of Layers: 4  Compaction: 119cm
Date Taken: 4/5/04  UTM Location: UTM-17-0341497E 3081656N

I. 0-39cm 10YR6/2 light brown gray fine single grained sand high to medium content of larger roots (mangrove), and medium to high content (gradually decreasing towards bottom of layer) of tiny roots, sand highly mixed w/ darker and lighter colors, very gradual boundary.

II. 39-76cm 10YR7/3 very pale brown fine single grained sand, medium sized roots run down through layer, very gradual boundary.

III. 76-140cm 10YR3/6 dark yellow brown very fine single grained sand, long root runs from 76-98cm, little to no other organic matter, mottles of 7.5YR2.5/2 very dark brown, sand gradually gets lighter brown, very gradual boundary.

IV. 140-248cm 10YR5/3 brown very fine single grained sand, few 7.5YR2.5/2 mottles near top of layer, very little to no organic matter throughout layer, few tiny dark streaks/mottles from 165-195cm, mostly homogenous pure sand layer, sediment gradually decreases towards end of core.
Site Name: Weedon Island  
Core I.D.: 04WI10  
Date Taken: 4/5/04  
Core length: 411cm  
Number of Layers: 7  
Core Sections: 3  
Compaction: 44cm  
UTM Location: UTM-17-0341497E 3081656N

I. 0-43cm 10 YR7/2 light gray fine single grained sand, medium to high root content, large (mangrove) root chunks at 10cm, 115cm, 30cm, and 42cm, many tiny roots and plant material from 0-30, decreasing after 30cm, color gradually gets darker, gradual boundary.

II. 43-91cm 10YR5/3 brown fine single grained sand, medium sized roots (mangrove?) throughout layer gradually becoming less, color gradually turns more yellow, gradual boundary.

III. 91-298cm 10YR5/6 yellow brown very fine single grained sand, little to no organic (few roots near top) matter, mostly homogenous sand 153-200cm fine streaks of 10YR3/3 dark brown, distinct boundary.

IV. 298-336cm 5YR3/4 dark red brown very fine highly compacted sand, mottles and streaks of 10YR5/6 yellow brown from 305-341, highly compacted chunks of dark (possibly organic) matter from 305-341cm, wavy semi distinct boundary.

V. 336-395cm 10YR7/3 very pale brown, medium amount of mottling w/ 5YR3/4 dark red brown, few streaks of plant matter gradually decreasing towards bottom of layer, very distinct boundary.

VI. 395-396cm 5YR3/4 dark red brown highly compacted fine sand, very distinct boundary.

VII. 395-411cm 10YR6/4 light yellow brown highly compacted very fine sand, broken into chunks, little to no organic matter.
Site Name: Weedon Island  
Core I.D.: 04WI12  
Number of Layers: 3  
Date Taken: 10/30/04  
UTM Location: UTM-17-0341818E 3082887N

I. 0-20cm 10YR7/1 light gray many medium sized pieces of chert and gravel, abrupt boundary.
II. 20-65cm 10YR8/3 very pale brown sand w/ medium amount of tiny shell fragments in horizontal layers, abrupt boundary.
III. 65-70cm 10YR7/1 light gray clay, highly horizontally laminated, abrupt boundary.
IV. 70-89cm 10YR8/3 very pale brown sand w/ medium amount of tiny shell fragments throughout, clay chunk at 76cm, abrupt boundary.
V. 89-92cm 10YR2/1 black highly compacted peat and intermixed sand layers abrupt boundary.
VI. 92-95cm 10YR8/3 very pale brown very fine sand w/ medium amount of tiny shell fragments throughout, abrupt boundary.
VII. 95-98cm 10YR2/1 balck peat layers intermixed w/ sand layers, abrupt boundary.
VIII. 98-112cm 10YR8/3 very pale brown very fine sand w/ medium amount of tiny shell fragments, abrupt boundary.
IX. 112-120cm 10YR7/1 light gray clay highly laminated abrupt boundary.
X. 120-138cm 10YR8/1 white sand and clay mix some laminations, abrupt boundary.
XI. 138-160cm 10YR8/1 whitish clay, somewhat laminated near top, abrupt boundary.
XII. 160-181cm 10YR8/1 white sandy clay mix, some laminations abrupt boundary.
XIII. 181-211cm 10YR7/1 light gray to whitish and blueish gray pure clay, laminated especially near bottom, abrupt boundary.
<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>IXV. 211-248cm 10YR7/2 light gray highly mottled sand, high organic content, many flaky roots, gradual boundary.</td>
<td></td>
</tr>
<tr>
<td>XV. 248-289cm 10YR7/3 very pale brown very fine sand with few roots running downward through layer.</td>
<td></td>
</tr>
</tbody>
</table>
Site Name: Weedon Island  
Core length: 72cm  
Core Sections: 1  
Core I.D.: 04WI14  
Number of Layers: 3  
Compaction: 0cm  
Date Taken: 10/30/04  
UTM Location: UTM-17-0341805E 3082849N

I. 0-18cm 10YR8/2 very pale brown very fine single grained sand, few well mixed organic materials (hair roots, small sticks, tiny broken shell frags) wavy semi-abrupt boundary.

II. 18-58cm 10YR8/3 very pale brown very fine single grained sand, more compacted than top layer, medium to many mottles of 10YR8/1 white sand throughout layer, and from 21-27cm few small (less than 1cm) mottles of 10YR4/4 dark yellow brown clay, and streaks of 10YR4/4 clay at boundary, wavy abrupt boundary.

