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"Taylor County Beaches Pathogen and Nutrient Sources Assessment Study: Seasonal Water Quality Impacts"

-FINAL REPORT-

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Taylor County Beaches Pathogen and Nutrient Sources Assessment Study: Seasonal Water Quality Impacts

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EXECUTIVE SUMMARY

Prior to 2004, beach water quality sampling conducted by the Suwannee River Management District and the Taylor County Health Department has shown that counts of the pathogen indicators fecal coliform and enterococci frequently exceed the water quality standards for recreationally used surface waters at coastal communities in Taylor County, FL. This resulted in frequent beach advisories, significant because these waters are commonly used for recreational fishing (including scallops). In fact, the ongoing weekly beach monitoring program posts advisories approximately 46% of the time due to high concentrations of indicator bacteria (>400 CFU/100ml for fecal coliforms, >100 CFU/100ml for *Enterococcus*), and between the years of 2004 and 2006, the SRWMD and TCHD monitoring programs found that 94 of 181 samples (52%) failed for enterococci. Nutrients, while not a part of the regular beach water quality monitoring program, were also of concern. Initially, it was suspected that onsite sewage treatment and disposal systems (OSTDS), in particular pre-1983 and other systems operating without a permit may be a source of the pathogen indicators in these waters.

Of concern are the rapid development and the change from seasonal to full-time residents in the coastal communities of Taylor County, FL, both of which have been identified as potential threats to water quality. Most of the coastal communities historically rely on OSTDS. Various studies (Meeroff et al. 2005; Morin et al. 2005; Ahmed et al. 2004; Lipp et al. 2001) have investigated the contribution of failing septic tanks on the degradation of water quality, particularly during the seasonal high water table (SHWT) elevation, when septic tanks are expected to operate inefficiently.

There is a need to obtain information on bacteriological and nutrient sources and to evaluate the contribution of OSTDS to the observed water quality problems. The information gathered will be used by state and local officials to address the contamination of coastal waters, to develop plans to improve sewage treatment and disposal in the coastal communities, and provide data that may be applicable to the management of shellfish in this and other areas. The United States Environmental Protection Agency (USEPA), through the Gulf of Mexico Program, has provided funding for this investigation to the Florida Department of Health, Bureau of Onsite Sewage Programs, which contracted Florida Atlantic University (FAU) to assist in the scientific study to assess possible sources of pathogen indicators and the contribution of OSTDS to coastal surface water quality in Taylor County, FL, by using multiple tracers. Additional support was provided by the Florida Department of Health and the Florida Department of Environmental Protection.

The objective of this study is to test the hypothesis that OSTDS significantly contribute to the observed water quality degradation and that the problem is aggravated during the SHWT. This hypothesis will be evaluated using pair-wise comparison, intervention analysis, and multiple tracers. The results will be used to assess source tracking hypotheses for nutrients and pathogen indicators so that water quality managers will be able to develop plans for improving water quality in these coastal communities. The results will be used to evaluate source tracking hypotheses for nutrients and pathogen indicators so that water quality managers will be able to develop plans for improving water quality in coastal communities.

The results of the first year of sampling prompted additional questions that could only be addressed by returning for another round of sampling with additional recommended analyses and sampling site density. By using multiple tracers, including nitrogen isotopic ratios and shallow sediment re-growth experiments, seasonal variability issues were addressed for distinguishing between human and non-human sources and also between functioning OSTDS and surface runoff contributions to pathogen indicators and nutrient concentrations for identification of significant sources of contamination.

A summary of the results of the five sampling events conducted between 2006 and 2007 indicate the following:

- As expected, the percentage of violations for dissolved oxygen, *Enterococcus*, and *E. coli* are all higher in the SHWT season.

- DO decreased during the SHWT events, in contract to expectations. It is hypothesized that since microbial activity generally increased during this period, it could have accounted for the observed consumption of dissolved oxygen, even after temperature effects are taken into account.
- The bacteriological results also reveal that *Enterococcus* counts are generally higher in OSTDS areas as compared to sewered areas, by a factor of about 1.5, independent of season.
- For both *Enterococcus* and *E. coli*, the microbial densities were generally higher for the SHWT, especially for the OSTDS areas. Between 5-10% of all *Enterococcus* samples violated the trigger levels in SLWT, but 30-35% violated in SHWT.
- A general increasing trend from upstream to downstream is apparent. *Enterococcus* counts were higher in the SHWT period when compared to the SLWT, by a factor of 2 – 3. However, *E. coli* was found to be consistently higher in the sewered areas, which was not expected. When taken in context with the *Enterococcus* results, these higher levels of *E. coli* may not be necessarily of human origin.
- Unexpectedly, *E. coli* violations are nearly four times more frequent at sewered sites compared to those served by OSTDS, a trend that increased in 2007. Since the sewer system was only just recently installed, water quality conditions monitored may still reflect previous contamination from older OSTDS, or more likely that microbial regrowth in warm, shallow, stagnant waters may be causing this signal.
- No noticeable differences in ammonia trends are observed between sites with sewer and sites with OSTDS.
- Ammonia was generally higher during the May SLWT sampling events for all sites.
- TOC and higher ammonia in the 2006 SLWT (May and December) data may indicate anthropogenic background sources from lawn fertilizers or an industrial source, but this requires further research. On average, nitrate levels were below the concentrations considered high for coastal marine environments

- From the speciation of nitrogen containing parameters (ammonia, nitrate, nitrite, and total nitrogen), it was determined that most of the nitrogen detected was in the form of organic nitrogen. The nitrogen isotope analysis seems to implicate fertilizers at the beach communities, but a possible industrial source signal could not be discounted upstream at the background site locations in May 2007.
- High total nitrogen (which was indicative of organic-N) in conjunction with higher *Enterococcus* concentrations would tend to indicate a greater contribution of nutrients to coastal waters from septic systems as opposed to runoff contributions.
- Keaton Beach had 2-3 isolated cases of extreme microbial contamination recorded during the 2006 SLWT. The elevated microbial counts were repeated in May 2007 SLWT, which may indicate a persistent local source, such as sediment reservoirs of pathogen indicators.
- During the SLWT, only 1 of 6 Ec/Ent ratio values was above the human-derived input cut-off (ratio > 4). However, during the SHWT sampling events, more than 50 percent of the ratios were indicative of human contributions.
- All of the beach sites showed *E. coli/Enterococcus* ratios that were well above 4.0, indicative of human-derived sources of pollution, within the documented limits of this parameter.
- The background sites, with the exception of the Creek at Dekle Beach, consistently produced *E. coli/Enterococcus* ratios below approximately 1.0, a possible indication of a contribution from non-human sources of pollution.
- Sewered areas (Keaton Beach and Cedar Island) have not shown improved water quality in comparison to areas that remain on OSTDS. Thus, in sewered areas, the possibility that remnant OSTDS inputs have not been fully flushed from the surficial soils cannot be discounted. This finding is also supported by the absence of a change in slope in the bacteriological densities over time at the sewered sites.
- After tidally influenced transport, the ground water and runoff contributions for a given area do not return to exactly the same water quality level from which they originated. This daily periodicity can be termed as a "slosh" effect, which may play an important role here in cycling nutrients and pathogen indicators. A second

possibility is that during the SHWT, the soils and canals in the sewered areas may be flushed less effectively, and therefore do not show the same concentrations of bacteria as the septic areas that would tend to leach even more bacteria into the soil

- Overall, the molecular data indicated that the analyzed water samples were not grossly contaminated with fecal contamination or human-derived fecal contamination. These results are supported by the low IDEXX MPN results for *Enterococcus* and the lack of confluent growth from the samples incubated on the bacterial media.
- Caffeine was not shown to be an effective tracer.
- Optical brighteners were also ineffective.

Interesting differences in multiple water quality tracers between sewered and non-sewered areas were observed. In terms of microbial pathogen indicators, unexpectedly high *E. coli* counts were found at sewered sites, along with potential re-growth in shallow sediments, which point to legacy OSTDS sources, sediment reservoirs harboring pathogen indicators, or steady upstream contributions. Some evidence of human-derived input from sewage or OSTDS is found, and from molecular techniques, an important dog or bird contribution cannot be discounted. Elevated TOC and higher ammonia levels at the beach communities may indicate recent anthropogenic input from lawn fertilizers or an upstream industrial source, but this certainly requires further research. The nitrogen isotope analysis from May 2007 supports this supposition, in particular for the beach communities. Elevated levels of total nitrogen (which was indicative of organic-N) combined with high enterococci tend to implicate a greater contribution of nutrients to coastal waters from OSTDS, but this combination was not seen consistently. OSTDS are expected to perform better during the SLWT event, with the likelihood of failure increasing in the SHWT event. This field study demonstrates that the magnitude of water quality degradation in the area may have a contribution from OSTDS, but outlines other potentially more important inputs. The analysis indicates that the source of the differences may be due to human-derived inputs.

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INTRODUCTION

Taylor County is bordered by Jefferson, Madison, Lafayette, and Dixie Counties and by the Gulf of Mexico. The total area of the County is 789,000 acres (3,191 km^2), of which approximately 15% is comprised of water bodies. Taylor County has four rivers, numerous canals, creeks, and springs, and nearly 60 miles of Gulf of Mexico coastline. The major tourist attractions are fishing and scalloping, particularly from July through September. Half of its southern coast is part of the "*Big Bend Sea Grasses Aquatic Preserve*" and is classified as "*Outstanding Florida Waters*."

The surface water quality criteria to be met for the study sites correspond to Class III waters (recreational use and fish and wildlife health) and are detailed below (FAC 602-302.530):

- Fecal coliform < 10% over 400 MPN per 100 mL, not to exceed 800, on any given day
- Dissolved oxygen not less than 5.0 mg/L in freshwater, never less than 4.0 mg/L in marine waters
- Nutrients (total nitrogen and total phosphorus) limited as needed to avoid imbalance in natural populations
- Turbidity < 29 NTU above natural background concentrations

Prior studies have been conducted by the Suwanee River Water Management District (SRWMD) and the Taylor County Health Department (TCHD) to determine if water quality criteria are being met in Taylor County. An ongoing weekly beach monitoring program posts advisories approximately 46% of the time due to high concentrations of indicator bacteria (>400 CFU/100ml for fecal coliforms, >100 CFU/100ml for *Enterococcus*), and between the years of 2004 and 2006, the SRWMD and TCHD monitoring programs found that 94 of 181 samples (52%) failed for enterococci. Because these waters are used for drinking, recreation, and the harvesting of seafood, it is imperative to maintain the microbiological quality and safety of water. Contamination of these water systems can result in human health risks and significant economic losses due to closures of beaches and shellfish harvesting areas (Scott et al. 2002).

Rapid development and the change from seasonal to full-time residents in the coastal communities of Taylor County, FL have been identified as a potential threat to coastal water quality. Most of the coastal communities historically rely on On-Site Treatment and Disposal Systems (OSTDS). Moreover, the relatively high density in small lots can be a problem. Various studies (Meeroff et al. 2005; Morin et al. 2005; Ahmed et al. 2004; Lipp et al. 2001) have investigated the contribution of failing septic tanks on the degradation of water quality, particularly during the seasonal high water table (SHWT) elevation, when septic tanks are expected to operate inefficiently.

Florida Atlantic University (FAU) was contracted to conduct a scientific study to assess possible sources of pathogen indicators and the contribution of OSTDS to coastal surface water quality in Taylor County, FL, by using multiple tracers. The results will be used to evaluate source tracking hypotheses for nutrients and pathogen indicators so that water quality managers will be able to develop plans for improving water quality in coastal communities. The results of the first year of sampling prompted additional questions that could only be addressed by returning for another round of sampling with additional recommended analyses and sampling site density. By using multiple tracers, including nitrogen isotopic ratios and shallow sediment re-growth experiments, the proposed plan of work addressed the seasonal variability issues of distinguishing between human and non-human sources, and between functioning OSTDS and surface runoff contributions to pathogen indicators and nutrient concentrations for identification of significant sources of contamination. Table 1 lists the tracers to be analyzed in this study. Table A-2 shows the parameters, analytical methods, detection limits, method precision values, trigger levels, expected levels, and encountered ranges.

Table 1 – Summary of parameters analyzed.

Laboratory Parameters	**Field Parameters**
E. coli and total coliforms	pH
Enterococcus	Conductivity
Total organic carbon (TOC)	Salinity
Total nitrogen (TN)	Temperature
Ammonia-nitrogen	Dissolved oxygen (DO)
Nitrate	Turbidity
Caffeine	Optical brighteners

For 2007 follow-up work, it was desired to increase the site density (i.e. number of sites and distribution) and perform additional experimental work that was recommended to resolve confounding issues discovered in 2006 sampling. These included shallow sediment re-growth, existing infrastructure assessment, and unconventional source tracking tools. In particular, previous work demonstrated a general trend of higher *E. coli* at sewer sites and higher *Enterococcus* at OSTDS sites. This *E. coli* may be from human or natural sources, but if it can survive in the near-shore environment without external inputs, this will complicate source tracking. Thus it was proposed to conduct re-growth studies of shallow sediments in certain key beach sites (Adam's Beach, Dekle Beach, Keaton Beach, and Cedar Island Beach).

The objective of this study is to test the hypothesis that OSTDS significantly contribute to the observed water quality degradation and that the problem is aggravated during the SHWT. This hypothesis will be evaluated using pair-wise comparison, intervention analysis, and multiple tracers. The results will be used to assess source tracking hypotheses for nutrients and pathogen indicators so that water quality managers will be able to develop plans for improving water quality in these coastal communities.

SAMPLING METHODOLOGY

SAMPLING SITES

All sampling sites were selected in order to represent two main groups, sites with central sewer systems and sites served by OSTDS. This was done to allow comparison of the overall water quality between similar neighborhoods, two connected to a public sewer network and the other two served exclusively by septic tanks. Two sewered areas and two non-sewered areas were selected and approved with input from the Taylor County Health Department and the Florida Department of Health Bureau of Onsite Sewage Programs. In each of the four locations, at least three sampling site categories were used, a beach site, a canal/creek (upstream) site, and a background site.

Figure 1 – General location of sampling sites in Taylor County, FL.

The objective of the field study is to distinguish between possible human sources of pollution and various other types of contamination in coastal waterways within Taylor County, FL. Locations were chosen including coastal canals, inland rivers, and beaches.

The sampling locations were paired according to OSTDS effects, intervention analysis (before/after sewer installation) effects, beach vs. canal, population density, and upstream effects. Paired sites are summarized in Table 2 and discussed in more detail in Appendix B.

Table 2 – Breakdown of paired sites for 2006-2007.

Type	Location	Beach	Canal/Creek (Upstream)	Background
Developed without Sewer	Dekle Beach (ρ= low)	A. Dekle Beach JI. Jugg Island Rd	B. Canal at Mexico Rd	C. Creek at Dekle
	Steinhatchee (ρ= high)	J. Main Street Steinhatchee	K. Third Avenue Fork M. Steinhatchee at Airstrip Dr. (L. Boggy Creek @ 51)	N. Steinhatchee Falls
Developed with Sewer Being Installed	Keaton Beach (ρ= medium)	F. Keaton Beach	E. Cortez Road Canal MR. Marina Road (D. Cortez Pump station)	G. Blue Creek at Beach Road
	Cedar Island (ρ= medium)	I. Cedar Island Beach SL. Seahawk Lane	H. Heron Road Canal	G. Blue Creek at Beach Road

Some of the selected sites coincide with sampling sites from previous studies: four beach sites coincide with the Florida Department of Health (FDOH) Beach Monitoring Program sampling points (data from 2000 to 2006), and ten sites coincide with some of the sampling points of a previous FDOH study on water quality in Taylor County (data from 2004 to 2005). Available data previous to this study will allow an intervention analysis to evaluate the change in concentration of water quality parameters (e.g. *E. coli*, *Enterococcus*) prior to and after sewer installation.

According to prior work conducted in Taylor County, additional sampling locations for the 2007 follow-up study were desired to assist in resolving confounding issues in source tracking hypotheses. New sites were selected based on professional judgment of the representativeness for the location type. The locations were approved by the FDOH project officer by conference call on May 17, 2007 (and in writing on May 18, 2007), and prior to any sampling taking place. All sampling site locations are located in the hydrologic unit code (HUC) 3110102. The overall sampling site list and which program each site was part of is listed in Table 3.

Table 3 - Summary of sample site locations (highlighted rows indicate new sites for this study).

Site Code	Name	Location	Hydrology	Residential Development	Healthy Beaches Site?	CHD 04/05 sampling?	FAU 2006 sampling?
PL	Fenholloway at Peterson's Landing	Spring Warrior Beach	Estuary of the Fenholloway	Developed area without sewer?	No	No	No
HS	Hampton Springs Bridge	Perry	Middle of the Fenholloway	Developed area with sewer?	No	No	No
FR	Fenholloway River @ 19/Alt27	Perry	Downstream of Buckeye	Developed area with sewer	No	No	No*
AB	Adam's Beach	Adam's Beach	Beach	Undeveloped without sewer	Yes	Yes	No
A	Dekle Beach	Dekle Beach	Beach	Developed area without sewer	Yes	Yes	Yes
JI	Jugg Island Road	Dekle Beach	Beach (downstream)	Developed area without sewer	No	No	No
B	Dekle Beach Canal @ Mexico Road	Dekle Beach	Canal (dead-end)	Developed area without sewer	No	Yes	Yes
C	Creek at Dekle Beach	Dekle Beach	Creek	Upstream, none	No	Yes	Yes
D	Cortez Road Canal (Pump Station)	Keaton Beach	Canal (dead-end)	Upstream, of Blue Creek and developed area with sewer installed**	No	No	Yes
E	Cortez Road Canal Upstream (Jet Skis)	Keaton Beach	Canal (midstream)	Midstream, developed area with sewer installed	No	No	Yes
MR	Marina Road	Keaton Beach	Canal at mouth	Downstream, developed area with sewer installed	No	No	No
F	Keaton Beach	Keaton Beach	Beach	Beach, developed area with sewer installed	Yes	Yes	Yes
G	Blue Creek at Beach Road	Keaton Beach Or Cedar Island	Creek	Upstream, background, no development	No	Yes	Yes
H	Heron Road Canal	Cedar Island	Canal (dead-end)	Developed area with sewer installed	No	Yes	Yes
I	Cedar Island Beach	Cedar Island	Beach	Developed area with sewer installed	Yes	Yes	Yes
SL	Seahawk Lane	Cedar Island	Beach towards the estuary of Blue Creek	Developed area with sewer installed	No	No	No
J	Main Street (Roy's)	Steinhatchee	Estuary of the Steinhatchee	Downstream, developed, high population, OSTDS	No	No (SRWMD data available)	Yes
K	3rd Avenue Fork	Steinhatchee	River	Middle stream, developed, high population, OSTDS	No	No	Yes
L	Boggy Creek at 51	Steinhatchee	Creek	Upstream creek, developed, high population, OSTDS	No	No	Yes
M	Steinhatchee at Airstrip Drive	Steinhatchee	Creek	Upstream creek gradient, developed, high population, OSTDS	No	No	Yes
N	Steinhatchee Falls	Steinhatchee	River	Upstream, background, low density, OSTDS, campground	Yes	No (SRWMD data available)	Yes

*Monitored on one occasion during 2006 sampling
**Historical data show that this is a site with intermediate concentrations

Boundaries of the Study

The monitoring program includes sampling sites located along the "loop" extending from Adams Beach to Steinhatchee in Taylor County, FL. Four beach monitoring sites are identical to those already implemented as part of the Florida Healthy Beaches Program. These include (from north to south): Adam's Beach, Dekle Beach, Keaton Beach, and Cedar Island. A summary of the sampling locations is found in Table 3. The highlighted sites were sampled only in 2007. Global Positioning Systems (GPS) were used to locate all monitoring sites. Some variation in position may occur due to tidal effects, flooding, etc. In some cases, tidal variability is expected, because some sampling sites are located in shallow (< 6 in.) water.

The seven new sites were selected to address several confounding issues that arose during the first year of monitoring. The Fenholloway River set of sites (FR, HS, and PL) attempted to follow-up on the findings from the December 2006 SLWT event. Using aerial photography and field reconnaissance, it was determined that a large industrial source discharges into the Fenholloway River upstream of the impacted areas, north of Adam's Beach. It was hypothesized that this source potentially influences the nutrient dynamics of the coastal areas of Taylor County due to the prevailing current direction and the magnitude of the loading.

To investigate the river's effect, the thought process was to follow the effluent from near the original discharge (FR) to the middle stream and Hampton Springs (HS) and finally to where the river exits into the Gulf of Mexico at Peterson's Landing (PL). The FR site is located approximately one mile downstream of the industrial discharge of a specialty cellulose mill (Buckeye Florida). The HS site is located about midway from the mill to the ocean along the Fenholloway River. The site is underneath an abandoned bridge with almost no development nearby. It is downstream of a golf course and upstream of the Taylor Correctional Institute and the Perry sanitary landfill. The PL site is located at a boat landing near the mouth of the Fenholloway River, where it discharges to the Gulf of Mexico.

Once the Fenholloway exits to the ocean, the prevailing north-to-south current should take the pollutant load towards the impacted beach communities. This hypothesis was investigated by including Adam's Beach (AB) as an additional sampling point between

Peterson's Landing and Dekle Beach to potentially determine a concentration gradient in the flow of bulk transport. Adam's Beach was one of the previously sampling sites in prior studies of beach water quality conducted by the Health Department. It showed historically high levels of microbial indicators. No homes or septic tanks are located nearby, but it is a boat landing with evidence of frequent human activity. The landing is extremely shallow and requires the sampler to walk a substantial distance before reaching knee-high water levels.

At Dekle Beach, the May 2006 SLWT showed high ammonia readings. The ammonia also increased in the upstream direction, unexpectedly. Historically, May is also the highest average water usage month. This was attributed to irrigation, which would result in increased runoff of ammonia-based fertilizers. It was determined that a more representative background site might resolve this issue in follow-up testing. However, site reconnaissance did not reveal a suitable or accessible alternative to the Creek at Dekle Beach site. Therefore, it was determined to monitor an upstream beach location at Jugg Island Road (JI), which is also connected to the discharge of the upstream creek (site C)

At Keaton Beach, unexpectedly high ammonia and microbial indicators during May 2006 SLWT indicated the possibility of a sewer leak, which masked any differences between Dekle Beach (OSTDS) and Keaton Beach (sewer). It was hypothesized that remnant OSTDS inputs have not had sufficient time to completely flush out of the subsurface and surficial soils. More station density was desired to resolve spatial variability due to potential sewer leaks. It was determined to sample near the end of Marina Road (MR), which is located upstream of the beach site (F) and downstream of the Cortez Road canal site (E) along the open end, which serves to address the issue of the Blue Creek estuary as well as the concentration gradient downstream of the pump station (D).