III. 58-72cm 2.5Y8/3 pale yellow clay sand mixture, sand is coarser than above layer, large rock at 63-66cm, more sand than clay surrounding rock, clay turns to a 5Y6/2 light olive gray below rock mixed w/ some sand mottles and lighter clay 2.5Y8/3.
Site Name: Weedon Island
Core length: 255cm
Core Sections: 2
Core I.D.: 04WI16
Number of Layers: 5
Compaction: 89cm
Date Taken: 10/30/04
UTM Location: UTM-17-0341494E 3082196N

I. 0-6cm 10YR8/2 very pale brown fine single grained sand, pretty homogenous, few black 10YR2/1 organic specks and very fine hair roots, very abrupt boundary.

II. 6-20cm 10YR2/1 black, compacted sticky organic sandy mud, sand content increases slightly towards end of layer, few very fine hair roots, pretty abrupt wavy boundary.

III. 20-184cm 10YR6/3 pale brown fine single grained sand, top of layer has darker organic leaching from above layer until 30cm, medium small roots scattered from top of layer to 100cm, then again at 125cm to bottom of layer, organic wavy streak at 45cm, organic matter w/ rusty appearance from 68-76cm mottling of 10YR8/2 very pale brown sand begins at 150cm and continues to increase to bottom of layer, gradual boundary.

IV. 184-254cm 10YR8/1 white very fine single grained sand, few thin roots from 184-195cm, speckles (very small mottles) of 10YR6/3 pale brown sand starting at 220cm to 254cm, mostly homogenous layer of pure white sand, abrupt boundary.

V. 254-255cm 10YR2/1 black organic mud possibly more sand below streak, or maybe another layer, end of core.
Site Name: Weedon Island
Core length: 188cm  Core Sections: 3
Core I.D.: 04WI18  Number of Layers: 4  Compaction: 43cm
Date Taken: 10/30/04  UTM Location: UTM-17-0341345E 3082048N

I. 0-15cm 10YR7/1 light gray very fine single grained sand, medium amount of thin hair roots, roots end abruptly at boundary and sand gradually gets lighter, few black flecks (possibly charcoal) semi gradual boundary.

II. 15-73cm 10YR8/1 white very fine single grained pure sand, very little organic matter, a medium sized root at 28-33cm, small very thin plant matter at 42-48cm and 58-61cm, sand begins to darken at 65cm, boundary is semi abrupt w/ somke darkening of sand in layer II.

III. 73-107cm 10YR5/2 grayish brown very fine compressed sand, many flaky roots, peety in consistancy, from 90-100cm sand lightens to 10YR8/2 very pale brown and then at boundary begins to darken again to 10YR6/4 light yellow brown, roots gradually decrease but continue into layer IV, semi gradual boundary.

IV. 107-299cm 10YR6/4 light yellow brown at top of layer very fine single grained sand, medium sized and medium amount of flaky roots at top of layer, roots gradually decrease until 160cm, from 160-299 little to no organic matter pure sand, one long medium root from 210-260cm, sand lightens slightly to 10YR8/6 from middle of layer towards the bottom 160-250 and then darkens again slightly from 250-299cm w/ very few thin flaky roots.
Site Name: Weedon Island  Core length: 337cm  Core Sections: 3
Core I.D.: 05WI19  Number of Layers: 6  Compaction: 9cm
Date Taken: 1/27/05  UTM Location: UTM-17-340579E 3082298N

I. 0-8cm light gray 10YR7/1 very fine single grained sand, medium amount of organic (detritus) material, semi-abrupt boundary.
II. 8-15cm 10YR2/2 very dark brown very fine sand, high organic content, large root at 11cm, many smaller flaky roots, abrupt boundary.
III. 15-68cm 10YR8/1 white very fine single grained sand, medium organic, tiny roots throughout layer, abrupt boundary.
IV. 68-100cm 10YR2/2 very dark brown very fine sand, high organic decayed content, compacted w/ some flaky roots, sand b/c lighter brown towards bottom of layer, semi-abrupt boundary.
V. 100-245cm 10YR3/4 dark yellow brown very fine single grained sand w/ very little organic matter, few flaky roots near top of layer, sand has metallic glimmer, gradual boundary.
VI. 245-332cm 10YR8/2 very pale brown very fine single grained sand very few tiny roots.
Site Name: Weedon Island  
Core length: 324cm  
Core Sections: 4

Core I.D.: 05WI20  
Number of Layers: 5  
Compaction: 0cm

Date Taken: 1/27/05  
UTM Location: UTM-17-0340581E 3082281N

I. 0-25cm 10YR6/1 gray very fine single grained sand medium to high well mixed organic matter, many very thin hair roots, wavy, somewhat gradual boundary.

II. 25-100cm 10YR7/2 light gray very fine single grained sand, gradual transition to 10YR6/3 pale brown, smaller thin roots from 25-45cm, larger roots at 45-65cm in clumps, very few roots from 65-90cm, 90-100 more dense flaky type roots and sediment seems compacted, somewhat like peet at layer boundary, semi gradual boundary.

III. 100-155cm 10 YR8/2 very pale brown to 10YR8/1 white very fine single grained sand, high root content throughout layer, larger roots at 118-135cm, all roots flaky, abrupt boundary.

IV. 155-200cm 10YR2/1 black compacted very fine sand and organic matter, dark peety layer w/ intermixed roots, pretty homogenous, gradual transition at bottom of layer to 5YR3/4 dark red brown very fine sand, gradually little to no organic matter near bottom, gradual boundary.

V. 200-324cm 5YR3/4 dark red brown fine sand, slightly sticky, few roots at 210-220cm, 300-308cm, 310-320cm, sand has metallic glimmer, gradual transition to a lighter 5YR4/6 yellowish red sand, pretty homogenous layer.
Site Name: Weedon Island

Core I.D.: 05WI21

Date Taken: 2/3/05

Core length: 224cm

Core Sections: 2

Number of Layers: 4

Compaction: 81cm

UTM Location: UTM-17-0340453E 3082259N

I. 0-33cm 10YR7/3 very pale brown coarse single grained sand w/ medium to high organic matter, dark organic peat like streaks at 9-10cm and 19-21cm, amount and size of roots increase towards bottom of layer, and sand b/c slightly finer, straight abrupt boundary.

II. 33-51cm 10YR2/1 black very fine compacted single grained sand, high flaky root content, peat like layer, roots lessen near bottom and color gradually lightens, nondistinct gradual boundary.

III. 51-96cm 10YR3/4 dark yellow brown very fine single grained sand, medium root content w/ long medium sized roots extending downwards from upper layer, amount of roots lessen near bottom, few at bottom, sand gradually gets lighter, gradual boundary.

IV. 96-224cm 10YR6/4 light yellow brown very fine single grained sand at top of layer gradually turning more yellow 10YR6/6 brown yellow at 145-205cm and last 19cm light yellow brown, few small roots at top of layer extending down from previous layer, medium to large roots at 115-130cm, 160-165cm, and 187-197cm.
Site Name: Weedon Island

Core length: 325cm

Core I.D.: 05WI22

Core Sections: __

Number of Layers: 4

Compaction: 20cm

Date Taken: 2/3/05

UTM Location: UTM-17-0340453E 3082259N

I. 0-21cm 10YR6/1 gray very fine sand, well mixed, very high root and organic content from 0-10cm, roots mainly small hair-like roots, medium to few roots from 10-21cm and a gradual transition from gray to white sand, boundary gradual.

II. 21-105cm 10YR7/1 light gray very fine single grained sand, gradually turning to 10YR8/1 white by 70cm to the end of layer, medium to high root content from 21-65cm, very few roots from 65-105cm, last 5cm (100-105cm) gradual transition to 10YR7/2 light gray sand, gradual boundary.

III. 105-158cm 10YR3/3 dark brown very fine sand, high organic matted root matter, roots are medium sized and flaky, very compacted, much like peet, at 140cm begins to b/c less compacted and medium root content, from 140-168cm gradual transition to 10YR6/6 brown yellow sand and fewer roots.

IV. 218-325cm 10YR7/6 yellow very fine single grained sand, few medium sized roots like those in layer III near top of layer, 173-190cm 2 long medium sized roots and others at 212-214cm, 235-242cm, and 250-255cm, sand is homogenous and gradually turns slightly lighter 10YR8/4 by the bottom, little to no organic matter after 255cm until last 1cm of core which has medium amount of small roots, few black flecks around 280cm.
<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-23</td>
<td>10YR7/1 light gray</td>
<td>very fine single grained sand, medium amount of well sorted organic matter, clump of roots and sticks from 15-23cm, well sorted layer gradual nondistinct boundary.</td>
</tr>
<tr>
<td>23-70</td>
<td>10YR5/2 grayish brown</td>
<td>very fine single grained sand, few to medium amount of organic matter at top of layer gradually increasing to high organic (mainly roots) content, large thick roots start at 40cm, small patches of white sand around roots from 55-70cm, abrupt straight boundary.</td>
</tr>
<tr>
<td>70-80</td>
<td>10YR2/1 black</td>
<td>sandy mud, very compressed w/ high flaky root content, peaty layer, semi-abrupt boundary.</td>
</tr>
<tr>
<td>80-212</td>
<td>10YR6/2 light brown gray</td>
<td>w/ many streaks and mottles of 10YR2/2 very dark brown at top of layer gradually decreasing and becoming few by 150cm, medium amount of long flaky roots until 150cm, from 160-212cm few organic matter, pure sand, pretty abrupt boundary.</td>
</tr>
<tr>
<td>212-231</td>
<td>10YR2/1 black organic muddy sand</td>
<td>layer, few solid roots or organic matter, more sandy than layer III, gradual boundary.</td>
</tr>
<tr>
<td>231-335</td>
<td>10YR3/6 dark yellow brown</td>
<td>very fine single grained sand w/ few to medium amount of roots at top gradually decreasing towards bottom, sand has metallic glimmer at top gradually decreasing, sand gradually b/c lighter to 10YR5/4 yellow brown by bottom, 2 long roots at 285-320cm.</td>
</tr>
</tbody>
</table>
Site Name: Weedon Island
Core length: 246cm
Core I.D.: 05WI24
Core Sections: 2
Number of Layers: 5
Compaction: 81cm
Date Taken: 2/3/05
UTM Location: UTM-17-0340838E 3082289N

I. 0-13cm 10YR7/2 light gray very fine single grained sand, few to medium amount of broken shells, sticks, roots (organic matter), well mixed sand gradually gets lighter, gradual boundary.