At Cedar Island, we recorded extremely high microbial densities (1840 – 24,200 MPN/100 mL) and ammonia levels (0.3 – 0.5 mg/L as NH_3-N) in May 2006 SLWT. These observations are more indicative of impacts associated with urban or agricultural wastewater than natural levels. It was hypothesized that this may be attributed to either re-growth in the shallow sediments or inputs from contaminated sediments in the nearby boat marina. An additional sampling location at Seahawk Lane (SL) was proposed to address these issues as well as assist in resolving the issue of the Blue Creek estuary. The Seahawk Lane site is located in between the Blue Creek estuary and the Cedar Island Beach (I) site upstream of the boat marina and downstream of Sandpiper Spring.

SAMPLING EVENTS

In a previous study, Morin et al. (2005) suggested that septic tanks do not work properly when the water table is high, since insufficient distance between the drainfield and the groundwater level (<0.6 m) leads to inadequate treatment. In many parts of coastal Florida, the water table is constantly high, often reaching ground level elevations during the wet season. Thus, the drainfield piping network may become submerged, and the wastewater becomes directly connected to the receiving water body. Because of this fact, sampling activities were purposely designed to be conducted during the seasonal high (September) and seasonal low water table elevation (May, December) events.

To determine the SHWT and SLWT, and the timing of sampling events, multiple approaches (ground water levels, tidal periods, rainfall patterns, historical water quality data, etc.) were used to determine the expected seasonality of groundwater table elevation in the coastal areas. First, historical ground water level measurements from three shallow monitoring wells in Taylor County, FL were analyzed. This data was acquired from the Suwanee River Water Management District c/o Warren Zwanka, Hydrogeologist, P.G. (9225 CR49, Live Oak, FL 32060; 800-226-1066). The data consisted of daily and average monthly ground water level measurements from 1995 until 2005. The wells used were:

1. 020731002 (30°15’48.283’’ N Latitude, 83°39’39.745’’ W Longitude)
2. 020828001 (30°17’21.166’’ N Latitude, 83°32’10.334’’ W Longitude)
3. 030730001 (30°11’45.332’’ N Latitude, 83°40’11.743’’ W Longitude)

For each well, the water level data was compiled as monthly averages for each year, representative of the previous ten year time span for each well and was plotted in Figure 2. Error bars shown indicate the characteristic variability in the aggregate data over the ten year timeframe and correspond to one standard deviation from the mean. From Figure 2, the seasonal high water table typically occurs during the months of March – April. The lowest water table elevation is typically during June. The differences were on the order of one foot. However, these monitoring wells were quite removed from the coast as indicated by their high water table elevations, and may not show the same seasonality as coastal waters. The same wells were analyzed for 2006 and 2007 as shown in Figure 2 (right). The same general trend is followed, although the conditions were uncharacteristically drier than expected from historical values.

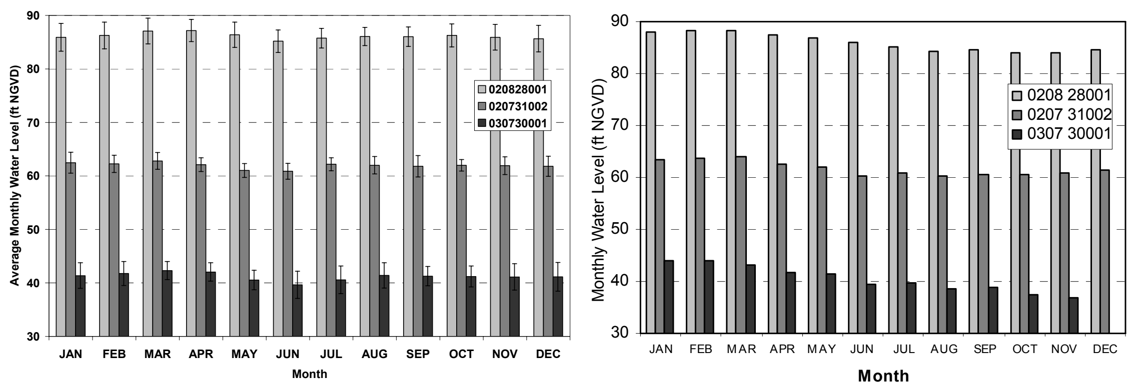

Figure 2 - Determination of seasonal high water table using mean ground water level data from three shallow monitor wells in Taylor County, FL. The graph on the left shows data from 1995 – 2005 (SRWMD 2005). The graph on the right shows the 2006 trend.

Average precipitation records were also considered for the determination of seasonal water level elevations. Using data provided by the NOAA National Climatic Data Center (NCDC) Weather Station Historical Data Service (http://www.ncdc.noaa.gov/oa/climate/stationlocator.html), the daily rainfall data for three stations in the Taylor County area, were obtained. The stations used were: 1) Perry (30°06'N / 83°34'W; 13.7 m above sea level; in service 1948 – present; COOP ID 087025); 2) Sea Hag Marina (29°40'N / 83°23'W; 1.5 m above sea level; in service 2002 – present; COOP ID 088076); 3) Steinhatchee 6 ENE (29°40'N / 83°24'W; 3.0 m above sea level; in service 1958 - 2001; COOP ID 088565), and Huxford Tower (http://flame.fl-dof.com/fire_weather/observations/dof_rainfall.html). Figure 3 shows the results of this analysis. All stations showed that the wettest months occurred in June through September. Generally drier periods occur in November – December and April – May. The 2006 data was characterized as a dry year, particularly in summer. Also, December was uncharacteristically wetter than expected, although all of the rainfall in the month occurred after the December sampling event (December 12-14, 2006).

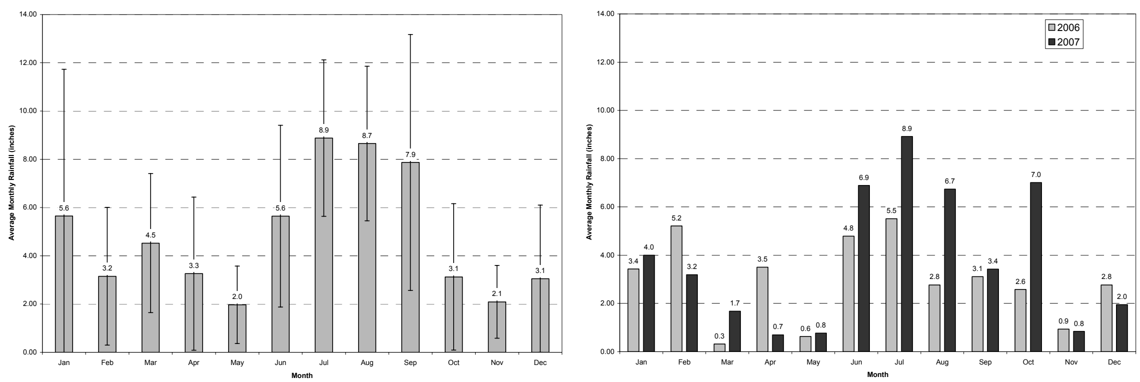

Figure 3 - Average monthly rainfall for Steinhatchee EN, FL station. The graph on the left is for 1995 – 2001, error bars represent one standard deviation from the mean. The graph on the right is for 2006 and 2007 data.

Sampling events were planned to occur for 3 consecutive days during each sampling trip. Sample collection was timed to coincide with ebb tide, the period in which the water level is falling from high tide to low tide. This was done to get a better representation of the potential contamination contribution from human sources. Samples collected during flood tide, the period when the water level is increasing from low tide to high, tend to underestimate the contribution of inland or terrestrial sources. Under the flood tide condition, most of the water is of marine origin, and thus dilution plays a confounding role in the results. During field sampling events, all samples were collected from downstream to upstream, to avoid possible cross contamination.

FIELD SAMPLING METHODOLOGY

The field sampling protocol basically replicated the May, September, and December 2006 sampling event for the three beach site locations (Dekle Beach, Keaton Beach, and

Cedar Island) and Steinhatchee with the additional sampling locations described earlier. Sampling consisted of three consecutive days, collected during outgoing tide. Samples were collected and analyzed according to the previous QAPP or similarly effective methods.

The following physical parameters were determined in the field:

- pH (YSI 556 probe, FDEP FT1100)
- Conductivity (YSI 556 probe, FDEP FT1200)
- Salinity (YSI 556 probe, FDEP FT1300)
- Temperature (YSI 556 probe, FDEP FT1400)
- DO (YSI 556 probe, FDEP FT1500)
- General weather conditions (sunny, cloudy, or rainy) and wind characteristics
- Ambient air temperature
- Tidal conditions (ebb, flood, or slack; high, medium, or low)
- Current direction and strength

The following parameters were determined in the laboratory and governed by the following SOPs:

- Ammonia and other anions of interest (NOAA seawater protocol)
- *E. coli* and Total Coliforms (FAU LT6100)
- *Enterococcus* (FAU LT6200)
- Total Organic Carbon and Total Nitrogen (FAU LT5200)

SAMPLE HANDLING

Sampling collection, preservation, storage, and analysis followed the field sampling procedures governed according to the previous Quality Assurance Project Plan (QAPP, March 2006) filed and approved for DOH contract number CO0F7: Taylor County Beaches Pathogen and Nutrient Sources Assessment and specific Standard Operation Procedures (SOPs) for each parameter. Field parameters: pH, conductivity, salinity, temperature, and DO were determined using a YSI 556 multiparameter probe. Turbidity was recorded using a portable nephalometric VWR Model 800 turbidometer. TOC/TN analysis was conducted in the laboratory using an Apollo 9000 TOC/TN analyzer. Bacterial analyses were conducted by the defined substrate fluorescent antibody technique using the IDEXX quanti-tray method.

QUALITY CONTROL

Analysis of caffeine, ammonia, and nitrate were reported by a certified laboratory, *Florida Environmental Services (FES)*, *US Biosystems*, or *NOAA-AOML's Ocean Chemistry Division*. QA/QC procedures of the certified laboratory's quality assurance plan were inspected and can be made available upon request (for an additional fee, according to the contract laboratory's policy). Where appropriate, calibration forms, calibration curves, and results for field duplicates, laboratory replicates, and blanks are attached (See Appendix C and D).

Caffeine

The contract laboratory used for this project is not NELAC certified for the analysis of caffeine. Certification was not critical since the caffeine sampling was conducted for screening purposes only. Dr. Piero Gardinali of Florida International University (whose research team developed specific analytical procedures for caffeine in surface waters) suggested a GC/MS method of detection that was adopted by the contract laboratory. This method was approved by Lyle Johnson and Maria Castellanos with Florida Environmental Systems. The lowest possible detection limit of 0.01 µg/L was used. Dr. Gardinali suggested from his research that if the caffeine samples yielded results greater than 0.10 µg/L, this was likely to be indicative of human-derived inputs.

According to the approved sampling plan, caffeine analysis was scheduled to be collected at each sampling site once per event (a total of 14 samples per event). During the seasonal low water table, caffeine levels were expected to be below detection, which, in general, they were (only 3 of the 14 showed detectable levels, and all were below the 0.10 µg/L trigger level). During the seasonal high water table event, caffeine sampling was conducted more frequently (a total of 20 samples), since caffeine levels were anticipated to be detected more often. This expectation is based on the assumption that the main source of caffeine contamination is from septic tanks, when performance is compromised during the seasonal high water table. However, only one background site (Steinhatchee Falls) showed detectable levels. As a result, the caffeine testing program did not indicate large amounts of human-derived inputs. Because so few sites had detectable results, it was expected that SLWT in December would provide no further useful caffeine information. The conclusion is that caffeine may be a useful tracer, but it must be used in an environment much more densely populated than what is present in Taylor County, FL. Follow-up testing in 2007 did not include caffeine as a tracer.

Ammonia

For the ammonia testing, preserved ($pH<2$ with H_2SO_4) samples were analyzed by a contract laboratory. The analytical detection limit was 0.1 mg/L as N, and the laboratory practical quantitation limit was 0.3 mg/L as N during the SLWT (May 2006). Results varied from below detection to 0.9 mg/L as N. This corresponds to the low range for the analytical technique. Field duplicate analysis for ammonia showed differences of 0.1, 0.6, and 0.1 mg/L as N for each of the three sampling days in May 2006 (SLWT). However, an irregularity was found in the trip blank which showed 0.2 mg/L as N. This may indicate a possible contaminated sample or an analytical error. Changing the analytical method was suggested, and a different certified laboratory (US Biosystems) analyzed the ammonia samples for the September 2006 (SHWT) sampling event. Comparison testing conducted by the *National Oceanic and Atmospheric Administration - Atlantic Oceanographic and Meteorological Laboratory* confirmed that the trip blank readings were false positives related to the dilution water used. Replacing the dilution water with reagent water treated by double reverse osmosis and subsequent deionization yielded similar false positives for ammonia in trip blanks prepared for testing in Boynton Beach, FL. This was remedied by substituting the trip blanks with sterile low-nutrient marine samples collected from the Gulfstream current for the December 2006 sampling event (SLWT) and all other subsequent sampling events. During the 2006 SHWT (September), the analytical detection limit was 0.01 mg/L as N, and the practical quantitation limit was 0.02 mg/L (see Table 4). In the 2006 SHWT event, the trip blank for ammonia was below detectable limits, and results for samples varied from below detection to 0.13 mg/L as N, which were generally higher during the May 2006 (SLWT) event. For the December 2006 SLWT event and subsequent 2007 sampling events, ammonia and other nutrient analyses were conducted by NOAA-AOML. Samples were preserved using $CHCl_3$ and analyzed using an ammonia method developed specifically by NOAA-AOML for marine and brackish systems.

Table 4 – MDLs and PQLs for ammonia testing. All values are in units of mg/L as N.

Sampling Event	MDL	PQL	Range	Laboratory
SLWT (05/2006)	0.1	0.3	ND – 0.9	Florida Env.
SHWT (09/2006)	0.01	0.02	ND – 0.13	US Biosystems
SLWT (12/2006)	0.004	0.010	ND – 0.13*	NOAA AOML
SLWT (05/2007)	0.00056	0.0017	ND – 0.09**	NOAA AOML
SLWT (09/2007)	0.00098	0.0042	ND – 0.14***	NOAA AOML

*Additional samples collected from Fenholloway River were measured at 3.18 – 3.88 mg N/L
**Additional samples collected from the Fenholloway River were measured at 0.297 – 2.983 mg N/L
*** Additional samples collected from the Fenholloway River were measured at 0.412 – 3.212 mg N/L

Nitrate

For nitrate testing, samples were collected unpreserved and analyzed by a contract laboratory. The method used had a short hold time of 48 hours (unpreserved). If any sample violated the hold time, the results were flagged. However, during the September 2006 sampling event (SHWT), when hold times were violated, samples were analyzed for nitrate + nitrite (which remained within hold) rather than nitrate only. These samples were then analyzed for nitrite (also within hold), and the nitrate value was determined by difference. Samples that did not violate the hold time were not flagged and were analyzed for nitrate using the direct nitrate analytical method. Of the 45 samples tested in this manner in September 2006 (SHWT), nitrite data and nitrite + nitrate data is included in the raw data table in the appendix.

During the May 2007 SLWT sampling event, three of the samples (070522E1, 070523JI1 and 070524JI1) were flagged as “?-data rejected” because the nitrate plus nitrite results were lower than the nitrite results. Even after re-examining the raw data, no possible errors were discovered to explain the analytical result. No contamination was found, calibration checks passed, no sample injection error was found, but the sample duplicate for two of the three runs was found to violate the +/- 20% criterion. In addition, five samples in May 2007 (and 8 overall) were listed as out of range (OR). The explanation for samples flagged as "or" is that when an analytical run is initiated, the nutrient detector is set to the appropriate full scale absorbance range (AUFS). This is determined by the highest standard used in the linear calibration curve regression. The highest standard is chosen based on the lowest value that will determine all or most of the unknown samples based on previous experience. The reasoning for this is that the higher the standard (and the AUFS range) the lower the sensitivity. When a sample has values that exceed the detector's AUFS, the peak and its value are off scale and are not quantified. To determine the appropriate value for the sample, it is then diluted and re-analyzed. Sometimes the value is so high that several dilutions are required. However, there comes a point when no aliquot is left for dilution, and in that case the value is listed as out of range (OR) on the data sheet. Another flag that occurred "O-sampled but analysis lost or not performed" was used when a sample vial from either a defect in the test tube (a hair line crack) or more likely the test tube was filled to the top resulting in the tube cracking during the freezing process. The provided test tubes are filled to about 0.5 mL from the top in the field, but this is not measured accurately and can vary significantly. Sample leaks can also occur when the chloroform, which is added for preservation of NH4+ samples, accidentally touches the side of the plastic test tube. Chloroform will melt the polystyrene tubes very easily and will also erase the sample label markings. In this case, samples are listed as "not available" for analysis because the test tube identification labels are unreadable. This occurred only once during the entire sampling program and was remedied by marking the test tube cap and side with a simple numbering scheme that followed the order as listed on the appropriate chain of custody form.

During the May 2006 SLWT, the analytical detection limit was 0.011 mg/L as N, and the laboratory practical quantitation limit was 0.033 mg/L as N (see Table 5). Results varied from below detection to 0.05 mg/L as N. Two field duplicates and the trip blanks were below detection, the last day's duplicates were recorded at 0.012 and 0.014 mg/L as N, respectively. During the September 2006 SHWT, the analytical detection limit was 0.0062 mg/L as N, and laboratory practical quantitation limit was 0.05 mg/L as N.

Results, again, varied from below detection to 0.05 mg/L as N. The trip blanks were all below detection in 2006. In 2007, the May trip blank nitrate concentration was 0.00448 mg/L as N, which was just above the practical quantitation limit of 0.004 mg/L as N, and the September 2007 trip blank nitrate level was 0.00294 mg/ L as N, which is just below the practical quantitation limit of 0.003 mg/L as N. As previously described, the trip blanks for nutrient sampling were collected in the open ocean by NOAA personnel and is actually a low nutrient seawater sample rather than an ammonia-free sample. This was done as requested by the AOML laboratory technicians because of consistent sample blank failures in past analyses. Therefore, it is not possible to control the nitrate levels in this type of open ocean trip blank. Nevertheless, these values were on the extremely low end of the analytical scale of the instrument, on both occasions. Overall very low levels of nitrate were found during all events, save for the Fenholloway River samples.

Table 5 – MDLs and PQLs for nitrate testing. All values are in units of mg/L as N.

Sampling Event	MDL	PQL	Range	Laboratory
SLWT (05/2006)	0.011	0.033	ND – 0.050	Florida Env.
SHWT (09/2006)	0.0062	0.050	ND – 0.050	US Biosystems
SLWT (12/2006)	0.0010	0.003	ND – 0.129*	NOAA AOML
SLWT (05/2007)	0.0008	0.004	ND – 0.097**	NOAA AOML
SLWT (09/2007)	0.0017	0.003	ND – 0.1295***	NOAA AOML

*Additional samples collected from Fenholloway River were measured at 0.324 – 0.632 mg N/L
**Additional samples collected from Fenholloway River were measured at 0.230 – 0.998 mg N/L
***Additional samples collected from Fenholloway River were measured at 0.078 – 0.532 mg N/L

Concerning QA/QC data for nutrients analyzed by NOAA-AOML, regressions, blanks, standard ranges, and slopes for the different nutrients groups for each run are provided in the appendix. The reported blank is a reagent blank. No Laboratory Fortified Blanks (LFBs) were analyzed. Certified reference materials are not available for the sweater nutrient suite due to the inherent instability of the nutrient species. Thus, standards were made from scratch prior to each analysis run. International inter-laboratory comparisons are conducted, and NOAA-AOML participates biannually.

For each field operation, several analytical runs are preformed. This is due to the low number of samples analyzed. The samples are run this way to minimize baseline drift and micro-air bubble formation. It also provides a measure of protection against contaminated reagents or a poorly performing cadmium column. During each analysis, a regression is performed, along with an instrument blank, several washes, and additional blanks. Therefore, out of a run of 30 samples there are approximately 20 additional injections for QA/QC purposes. A source that one might review to help explain in detail the procedures and methods used for the nutrients analysis conducted by NOAA-AOML is the following: “A Suggested Protocol for Continuous Flow Automated Analysis of Seawater Nutrients (Phosphate, Nitrate, Nitrite, and Silicic Acid) in the WOCE Hydrographic Program and the Joint Global Ocean Fluxes Study (Gordon, L.I. et al. 1994). Another source of information would be the USEPA methodology papers. The detection limits from the method papers are described in Table 6.

Table 6 – Summary of published analytical ranges for nutrient samples analyzed by NOAA-AOML.

Parameter	USEPA Method	Low Detection Limit	High Linear Limit
Nitrate + Nitrite	353.4	0.075 µg N/L	5.0 mg N/L
Ammonium	349.0	0.300 µg N/L	4.0 mg N/L
Silicic Acid	366.0	0.0012 mg Si/L	6.0 mg Si/L
Ortho-Phosphate	365.5	0.0007 mg P/L	0.39 mg P/L

FAU TESTING

For the tests performed at the FAU Laboratories for Engineered Environmental Solutions, one field duplicate (FD) was collected for each sampling day, and a lab replicate (LR) was analyzed for microbiological parameters and TOC/TN. Once per sampling event, a field trip blank was analyzed. For the total organic carbon (TOC) and total nitrogen (TN) tests, one calibration standard verification, one calibration check verification, and one blank check verification were also analyzed for approximately every 20 samples. Duplicates, standards, and calibration checks have to meet the acceptable criteria described in the applicable SOP (i.e. duplicate and replicates should fall within 20%, calibration checks and standards should fall within 15%, for both TN and TOC). Data are flagged if otherwise.

TOC/TN

Prior to sampling, the expected results for TOC were between the range 1 – 200 mg/L, and the results for TN were expected to be between 0 – 10 mg/L, the first set of samples collected on May 3, 2006 (SLWT), were analyzed with the instrument adjusted to the medium range of detection (0-750 mg/L TOC, 0-20 mg/L TN). However results later showed that the majority of TOC levels were below 20 mg/L and TN levels were below 2 mg/L. Since the calibration curve was based on values much higher than the concentration range found, the samples analyzed from May 3, 2006 thus received a flag "K" signifying that the values were computed using the middle range of sensitivity. The samples could not be re-analyzed due to the lack of sufficient sample volume, and dilutions could not be analyzed due to limit of instrument detection and the amount of time that the samples were exposed to temperatures higher than 4°C. Subsequent analyses for September and December events were performed using the most sensitive setting (0-20 mg/L TOC, 0-1 mg/L TN). Samples with concentrations higher than the specified range were diluted and re-run using additional sub-samples collected.

Calibration standards, calibration checks, duplicates, and trip blanks were analyzed. The TOC/TN calibration curves are attached (see Appendix C). Data was flagged when the results were not found to be within the requirements stated in the QAPP or the individual parameter SOP. Calibration checks were expected to fall within 15% relative error and field duplicates and laboratory replicates within 20%. In May 2006, during transport, some sample bottles (n = 7) broke prior to analysis due to temperatures falling below 0°C during storage. The resulting expansion of the ice, in glass bottles collected with no head space, caused the containers to rupture. As a result, unpreserved samples (without acid) for each of these instances were analyzed instead. These samples were flagged "Y" since they violated the preservation protocol. This did not occur during any of the other sampling events. TN data is not available for September 2007 SHWT events due to a detector malfunction.

Total Coliforms

Samples were diluted to a proportion of 1:10 with sterile dilution water obtained through double reverse osmosis and autoclave sterilization. This was done to limit salinity effects across sample sites. Field duplicates and laboratory replicates were performed once each sampling day. Trip blanks were collected once for every sampling event. Trip blanks were all below detectable limits, as expected. Field duplicates and lab replicates fell within the range of +/- 20% in about 50% of the samples. The raw data tables in Appendix A include the individual results as well as duplicates and replicates. Summary QA/QC information is tabulated in Appendix D.

Total coliforms generally indicate the presence of soil-associated bacteria and result from natural influences on a water body, such as rainfall runoff or wastewater inflows. In this study, the total coliform levels were generally high and were not particularly useful as an indicator or source tracking parameter, by itself. However, total coliforms were evaluated as a part of a suite of parameters.

E. coli

The IDEXX Colilert method allows detection of total coliforms simultaneously with *E. coli*. Samples were diluted to a proportion of 1:10 with sterile dilution water obtained through double reverse osmosis and autoclave sterilization. Field duplicates and laboratory replicates were performed once each sampling day. Trip blanks were collected once for every sampling event. Trip blanks were all below detectable limits, as expected, and 26% of the field duplicates and 46% of the laboratory replicates fell within a range of +/- 20%. The target value of 20% is a stricter criterion than typically reported for microorganism counts, which contributes to inflating the number of samples that exceeded this target. It was also noticed that relatively low concentrations corresponded to higher differences between samples and duplicates (or replicates). This criterion may have been adversely affected by the dilution, since results were already close to detectable values in some instances. The raw data tables in Appendix A include the individual results as well as duplicates and replicates. Summary QA/QC information is tabulated in Appendix D.

Enterococcus

Samples were diluted to a proportion of 1:10 with sterile dilution water obtained through double reverse osmosis and autoclave sterilization. Field duplicates and laboratory replicates were performed once each sampling day. Trip blanks were collected once for every sampling event. Trip blanks were all below detectable limits, as expected, and 13% of the field duplicates and 7% of the laboratory replicates fell within a range of +/- 20%. As seen with the *E. coli* results, low concentrations corresponded to higher differences between samples and duplicates (or replicates). The raw data tables in Appendix A include the individual results as well as duplicates and replicates. Summary QA/QC information is tabulated in Appendix D.

TRIP SUMMARIES

The first sampling trip was conducted during the first week of May 2006 (SLWT). The following is a daily summary of events.

SLWT (May, 2006)

May 1st – (Monday)	The FAU research team left the University Campus in Boca Raton, FL around 09:00 AM and arrived in Perry, FL at 08:00 PM. Along the way, the team evaluated the conditions at the proposed sampling site locations.
May 2nd – (Tuesday)	Meeting with James Rachal at 08:00 AM at the Taylor County Health Department (TCHD) office. A room with a sink was made available to be used as a temporary laboratory facility for the FAU research team. After all equipment was installed, the 14 sampling sites were visited (with James Rachal) to define the precise location of each sampling point.  Figure 4 – Temporary lab.
May 3rd – (Wednesday)	**First Sampling Day:** Dr. Eberhard Roeder met the FAU research team at 07:00 AM at the Days Inn Hotel. The first sample was collected at Dekle Beach at 08:16 AM, predicted time of ebb high tide. The field activity finished at 01:45 PM at Steinhatchee Falls. *The first two samples, Dekle Beach and Dekle Beach Canal, violated the holding time of 6 hours for the bacteriological tests, by less than one hour.*

May 4th – (Thursday)	**Second Sampling Day:** The first sample was collected at Dekle Beach at 08:30 AM, predicted time of ebb high tide. The field activity finished at 01:05 PM at Steinhatchee Falls. All samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD rather than at the field due to battery issues with the field turbidometer.
May 5th – (Friday)	**Last Sampling Day:** The first sample was collected at Dekle Beach at 10:05 AM, predicted time of ebb high tide. The field activity finished at 02:30 PM at Steinhatchee Falls. All samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD once again.
May 6th – (Saturday)	Readings of the bacteriological results for the last sampling day were recorded. All equipment was packed up for return to Boca Raton. Biohazardous waste was disposed of with the TCHD. The FAU research team arrived at University Campus in Boca Raton at 02:00 AM on May 7, 2006.

SHWT (September, 2006)

The second sampling trip was conducted during the last week of September 2006 (SHWT). The following is a daily summary of events.

Sept. 25th – (Monday)	The FAU research team left the University Campus in Boca Raton, FL around 06:00 AM and arrived at the Taylor County Health Department in Perry, FL, at 04:00 PM. All equipment was installed in the temporary laboratory, which was a storage/office without a sink on this occasion.
Sept. 26th – (Tuesday)	**First Sampling Day:** The first sample was collected at Dekle Beach at 06:12 AM, predicted time of ebb tide. The field activity finished at 11:05 AM at Steinhatchee Falls. All samples met the appropriate holding times. Turbidity tests were conducted at the TCHD.

Sept. 27th – (Wednesday)	**Second Sampling Day:** The first sample was collected at Dekle Beach at 06:14 AM, during ebb tide. The field activity finished at 10:00 AM at Steinhatchee Falls. All samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD.
May 28th – (Thursday)	**Last Sampling Day:** Dr. Eberhard Roeder and Ms. Elke Ursin met the FAU research team at 05:30 AM at the Days Inn Hotel. The first sample was collected at Dekle Beach at 06:11 AM, during ebb tide. The field activity finished at 10:00 AM at Steinhatchee Falls. All the samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD, and samples for DNA analysis were filtered upon returning to the TCHD in the afternoon.
Sept. 29th – (Friday)	Readings of the bacteriological results for the last sampling day were recorded. All equipment was packed up for return to Boca Raton. Biohazardous waste was disposed of with TCHD. The FAU research team arrived at University Campus in Boca Raton at 12:10 AM on Saturday, September 30, 2006.

SLWT (December, 2006)

The third sampling trip was conducted during the second week of December 2006 (SLWT). The following is a daily summary of events.

Dec. 11th – (Monday)	The FAU research team left the Boca Raton Campus around 06:00 AM and arrived at the Taylor County Health Department in Perry, FL, at 04:00 PM. All equipment was installed in the temporary laboratory, which was the same storage/office used during the September trip.

Dec. 12th – (Tuesday)	**First Sampling Day:** The first sample was collected at Dekle Beach at 06:52 AM, predicted time of ebb tide. Two new sites were sampled during this trip, a new site along the Steinhatchee River (middle river) and one at Fenholloway River. The field activity finished at 11:58 AM. All samples met the appropriate holding times. Turbidity tests were conducted at the TCHD. Ammonia and nitrate samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis.
Dec. 13th – (Wednesday)	**Second Sampling Day:** The first sample was collected at Dekle Beach at 07:57 AM, near the predicted time of ebb high tide. The field activity finished at 12:15 PM. All samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD. Ammonia and nitrate samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis.
Dec. 14th – (Thursday)	**Last Sampling Day:** The first sample was collected at Dekle Beach at 10:10 AM, near the predicted time of ebb high tide. The field activity finished at 02:00 PM. All samples met the appropriate holding times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted at the TCHD. Ammonia and nitrate samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis.
Dec. 15th – (Friday)	Readings of the bacteriological results for the last sampling day were recorded. All equipment was packed up for return to Boca Raton. Biohazardous waste was disposed of with TCHD. The FAU research team arrived at the University Campus in Boca Raton at 12:20 AM Saturday morning (December 16, 2006).

SLWT (May, 2007)

The fourth FAU sampling trip was conducted during the SLWT during the third week of May 2007. The following is a daily summary of events.

May 21 – (Monday)	FAU research team left the University Campus in Boca Raton, FL around 03:00 AM and arrived at the Taylor County Health Department (TCHD) office in Perry, FL at 11:30 AM. All equipment was installed in the temporary laboratory, which was the same storage/office space used during the last sampling campaign in December 2006. Afterwards, several new sites were visited in preparation for sampling on the following day. Seven new sites were selected and sampled during this trip, these included three sites along the Fenholloway River (Peterson's Landing, Hampton Springs Bridge, and Fenholloway River at 19/Alt27), Adam's Beach, Goodtime Drive (Dekle Beach), Marina Road (Keaton Beach), Sandpiper Lane (Cedar Island).
May 22 – (Tuesday)	**First Sampling Day:** The first sample was collected at Adams Beach at 08:21 AM, predicted time of ebb tide (7:51 AM). The field activity finished at 12:58 PM at Fenholloway River. All samples met the appropriate hold times. Samples of shallow sediments were collected for four representative coastal sites. Once the team returned to the TCHD lab, two members returned to the field to collect the final two sites (Peterson's Landing and Hampton Springs Bridge). Turbidity tests were conducted in the TCHD laboratory rather than in the field. Nutrient samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis.

May 23 – (Wednesday)	**Second Sampling Day:** The first sample was collected at Hampton Springs Bridge at 07:56 AM, near the predicted time of ebb high tide (8:51 AM). The field team vehicle was temporarily stuck in the dry sand at the first site and required assistance to pull the vehicle out and back on the road. This resulted in an unanticipated 75-minute delay. The field activity finished at 2:03 PM at Fenholloway River. Nine sites were selected for molecular tracers. All samples (except Hampton Springs Bridge) met the appropriate hold times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted in the TCHD laboratory rather than in the field. Nutrient samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis. Molecular tracer samples were prepared from 3:00 PM to 11:30 PM in the TCHD laboratory.
May 24 – (Thursday)	**Last Sampling Day:** The first sample was collected at Hampton Springs Bridge at 09:00 AM, near the predicted time of ebb high tide (09:50 AM). While two members of the sampling team prepared the shallow sediment samples for re-growth analysis (*n* = 4), the other two collected the Peterson's Landing and Hampton Springs samples. The team met at the TCHD laboratory to prepare the bacteriological tests for the six samples, and then resumed field collection at Adam's Beach at 10:53 AM The field activity finished at 03:06 PM at Fenholloway River. All samples met the appropriate hold times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted in the TCHD laboratory rather than in the field. The molecular tracer samples that were incubated the day before were prepared for shipment to NOAA-AOML. The nitrogen isotope samples were filtered and frozen under dry ice. Nutrient samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis, along with the molecular tracer samples (*n* = 36).

May 25 – (Friday)	Readings of the results for the last sampling day for bacteriological tests were recorded. At 1:30 PM, the team visited the Taylor Coastal Utilities Wastewater Treatment facility near Cedar Island, FL. After returning to the TCHD, all equipment was packed up for return to Boca Raton. Biohazardous waste was disposed of with TCHD personnel. The FAU research team left Perry at 04:30 PM and arrived at the University Campus in Boca Raton at 02:15 AM Saturday morning (May 26, 2007).

SHWT (September, 2007)

The fifth FAU sampling trip was conducted during the SHWT during the third week of September 2007. The following is a daily summary of events.

September 17 (Monday)	FAU research team left the University Campus in Boca Raton, FL around 06:00 AM and arrived at the Taylor County Health Department (TCHD) office in Perry, FL at 1:30 PM. All equipment was installed in the temporary laboratory, which was the same storage/office space used during the last sampling campaign in May 2007. Afterward, the second sampling vehicle was picked up locally in town.
September 18 (Tuesday)	**First Sampling Day:** The field activity was split between two teams of two samplers, as described earlier. **(Team A, L. Hess and A. Ruffini):** The first sample was taken at Roy's Restaurant (site J) at 6:25 AM, near predicted time of ebb tide (5:15 AM). The field activity finished at 9:41 AM at Petersons Landing (site PL). Meteorological data was not collected at sampling time because the second portable weather station was not functioning. **(Team B, D. Meeroff and H. Hashimoto):** The first sample was taken at Adams Beach (site AB) at 6:09 AM, near predicted time of ebb tide (5:15 AM). The field activity finished at 9:45 AM at Heron Road (site H). All samples from both teams met the appropriate hold times. Turbidity tests were conducted in the TCHD laboratory rather than in the field.

September 19 (Wednesday)	**Second Sampling Day:** The field activity was split between two teams of two samplers, as described earlier. **(Team A, L. Hess and A. Ruffini):** The first sample was taken at Roy's Restaurant (site J) at 6:48 AM, near predicted time of ebb tide (5:51 AM). The field activity finished at 10:38 AM at Adams Beach (site AB). Due to an incorrect number of sample bags collected at Boggy Creek, a re-sampling was undertaken at 4:15 PM (between low and high tide) and noted in the log (sample data was not impeded by tides because the Boggy Creek site is not tidally influenced). In addition to the typical samples collected on day 1, sediment samples were taken from: Adams Beach for regrowth studies. Also four additional surface water samples were taken from: Adams Beach, Petersons Landing, Fenholloway River, and Boggy Creek for molecular techniques testing. **(Team B, D. Meeroff and H. Hashimoto):** The first sample was taken at Deckle Beach (site A) at 6:15 AM, near predicted time of ebb tide (5:51 AM). The field activity finished at 9:15 AM at Heron Road (site H). In addition to the typical samples from day 1, sediment samples were taken from: Deckle Beach, Keaton Beach, and Cedar Island Beach for sediment regrowth testing. Also four additional surface water samples were taken from: Deckle Beach, creek at Deckle Beach, Keaton Beach, Blue Creek at Beach Road, and Cedar Island Beach for molecular techniques testing. 11 of 23 samples did not meet the appropriate hold times for bacteriological testing due to the amount of time required to collect the additional sediment and water samples. None of the hold violations exceeded 60 minutes. The readings for the previous day's bacteriological tests were recorded. Turbidity tests were also conducted in the TCHD laboratory rather than in the field. Nutrient samples were prepared in the field laboratory. Also, molecular tracer samples were prepared using additional sample bags, and shallow sediment re-growth samples were prepared using additional sediment samples. These last two sets of tests were conducted at the TCHD laboratory.

September 20 (Thursday)	**Last Sampling Day:** The field activity was split between two teams of two samplers, as described earlier. All isotope analysis samples were collected on this day. **(Team A, L. Hess and A. Ruffini):** The first sample was taken at Roy's Restaurant (site J) at 7:30 AM, near predicted time of ebb tide (6:50 AM). The field activity finished at 10:23 AM at Petersons Landing (site PL). **(Team B, D. Meeroff and H. Hashimoto):** The first sample was taken at Deckle Beach (site A) at 7:20 AM, near predicted time of ebb tide (6:50 AM). The field activity finished at 10:25 AM at Adams Beach (site AB). The trip blank sample was performed at Adams Beach (site AB) at 10:47 AM. All samples met the appropriate hold times, and the readings for the previous day's bacteriological tests were recorded. Turbidity tests were conducted in the TCHD laboratory rather than in the field. The molecular tracer samples that were incubated the day before were prepared for shipment to NOAA-AOML. The nitrogen isotope samples were filtered and frozen under dry ice. Nutrient samples were prepared in the field laboratory and shipped by FedEx to NOAA-AOML for analysis, along with the molecular tracer samples (n = 36).
September 21 (Friday)	Readings of the results for the last sampling day for bacteriological tests were recorded by 2:30 PM. All equipment was packed up for return to Boca Raton. Biohazardous waste was disposed of with TCHD personnel. The FAU research team left Perry at 03:30 PM and arrived at the University Campus in Boca Raton at 1:15 AM Saturday morning (September 22, 2007).

RESULTS AND DISCUSSION

The results herein are organized and presented by sampling site. Sites were grouped into two categories: sites with OSTDS (septic tanks) and sites with sewer.

DEVELOPED SITES WITH SEPTIC TANKS

Dekle Beach

The Dekle Beach location was representative of a low-density developed area served by OSTDS. Measured DO was in the range of 3.1 – 9.1 mg/L. On the first sampling day in September 2006 (SHWT), the beach site (Site A) presented the lowest DO concentration (3.1 mg/L). This value does not meet the Class III criterion for marine waters (>4.0 mg/L). In September, the upstream and background sites also violated the Class III criterion. The violations occurred at the upstream site on the first and second day and at the background site on the first day. It is interesting to note that DO violations only occurred during the SHWT. Table 7 shows the range of DO levels and nutrients noted in the 2006 sampling events. Table 8 summarizes the 2007 results.

Table 7 – Dekle Beach nutrient results for 2006.

			SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
Site	**Charac.**	**Parameter**	**Day 1**	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**
A	Beach	DO	8.7	6.7	5.8	**3.1**	4.4	4.5	9.1	7.0	7.1
B	Upstream	(mg/L)	7.6	6.2	5.8	**3.4**	**3.6**	4.3	7.4	6.0	8.5
C	Background		6.5	6.4	5.4	**3.8**	4.6	4.7	8.1	7.5	5.2
A	Beach	NH_4^+	<0.1	0.24	0.13	0.17	0.13	0.08	0.01	<0.01	0.01
B	Upstream	(mg/L as N)	0.67	0.22	0.13	0.12	0.07	0.04	0.04	0.06	0.01
C	Background		0.72	0.28	0.30	0.06	0.07	0.05	0.05	0.05	0.06
A	Beach	NO_3^-	<0.011	<0.011	<0.011	<0.0052	<0.0052	0.020	0.007	0.004	0.003
B	Upstream	(mg/L as N)	<0.011	<0.011	<0.011	<0.0052	0.020	<0.0052	0.007	0.010	0.003
C	Background		<0.011	<0.011	<0.011	0.020	0.020	0.020	0.009	0.009	0.007
A	Beach	TN	0.8	0.3	0.5	0.6	0.7	0.6	0.4	0.3	0.3
B	Upstream	(mg/L as N)	0.6	0.6	0.5	0.6	0.8	0.7	0.3	0.4	0.3
C	Background		0.7	0.4	0.6	0.6	0.7	0.6	0.4	0.4	0.5
A	Beach	TOC	16	11	11	15	20	19	10	11	10
B	Upstream	(mg/L as C)	12	13	11	17	21	18	13	11	10
C	Background		12	10	11	17	21	18	12	12	11

Note: Values in **bold** indicate violations of the trigger level

Table 8 – Dekle Beach nutrient results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
A	Beach	DO (mg/L)	7.5	6.6	6.8	4.4	4.2	**3.8**
JI	Beach		7.6	6.9	7.1	**2.6**	**2.7**	**2.3**
B	Upstream		7.2	6.7 ± 0.5	7.4	**3.0**	**2.0**	**2.6**
C	Background		6.5	6.0	6.3	**3.9**	4.7	**3.5**
A	Beach	NH_4^+ (mg/L as N)	0.00	0.00	0.00	0.00	0.01	0.01
JI	Beach		0.01	0.01	0.01	0.02	0.02	0.03
B	Upstream		0.06	0.05 ± 0.02	0.00	0.08	0.07	0.14
C	Background		0.06	0.03	0.04	0.07	0.06	0.11
A	Beach	NO_3^- (mg/L as N)	0.00	0.00	0.00	0.00	0.05	0.00
JI	Beach		0.01	0.00	0.00	0.00	0.00	0.01
B	Upstream		0.01	0.00	0.01	0.01	0.01	0.02
C	Background		0.01	0.01	0.01	0.02	0.01	0.03
A	Beach	TN (mg/L as N)	0.5	0.5	0.4			
JI	Beach		0.4	0.5	0.5			
B	Upstream		0.7	0.6	0.5			
C	Background		0.7	0.6	0.5			
A	Beach	TOC (mg/L as C)	7.3	7.5	8.4	7.4	10.5	8.2
JI	Beach		5.5	7.3	8.4	8.1	5.7	6.0
B	Upstream		8.9	7.8 ± 0.1	8.6	7.2	10.5	
C	Background		9.1	7.9	7.5	5.0	4.9	

Note: Values in **bold** indicate violations of the trigger level

In terms of nutrients, analyses were conducted to determine the levels of ammonia, nitrate, total nitrogen, and total organic carbon at the three sites. Figure 5 shows that during the May 2006 event (SLWT), the ammonia was generally higher than in September 2006 (SHWT) or December 2006 (SLWT). The trend for the 2007 events was more indicative of the September and December events in 2006, and largely different that the May 2006 SLWT event.

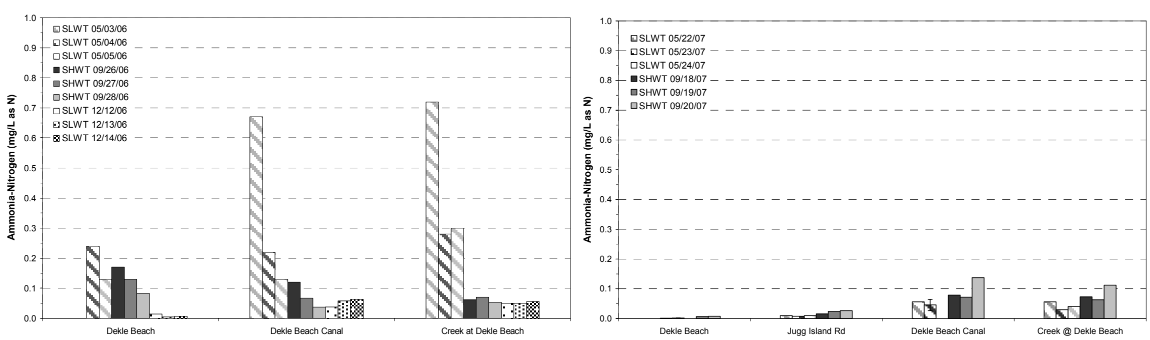

Figure 5 – Results for Ammonia at Delke Beach for 2006 (left) and 2007 (right).