II. 13-173cm 10YR8/1 white very fine single grained sand, highly mottled at top of layer w/ 10YR8/2 very pale brown sand and gradually mottling lessons and by 95cm pure white sand, few black phosphate flecks throughout layer, very few organic matter, medium roots at 40-45cm 57-58cm, tiny hair roots at 73cm, large root 90-95cm, no organics from 95cm-163cm, few small flacky roots at 163-173cm, very abrupt straight boundary.

III. 173-184cm 10YR2/2 very dark brown very fine single grained sand, darker streaks of 10YR2/1 black throughout layer, slight metallic glimmer, sand gradually gets lighter and more yellowish/red very gradual boundary.

IV. 184-245cm 7.5YR3/4 dark brown very fine single grained sand, streaked of 10YR7/4 very pale brown from 200-207cm, no organic matter, sand gradually lightens to 7.5YR4/6 strong brown, abrupt wavy boundary.

V. 245-246cm 10YR6/4 light yellow brown very fine single grained sand.
Site Name: Weedon Island
Core length: 248cm
Core Sections: 2
Core I.D.: 05WI25
Number of Layers: 3
Compaction: 2cm
Date Taken: 2/11/05
UTM Location: UTM-17-0341094E 3082358N

I. 0-18cm 10YR7/1 light gray very fine single grained sand, few to medium amount of organic matter, few very small roots/sticks/leaves, well mixed, larger medium sized root clump at 8-12cm, wavy semi-abrupt boundary.

II. 18-143cm 10YR8/1 white very fine single grained sand many medium (1cm wide) mottles from 18-32cm, pure white homogenous sand after 32cm, w/ few well mixed black phosphate particle, one large root at 45cm, one medium root at 75cm, very abrupt wavy boundary.

III. 143-248cm 10YR8/4 very pale brown very fine single grained sand, a streak of 10YR6/2 light brown gray sand at top boundary, very small mottles and streaks throughout layer, layer looks spotted, medium to large mottles of 10YR8/1 white sand from 210-220cm, w/ 10YR6/2 surrounding white sand, sand gradually darkens throughout layer to 10YR5/4 yellow brown w/ a streak of 10YR2/2 very dark brown sand in last 1/2cm of core.
Site Name: Weedon Island  
Core I.D.: 05W126  
Date Taken: 2/11/05  
Core length: 254cm  
Core Sections: 2  
Number of Layers: 6  
Compaction: 97cm  
UTM Location: UTM-17-0340989E 3082304N

I. 0-14cm 10YR6/2 light brown gray very fine sand highly well mixed; medium twigs, leaves, and other organic matter highly bioturbated non-sticky single grained sand abrupt boundary.

II. 14-45cm 10YR8/1 white very fine sand, highly mottled w/ 10YR6/2 light brown gray very fine sand, a net or twine rope from about 25-45cm, piece of green glass at 41cm, piece of white chipped rock at about 35cm, layer gradually gets lighter in color, gradual boundary.

III. 45-110cm 10YR8/1 white very fine single grained sand, few black phosphate flecks, few mottles near top of layer 45-80cm of 10YR7/1, sand more pure white towards bottom boundary, distinct wavy boundary starting at 110cm and slanting to 124cm.

IV. 110-233cm 10YR8/4 very pale brown very fine single grained sand, medium mottling from 110-185cm of 10YR6/3 pale brown sand, small root at 148 and 154cm, long skinny root from 210-215cm, abrupt straight boundary.

V. 233-252cm 10YR8/1 white very fine sand, few well mixed black phosphate flecks, very homogenous layer, no organic matter, abrupt straight boundary.

VI. 252-254cm 10YR3/2 very dark gray brown very fine, single grained sand.
Site Name: Weedon Island  
Core I.D.: 05WI27  
Date Taken: 2/11/05  
Core length: 289cm  
Core Sections: 3  
Number of Layers: 5  
Compaction: 58cm  
UTM Location: UTM-17-0340838E 3082281N

I. 0-16cm 10YR6/2 light brown gray very fine single grained sand, highly mixed w/ small twigs and other organic matter, gradual boundary.

II. 16-73cm 10YR7/4 very pale brown very fine single grained sand, highly mottled w/ 10YR5/2 grayish brown and 10YR8/2 very pale brown sand appears highly disturbed, many tiny hair roots and twigs from 16-40cm, and few towards bottom of layer, larger roots at 45cm, 50cm, and a very thick root at 70cm (appears to be mangrove).

III. 73-127cm from 10YR7/1 light gray near top of layer and gradually becomes 10YR8/1 white at bottom of layer, gradual transition, very fine single grained sand few small roots from 73-115cm, no roots in bottom of layer abrupt straight boundary.

IV. 127-258cm 10YR5/1 gray gradual transition to 10YR5/6 yellow brown at bottom, many black phosphate flecks and some mixed white sand like layer III near top of layer, gradually decreasing, gradual transition to pure very fine sand, small pieces of organic matter (possibly decomposed root) at 205cm, sand has metallic glimmer especially in second half of layer.

V. 258-289cm 10YR6/4 light yellow brown highly mottled and streaked w/ 10YR4/4 dark yellow brown very fine single grained sand, no organic matter.
<table>
<thead>
<tr>
<th>Layer</th>
<th>Color Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>10YR7/1</td>
<td>light gray very fine single grained sand, very well mixed medium to high organic content, many large/medium/small roots and sticks from 11-17cm, first 10cm many very small organic frags, well mixed and homogenous, sand gradually gets browner, gradual non-distinct boundary.</td>
</tr>
<tr>
<td>II.</td>
<td>10YR7/3</td>
<td>very pale brown very fine single grained sand, highly mottled and streaked w/ 10YR7/1 light gray sand from 17-40cm, and highly mottled w/ 10YR8/4 very pale brown sand, 10YR8/6 yellow sand and 10YR7/1 light gray sand, appears marbled, medium to high root content from 17-30cm w/ medium and small sized roots, few small roots, abrupt straight boundary, one large root from 55-65 through boundary.</td>
</tr>
<tr>
<td>III.</td>
<td>10YR8/6</td>
<td>yellow very fine single grained sand, medium to few organic root content from 61-140cm long roots from 130-140cm, scattered smaller roots from 61-130cm, mottling of 10YR6/6 brown yellow and 10YR7/3 very pale brown from 61-77cm, w/ a streak at 70-75cm, one long medium sized root from 181-194, sand gradually gets lighter throughout layer becoming 10YR8/4 very pale brown at bottom, few mottles of 10YR7/2 light gray from 200-220cm, one large mottle of 10YR6/4 from 250-252cm, mostly pure homogenous sand from 140-252cm.</td>
</tr>
<tr>
<td>Layer</td>
<td>Description</td>
<td></td>
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</tr>
<tr>
<td>I.</td>
<td>0-30cm 10YR7/1 light gray very fine single grained sand, very high organic content, many small medium sized roots from 5-15cm, smaller broken organic matter in first 5cm, roots and sticks throughout layer, sand gradually gets lighter, very gradual boundary.</td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>30-157cm 10YR7/2 light gray very fine single grained sand, very high amount of medium sized roots throughout rest of layer, many 10YR8/1 white mottles from 50-70cm making a marbled appearance, white sand seems to have mixed into layer from 70-157 giving a frosted appearance, semi abrupt wavy boundary.</td>
<td></td>
</tr>
<tr>
<td>III.</td>
<td>157-205cm 10YR3/2 very dark gray brown very fine single grained sand, from 157-180cm many small mottles of 10YR7/2 light gray sand, mottles gradually decrease, medium root from 157-163cm, 172-176cm, and 180-190cm, sand gradually lightens after 195cm, sand has frosty appearance throughout layer, very gradual boundary.</td>
<td></td>
</tr>
<tr>
<td>IV.</td>
<td>205-230cm 10YR5/3 brown very fine single grained sand, medium root at 205-207cm, 210cm, and 220cm, few roots compared to above layers, sand appears frosted.</td>
<td></td>
</tr>
</tbody>
</table>
I. 0-35cm 10YR5/1 gray fine single grained sand, high content of leaf litter, and organic matter from 0-10cm, few from 10-25cm, 25-35cm medium amount of medium sized roots, sand gradually gets lighter, gradual boundary.

II. 35-86cm 10YR7/1 light gray to 10YR8/1 white very fine single grained sand, few very small roots from 35-45cm and one large root at 40-45cm, very few to no organic matter and fine roots throughout rest of layer, pretty homogenous pure white sand, very abrupt straight boundary.

III. 86-108cm 10YR3/3 dark brown very fine compacted single grained sand and organic matter, medium to many flaky roots and organic matter, somewhat peety layer, homogenous, abrupt straight boundary.

IV. 108-145cm 5YR4/6 yellowish red fine single grained sand, sand has metallic glimmer, few decomposing larger roots at 110cm and 125-135cm, few medium sized roots from 135-145cm, sand gradually gets lighter, gradual boundary.

V. 145-299cm 10YR6/4 light yellow brown very fine single grained sand gradually lightening to 10YR7/3 very pale brown sand by 195cm, medium amount of medium sized roots running downward throughout layer, pretty homogenous layer.
Site Name: Weedon Island  
Core I.D.: 05WI31  
Date Taken: 2/17/05  

Core length: 225cm  
Number of Layers: 5  
Compaction: 67cm  
UTM Location: UTM-17-0341805E 3081791N

I. 0-20cm 10YR2/1 black organic mud, very small sand content, 0-10cm 80% small to medium roots, few larger roots at 10cm, 10-20cm more compact mud and less roots, very abrupt boundary.

II. 20-74cm 10YR7/2 light gray very fine single grained sand, few to medium mottles of 10YR2/1 black sandy mud throughout, few medium sized roots at 25cm, 32-35cm, and 55-60cm, sand gradually gets lighter brown to 10YR8/2 very pale brown, abrupt wavy boundary.

III. 74-77cm 10YR2/2 very dark brown very fine sand, feels slightly muddy, pure muddy homogenous sand, abrupt boundary.

IV. 77-200cm 10YR4/4 dark yellow brown very fine single grained sand, medium amount of long stem roots running downward throughout layer, sand gradually gets lighter 10YR5/4 yellow brown near boundary, very gradual boundary.