The ammonia concentration tended to increase as the sampling sites moved upstream in the 2006 SLWT (both in May and, to a lesser extent, in December). The reverse was true in the 2006 SHWT. Since ammonia is an indicator of recent nitrogen contributions, septic tanks could be a potential source. However, if this was the case, the upstream site would tend to be closer to the background concentrations. Since this was not observed, the ammonia increase may be an indication of the application of fertilizers from lawns, as opposed to septic tanks. Since northern Florida is more influenced by frontal systems that tend to carry more rainfall in the spring months compared to South Florida, and since the first fertilizer applications are generally done in the spring, this is a potential source and would explain why the issue does not arise in December when fertilizers are generally not applied. This is further supported by looking at the potable water usage statistics in the area, which indicate that May is the highest usage month on average (Figure 6). It is likely that much of this additional usage is attributable to irrigation, which would result in increased runoff of ammonia-based fertilizers. A more representative background site location might resolve this issue in follow-up testing.

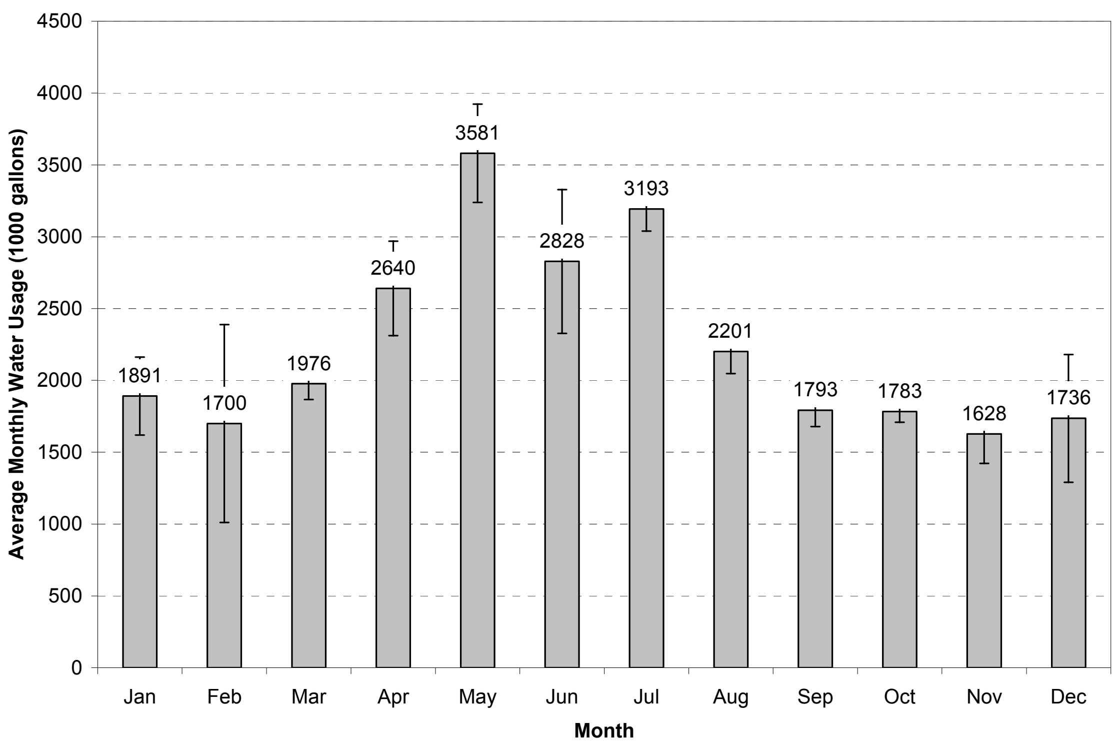

Figure 6 - Monthly water usage in Taylor County over the period including 2000 to 2004.

In 2007, follow-up testing revealed that the ammonia levels were all below 0.14 mg N/L, which is considerably lower than the ammonia levels recorded in 2006, but still double the value considered high in shallow coastal waters (0.07 mg N/L, Zhang 2006). As in 2007, the trend was for the ammonia to increase in the upstream direction. This trend also held true for both seasons, unlike in 2006. The Jugg Island Road site (JI) shows a concentration gradient from upstream to the beach. This site is located downstream of the Dekle Beach site (A) and also downstream of the background site (C). It is a possibility that the ammonia is of terrestrial origin (fertilization practices) from the Dekle Beach community; however, at the JI site, dogs were also observed on all sampling dates in 2007.

Nitrate concentrations were below the detection limit at all sites within the Dekle Beach area during the 2006 SLWT, and although most of the samples were again below the detection limit during the 2006 SHWT, the background site presented a detectable nitrate concentration for all three days. In 2007, the nitrate levels were again very low; however, in the 2007 SHWT, the background site (C) recorded nitrate values that were 2-3 times higher than the previous year. In addition, one (September 19, 2007) of the three days at the Dekle Beach site (A) showed a value of 0.05 mg N/L for nitrate. This nitrate spike was not repeated on either of the other two sampling days at this site.

Figure 7 shows that total nitrogen concentrations were relatively constant throughout the site, regardless of the season for both years. The TN results for the May SLWT events are similar in 2006 and 2007. No data is available for the 2007 SHWT due to an equipment malfunction. This should be re-sampled in the future. TOC (Figure 8) also appeared to have been generally constant across all sampling areas during the 2006 SLWT event periods and the 2006 SHWT events, although the SHWT events had higher concentrations when compared to the SLWT samples, and the December 2006 SLWT values were slightly lower than the May 2006 SLWT events. The May 2007 SLWT results were slightly lower than the Dec 2006 results. SHWT values were much lower than the 2006 SHWT results. The reasons are unclear, but rainfall may be a factor. Additional sampling is recommended. Note that all figures for each parameter have been set with the same y-axis range to facilitate comparisons across the four different sampling locations (Dekle Beach, Keaton Beach, Cedar Island, and Steinhatchee).

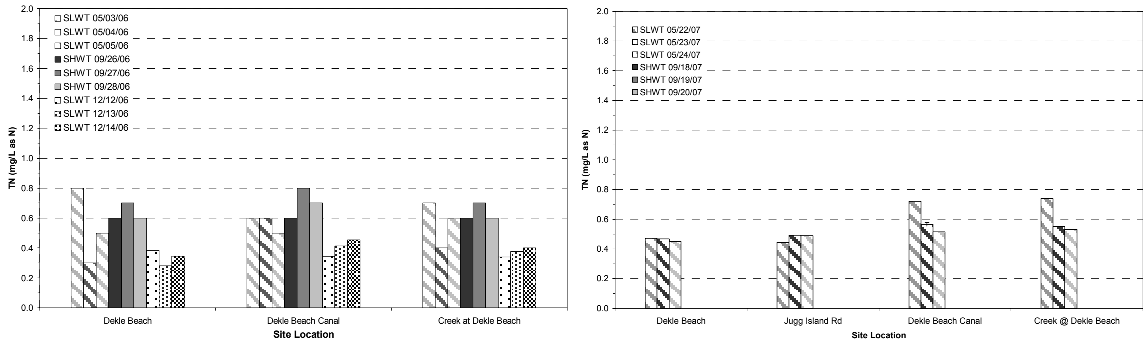

Figure 7 – **Results for Total Nitrogen at Delke Beach for 2006 (left) and 2007 (right).**

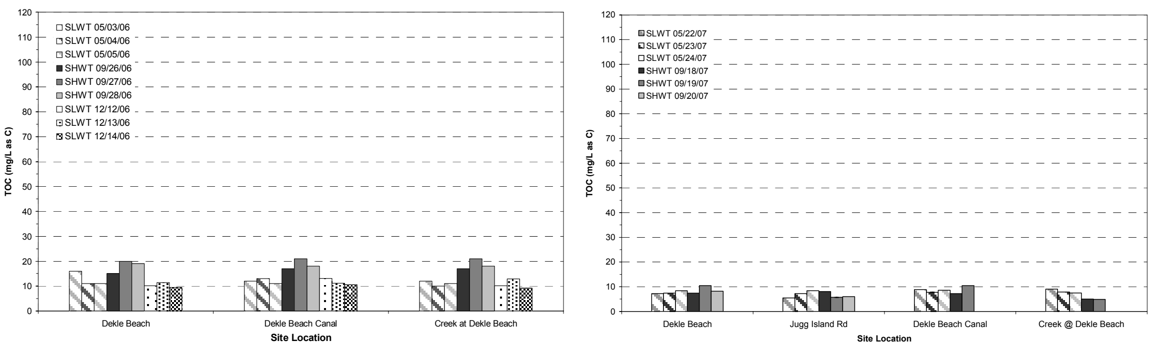

Figure 8 – **Results for TOC at Delke Beach for 2006 (left) and 2007 (right).**

Table 9 shows the microbial constituents analyzed for the Dekle Beach community in 2006, and Table 10 summarizes the same parameters for 2007. In terms of microbial water quality, concentrations of *Enterococcus*, *E. coli* and total coliforms were compared. *Enterococcus* concentrations were generally lower at the beach than the upstream and background sampling points.

Table 9 – Dekle Beach turbidity and bacterial results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
A	Beach	Turbidity	0.8	3.9	0.9	3.5	2.5	2.3	0.4	0.7	0.5
B	Upstream	(NTU)	1.4	1.7	1.1	1.4	1.4	1.2	0.7	1.1	0.7
C	Background		1.8	2.7	2.6	2.5	1.3	1.5	0.4	0.7	0.8
A	Beach	*Enterococcus*	20	<10	<10	52	<10	10	<10	<10	<10
B	Upstream	(MPN/100 mL)	85	**122**	74	**110**	31	**185**	20	20	20
C	Background		75	31	10	**220**	63	20	10	10	10
A	Beach	*E. coli*	**484**	278	390	**620**	**1890**	**1730**	63	98	91
B	Upstream	(MPN/100 mL)	**693**	**1040**	**698**	**808**	**2400**	**8160**	285	187	250
C	Background		**1300**	**1540**	**815**	**1510**	**1550**	**2250**	185	183	97
A	Beach	Total Coliforms	8660	6290	5100	4790	24200	>24200	1178	1000	751
B	Upstream	(MPN/100 mL)	4200	5170	12000	19900	15500	17300	3538	1815	3325
C	Background		6870	5490	12000	13000	17300	>24200	3945	2318	1532
A	Beach		24	56	78	12	378	173	13	20	19
B	Upstream	Ec/Es Ratio	8	9	9	7	77	44	14	9	15
C	Background		17	50	82	7	25	113	19	18	10

Note: Values in **bold** indicate violations of the trigger level

Table 10 – Dekle Beach turbidity and bacterial results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
A	Beach	Turbidity (NTU)	0.9	1.2	1.5	1.4	1.1	1.3
JI	Beach		1.6	1.9	1.8	5.5	1.9	1.3
B	Upstream		2.3	2.3 ± 0.2	1.8	1.6	1.5	1.8
C	Background		2.1	2.3	2.3	0.7	1.8	1.2
A	Beach	*Enterococcus* (MPN/100 mL)	<10	10	<10	20	<10	10
JI	Beach		<10	<10	10	10	<10	**318**
B	Upstream		<10	15 ± 11	10	63	**213**	**201**
C	Background		31	<10	30	52	20	**169**
A	Beach	*E. coli* (MPN/100 mL)	130	30	71	**24196**	**528**	**6294**
JI	Beach		152	40	97	**17329**	**1510**	169
B	Upstream		162	51 ± 22	70	**1892**	**3968**	**5475**
C	Background		132	82	112	**1993**	**2367**	**15531**
A	Beach	Total coliforms (MPN/100 mL)	12997	19863	9804	>24196	11199	12033
JI	Beach		9804	24196	17329	>24196	9804	5172
B	Upstream		2046	10919	9208	19863	8164	8664
C	Background		12997	19863	14136	24196	7215	>24196
A	Beach	Ec/Es Ratio	26	3	14	1210	106	629
JI	Beach		30	8	10	1733	302	1
B	Upstream		32	4	7	30	19	27
C	Background		4	16	4	38	118	92

Note: Values in **bold** indicate violations of the trigger level

Figure 9 shows that the *Enterococcus* concentrations were below the trigger level (100 MPN/100mL) on the beach for both 2006 and 2007. However, upstream of the beach, the canal site showed concentrations near the trigger level (3 of 6 were above), while further upstream, the quantities diminished below the trigger level except for one sample in the 2006 SHWT and another one in 2007 SHWT. The higher concentrations observed in the upstream site both years were possibly due to fresh input from residential septic tanks, influenced by the timing of the sampling (early morning peak residential flow). Sampling during the December 2006 SLWT with cooler water temperatures showed minimal amounts of *Enterococcus*.

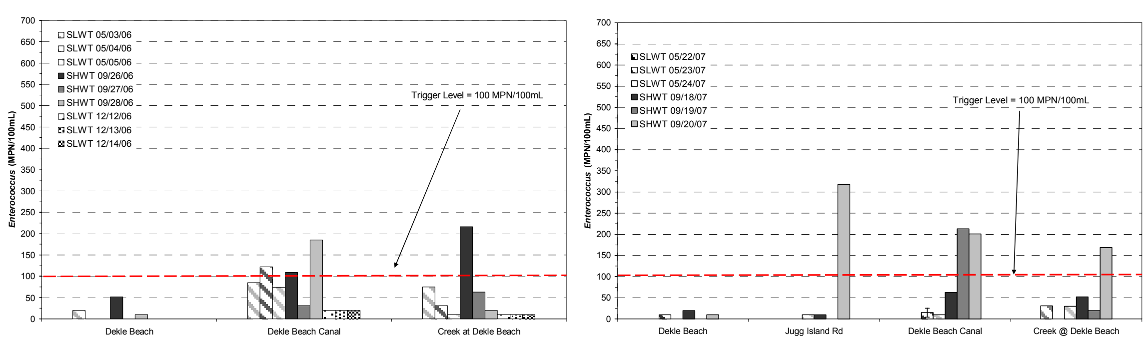

Figure 9 – Results for *Enterococcus* at Delke Beach for 2006 (left) and 2007 (right).

E. coli densities at the Dekle Beach area were generally higher during the SHWT in both years compared to the same site at SLWT. The SHWT values also consistently violated the trigger level of 400 MPN/100 mL (see Figure 10). The highest value in 2006 (8160 MPN/100mL) was encountered at the upstream site (B), which was expected due to its relative proximity to active septic tanks and less influence from marine dilution. In 2007, the highest value recorded (>24196 MPN/100 mL) was at the beach itself (A). The 2007 SHWT *E. coli* samples were extremely high (>10^5/100 mL). In fact, three of the samples taken here were measured beyond the scale of the figure at well above 15,000 MPN/100 mL. Although this was unexpected, the Taylor County Health Department weekly beach sampling program had recorded excessively high values in the preceeding weeks as well. The cooler temperatures characteristic of the December 2006 sampling (SLWT) resulted in minimal amounts of measurable *E. coli.*

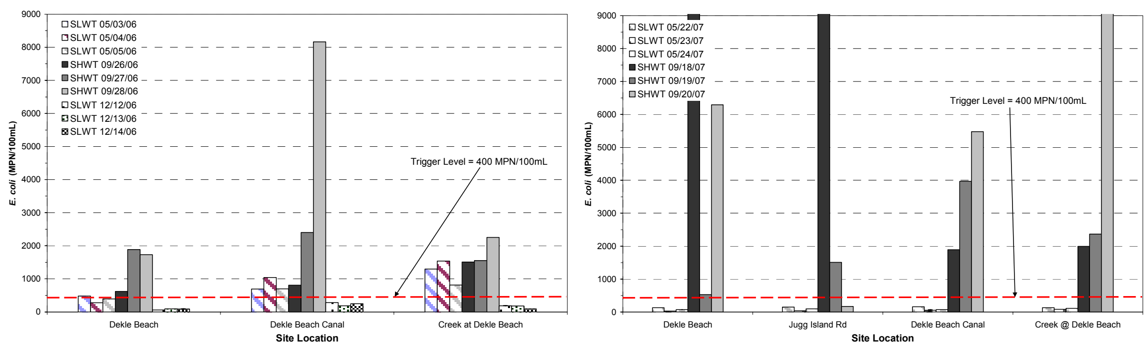

Figure 10 – **Results for *E. coli* at Delke Beach for 2006 (left) and 2007 (right).**

Except for the last sampling day in 2007 SHWT at the new Jugg Island Road site (JI), the *E.coli/Enterococcus* ratios were higher than 4.0, suggesting a human source of pollution. The one exception at site JI (Ec/Es = 0.5) is likely due to recent dog inputs. Turbidity was also monitored for the microbial samples since high turbidity may indicate surface runoff or wind-driven mixing of sediments into the water column. This second input could be related to a legacy source of pathogens protected from the elements within the shallow sediment and representing a possible source of bacterial regrowth that will be discussed in more detail later. Overall, turbidity values were generally low, although the SHWT event showed slightly higher levels. None of these samples was overly turbid.

Steinhatchee

The Steinhatchee location was representative of a higher density, developed area served exclusively by OSTDS. The sites sampled were mostly freshwater as opposed to marine or brackish water from the other beach monitoring locations. Table 11 summarizes nutrient values for the Steinhatchee sites in 2006, and Table 12 summarizes the readings for 2007 sampling. In terms of nutrients, analyses were conducted to determine the levels of ammonia, nitrate, total nitrogen, and total organic carbon at the 5 sites. The DO levels were in the range of 1.1 – 9.7 mg/L (Table 11 and Table 12). With the exception of Site J (Main Street-Roy's), during the 2006 SHWT, all the sites consistently violated the Class III criterion for DO (>5.0 mg/L for freshwater). This phenomenon was not repeated in 2007, where no single violations were recorded.

Table 11 – Steinhatchee nutrients results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
J	Downstream	DO (mg/L)	5.4	5.6	5.1	**4.6**	5.2	5.4	9.7	8.0	7.9
K	Upstream		5.8	6.6	5.8	**3.3**	**1.7**	**1.6**	5.7	**4.5**	5.3
L	Tributary		5.3	6.9	6.1	**3.3**	**2.4**	**2.4**	**1.6**	**0.5**	**3.3**
M	Upstream		6.5	6.6	6.4	**2.7**	**2.6**	**2.8**	**3.3**	**2.6**	**1.4**
N	Background		6.9	6.6	6.5	**1.1**	**1.4**	**1.4**	**2.2**	**2.0**	**1.8**
J	Downstream	NH_4^+ (mg/L as N)	0.23	<0.1	<0.1	0.13	0.02	0.02	0.04	0.04	0.05
K	Upstream		0.23	0.14	0.24	0.01	0.04	<0.010	0.06	0.05	0.05
L	Tributary		0.15	0.15	0.10	0.03	<0.010	0.05	0.03	0.03	0.05
M	Upstream		0.63	0.69	0.51	<0.010	<0.010	<0.010	0.05	0.09	0.10
N	Background		0.24	0.13	<0.1	<0.010	<0.010	<0.010	0.13	0.13	0.13
J	Downstream	NO_3^- (mg/L as N)	<0.011	<0.011	<0.011	0.02	0.02	0.01	0.015	0.025	0.028
K	Upstream		0.04	<0.011	0.03	0.01	0.04	<0.0052	0.129	0.060	0.107
L	Tributary		0.03	0.01	0.01	0.04	0.05	0.05	0.008	0.011	0.005
M	Upstream		<0.011	<0.011	<0.011	0.02	<0.0052	0.02	0.018	0.029	0.024
N	Background		0.02	<0.011	<0.011	0.01	<0.0052	<0.0052	or	or	0.012
J	Downstream	TN (mg/L as N)	0.9	0.4	0.4	0.5	0.4	0.4	0.2	0.4	0.3
K	Upstream		0.1	0.3	0.3	0.2	0.4	0.3	0.3	0.4	0.3
L	Tributary		0.5	0.3	0.4	1.1	1.0	0.8	0.4	0.5	0.6
M	Upstream		1.8	0.8	1.0	0.2	0.3	0.3	0.4	0.3	0.4
N	Background		0.6	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.3
J	Downstream	TOC (mg/L as C)	10	12	10	18	16	16	7.6	7.6	7.5
K	Upstream		4.0	8.0	8.0	10	16	13	11	11	7.4
L	Tributary		14	13	15	72	79	91	37	33	38
M	Upstream		20	16	13	19	21	21	15	17	18
N	Background		16	17	11	18	20	20	19	5.8	19

Note: Values in **bold** indicate violations of the trigger level
or = out of range

Table 12 – Steinhatchee nutrients results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
J	Downstream	DO (mg/L)	5.7	5.5	6.0	5.6	6.5	5.9
K	Upstream		6.2	6.0	6.8	6.8	6.5	7.5
L	Tributary		8.6	8.2	9.1	9.5	9.5 ± 0.2	9.5
M	Upstream		8.1	7.8	8.7	8.9	9.0	9.2
N	Background		8.5	8.3	9.5	9.2	9.2	9.3
J	Downstream	NH_4^+ (mg/L as N)	0.03	0.04	0.03	0.04	0.02	0.06
K	Upstream		0.04	0.04	0.04	0.05	0.05	0.08
L	Tributary		0.09	0.07	0.07	0.02	0.02	0.05
M	Upstream		U	0.01	0.01	0.03	0.03	0.04
N	Background		0.04	0.08	0.08	0.04	0.04	0.06
J	Downstream	NO_3^- (mg/L as N)	0.01	0.01	0.01	0.02	0.13	0.02
K	Upstream		0.05	0.06	0.05	0.06	0.06	0.08
L	Tributary		0.01	0.02	0.02	0.04	0.05	0.09 ± 0.01
M	Upstream		0.01	0.01	0.02	0.04	0.04	0.06
N	Background		0.01	0.00	0.01	0.02	0.03	0.03
J	Downstream	TN (mg/L as N)	0.6	0.4	0.4			
K	Upstream		0.7	0.4	0.4			
L	Tributary		0.7	0.7	0.6			
M	Upstream		0.4	0.4	0.3			
N	Background		0.4	0.3	0.4			
J	Downstream	TOC (mg/L as C)	9	6	4			
K	Upstream		8	6	6			
L	Tributary		14	16	12			
M	Upstream		9	11	11			
N	Background		10	8	11			

Note: Values in **bold** indicate violations of the trigger level; U = below detection

Figure 11 shows that during the May 2006 event (SLWT), the ammonia was higher at all sites when compared with the September 2006 SHWT. Ammonia concentrations in December 2006 (SLWT) were higher than September 2006 (SHWT), but about half of the values measured in May 2006 (SLWT). The ammonia concentration tended to increase as the sampling sites moved upstream in both SLWTs, with the Boggy Creek site of particular significance in May 2006. This appears to have changed in the later sampling events. Since ammonia is an indicator of recent nitrogen contributions, septic tanks could be a source. However, the upstream site would tend to be more similar to the background levels. In 2007, all sites for both seasons were below 0.1 mg N/L for ammonia. The unexpectedly low ammonia results in 2007 made it difficult to interpret nitrogen isotope ratios collected from the Steinhatchee sites. This will be discussed in more detail later.