V. 200-225cm 10YR8/3 very pale brown very fine single grained sand, gradually turning lighter 10YR8/2 very pale brown by end of core, very few organic matter, few medium roots at 205-207cm and 224cm.
**Site Name:** Weedon Island  
**Core length:** 257cm  
**Core Sections:** 2  
**Core I.D.:** 05WI32  
**Number of Layers:** 7  
**Compaction:** 24cm  
**Date Taken:** 2/17/05  
**UTM Location:** UTM-17-0341691E 3081812N

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>0-10cm 10YR3/1 very dark gray very fine sand w/ high organic content, well mixed homogenous layer w/ many small roots throughout, somewhat sticky and compacted, sand gets slightly lighter, semi-abrupt boundary.</td>
</tr>
<tr>
<td>II.</td>
<td>10-97cm 10YR7/1 light gray very fine single grained sand, medium organic content smaller flaky roots from 10-40cm then roots become slightly larger, one medium to large sized root from 30-33cm, longer medium sized flaky roots from 65-97cm, sand gradually gets lighter after 35cm turning 10YR8/2 very pale brown, mottled and streaked w/ 10YR7/3 very pale brown, looks marbled, very abrupt boundary.</td>
</tr>
<tr>
<td>III.</td>
<td>97-105cm 10YR2/1 black muddy sand, 2 long roots stretching through layer running from above layer through to the layer below, few flaky roots at bottom of layer, abrupt boundary.</td>
</tr>
<tr>
<td>IV.</td>
<td>105-120cm 10YR5/3 brown very fine single grained sand, few black 10YR2/1 long streaks, one long medium sized root running down from above layer, abrupt boundary.</td>
</tr>
<tr>
<td>V.</td>
<td>120-123cm 10YR2/1 black muddy sand, homogenous, abrupt boundary.</td>
</tr>
<tr>
<td>VI.</td>
<td>123-201cm 10YR3/2 very dark gray brown near top of layer gradually lightening to 10YR6/4 lighter yellow brown, medium amount of medium sized roots from top of layer to 165cm, black 10YR2/1 mottling and streaking until 140cm, sand has frosted appearance, gradual boundary.</td>
</tr>
<tr>
<td>VII.</td>
<td>201-257cm 7.5YR4/4 brown very fine single grained sand, metallic or frosty appearance, few streaks and mottles of 7.5YR2.5/3 very dark brown, streak at 234-236cm.</td>
</tr>
</tbody>
</table>
Site Name: Weedon Island
Core length: 188cm
Core Sections: 2
Core I.D.: 05WI33
Number of Layers: 6
Compaction: 115cm
Date Taken: 2/17/05
UTM Location: UTM-17-0341622E 3081905N

I. 0-12cm 10YR5/1 gray very fine single grained sand, well mixed, high organic content (roots, leaves, sticks), abrupt straight boundary.

II. 12-35cm 10YR2/1 black organic mud mottles w/ 10YR6/2 light brown gray fine sand, many large mangroves roots at 15-23cm, broken mollusk shell at 24-25cm, mottling increases towards bottom of layer abrupt straight boundary.

III. 35-100cm 10YR6/2 light brown gray, turning lighter towards bottom, fine single grained sand w/ many streaks and mottles of 10YR2/1 black organic mud 1-2mm thick, w/ few tiny root hairs w/in mud, streaks from 40-50cm then becomes more mottled from 50-84cm then one thick streak at 84-90cm of 10YR2/1 black organic mud w/ few tiny hair roots, then sandy and mottled again, root pieces at 49cm and 62cm, abrupt boundary.

IV. 100-116cm 10YR4/4 dark yellow brown very fine sand, single grained, streaked w/ a mottle of 10YR8/1 white sand at 108-110cm, mixed streaks of 10YR8/1 white and 10YR2/1 black organic mud, layer appears somewhat mixed and bioturbated, abrupt pretty straight boundary.

V. 116-165cm 10YR5/6 yellow brown fine sand, slightly sticky, few black 10YR8/1 organic mottles from 116-150cm, sand gradually lightens to
| 10YR6/4 light yellow brown at bottom of layer. |
| VI. 165-185cm 10YR5/3 brown very fine sand, very mottled w/ 10YR6/4 light yellow brown sand and one big mottle of 10YR5/6 yellow brown sand at top boundary from 165-168cm |
Site Name: Weedon Island  
Core length: 170cm  
Core I.D.: 05WI34  
Number of layers: 5  
Core Section:  
Compaction: 161.5cm  
Date Taken: 2/24/05  
UTM Location: 17-0341204E 3082756N

I. 0-25cm 10YR4/1 dark gray homogeneous oxidized sand, clear quartz grains, loose single grained, with few to common fine rootlets and charcoal flecks, few medium oak roots near base, few scattered small shell fragments in lower 10cm (oyster lighting whelk), clear wavy boundary.

II. 25-48cm 10YR3/2 very dark grayish brown slightly organic fine sand, clear quartz grains, few fine dark grayish mottles, loose, single grained to weakly granular structure, 30% of matrix is shells (eastern oyster, crown conch, lightning whelk, moonsnail), some animal bone fragments, few fine roots at top, few fine charcoal flecks, clear wavy boundary.

III. 45-59cm 10YR4/2 dark grayish brown becoming 10YR5/2 grayish brown fine sand, loose, single grained to weakly granular structure, trace amount of shell (moonsnail and oyster fragments), few fine roots, clear quartz grains, irregular boundary, possible root/bioturbation, few fine pale brown mottles, with midden organics and shells and leaching from zone II.

IV. 58-134cm 10YR7/4 very brown to 10YR7/6 yellow fine sand, loose, single grained, 58-80cm bioturbated with 10YR5/3 brown and 10YR6/3 pale brown mottles and common roots, yellow sand has a few medium roots at 105 and 115-132cm, faint charcoal impressions, clear smooth boundary, yellow quartz grains mixed with clear.