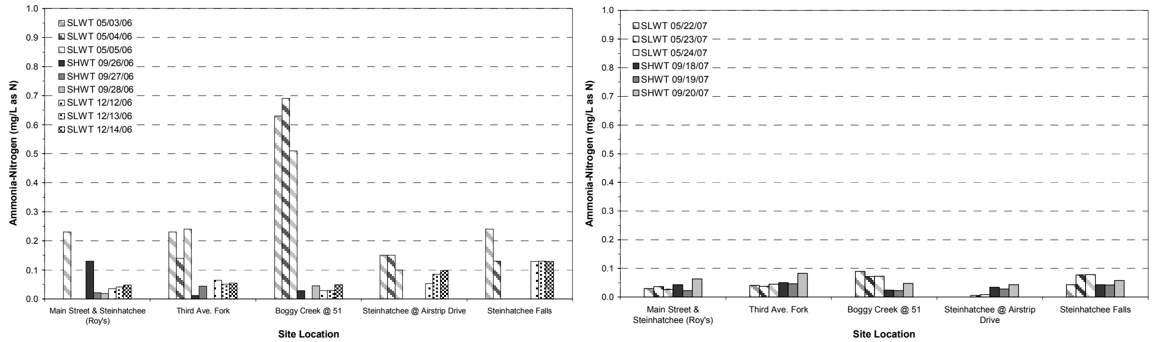

Figure 11 – Results for Ammonia at Steinhatchee for 2006 (left) and 2007 (right).

Nitrate concentrations were below the detection limit at all sites within the Steinhatchee area during the 2006 SLWT (May 2006). During the 2006 SHWT (September 2006), although most of the samples were again below the detection limit, the background site presented a detectable nitrate concentration for all three days. In 2006, nitrate values were highest in December (2006 SLWT), but only for Site K. Two samples in December 2006 (Site N, days 1-2) were "over range" and could not be re-analyzed due to insufficient sample. In 2007, the SHWT (September) sampling event nitrate levels were generally higher than those recorded in SLWT (May), with some samples at or above 0.1 mg N/L of nitrate-nitrogen.

Figure 12 shows that total nitrogen concentrations were relatively constant throughout Steinhatchee, except at the Boggy Creek site, regardless of the season or year. In 2006, the Boggy Creek site (L) shows generally higher levels of TN in May 2006 and September 2006, but thereafter, the levels return to the average baseline seen at the other Steinhatchee sites. Figure 13 shows that TOC was generally constant across all site locations during the SLWT and SHWT events, except for the SHWT (September).

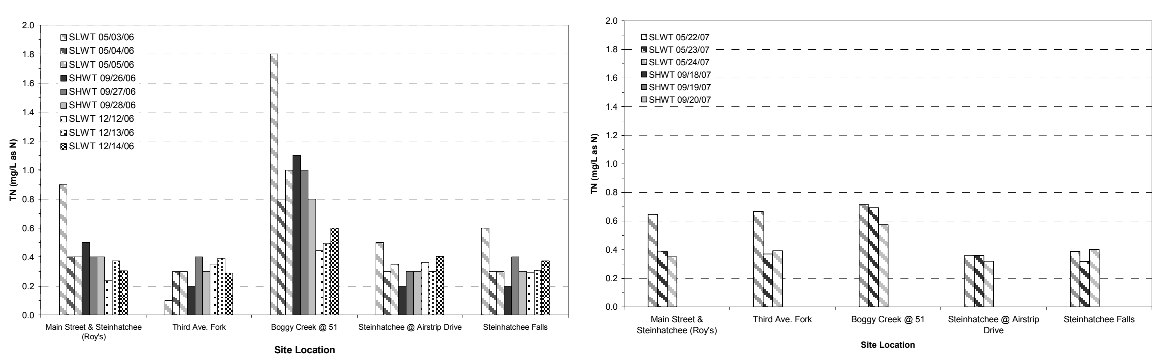

Figure 12 – Results for Total Nitrogen at Steinhatchee for 2006 (left) and 2007 (right).

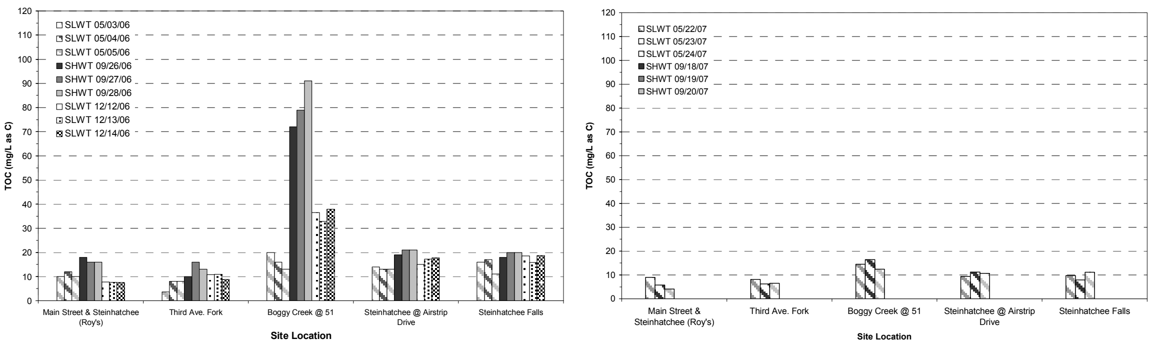

Figure 13 – Results for TOC at Steinhatchee for 2006 (left) and 2007 (right).

All Steinhatchee sampling sites were similar except for the Boggy Creek site (L) September 2006 SHWT that was 4 times higher than the values of the other four sites or compared to the May 2006 SLWT event and double for the December 2006 SLWT event. Boggy Creek has no known point sources with NPDES (treated sanitary sewer) or MS4 (municipal separate storm sewer for populations >50,000) permits. Agricultural animal input is not considered significant in this watershed (USEPA 2003). The undeveloped portion of the watershed comprises greater than 99% of the total area. Thus OSTDS, stormwater runoff, and domestic animal inputs from urban development are not expected to be important. Something else occurs here that deserves further investigation. However, the higher TOC levels at Boggy Creek observed in 2006 were not repeated during the May 2007 SLWT.

According to the Florida Department of Environmental Protection (FDEP) *Basin Status Report for the Suwannee Basin*, part of the Steinhatchee River watershed (more specifically, the Boggy Creek drainage basin) is 98 percent pine flatwoods and wetlands, most of which are used for commercial timber production (FDEP 2001). Thus there is a potential for “agricultural” inputs from tree farming operations. During the three sampling events, evidence of recent human activity was also noted at the Boggy Creek site. In particular, recently deposited litter, fresh tire tracks in the mud, and dead animal carcasses (wild boars). In May 2006, the site showed indications of recent boating/fishing activity and a fresh hydrocarbon sheen was noted streaking across the water surface near the sampling site. The samples collected were characterized by a deep reddish-brown color indicative of humic and fulvic acids and a large amount of decaying vegetation. The reddish-brown water sampled at Boggy Creek indicative of decaying vegetation was reminiscent of the highly colored water collected from the Fenholloway River. The connection between these two water sources was not investigated but could simply be tannic constituents from the upstream pines and timber activity. In September 2006, a hydrocarbon sheen similar to those recorded in May 2006 was also observed, and in December 2006 the turbidity increased noticeably. On the last sampling day of December 2006, several gun shots were heard in the nearby wetlands just north of the sampling site, presumably from hunters in the area.

Table 13 shows the results for microbial constituents in 2006, and Table 14 summarizes the same parameters in 2007. In terms of microbial water quality, concentrations of *Enterococcus*, *E. coli* and total coliforms were compared. *Enterococcus* concentrations were lower at the beach than the upstream and background sampling points. For 2006, Figure 14 shows that the *Enterococcus* concentrations were generally below the trigger level (100 MPN/100mL) at the rivermouth (5 of 6). However, in the upstream direction, the Third Street Fork site (Site K) showed concentrations above the trigger level approximately 50 percent of the time in both 2006 and 2007. The Boggy Creek site (Site L) showed concentrations above the trigger level most of the time (5 of 6) in the September 2006 (SHWT) and December 2006 (SLWT) sampling events. This trend continued in 2007 SHWT with three out of three days showing violations, and those counts were even higher than those measured in 2006. Further upstream, the quantities diminished below the trigger level in both years except for one sample in the 2006 SHWT (September) at Steinhatchee Falls. The higher concentrations in the upstream site (Site K, Third Avenue Fork) may have been due to fresh input from residential septic tanks.

Table 13 – Steinhatchee turbidity and bacterial results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
J	Downstream		0.6	1.8	1.1	2.7	1.3	1.2	0.4	0.4	0.4
K	Upstream	Turbidity	1.4	1.6	0.4	1.0	1.0	0.6	1.0	0.7	0.4
L	Tributary	(NTU)	1.3	2.1	1.4	1.0	1.3	1.5	17.8	12.7	0.6
M	Upstream		6.4	8.1	7.4	1.6	1.3	1.5	2.4	1.9	11.8
N	Background		1.7	2.8	1.8	1.9	1.5	1.5	8.7	2.8	2.3
J	Downstream		<10	52	40	**183**	20	<10	20	31	20
K	Upstream	*Enterococcus*	41	85	**260**	**307**	**169**	41	41	63	ns
L	Tributary	(MPN/100 mL)	52	15	20	**388**	**120**	**262**	**359**	**235**	31
M	Upstream		10	61	74	52	20	10	10	20	10
N	Background		<10	41	10	41	**146**	84	31	31	20
J	Downstream		199	**3280**	**528**	**496**	**411**	241	52	63	97
K	Upstream	*E. coli*	30	75	74	324	160	41	75	146	ns
L	Tributary	(MPN/100 mL)	10	10	**411**	383	109	132	197	341	85
M	Upstream		<10	10	<10	41	20	20	63	26	21
N	Background		20	<10	<10	108	30	10	10	10	10
J	Downstream		5170	12000	6870	17300	10500	9210	1515	2878	2851
K	Upstream	Total coliforms	10500	15500	11200	10500	9210	8160	14136	15531	ns
L	Tributary	(MPN/100 mL)	10500	14100	15500	11200	17300	13000	17329	6294	6867
M	Upstream		1330	906	985	3650	2380	2490	1202	1001	639
N	Background		959	1270	1220	4350	2050	3870	>24196	272	471
J	Downstream		NA	63.1	13.2	2.7	20.6	NA	2.6	2.0	4.9
K	Upstream		0.7	0.9	0.3	1.1	0.9	1.0	1.8	2.3	ns
L	Tributary	Ec/Es Ratio	0.2	0.7	20.6	1.0	0.9	0.5	0.5	1.5	2.7
M	Upstream		NA	0.2	NA	0.8	1.0	2.0	3.7	1.3	2.1
N	Background		NA	NA	NA	2.6	0.2	0.1	0.3	0.3	0.5

Note: Values in **bold** indicate violations of the trigger level

Table 14 – Steinhatchee turbidity and bacterial results in 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
J	Downstream		3.3	1.5	1.6	0.6	1.2	1.7
K	Upstream	Turbidity	1.0	1.5	0.8	0.6	1.1	1.1
L	Tributary	(NTU)	7.3	8.2	9.7	0.8	1.8	1.7
M	Upstream		1.4	2.2	1.7	1.2	2.0	1.9
N	Background		3.1	3.5	3.0	1.2	1.8	1.7
J	Downstream		<10	52	<10	10	<10	10
K	Upstream	*Enterococcus*	**146**	**132**	97	63	**121**	86
L	Tributary	(MPN/100 mL)	52	86	42 ± 15	**657**	**345 ± 199**	**233**
M	Upstream		<10	30 ± 18	<10	63	52	30
N	Background		<10	<10	20	41	10	52
J	Downstream		80	61	109	**488**	284	**5794**
K	Upstream	*E. coli*	50	20	63	148	355	107
L	Tributary	(MPN/100 mL)	<10	<10	41 ± 14	96	233 ± 79	135
M	Upstream		10	10	<10	<10	15 ± 7	10
N	Background		<10	<10	<10	20	41	10
J	Downstream		8164	9804	3873	8164	5475	7270
K	Upstream	Total coliforms	19863	6488	17329	10462	24196	11199
L	Tributary	(MPN/100 mL)	<10	14136	17697	6488	6867	5794
M	Upstream		1376	5830	1421	2909	8960	1860
N	Background		789	432	663	2755	1333	1515
J	Downstream		16	1.2	22	49	57	579
K	Upstream		0.3	0.2	0.6	2.3	2.9	1.2
L	Tributary	Ec/Es Ratio	0.1	0.1	1.0	0.1	0.7	0.6
M	Upstream		2.0	1.2	1.0	0.1	0.3	0.3
N	Background		1.0	1.0	0.3	0.5	4.1	0.2

Note: Values in **bold** indicate violations of the trigger level

E. coli densities for the Steinhatchee area were similar during all sampling events, with the exception of the SLWT (May, Day 2), when the value measured at the mouth of the Steinhatchee River (Site J) violated the trigger level of 400 MPN/100 mL by a factor of 8 (see Figure 15). A similar phenomenon was observed in 2007, but this time the violation occurred in SHWT (September). These two isolated events could have occurred shortly after a large release of waste from the septic tank or might be attributable to the restaurant workers dumping spent wash water from mop buckets as witnessed once in 2006. The *E.coli/Enterococcus* ratios were generally less than 4, suggesting a non-human source of pollution. In 2007, only the rivermouth shows consistent signs of human contribution based on the EC/Es ratio (5 of 6). Turbidity was monitored for the microbial samples, since high turbidity may indicate terrestrial runoff or wind-driven mixing of the overlying water column with the sediments. However, none of these samples was overly turbid, although the December 2006 Boggy Creek values were elevated compared to the other two sampling events that year. Samples collected in 2007 during May and September showed similarly low turbidity as expected from the 2006 results.

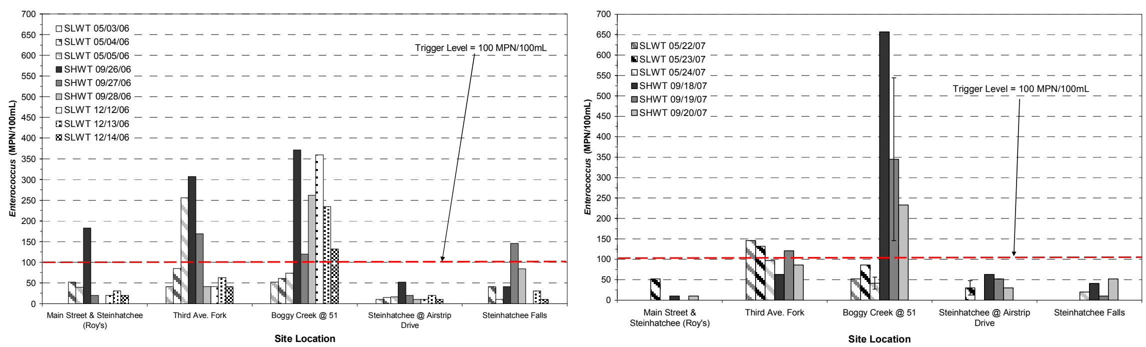

Figure 14 – Results for *Enterococcus* at Steinhatchee for 2006 (left) and 2007 (right).

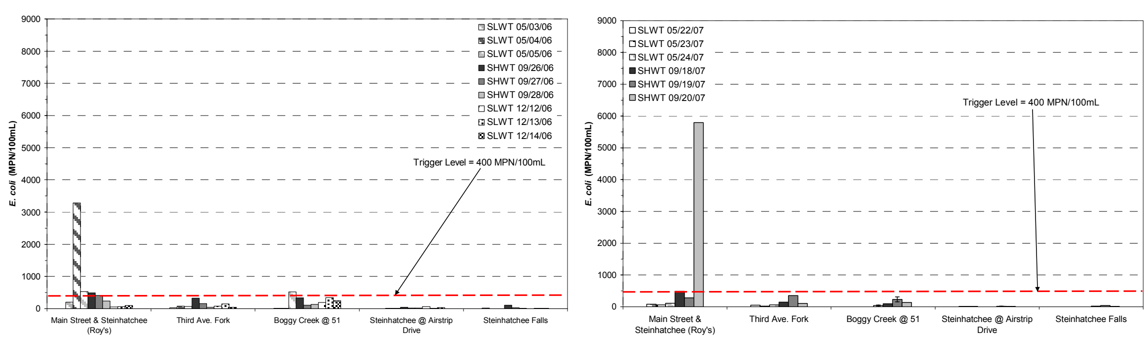

Figure 15 – Results for *E. coli* at Steinhatchee for 2006 (left) and 2007 (right).

One interesting observation from the Boggy Creek site (L) in September 2007 was that on the second sampling day, the field team returned to take a second sample in the afternoon to collect water for the molecular techniques assay. In the early morning sample collected at 7:45 AM just after local high tide, the *E. coli* and total coliform counts were about double compared to those taken in the afternoon at 4:15 PM just after local low tide. The *Enterococcus* counts were almost five times higher. Since the Boggy Creek tributary is too far upstream to show a tidal effect, we believe that this may be attributed to dieoff associated with exposure to direct sunlight.

DEVELOPED WITH SEWER RECENTLY INSTALLED

Keaton Beach

The Keaton Beach location was representative of a medium-density, developed area with a sewer system recently installed. The DO values were in a broad range (1.0 – 10.5 mg/L), with generally lower values decreasing from the beach in the upstream direction. The pump station site (Site D) violated the Class III criterion for DO (<5.0 mg/L for freshwater) for all 3 sampling days during the both SHWT events in 2006 and 2007. The DO levels for the SLWT (May 2006, 2007 and December 2006) were well above the criterion for both marine and freshwater for all Keaton Beach sampling sites. Near saturation values were encountered during the cooler December 2006 sampling event. Table 15 summarizes the nutrient data for Keaton Beach in 2006, and Table 16 lists the results from 2007. In terms of nutrients, an analysis was conducted to determine the levels of ammonia, nitrate, total nitrogen, and total organic carbon.

Table 15 – Keaton Beach nutrients results for 2006.

			SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
Site	**Charac.**	**Parameter**	**Day 1**	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**
F	Beach	DO	6.6	6.1	5.3	4.8	5.2	5.6	10.0	6.3	9.3
E	Midstream	(mg/L)	6.2	5.9	5.4	4.5	4.7	4.9	8.1	8.4	6.2
D	Upstream		5.9	5.7	5.1	**2.6**	**1.7**	**1.9**	10.3	6.6	10.5
G	Background		6.8	6.8	5.7	**4.9**	**4.9**	5.0	8.0	8.9	6.7
F	Beach	NH_4^+	0.28	0.15	0.10	0.08	0.11	0.07	0.01	0.11	0.01
E	Midstream	(mg/L as N)	0.50	0.20	<0.1	0.04	0.06	0.06	0.11	0.04	0.08
D	Upstream		0.44	0.65	<0.1	0.06	<0.010	0.1	0.03	0.12	0.03
G	Background		0.18	<0.1	<0.1	0.03	<0.010	<0.010	0.12	0.01	0.13
F	Beach	NO_3^-	<0.011	<0.011	<0.011	<0.0052	<0.0052	0.02	0.003	0.020	0.004
E	Midstream	(mg/L as N)	<0.011	<0.011	<0.011	0.02	0.02	0.02	0.014	0.010	0.014
D	Upstream		<0.011	<0.011	<0.011	<0.0052	<0.0052	<0.0052	0.004	0.068	0.005
G	Background		0.04	0.05	0.05	<0.0052	<0.0052	0.01	0.050	0.005	0.063
F	Beach	TN	0.3	0.3	0.5	0.5	0.5	0.5	0.3	0.4	0.2
E	Midstream	(mg/L as N)	0.3	0.5	0.4	0.5	0.6	0.9	0.4	0.6	0.3
D	Upstream		0.8	0.7	0.7	0.7	0.7	0.7	0.5	0.4	0.6
G	Background		0.4	0.5	0.4	1	1.1	1	0.3	0.3	0.4
F	Beach	TOC	7	9	10	14	14	14	7	8	5
E	Midstream	(mg/L as C)	7	12	9	18	19	20	11	21	7
D	Upstream		14	22	18	66	69	67	21	15	20
G	Background		5	8	7	72	104	67	12	7	11

Note: Values in **bold** indicate violations of the trigger level

Table 16 – Keaton Beach nutrients results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
F	Beach	DO (mg/L)	6.5	6.0	6.5	5.0	4.2	**3.6**
MR	Beach		6.3	6.1	6.4	4.5	4.3	5.0
E	Midstream		6.1	5.9	6.3	**3.3**	**3.7**	4.1
D	Upstream		6.1	5.8	6.5	**1.0**	**1.7**	**2.4**
G	Background		8.4	7.9	8.6	5.8	5.9	6.3 ± 0.1
F	Beach	NH_4^+ (mg/L as N)	0.00	0.01	0.00	0.01	0.01	0.02
MR	Beach		0.04	0.05	0.00	0.04	0.04 ± 0.01	0.05
E	Midstream		0.00	0.00	0.00	0.04	0.04	0.11
D	Upstream		0.00	0.00	0.00	0.09	0.08	0.07
G	Background		0.08	0.09	0.08	0.09	0.09	0.10
F	Beach	NO_3^- (mg/L as N)	0.01	0.00	0.01	0.00	0.00	0.00
MR	Beach		0.01	0.01	0.00	0.01	0.01	0.01
E	Midstream		0.00	0.00	0.00	0.01	0.01	0.01
D	Upstream		0.01	0.00	0.01	0.00	0.00	0.01
G	Background		0.02	0.10	0.08	0.06	0.08	0.09
F	Beach	TN (mg/L as N)	0.6	0.3	0.4			
MR	Beach		0.6	0.5	0.4			
E	Midstream		0.7	0.5	0.5			
D	Upstream		1.0	0.7	0.6			
G	Background		0.5	0.4	0.4			
F	Beach	TOC (mg/L as C)	7.2	5.6	4.7	6.5	6.9	6.2
MR	Beach		6.7	6.4	5.2	5.3	4.2	4.9
E	Midstream		8.0	7.8	6.6			
D	Upstream		15	15	10			
G	Background		4.9	6.2	4.3 ± 0.6			

Note: Values in **bold** indicate violations of the trigger level

Figure 16 shows that during the May 2006 event (SLWT), the ammonia concentrations were generally higher when compared to the September 2006 event (SHWT) and the December 2006 event (SLWT). Ammonia levels tended to increase as the sampling sites moved upstream in the 2006 SLWT, similar to Dekle Beach, however with generally lower concentrations. In 2007, the generally increasing trend in the upstream direction is repeated but with lower overall concentrations of ammonia. No spikes above 0.1 mg N/L were observed in either season in 2007. Since ammonia is an indicator of recent nitrogen contributions and the area was recently converted to sewer, the results suggest the application of fertilizers from lawns. In December 2006, the Cortez Road and Blue Creek sites showed higher ammonia than in the SHWT event in May 2006. The data is inconclusive for this event.