V. 134-170cm 10YR7/3 becoming 10YR8/2 very pale brown fine sand, loose, single grained, fairly homogeneous, few root fragments at 150-165cm, mixture of clear patinated quartz 134-140cm, below is clear quartz.
Site Name: Weedon Island  
Core length: 208cm  
Core Sections: 2  
Core I.D.: 05WI35  
Number of layers: 6  
Compaction: 97cm  
Date Taken: 2/24/05  
UTM Location: 17-0341219E 3082744N

I. 0-23 cm 10YR5/2 grayish brown very fine sand, medium amount of small shell fragments evenly interspersed in layer, very small root and organic matter, homogeneous layer, abrupt boundary.

II. 23-54 cm 10YR5/2-10YR4/2 grayish brown to dark grayish brown very fine sand, large mullusk shells and fragments surrounded by sand large root at 25-30 cm and 43-47 cm abrupt shell boundary.

III. 54-65 cm 10YR6/4 light yellow brown very fine sand, no shells and only very few small roots and organic matter, upper part wavy boundary with darker sand but no shells, abrupt bottom boundary, homogeneous sand layer.

IV. 65-88 cm 2.5Y2.5/1 black to 10YR5/1 gray, mostly large shells and shell fragments intermixed with some sand, top part very dark black sand surrounding shells, sand and shells get lighter towards bottom, mixture of shells, mainly oysters, abrupt lower boundary.

V. 88-102 cm 10YR6/2 light brown gray very fine sand, very few shell fragments, one small gastropod at 91 cm, some roots and shell fragments at 98-102 cm mostly homogeneous layer, wavy bottom boundary.

VI. 102-208 cm 10YR6/6 yellow fine sand, top boundary wavy with 10YR6/2 gray sand extending down in places to 114 cm, small stringy roots at 149-157 cm and scattered in small amounts in layer, pretty homogeneous with a few small white chunks, larger root at 126 cm, sand seems well packed with some harder chunks, color gets slightly lighter at bottom gradually.
Site Name: Weedon Island  Core length: 319cm  Core Sections: 4
Core I.D.: 05WI36  Number of layers: 5  Compaction: 21.5cm
Date Taken: 2/24/05  UTM Location: 17-0341221E 3082685N

I. 0-22cm. 10YR7/1 light gray, very fine grained sand, organic leaves and roots throughout, decreasing towards end of section. Flecks of charcoal present, transition is gradual and mottled.

II. 22-74cm. 10YR8/1 white very fine sand, mottled with 10YR7/1 light gray very fine sand towards top of section, larger roots and organic matter from 22cm-42cm, smaller bits speckled throughout, lower boundary gradual with darker sediment intermixed from 70-74cm.

III. 74-118cm. 10YR3/4 dark yellow brown very fine sand, a few thin roots near top of layer, from 94-118cm, many long thin roots as well as thicker roots and organics from 108-119cm, gradual color change to lighter yellow brown near bottom of layer, gradual transition.

IV. 118-182cm. 10YR8/4 very pale brown very fine sand, starts out darker at top of layer and transitions to very pale brown and then begins to get darker again. Medium amount of root matter from 118-146cm, larger root at 140-146cm, then a few small root and darker organic matter from 146-182cm, very gradual transition to darker metallic brown looking sand.

V. 182-319cm. 10YR4/6-10YR3/6 dark brown very fine sand, lighter at top of layer and gradually darker, long dark roots from 185-198, and 208-223, and a large root chunk at 244-248cm (collected for dating), very few other small roots and organics mixed in, sand has metallic glimmer.
Site Name: Weedon Island  
Core length: 234cm  
Core Sections: 3
Core I.D.: 05WI37  
Number of Layers: 7
Compaction: 60cm
Date Taken: 2/24/05  
UTM Location: UTM-17-0341063E 3082734N

I. 0-27cm 10YR7/1 light gray very fine single grained sand, well mixed w/ very fine roots and flecks of organic matter, medium sized root at 12cm, few flaky roots near end of layer, abrupt straight boundary.

II. 27-49cm 10YR4/3 brown very fine sandy peat like layer, very compacted w/ many flaky roots and organic flecks, very abrupt boundary.

III. 49-72cm 10YR3/1 very dark gray, organic sand, very high content (90%) shells (oysters mainly), abrupt end of shells at 72cm.

IV. 72-89cm 10YR3/1 very dark gray very fine sand, very compacted some what peat like w/ some flaky roots, small chunks of 10YR8/6 yellow sand mixed in, homogenous layer, abrupt boundary.

Sediment lost from 89-115cm.

V. 89-129cm 10YR4/1 dark gray very fine single grained sand w/ some very small mottles of 10YR2/1 black sand, few flaky roots at bottom of layer, semi gradual boundary.

VI. 129-157cm 10YR2/2 very dark brown very fine sandy peat, highly compacted especially middle of layer, w/ flaky roots, semi gradual boundary as sand becomes less compacted and lighter in color.

VII. 157-234 10YR7/3 very pale brown very fine single grained sand, long tap roots starting at top of layer running down to 205cm, smaller root chunks from 205-234cm, sand gets gradually lighter from 10YR5/3 brown at top to 10YR8/3 very pale brown at bottom.
Site Name: Weedon Island  
Core length: 504cm  
Core Sections: 6
Core I.D.: 05WI38  
Number of Layers: 6  
Compaction: 70cm
Date Taken: 5/10/05  
UTM Location: UTM17-0340400E 3082184N

I. 0-38cm 10YR6/1 gray, dries to 10YR7/1 light gray, fairly homogeneous fine sand, moist, very fine clear quartz, some silt; few scattered clam valves and fragments, one has drill hole at 34cmbs, 1 root frag at 32cmbs, clear smooth boundary; few scattered phosphate particles.