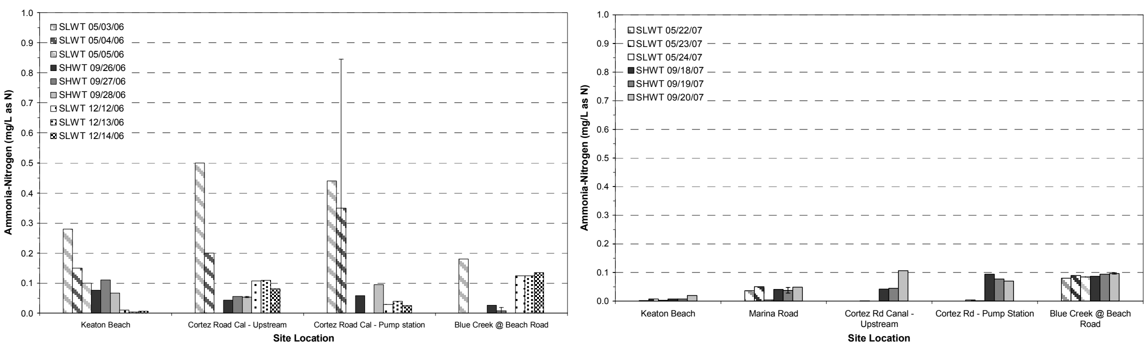

Figure 16 – Results for Ammonia at Keaton Beach for 2006 (left) and 2007 (right).

Nitrate concentrations were at or below the detection limit at all sites within the Keaton Beach area during the 2006 and 2007 SLWT events. Although most of the samples were low, the background site presented a detectable nitrate concentration for all three days in all three SLWT events, generally one order of magnitude higher than the other sites downstream. During the 2006 SHWT, nitrate levels were comparatively very low, with most values below detection. In 2007, the only site within Keaton Beach with high nitrate levels was the background site at Blue Creek (G), which was greater than 0.07 mg N/L on 5 of the 6 sampling days.

Figure 17 shows that total nitrogen concentrations generally increased going upstream, and that the 2006 SHWT results were generally higher than the 2006 SLWT event in 2 of 4 instances. The reasons for this are not clear when looking at the TN data. It is apparent from nitrogen speciation (i.e. ammonia, nitrate, nitrite, and total nitrogen) that most of the nitrogen detected is of organic origin. The 2007 levels are similar to those seen in 2006.

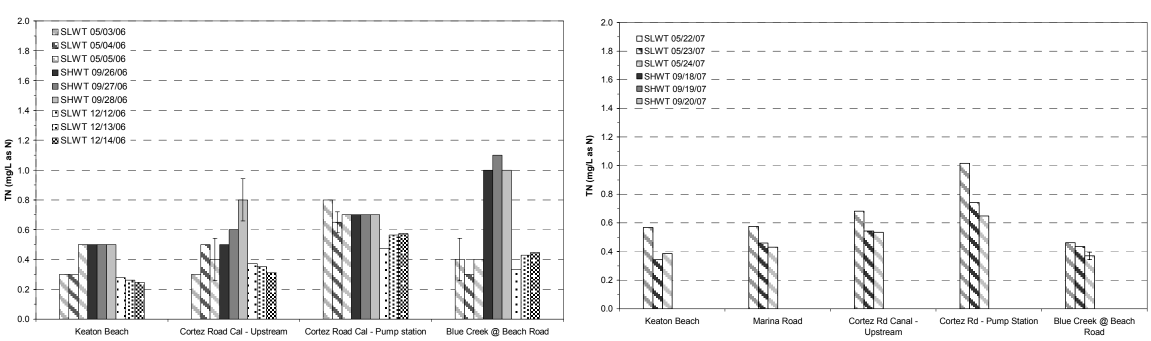

Figure 17 – Results for Total Nitrogen at Keaton Beach for 2006 (left) and 2007 (right).

TOC also increased appreciably (Figure 18) as the sampling moved upstream in 2006. While near the beach, the change in TOC from 2006 SLWT to 2006 SHWT events was about 50 percent, which is similar to trends seen at the OSTDS site locations. However, the difference in the two upstream sites was a factor of 3 to 7 times the SLWT results. This suggests irrigation runoff (rainfall was very scarce during May) or some other discharge. However the recent application of fertilizers is not suggested, since the average ammonia values at these sites remained low, except in May 2006 SLWT. Another remote possibility for this contribution would be a contribution from the wastewater discharge infiltration basins located just southeast of the upstream site (D). An investigation is warranted as to the source of this runoff component and whether an upstream discharge into the water body is also involved. The May 2007 samples were about 50 percent lower than the SLWT events in 2006, and recurrence of the 2006 SHWT spike was not noted in the data.

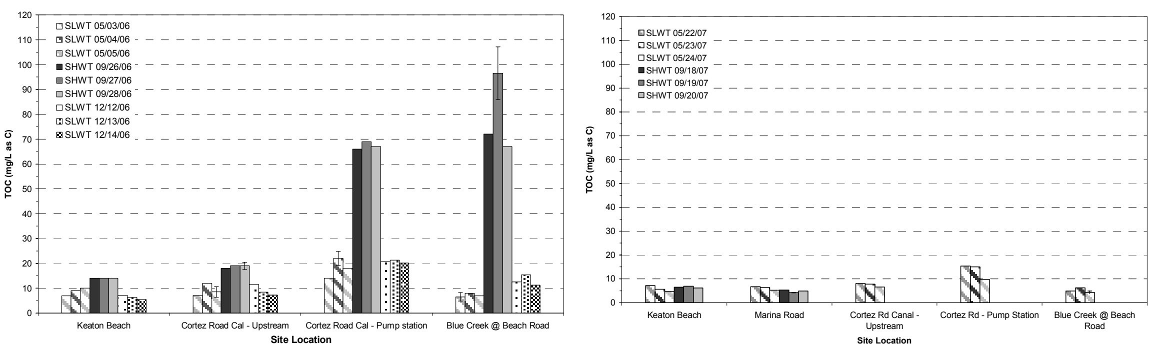

Figure 18 – Results for TOC at Keaton Beach for 2006 (left) and 2007 (right).

Table 17 shows the microbial constituents analyzed for 2006, and Table 18 summarizes those values for 2007 follow-up sampling. In terms of microbial water quality, concentrations of *Enterococcus*, *E. coli*, and total coliforms were compared.

Table 17 - Keaton beach turbidity and bacterial results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
F	Beach	Turbidity	0.6	1.7	1.1	1.1	1.0	0.7	0.5	0.4	0.7
E	Midstream	(NTU)	2.7	5.5	3.7	1.5	1.2	1.2	0.0	1.1	0.4
D	Upstream		2.1	2.0	1.2	2.0	3.5	3.0	0.9	0.5	0.9
G	Background		1.7	2.4	1.5	1.2	1.1	1.3	0.2	2.2	0.6
F	Beach	*Enterococcus*	41	<10	<10	<10	<10	<10	<10	<10	10
E	Midstream	(MPN/100 mL)	**609**	<10	<10	31	62	55	10	20	<10
D	Upstream		10	61	<10	**201**	**158**	**279**	10	10	<10
G	Background		20	10	51	52	35	20	<10	31	<10
F	Beach	*E. coli*	278	**790**	**560**	**1340**	**1600**	**891**	191	31	97
E	Midstream	(MPN/100 mL)	**488**	245	281	**490**	**1180**	**700**	31	52	20
D	Upstream		**4610**	**8160**	**8160**	**2060**	**2360**	**1530**	85	169	63
G	Background		20	41	30	98	20	41	63	199	187
F	Beach	T. coliforms	6590	14100	17300	10500	24200	9800	3430	1066	1532
E	Midstream	(MPN/100 mL)	5490	7270	2040	9800	15500	12000	1732	1892	805
D	Upstream		>24200	>24200	>24200	14100	17300	14100	1201	5247	1664
G	Background		2600	4110	4110	14100	17300	4110	3436	959	5748
F	Beach	Ec/Es Ratio	6.8	158	112	268	320	178	38	6.2	10
E	Midstream		0.8	49	56	16	19	13	3.1	2.6	4.0
D	Upstream		461	134	1632	10	15	5.5	8.5	17	13
G	Background		1.0	4.1	0.6	1.9	0.6	2.1	13	6.4	37

Note: Values in **bold** indicate violations of the trigger level

Table 18 – Keaton beach turbidity and bacterial results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
F	Beach	Turbidity	1.1	1.3	1.6	0.3	0.9	0.7
MR	Beach	(NTU)	2.8	2.3	2.1	2.2	1.1	1.5
E	Midstream		3.4	3.4	4.8	3.3	1.3	1.8
D	Upstream		1.2	1.3	1.4	3.9	3.1	1.5
G	Background		2.3	2.5	2.2 ± 0.1	2.6	3.0	3.2 ± 0.1
F	Beach	*Enterococcus*	10	20	<10	<10	20	10
MR	Beach	(MPN/100 mL)	20	31	31	**120**	41	52
E	Midstream		31	10	<10	41	97	41
D	Upstream		20	31	<10	63	**106**	74
G	Background		26 ± 22	20	**124 ± 57**	**146**	**253**	**149 ± 25**
F	Beach	*E. coli*	91	92	150	**1602**	**1951**	**1565**
MR	Beach	(MPN/100 mL)	111	116	187	**7701**	**1951**	**3169**
E	Midstream		245	71	41	**4569**	**3968**	**737**
D	Upstream		256	256	41	**1576**	**2755**	**1119**
G	Background		85 ± 57	<10	<10	345	**496**	**427 ± 298**
F	Beach	Total coliforms	5475	7701	4160	9208	9804	6488
MR	Beach	(MPN/100 mL)	8664	3076	9804	12997	12997	19863
E	Midstream		8164	9804	8164	10462	12033	14136
D	Upstream		>24196	19863	>24196	9208	15531	7270
G	Background		2305	2247	6310	4884	4352	3904
F	Beach	Ec/Es Ratio	9.1	4.6	30.0	320.4	97.6	157
MR	Beach		5.6	3.7	6.0	64.2	47.6	60.9
E	Midstream		7.9	7.1	8.2	111.4	40.9	18.0
D	Upstream		12.8	8.3	8.2	25.0	26.0	15.1
G	Background		4.3 ± 6.0	0.3	0.0	2.4	2.0	2.7 ± 1.6

Note: Values in **bold** indicate violations of the trigger level

Enterococcus concentrations were generally lower at the beach than the upstream and background sampling points in 2006. This trend was also observed in 2007 for the upstream sites, but unexpectedly the background site enterococci counts were mostly above the trigger level in 2007 (4 of 6). This phenomenon deserves further investigation. Figure 19 shows that the *Enterococcus* concentrations were below the trigger level (100 MPN/100mL) on the beach in both years. However, upstream of the beach (F), the Keaton Beach canal pump station site at Cortez Road (D) showed *Enterococcus* violations during the 2006 SHWT, but did not violate the trigger level during either of the other two sampling events in 2006 (SLWT). The background site was always observed to be below the trigger level for all three sampling events in 2006, but this was not observed in 2007. In conjunction with the prior analysis, a summer sanitary sewer overflow at the pump station in 2006 might be suggested, although this does not resolve the upstream issues with TOC (likely of natural origin).

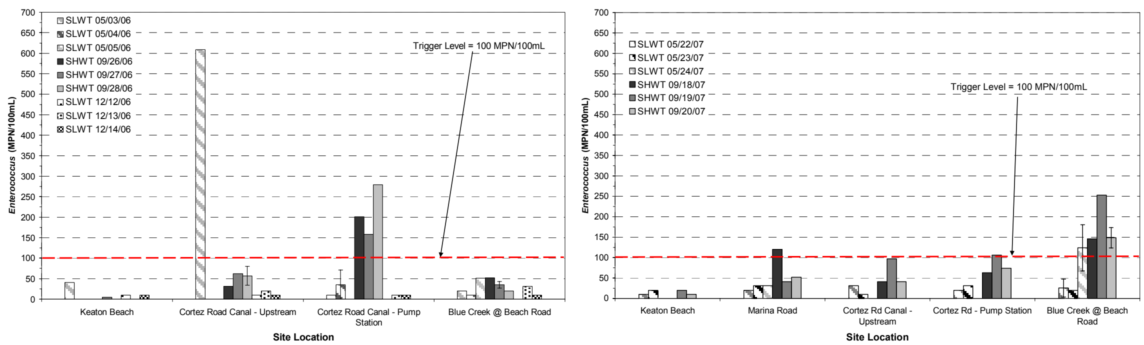

Figure 19 – Results for *Enterococcus* at Keaton Beach for 2006 (left) and 2007 (right).

With regard to *E. coli*, the beach site showed violations of the trigger level except for the December 2006 and May 2006 events. Like the *Enterococcus* results, the pump station site shows a dramatic exceedance of the *E. coli* trigger level of 400 MPN/100 mL (see Figure 20 – the violation is a magnitude higher than the trigger level). The problem is more acute during the May 2006 SLWT event, as there were no significant levels of *E. coli* in December 2006. The 2007 SHWT results at Keaton Beach violated the trigger level for all sites but the background (G). No microbial concerns with *E. coli* were encountered upstream of the pump station at the background site in either year, although the 2007 levels were slightly higher.

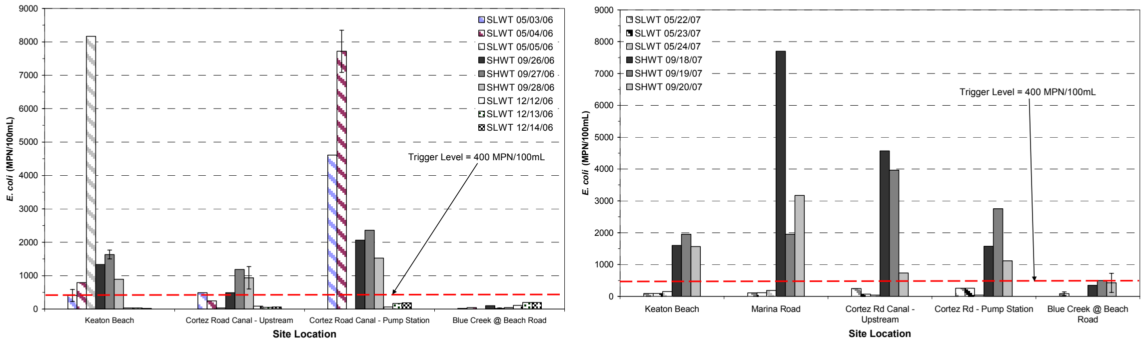

Figure 20 – Results for *E. coli* at Keaton Beach for 2006 (left) and 2007 (right).

This site is characterized by a large population of shore birds, and it is possible that the strong *E. coli* signal may have an important avian contribution. However, the *E. coli/Enterococcus* ratios were generally greater than 4.0 from the pump station, downstream, suggesting a human source of pollution. The upstream ratios were more indicative of mixed natural or animal contributions (<1.0 or between 1.0 and 4.0). Turbidity was also monitored to indicate if runoff from the surface is important. High microbial values coupled with turbidity may indicate runoff of agricultural origin. None of these samples was overly turbid, but some turbidity was present in the upstream samples.

Cedar Island

The Cedar Island community was selected as representative of a medium-density, developed area with a recently installed sewer system. For this set of sites, the general physical water quality parameters fell within expected levels, and conductivity, salinity, and TDS were in accordance with the saltwater/freshwater regime. The DO values were in the range of 4.2 – 10 mg/L. During the SHWT, Site G violated the Class III criteria (>5.0 mg/L for fresh water) during the first and second day, and Site H violated the Class III criteria (>4.0 mg/L for marine water) during the first day of the SHWT. Table 19 summarizes the nutrient data for Cedar Island. In terms of nutrients, analysis was conducted to determine the levels of ammonia, nitrate, total nitrogen, and total organic carbon at the 3 sites.

Table 19 – Cedar Island nutrients results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
I	Beach	DO	6.1	5.6	5.1	**4.8**	**4.9**	5.3	10	5.9	8.8
H	Upstream	(mg/L)	5.6	5.6	5.0	**4.2 ± 1.5**	**4.3**	**4.3**	7.2	5.9	5.2
G	Background		6.8	6.8	5.7	**4.9**	**4.9**	5.0	8.0	8.9	6.7
I	Beach	NH_4^+	0.31	<0.1	0.45	0.04	0.07	0.07	0.02	0.01	0.05
H	Upstream	(mg/L as N)	0.16	<0.1	0.91	0.06	0.04	0.06	0.06	0.06	0.08
G	Background		0.18	<0.1	<0.1	0.03	<0.010	<0.010	0.12	0.12	0.13
I	Beach	NO_3^-	<0.011	<0.011	<0.011	0.01	0.02	0.01	0.011	0.005	0.017
H	Upstream	(mg/L as N)	<0.011	<0.011	<0.011	0.01	<0.0052	0.01	0.005	0.010	0.012
G	Background		0.04	0.05	0.05	<0.0052	<0.0052	0.01	0.050	0.068	0.063
I	Beach	TN	0.7	0.4	0.5	0.7	0.6	0.5	0.3	0.3	0.2
H	Upstream	(mg/L as N)	ns	0.3	0.3	0.7	0.6	0.8	0.3	0.3	0.3
G	Background		0.4	0.5	0.4	1.0	1.1	1.0	0.3	0.3	0.4
I	Beach	TOC	8.0	9.0	9.0	21	20	14	6.5	7.1	5.6
H	Upstream	(mg/L as C)	ns	9.0	6.0	25	20	18	6.9	5.8	6.7
G	Background		8.0	8.0	7.0	72	104	67	12	7.3	11

Note: Values in **bold** indicate violations of the trigger level
ns = not sampled

Table 20 – Cedar Island nutrients results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
I	Beach		5.8	5.6	6.1	**4.0**	4.3	5.1
SL	Beach	DO	5.9	5.7	6.4	4.8	5.0	5.4
H	Upstream	(mg/L)	6.1	5.7	6.5	**3.9**	**4.0**	**4.2**
G	Background		8.4	7.9	8.6	5.8	5.9	6.3 ± 0.1
I	Beach		0.00	0.00	0.00	0.01	0.02	0.04
SL	Beach	NH_4^+	0.00	0.01	0.02	0.04	0.06	0.11
H	Upstream	(mg/L as N)	0.05	0.04	0.02	0.03	0.02	0.04
G	Background		0.08	0.09	0.08	0.09	0.09	0.10
I	Beach		0.00	0.00	0.00	0.00	0.01	0.01
SL	Beach	NO_3^-	0.00	0.00	0.01	0.01	0.01	0.01
H	Upstream	(mg/L as N)	0.00	0.01	0.02	0.01	0.01	0.01
G	Background		0.02	0.10	0.08	0.06	0.08	0.09
I	Beach		0.5	0.4	0.4			
SL	Beach	TN	0.4	0.4	0.4			
H	Upstream	(mg/L as N)	0.5	0.4	0.4			
G	Background		0.5	0.4	0.4			
I	Beach		6.6	6.0	6.4			
SL	Beach	TOC	5.8	4.8	6.7			
H	Upstream	(mg/L as C)	5.8	4.7	4.9			
G	Background		4.9	6.2	4.3 ± 0.6			

Note: Values in **bold** indicate violations of the trigger level

Figure 21 shows that during the May 2006 event (SLWT), the ammonia levels were higher at all sites when compared with the September 2006 (SHWT) event. The December 2006 events were higher than the September 2006 SHWT, but generally more similar to the May 2006 event. For the May 2006 SLWT, 5 of the 9 samples were high in ammonia including one sample at the Heron Road Canal site (H), which was one order of magnitude higher than the level considered indicative of human pollution. Interestingly, thereafter, there are no further exceedances at site H for the remainder of 2006 and into 2007 sampling events. For the first two sampling events in 2006, the ammonia concentration tended to decrease as the sampling sites moved upstream. The reverse was true in December 2006, where there was a marked increase as the sampling moved in the upstream direction. This trend continued into 2007 for both SLWT and SHWT. In 2007, a beach site located between the Blue Creek estuary and the Cedar Island Beach site was sampled to see if a connection between estuary and the beach could be an important source of nutrients here. If this is indeed the case, then the concentrations would generally decrease from the Blue Creek site level to the Seahawk Lane levels and finally to the Cedar Island Beach site. The Heron Road site is located south of this gradient and would probably not show any effect. After analyzing the ammonia levels, the results from SLWT are inconclusive because the beach levels are below detection, but in SHWT the concentration gradient seems to support this hypothesis. Since ammonia is an indicator of recent nitrogen contributions and the area currently does not have septic tanks, the results suggest the application of fertilizers or some other anthropogenic source.

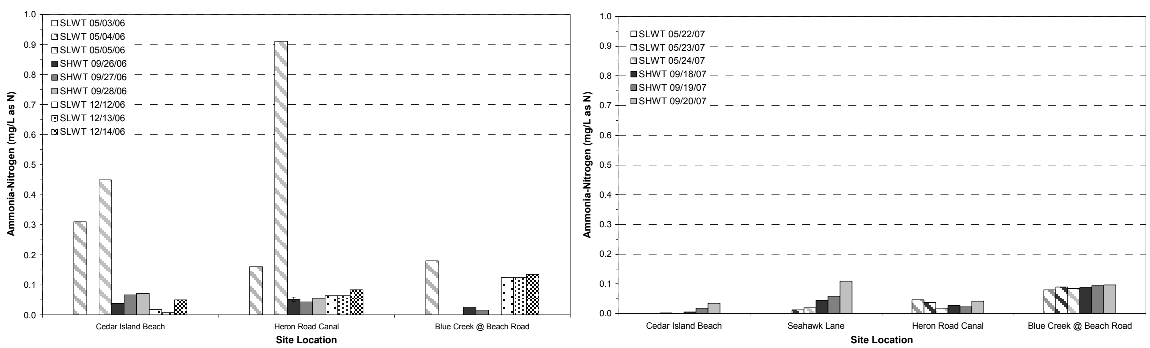

Figure 21 – Results for Ammonia at Cedar Island for 2006 (left) and 2007 (right).