II. 38-228cm 10YR6/2 light brownish gray fine sand dries to 10YR7/1 to b7/2 light gray sand, has marble appearance w/ 10YR3/2 many, medium to fine very dark grayish brown, organic or organic coated quartz in thin streaks and rounded mottles, mnay mottles or streaks of 10YR5/2 grayish brown sand, has sulfur smell, base is slightly scoured w/ blotch of organic mud, clear quartz throughout.

III. 228-287cm 2.5Y8/1 white very fine sorted; homogeneous, well sorted; few medium 10YR6/2 light brownish gray mottles and small organic streaks in upper 15cm, boundary is clear wavy; clear quartz grains, few black phosphate particles.

IV. 287-381cm 10YR7/3 very pale brown to 10YR7/2 light gray moist fine silty sand w/ some clay, dries to 10YR7/2, common medium mottles of white fine sand (zone III color) throughout, clear abrupt
<table>
<thead>
<tr>
<th>Boundary</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. 381-384cm</td>
<td>2.5Y8/1 white fine sand w/ clear quartz sand grains, few phosphate particles scattered, similar to zone III, clear abrupt boundary.</td>
</tr>
<tr>
<td>VI. 384-504cm</td>
<td>2.5Y7/1 light gray silty sand w/ faint very thin 1-2cm streaks of 2.5Y6/1 to 7/1 organic mud, or sandy clay, common medium mottles of light gray to light brownish gray silty sand and white sand, at 480-484cm 7.5YR6/3 light brown streaks w/ silty sand.</td>
</tr>
<tr>
<td>Layer</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>I.</td>
<td>0-39cm 10YR6/1 gray fine moist sand, dries to 10YR7/1, fairly homogenous, few fine organic mottles in lower half, very fine clear quartz, some silt, very few shell fragments diffuse boundary.</td>
</tr>
<tr>
<td>II.</td>
<td>39-238cm 10YR6/2 light brownish gray fine sand, and 10YR4/1 dark grayish brown organic matter or organic coated quartz, in thin streaks or rounded mottles, many mottles of 10YR5/2 grayish brown sand, has sulfur smell, scoured boundary, dark organic mottles and streaks start at 52cm and continues to 140cm w/ fewer above and below that area.</td>
</tr>
<tr>
<td>III.</td>
<td>238-276cm 2.5Y7/1 light gray fine sand, well sorted few organic streaks from zone II, diffuse gradual boundary, few scattered black phosphate particles; clear quartz sand.</td>
</tr>
<tr>
<td>IV.</td>
<td>276-293cm 10YR6/3 pale brown or 2.5Y6/3 light yellowish brown silty sand dries to 10YR6/2 light brownish gray, gradually grades to 10YR7/2 light gray color below 290cm, diffuse gradual boundary, clear quartz sand.</td>
</tr>
<tr>
<td>V.</td>
<td>293-414cm 2.5Y7/1 light gray fine sand, w/ some silt near upper 30-50cm of zone, dries to 2.5Y8/1 white sand, few scattered phosphate, clear wavy boundary, few organic streaks of 10YR5/2,</td>
</tr>
</tbody>
</table>
clear quartz.
VI. 414-434 cm 2.5Y7/1 light gray silty sand w/ faint very thin 1-3 mm streaks of 2.5Y6/1 to 7/1 organic mud or clay throughout, common medium mottles of light gray to light brownish gray silty sand and white sand, clear quartz.
Site Name: Weedon Island
Core length: 418cm
Core I.D.: 05WI40
Number of Layers: 7
Date Taken: 5/10/05
UTM Location: UTM-17-0340773E 3082232N

I. 0-31cm 10YR8/2 pale brown fine well-sorted sand, homogenous, very few dark gray 10YR4/1 mottles, boundary gradual, very few shell frags.

II. 31-148cm 10YR8/2 pale brown fine well-sorted sand, mottles increase to many giving a marble appearance, darker mottles 10YR3/2 very dark gray brown, few tiny shell frags throughout, larger bivalve half shell at 130cm, bark or wood fragment at boundary, wavy boundary.

III. 148-214 10YR6/2 light brown gray, large black 10YR2/1 mottle at top of layer, mottles of 10YR5/4 yellow brown starting around 160cm very few tiny shell frags, mottling becomes lighter towards gradual boundary, sand begins to become cemented as it dries, very sticky when wet, at end of layer.

IV. 214-232 10YR8/3 very pale brown sticky sand w/ many 10YR8/1 white mottles, no shells, completely cemented when dry, large dark mottle, or decomposed root mark at layer boundary.

V. 232-305cm 10YR8/3 very pale brown sticky sand w/ few mottles, mottles are more horizontal laminations (less mixed) of 10YR8/1 white sand, few thin darker laminations, completely cemented when dry, laminations
begin to end around 280cm.
VI.  305-318cm 10YR8/1 white sticky sand w/ medium mottles of 10YR8/3, cemented completely, abrupt wavy boundary from 316-220cm.
VII. 318-418cm 10YR8/3 very fine sticky sand, cemented as dries, w/ few to medium 10YR8/1 white laminations and mottles.