Nitrate concentrations were at or below the detection limit for nearly all Cedar Island sites during all sampling events in both years. During the 2006 SLWT (May and December), although most of the samples were again at or below the detection limit, the background site (G) presented a detectable nitrate concentration for all three days. This was continued into 2007, where the background site nitrate levels exceeded the value considered high for shallow coastal areas for 5 of the 6 samples collected. The only low nitrate value at the background site was on the first day of sampling in 2007 SLWT (May 22, 2007).

Figure 22 shows that total nitrogen concentrations generally decreased going upstream during the May 2006 SLWT event, and increased during the September 2006 SHWT and December 2006 SLWT events. Except for the beach, the September 2006 SHWT results doubled compared to the May 2006 SLWT. The December 2006 concentrations were about half of the May 2006 SHWT event. The 2007 levels were similar, and no differences in TN concentration among the sites upstream (H, G) was observed compared to the beach sites (I, SL).

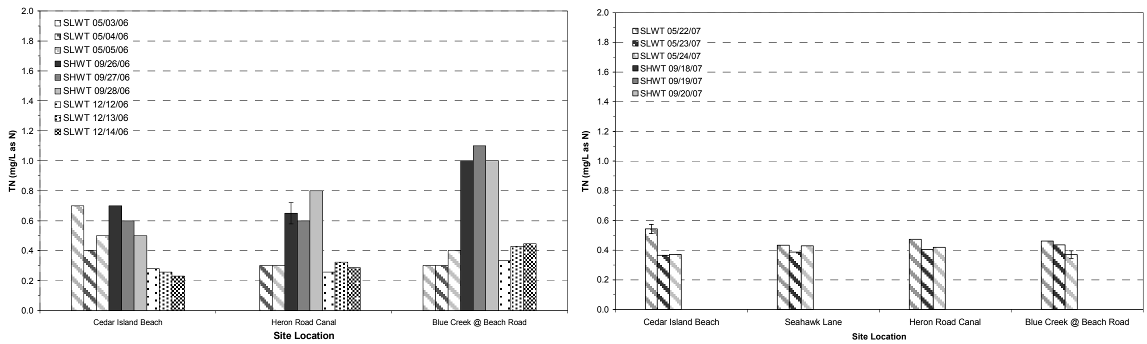

Figure 22 – Results for Total Nitrogen at Cedar Island for 2006 (left) and 2007 (right).

Figure 23 shows that TOC values in 2006 increased significantly as the sampling moved upstream, while near the beach, the change in TOC from SLWT to SHWT events was about 50 percent, which is similar to the other sampling site locations. May 2007 SLWT results mimicked the May and December 2006 SLWT events.

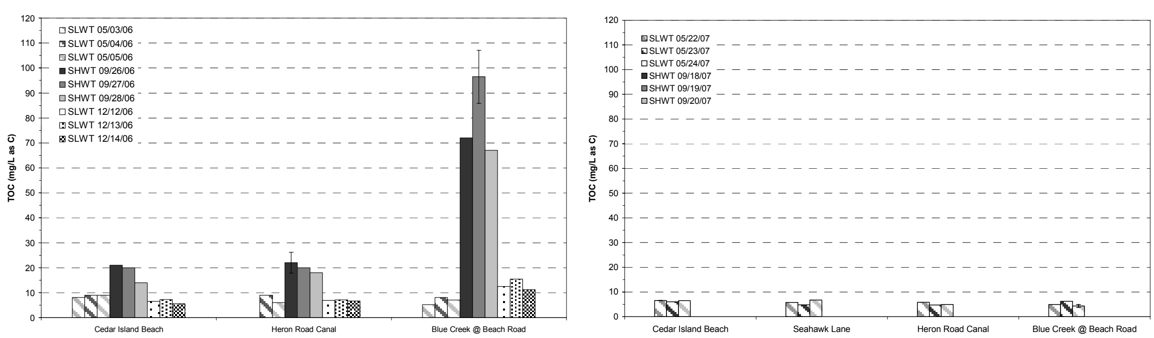

Figure 23 – Results for TOC at Cedar Island for 2006 (left) and 2007 (right).

Table 21 summarizes the microbial results for 2006, and Table 22 lists those for 2007. In terms of microbial water quality, concentrations of *Enterococcus*, *E. coli,* and total coliforms were compared. In 2006, *Enterococcus* concentrations were generally lower at the beach than the upstream and background sampling points. This was also observed in 2007, but the counts at the Cedar Island Beach site (I) were considerably lower than the previous year. Figure 24 shows that the *Enterococcus* concentrations were generally below the trigger level (100 MPN/100mL) on the beach (14 of 15) with the lone violation occurring in SHWT 2006. For both years, results were generally higher in the SHWT compared to the SLWT. The further upstream site (H) was below the trigger level, with one exception which occurred in the 2006 SHWT. None of the December 2006 SLWT samples showed significant amounts of *Enterococcus*, which is not unexpected. The background site (G) showed the most concentrated contamination from *Enterococcus* in SHWT 2007 with all three days violating the trigger level (4 out of 6 overall for both seasons compared to none in 2006).

Table 21 – Cedar Island turbidity and bacterial results for 2006.

Site	Charac.	Parameter	SLWT (May 2006)			SHWT (Sept 2006)			SLWT (Dec 2006)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
I	Beach	Turbidity	1.5	1.5	1.2	1.9	1.3	1.0	2.1	0.3	4.0
H	Upstream	(NTU)	2.2	3.3	2.4	3.2	1.6	1.5	0.7	1.2	1.5
G	Background		1.7	2.4	1.5	1.2	1.1	1.3	0.2	2.2	0.6
I	Beach	*Enterococcus*	<10	<10	10	**185**	63	20	<10	<10	10
H	Upstream	(MPN/100 mL)	52	20	10	41	**540**	10	<10	10	<10
G	Background		20	10	51	52	35	20	<10	31	<10
I	Beach	*E. coli*	350	**527**	**1340**	**10500**	**>24200**	**5790**	109	145	199
H	Upstream	(MPN/100 mL)	**850**	**956**	**431**	**910**	**4610**	**1840**	163	315	266
G	Background		20	41	30	98	20	41	63	199	187
I	Beach	Total Coliforms	7700	2700	11200	>24200	>24200	>24200	546	1961	1050
H	Upstream	(MPN/100 mL)	9210	12000	1990	1720	14100	17300	3470	4541	4587
G	Background		2600	4110	4110	14100	17300	4110	3436	959	5748
I	Beach		70	105	134	57	384	290	22	29	20
H	Upstream	Ec/Es ratio	16	48	43	22	8.5	184	33	32	53
G	Background		1.0	4.1	0.6	1.9	0.6	2.1	13	6.4	37

Note: Values in **bold** indicate violations of the trigger level

Table 22 – Cedar Island turbidity and bacterial results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
I	Beach		2.3	2.0	1.4	1.4	1.9	1.7
SL	Beach	Turbidity	2.0	2.1	1.9	2.6	2.7	3.7
H	Upstream	(NTU)	3.1	3.4	4.2	3.7	3.2	2.5
G	Background		2.3	2.5	2.2 ± 0.1	2.6	3.0	3.2 ± 0.1
I	Beach		<10	<10	<10	10	40	52
SL	Beach	*Enterococcus*	<10	<10	<10	74	41	**120**
H	Upstream	(MPN/100 mL)	20	<10	10	20	20	51
G	Background		26 ± 22	20	**124 ± 57**	**146**	**253**	**149 ± 25**
I	Beach		85.5	41	425	**7701**	**1459**	**1782**
SL	Beach	*E. coli*	164	94	104	**2809**	**530**	**852**
H	Upstream	(MPN/100 mL)	143	2909	218	**1345**	**1334**	**1631**
G	Background		85 ± 57	<10	<10	345	**496**	**427 ± 298**
I	Beach		9313	6867	>24196	>24196	7701	11199
SL	Beach	Total coliforms	9208	6131	14136	14136	4352	5794
H	Upstream	(MPN/100 mL)	15531	8164	14136	8414	7701	9208
G	Background		2305	2247	6310	4884	4352	3904
I	Beach		17	8.2	85	770	36	34
SL	Beach	Ec/Es Ratio	33	19	21	38	13	7.1
H	Upstream		7.2	582	22	173	67	32
G	Background		4.3 ± 6.0	0.3	0.0	2.4	2.0	2.7 ± 1.6

Note: Values in **bold** indicate violations of the trigger level

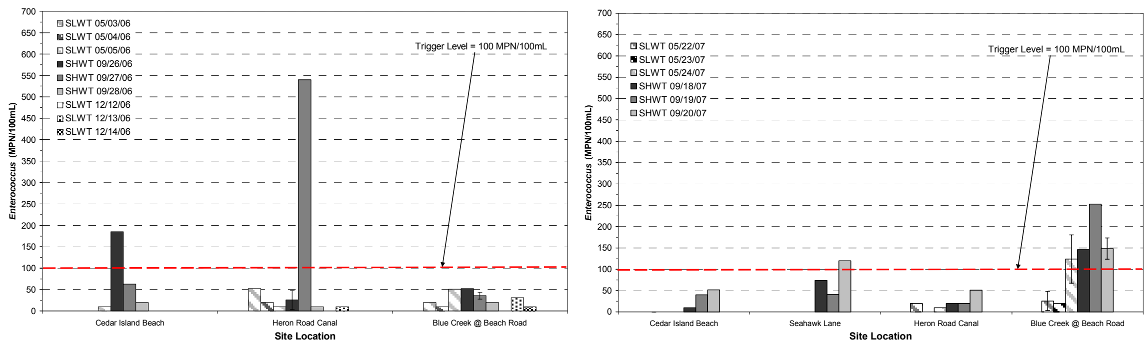

Figure 24 – Results for *Enterococcus* at Cedar Island

Results for *E. coli* generally showed exceedance of the 400 MPN/100mL trigger level on the beach and just upstream of the beach (see Figure 25) during the May 2006 SLWT and more prominently during the September 2006 SHWT sampling event. This trend continued in 2007. Extremely high microbial densities (from 1840 up to >24,200) were recorded during the September 2006 sampling in Cedar Island Beach (I) and the upstream canal site (H). Similarly high counts were found in September 2007 at those sites and also at the new beach site at Seahawk Lane (SL). Values of 10^5 CFU/100 mL are more characteristic of urban or agricultural wastewater inputs than natural levels. It was suspected that the source of this coliform contamination was related to legacy inputs from shallow sediment regrowth either from legacy septic inputs or from the nearby upstream estuary acting as a microbial incubation site. However, we cannot discount the possibility of the nearby boat channel mucky sediments providing a source as well. The purpose of selecting the Seahawk Lane site was to see if a concentration gradient between the estuary and the beach site exists. Additionally, its location is upstream of the boat channel. Therefore, if the mucky sediments are important then the Seahawk Lane site would have considerably less microbial counts compared to the downstream beach site. To account for the tidal sloshing effect, the SL sample was collected in a protected area outside of the strong prevailing bulk current streamline. It is interesting to note that adding the SL site improved the trend showing that higher *E. coli* counts are encountered in the direction inland toward the estuary. The 2007 results indicate a strong *E. coli* signal at the SL site, which would seem to support the estuarine source or local shallow sediment regrowth hypotheses. The December 2006 SLWT event showed generally lower *E. coli* levels compared to the May 2006

SLWT event, presumably due to lower temperatures. There were no recorded violations in December 2006 at any site.

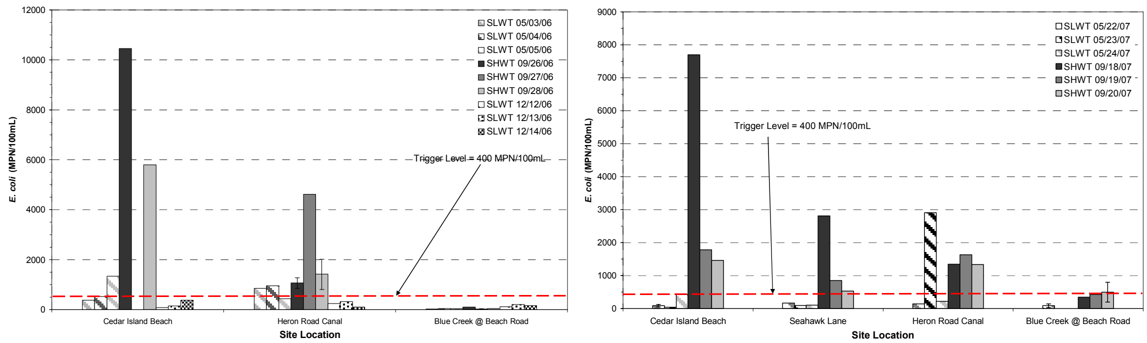

Figure 25 – Results for *E. coli* at Cedar Island for 2006 (left) and 2007 (right).

The *E.coli/Enterococcus* ratios were above 4.0 on the beach and at the site just upstream of the beach, which suggests inputs of human origin. The *E.coli/Enterococcus* ratios were generally below 3.0 for the background site (in May and September for both years), suggesting an important non-human or natural contribution upstream consistent with the other microbial findings. In December, the *Enterococcus* levels were too low to generate accurate Ec/Es ratios. Turbidity was similar to the other sites.

ADDITIONAL SITES

One potential source of nutrient contamination identified earlier is due to industrial release, such as from pulp and paper mills (Health Canada 2001; McMaster et al. 2004). From aerial photography and field reconnaissance, it was determined that a large industrial source discharges into the Fenholloway River upstream of the impacted areas, north of Dekle Beach. It was hypothesized that this source potentially influences the nutrient dynamics of the coastal areas of Taylor County, FL due to the prevailing current direction and the magnitude of the loading. During the dry season, this industrial effluent discharge can constitute up to 80% of the river's volume (Bortone and Cody 1999). The Fenholloway River is 36 miles long, and its watershed drains approximately 392 square miles of mostly rural areas (i.e. forest, wetlands, and natural areas). In 1947, the Fenholloway River was designated as Class V for navigation, utility, and industrial use. In 1997, the designation was changed to Class III for recreational use, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Historical water quality data for the river were obtained and are summarized in
Table 23.

Table 23 - Water Quality Data for Buckeye Florida Specialty Cellulose Mill.

Parameter	USEPA 2003	FDEP FILES FOR 2004	Proposed TMDL (USEPA 2003)
Flow	43 MGD	44 MGD	
BOD_5	22 mg/L (8200 lb/d)	22 mg/L (8200 lb/d)	1050 – 1255 lb/d

TSS	--	14 mg/L (5000 lb/d)	--
Ammonia	3.3 mg/L (1200 lb/d)	--	37 – 360 lb/d
Total Nitrogen (TN)	5.0 mg/L (1800 lb/d)	7.1 mg/L (2600 lb/d)	10.5 – 1075 lb/d
Total Phosphorus (TP)	2.0 mg/L (750 lb/d)	1.4 mg/L (550 lb/d)	79 – 360 lb/d
Specific Conductance	--	2700 µmhos/cm	--
Color	--	1200 PCU	--

During the December 2006 trip, samples were collected at the Fenholloway River downstream from a specialty cellulose mill. The results for ammonia were the highest measured over the course of the study, by a factor of 20. While all other sampling locations were essentially below 0.15 mg/L as N, the Fenholloway samples were all higher than 3.0 mg/L as N (nearly five times higher than the trigger level). The additional nutrients could also be coming from wastewater treatment facilities or septic tanks (discussed in more detail later). Historically, the City of Perry Wastewater Treatment Facility also discharged to the Fenholloway River, but this practice was halted in 2004 when the plant was switched to land treatment. Investigation of the connection between the upstream Fenholloway discharge and its potential impacts along the beaches south of the discharge was beyond the initial scope of this study, but in the follow-up sampling it was desired to investigate its effects. The selection of these additional sites was described earlier, and the nutrient results from 2007 sampling events are summarized in Table 24.

Table 24 – Additional sample site nutrients results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
FR	Source	DO (mg/L)	4.9	5.1	5.9	5.5	5.7	6.1
HS	Midstream		6.2	6.5	7.5	6.8	7.1	7.3
PL	Discharge		5.5	7.2	7.9	6.4	6.7	7.4
AB	Beach		8.1	7.0	7.4	4.4	7.0	6.1 ± 0.7
FR	Source	NH_4^+ (mg/L as N)	2.49	2.29	2.63	3.21	2.85	2.63
HS	Midstream		1.60	1.59	2.98	2.57	2.52	2.07 ± 0.05
PL	Discharge		0.55	0.39	0.30	0.41	0.44	0.62 ± 0.08
AB	Beach		0.00	0.06	ns	0.00	0.00	ns
FR	Source	NO_3^- (mg/L as N)	0.35	0.29	0.23	0.00	0.52	0.53
HS	Midstream		0.36	0.32	0.30	0.08	0.20	0.26 ± 0.01
PL	Discharge		1.00	0.30	0.42	0.24	0.25	0.38
AB	Beach		0.00	0.01	ns	0.00	0.04	ns
FR	Source	TN (mg/L as N)	6.9	6.5	6.5			
HS	Midstream		4.2	4.0	4.4			
PL	Discharge		2.5	2.0	1.8			
AB	Beach		0.6	0.5	0.5			
FR	Source	TOC (mg/L as C)	170	163	161			
HS	Midstream		97	91	119			
PL	Discharge		62	50	40			
AB	Beach		9.1	8.2	8.6	8.7	9.3	9.1

Note: Values in **bold** indicate violations of the trigger level

For this Fenholloway River set of sites, the general physical water quality parameters fell within expected levels, and conductivity, salinity, and TDS were in accordance with the saltwater/freshwater regime. The DO values were in the range of 4.9 – 7.9 mg/L. During the SLWT, the FR site violated the Class III criteria (>5.0 mg/L for fresh water) during the first day. This was the only DO violation recorded in this study. The Adams Beach site (AB) did not have any DO violations.

In terms of ammonia, the three Fenholloway River sites were 1-2 orders of magnitude higher than the 0.07 mg N/L threshold for human contamination in both seasons. Both the near to the industrial discharge and at the midstream site, the ammonia levels were high in the range of 1.6-3.2 mg N/L. Those levels decreased by a factor of 10 at the rivermouth discharge to ocean presumably due to tidal dilution forces. In the distance that the river's nutrient loading reaches the Adams Beach site location, the levels return to background. The nitrate levels follow a similar pattern, but the measured concentrations are not nearly as high as those seen for ammonia. The total nitrogen values are not much different than those seen at other sampling sites in this study, suggesting that the fraction of organic nitrogen may be less than at other sites. The TOC values behave like the ammonia levels for these sites. It is likely that this additional TOC is derived largely from the deep organic color (Figure 26).

Figure 26 – Photograph showing the large variation in apparent color from the Fenholloway River (left), to the Steinhatchee Falls (middle), and the Boggy Creek (right) site.

Table 25 summarizes the microbial results for 2007. In terms of microbial water quality, concentrations of *Enterococcus*, *E. coli,* and total coliforms were compared. Despite the noticeable color content of the river samples, the turbidity levels are not much higher than any of the other sites in this study. Earlier it was hypothesized that the industrial input may contribute nutrients and pathogen indicators as a continuous point source upstream of the beach communities. If this were true, then the microbial indicators would be high at these stations. The *Enterococcus* counts are consistently high for the river sites in both seasons, with 12 of 17 samples violating the trigger level, but the downstream beach site only has one violation from the five samples. It is interesting to note that the *E. coli* counts do not behave the same way. In fact, the river site nearest to the industrial discharge is at or below detection for all six sampling days, but the counts increase in the downstream direction and result in alarmingly high counts at the rivermouth (>10^4 MPN/100 mL) and Adams Beach (>10^5 MPN/100 mL) in SHWT. The large enterococci component suggests an influence from natural or animal sources in the upstream reaches, while the ratio at the rivermouth and downstream beach suggest a human influence, although this could be affected by a differential salinity induced die-off. It is not known if the industrial discharge is disinfected prior to release to the environment; however, the process water may contain chlorine dioxide as a bleaching agent which can act a residual disinfectant during the facultative lagoon treatment process. If this is the case, then a differential resistance exhibited by the two indicator species may be masking the source and acting as a confounding agent.

Table 25 – Additional sample site turbidity and bacterial results for 2007.

Site	Charac.	Parameter	SLWT (May 2007)			SHWT (Sept 2007)		
			Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
FR	Source	Turbidity (NTU)	4.9	5.5	5.6	3.7	3.9	3.6
HS	Midstream		2.8	3.1	3.2	2.3	3.6	2.6
PL	Discharge		2.8	2.3	2.6	1.8	1.8	2.2
AB	Beach		1.6	ns	3.6	3.4	1.7	2.5 ± 0.3
FR	Source	*Enterococcus* (MPN/100 mL)	41	72	ns	**318**	**269**	**228**
HS	Midstream		**164**	31	**106**	**278**	**168**	**119**
PL	Discharge		**144**	97	**187**	**208 ± 18**	**188 ± 60**	72
AB	Beach		<10	ns	<10	73	<10	**330 ± 21**
FR	Source	*E. coli* (MPN/100 mL)	<10	<10	<10	10	<10	<10
HS	Midstream		10	52	<10	63	52	75
PL	Discharge		30	41	40	**1292 ± 208**	**1025 ± 170**	**545**
AB	Beach		657	ns	81	**15531**	**11199**	**3625 ± 485**
FR	Source	Total coliforms (MPN/100 mL)	6910	>24196	>24196	>24196	>24196	10112
HS	Midstream		19863	6893	17329	14136	12033	6586
PL	Discharge		10112	9606	17329	>24196	10112	17329
AB	Beach		10462	ns	9804	>24196	>24197	10112
FR	Source	Ec/Es Ratio	0.1	0.1	ns	0.0	0.0	0.0
HS	Midstream		0.1	1.7	0.0	0.2	0.3	0.6
PL	Discharge		0.2	0.4	0.2	6.2 ± 0.5	5.9 ± 2.8	7.6
AB	Beach		131.4	ns	16.2	213	2240	11 ± 0.8

Note: Values in **bold** indicate violations of the trigger level

Sampling at the Fenholloway River site actually began in December 2006 SLWT. The data from this site including the 2006 and 2007 results is compiled in Table 26. Similar patterns as those already described are seen for the December 2006 SLWT results.

Table 26 – Water quality results monitored the Fenholloway River site (FR) for 2006-2007.

Parameter	SLWT (Dec 2006)			SLWT (May 2007)			SHWT (Sept 2007)		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
DO (mg/L)	7.6	6.3	7.0	4.9	5.1	5.9	5.5	5.7	6.1
Ammonia (mg/L N)	3.9	3.4	3.2	2.5	2.3	2.6	3.2	2.9	2.6
Nitrate (mg/L N)	0.3	0.6	0.6	0.4	0.3	0.2	0.0	0.5	0.5
TN (mg/L N)	ns	ns	ns	6.9	6.5	6.5			
TOC (mg/L C)	75	79	78	170	163	161			
Turbidity (NTU)	8.7	8.2	7.7	4.9	5.5	5.6	3.7	3.9	3.6
Enterococcus (MPN/100 mL)	31	41	75	41	72	ns	318	269	228
E. coli (MPN/100 mL)	10	<10	10	<10	<10	<10	10	<10	<10
Total Coliform (MPN/100 mL)	>24196	>24196	>24196	6910	>24196	>24196	>24196	>24196	10112
Ec/Es Ratio	0.3	0.1	0.1	0.1	0.1	ns	0.0	0.0	0.0

OTHER TRACERS

Caffeine

Caffeine was only detected in 3 sites during the May SLWT sampling event: Steinhatchee Falls (Site N), Third Avenue Fork (Site K), and Cedar Island Beach (Site I). When found, caffeine was detected at very low levels (< 0.04 μg/L). In September, one sample at Steinhatchee Falls (background site) was measured at 0.321 μg/L, which was above the threshold value. No definitive conclusions can be drawn from these results because at these levels, the dilution in the waterways neither precludes nor excludes the possibility of a wastewater contribution.

Optical brighteners (OB)

Optical brighteners are fluorescent dyes added to laundry detergents as whitening agents. The presence of optical brighteners is an indicator of gray water inputs. In this study, the qualitative method with cotton pads was used to evaluate the presence or absence of optical brighteners. No significant glow was observed on the collected pads during the events of May and September. However, on the second day of sampling during the SLWT, May 4th, 2006, the pad at Site J (Roy's) had a significant glow when passed over with a portable handheld UV lamp. This was most likely due to cleaning and mopping activities around the restaurant that coincided with the time of sample collection.

During the December 12, 2006 sampling event, possible optical brighteners were visually detected at Site L (Boggy Creek @51). This is the first time that visible fluorescence is detected under natural sunlight over the course of the study (see Figure 27). Later that same day, more evidence is discovered at Site N (Steinhatchee Falls). This is shown in Figure 28. In addition, a 55 gallon drum is discovered floating in the upstream portion of the Falls (Figure 29). It is possible that the drum contained a surfactant that could have been responsible for the observed fluorescence. Similar drums are seen elsewhere in Steinhatchee (Figure 30). In the previous sampling trip (September), the team also noticed that the portable restroom facility was being serviced with a large amount of cleaning agent applied by a truck (Figure 31). It is difficult to compare the appearance and morphological characteristics of the floating fluorescence because the lighting inside the portable restroom is not ambient sunlight, but there are similarities (Figure 32).

Figure 27 - During the December 12, 2006 sampling event, possible optical brighteners are visually detected at Site L, Boggy Creek @51, highlighted in the circle.

Figure 28 - During the December 12, 2006 sampling event, more evidence of optical brighteners is discovered at Site N (Steinhatchee Falls), highlighted in the circle.

Figure 29 - A possible explanation for the sudden appearance of optical brighteners at the surface is discovered (12/12/2006).

Figure 30 - Similar drums are discovered at Site J (Main Street - Roy's) on December 13, 2006.

Figure 31 - Photograph of the service truck cleaning the portable restroom facility during September 28, 2006 at Steinhatchee Falls.

Figure 32 - Photographs of the cleaning agent employed in the portable restrooms at Steinhatchee Falls.

Active searching for floating fluorescence, led to documentation of sightings of similar fluorescence on subsequent days during the December sampling event (see Figure 33 and Figure 34). However, without a suitable reference for comparison, it remains difficult to make a definitive evaluation of presence or absence (see Figure 35) in the qualitative test. It remains unclear if in fact these sightings are optical brighteners of human origin, and no obvious pattern to their appearance is determined.

Figure 33 - Floating fluorescence observed at Site G (Blue Creek @ Beach Road) on December 13, 2006. Note the submerged traffic cone to give a sense of scale.

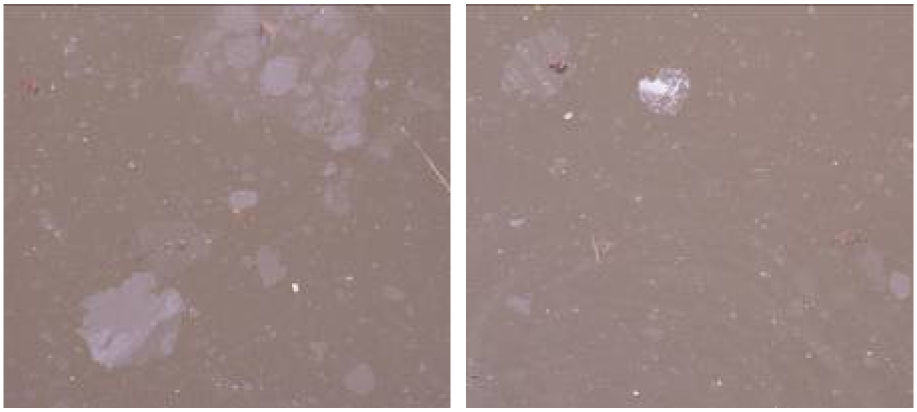

Figure 34 - More floating fluorescence visible under ambient sunlight at Site M (Steinhatchee River at Airstrip Drive).

Optical brighteners have just recently been employed as a tracer, and detection methods are still being evaluated. The absence of optical brighteners does not indicate that the sites are free of wastewater or gray water contribution. The method is still not perfected and is not certified. In addition, a reasonable amount of laundry soap manufacturers are taking optical brighteners out of their formulas, and dilution and solar exposure can mask results.

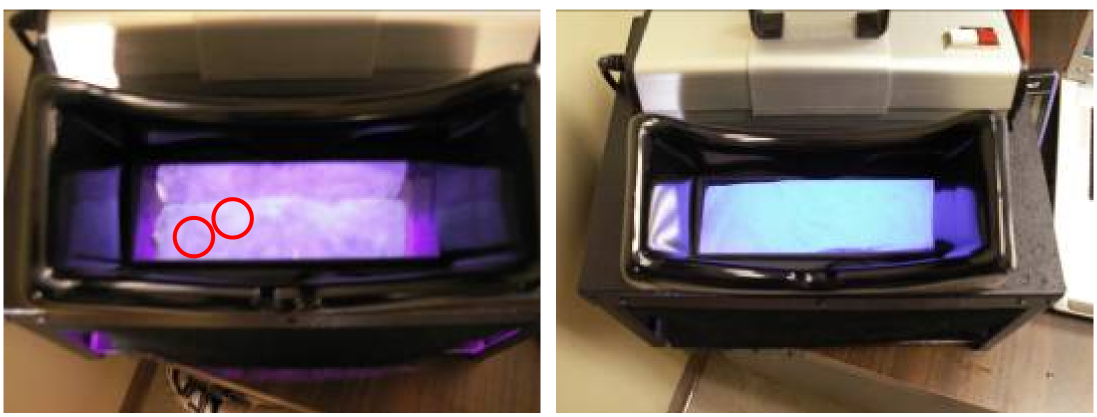

Figure 35 - A field collected optical brightener pad (Dekle Beach collected on 12/14/2006). In the left picture, a clean pad is shown on top to compare with the collected pad on the bottom. Very tiny flakes are visible under ultraviolet illumination (circled). In the right picture, a pad with optical brighteners is shown for comparison. Notice the same blue fluorescence seen for the tiny flakes on the left.

Molecular Techniques

In the 2006 sampling events, both optical brighteners and caffeine were tested as unconventional tracers of human pollution. However, the qualitative method for detection of optical brighteners was not sensitive enough to be considered an effective tracer, and caffeine results were inconclusive due to extremely high dilution and low development intensity. Therefore, neither of these methods was continued in 2007 sampling events. However, given the recent rapid advancements in technology, molecular techniques and nitrogen isotopic ratios were determined to be much more informative as tracers.

The molecular biology research team from the National Oceanographic and Atmospheric Administration Atlantic Oceanographic and Meteorological Laboratories (NOAA-AOML) Ocean Chemistry Division offered to attempt to analyze eight samples collected from the Taylor County study in an effort to determine if molecular techniques could be used as a tracer method. This is an experimental process being developed for NOAA, with no guarantee of success for same. Samples from four sites were collected from the September SHWT sampling event and another four sites from the December SLWT sampling event. For each set of four sampling sites, three different molecular based assays were performed, including two sets of DNA analyses, one set of *E. coli* tracer tests, and one set of *Enterococcus* tracer tests.

For each of the sets of four, an additional 2-4 L of samples were collected in sterile Whirl-Pak bags and transported to the temporary field laboratory. The selected sites (4 of 13) were picked based on the previous two days' results for microbiological analyses (i.e. those sites with the highest *E. coli* and *Enterococcus* values were selected). Collection of water in this manner was the best chance to collect sufficient material to be above the detection limit for the assay. For each site, 400-900 mL of sample was filtered in sterilized filter holders. Those samples prepared for *E. coli* and *Enterococcus* typing were filtered using Whatman 7141-104 cellulose nitrate filters, and those prepared for DNA testing were filtered in duplicate using Super®200 0.2 μm filters. The forceps that handled the filters were dipped in ethanol (HPLC grade) and flamed in a Bunsen burner prior to coming in contact with the filters.

For *Enterococcus*, the filter was then transferred to a Petri dish containing M Enterococcus Agar (90003-930 from VWR). For *E. coli* testing, the filter was then transferred to a Petri dish containing MTEC agar (233410 from VWR). Both sets of plates were then incubated at 35-37°C in a VWR 1525 signature series general purpose incubator for 1-2 days and then transported at 0°C until delivered to the NOAA-AOML facility, where they were stored at -80°C until analyzed. The DNA filters were transferred to an Analyslide® Petri dish and frozen immediately, but not at -80°C, without incubation. No positive controls were performed.

The filtered samples were then processed to collect DNA extracts. The environmental microbiology laboratory (Dr. Kelly Goodwin, PI) at the National Oceanographic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratories (AOML) performed molecular biological analysis on a subset of samples collected from Taylor County, FL. Molecular analysis was performed for the following, as detailed in Table 27:

- **Fecal indicating bacteria:**
  - *Enterococcus* spp. [Haugland et al. 2005]
- **Source tracking markers:**
  - Human HF8 gene cluster of *Bacteroides* spp. [Bernhard and Field 2000]
  - Human-specific *esp* gene of *Enterococcus faecium* [Scott et al. 2005]
- **Human bacterial pathogens (fecal):**
  - *E. coli* O157:H7 [Maurer et al. 1999]
  - *Salmonella* spp. [Kong et al. 2002]
- **Human bacterial pathogens (nonfecal):**
  - *Staphylococcus aureus* [Mason et al. 2001]

Three replicate water samples were collected from a study site and bacteria and particles were harvested onto membrane filters. The water (2000 - 4000 mL) was filtered onto Whatman 7141-104 cellulose nitrate filters or 0.2 μm Supor-200 filters. The cellulose nitrate filter membranes were incubated either on mTEC agar for enrichment of *E. coli* and *Salmonella* or M Enterococcus agar for enrichment of *Enterococcus* and *Staphylococcus*. Filters were incubated overnight at 35-37°C and then delivered frozen to AOML for processing. The goal was to obtain confluent growth on the membrane filters and to test for markers of human fecal pollution and a variety of pathogens. However, in general, the samples were not confluent growth, which was contrary to what was expected based on the measured microbial densities from the previous days' sampling.

Supor-200 filters were frozen and sent to AOML for later DNA extraction. DNA lysates were prepared from the filters by bead-beating (Haughland et al. 2005) in Qiagen AE buffer with a Qbiogene FastPrep bead beating instrument at speed 6.5 for a total of 40 s. The lysates were diluted 1:5 with fresh AE buffer and stored at -80˚C until analysis. An aliquot (5 μL) of each 1:5

dilution was utilized as template DNA in 50 μL PCR reactions as outlined in Table 27. Standard positive and negative PCR controls were used.

Samples were tested for the presence of amplifiable DNA and for PCR inhibition using primers that amplify a universal region of the bacterial genome (16S rRNA gene). As an additional control, samples were analyzed for the presence enterococci (23S rRNA gene targeting the enterococci group including *E. faecalis, E. faecium, E. durans, E. casseliflavus, E. gallinararum,* and *E. hirae*). The lysates also were analyzed for the presence of several pathogens and markers of human fecal pollution, as detailed in Table 27.

May and December 2006 Results

The goal was to obtain filters with confluent bacterial growth for the PCR analysis, but confluent growth was not obtained. Nonetheless, a subset of the samples received was analyzed by PCR. The results of the PCR assays are summarized in. All samples were amplifiable and without significant PCR inhibition, as indicated by successful amplification of 16S rDNA. Six out of nine samples contained enough *Enterococcus* DNA to generate successful amplification. The three negative samples had low concentrations of *Enterococcus*, as indicated by the following IDEXX enumeration (MPN/100mL): 20 (Creek at Deckle Beach) and <10 (Keaton Beach). In general, the *Enterococcus* counts were low for all of these samples, with only one sample exceeding the single sample standard for *Enterococcus* (104 MPN/100 mL). *Enterococcus* is the recommended indicator for marine waters (EPA 2004). Positive reactions were not obtained for any of the markers of human fecal pollution or for pathogens, even for the one site exceeding the single sample guideline for *Enterococcus* (sample 070918L Boggy Creek). All positive and negative controls functioned as expected (data not shown).

Growth enrichment was used here to enhance detection of rare pathogen signals, and confluent growth on the incubated filters is anticipated to be needed for adequate sensitivity. None of the filters from this study demonstrated true confluent growth; therefore negative signals are not unexpected. However, lack of confluent growth due to problems with the media cannot be ruled out because plate function was not verified through growth of positive controls.

The PCR assays described here have been adapted from clinical applications and the use of these protocols for environmental samples is in the research phase. These protocols have demonstrated good sensitivity with clinical samples; however, there is a known gap between the sensitivity achieved with assays under clinical conditions and the sensitivity achieved with environmental samples (Baums et al. 2007; Goodwin and Litaker 2007). The magnitude of this gap is currently under investigation. DNA extraction efficiencies were not quantified here, but are currently under investigation.

Overall, the molecular data indicated that the analyzed water samples were not grossly contaminated with fecal contamination or human-derived fecal contamination. These results are supported by the low IDEXX MPN results for *Enterococcus* and the lack of confluent growth from the samples incubated on the bacterial media. However, the possibility of false negative results can not be ruled out because of the possibility of low DNA extraction efficiencies and/or lack of confluent growth due to problems with the bacterial media.

Table 27 - Details of molecular analysis, including, gene target, PCR primer sequences, and thermocycling reaction conditions for 2006.

Target Organism/Gene	Primer Sequences 5' → 3'	PCR Thermocycling Conditions	Ref.
Universal Bacterial 16S rRNA gene	**Unifor:** ACTCCTACGGGAGGCAGC **Unirev:** GACGGGCGGTGTGTACAA	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 2.5uL Unifor primer (10uM), 2.5uL Unirev primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 30 cycles of 94˚C 30s, 58˚C 30s, 72˚C 30s; 70˚C 8min	Zheng et al. 1996
Enterococci group general 23S rRNA gene	**ECST748F:** AGAAATTCCAAACGAACTTG **ENC854R:** CAGTGGTCTACCTCCATCATT	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 4.5uL ECST748F primer (10uM), 1.5uL ENC854R primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 30 cycles of 94˚C 30s, 60˚C 30s, 72˚C 30s; 70˚C 8min	Haugland et al. 2005
Human-specific marker *Enterococcus faecium* *esp* gene	**espF:** TATGAAAGCACAAGTT **espR**: CGTCGAAAGTTCGATTTCC	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 1.5uL espF primer (10uM), 1.5uL espR primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 40 cycles of 94˚C 1min, 58˚C 1min, 72˚C 1min; 70˚C 8min	Scott et al. 2005
Human-specific marker *Bacteroides* HF8 gene cluster	**HF183F:** TCATGAGTTCACATGTCCG **Bac708R:** CAATCGGAGTTCTTCGTG	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 2uL HF183F primer (10uM), 2uL Bac708R primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 40 cycles of 94˚C 30s, 59˚C 30s, 72˚C 30s; 70˚C 8min	Berhnard et al. 2000

Target Organism/Gene	Primer Sequences 5’ → 3’	PCR Thermocycling Conditions	Ref.
Salmonella spp. *IpaB* gene	**IpaBF:** GGACTTTTTAAAAGCGGCGG **IpaBR:** GCCTCTCCCAGAGCCGTCTGG	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 1.5uL IpaBF primer (10uM), 1.5uL IpaBR primer (10uM), 1uL formamide, 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 35 cycles of 94˚C 1min, 62˚C 1min, 72˚C 1min; 70˚C 8min	Kong et al. 2002
Staphylococcus aureus clfA gene	**clfAF:** GCAAAATCCAGCACAACAGG AAACGA **clfAR:** CTTGATCTCCAGCCATAATTG GTGG	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 0.5uL ClfAF primer (10uM), 0.5uL ClfAR primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 40 cycles of 94˚C 1min, 55˚C 1min, 72˚C 1min; 70˚C 8min	Mason et al. 2001
Escherichia coli strain O157:H7 *rfb* gene	**0157PF8:** CGTGATGATGTTGAGTTG **0157PR8:** AGATTGGTTGGCATTACTG	**Per 50uL rxn:** 5uL Finzyme 10X buffer, 1.25uL dNTPs (10mM), 1.5uL BSA (10mg/mL), 5.0uL 0157PF8 primer (10uM), 5.0uL 0157PR8 primer (10uM), 0.75uL Finzyme, Hotstart Taq Polymerase. **Cycling:** 94˚C, 10min; 40 cycles of 94˚C 30s, 55˚C 30s, 72˚C 30s; 70˚C 8min	Maurer et al. 1999

Table 28 - Summary of PCR analysis for various markers of human fecal pollution and pathogens for 2006 sampling.

Site ID	Site description	IDEXX fecal indicators* (MPN/100mL)	universal bacterial 16S rRNA gene	enterococci 23S rRNA gene	Human marker, enterococci *esp* gene	Human marker, *Bacteroides* HF8 cluster	*Salmonella* spp., *IpaB* gene	*Staphylococcus aureus*, *clfA* gene	*E. coli* O157:H7, *rfb* gene
060918L	Boggy Creek @ 51	EC = 132 ENT = 262	+	+	-	-	-	-	-
060928I	Cedar Island Beach	EC = 5794 ENT = 20	+	+	-	-	-	-	-
060928C	Creek at Dekle Beach	EC = 2254 ENT = 20	+	-	-	-	-	-	-
060928F	Keaton Beach	EC = 891 ENT = <10	+	-	-	-	-	-	-
061213DI	Cortez Rd Canal – Pump Station	EC = 187 ENT = <10	+	+	-	-	-	-	-

* EC = *Escherichia coli*; ENT = *Enterococcus*

May 2007 Results

During the last two sampling events in 2006, the molecular techniques approach proved to be independent of the previous day's microbial density. Thus, it was recommended to expand the number of samples from four (4) to nine (9), in order to increase the chances of achieving confluent growth within 24 hours of extraction.

The molecular biology research team from the National Oceanographic and Atmospheric Administration Atlantic Oceanographic and Meteorological Laboratories (NOAA-AOML) Ocean Chemistry Division again offered to attempt to analyze samples collected from the Taylor County study in an effort to determine if molecular techniques could be used as an effective tracer method. This is still an experimental process being developed for NOAA, with no guarantee of success for same. Samples from nine sites were collected. For each, three different molecular based assays were performed, including two sets of DNA analyses, one set of *E. coli* tracer tests, and one set of *Enterococcus* tracer tests.

For each of the nine sites, an additional 2-4 L of samples were collected in sterile Whirl-Pak bags and transported to the temporary field laboratory. The selected sites were picked based on source tracking hypotheses.

- PL1 (Petersons Landing). This site is located at the mouth of the Fenholloway River, which contains the industrial discharge from a specialty cellulose mill. This is the point at which the river empties to the ocean. Any microbial input should appear as natural because there is very little opportunity for human sewage input along the length of this industrial river. This should represent the microorganisms cultured in the treatment facility to remove the BOD in the aerated treatment lagoons of the mill.
- AB1 (Adam's Beach). This site is located downstream of a boat landing. No homes are located nearby. Therefore, human sewage pollution from OSTDS should be minimal. However, this site is characterized by historically high microbial densities.
- A1 (Dekle Beach). This site is located along the beach with a relatively high density of septic tanks nearby and remnants of historic septic tanks destroyed by a storm even last decade. This site should show signs of human sewage indicators.

- C1 (Creek at Dekle Beach). This site is the background site for Dekle Beach. The creek is tidally influenced but should not show strong signals of human sewage because there are no close human settlements upstream.
- F1 (Keaton Beach). This site is located at a public beach with sewer networks recently installed in 2005. This site should show weaker signals of human sewage pollution but may show strong indicators of bird-derived microbial indicators.
- G1 (Blue Creek). This site is the freshwater background site for Keaton Beach and Cedar Island. This site should show no signs of human-derived fecal indicators because no settlements are nearby and the surrounding areas have recently been converted to sewer.
- I1 (Cedar Island Beach). This site is Gulf-front property with historically high microbial indicator density. Sewer was recently installed in 2005, but the old drainfields are now submerged with recent sea level rise and beach erosion in this area. The presence of a boat marina nearby with historically polluted sediments and muck may influence the readings here, which should theoretically show weak signals in terms of human sewage indicators.
- L1 (Boggy Creek @51). This site is a freshwater tributary of the Steinhatchee River. Over the past three sampling events, we noted unexpected findings even though this is supposed to be a natural background site. We are not sure what to expect here.
- FR1 (Fenholloway River @ 27). This site is the industrial discharge of a specialty cellulose mill located about 1 mile downstream of the plant. This site should show strong indicators of naturally-derived microbial tracers.

Samples were tested for the presence of amplifiable DNA and for PCR inhibition using primers that amplify a universal region of the bacterial genome (16S rRNA gene). As an additional control, samples were analyzed for the presence of Enterococci (23S rRNA gene targeting the Enterococci group including *E. faecalis, E. faecium, E. durans, E. casseliflavus, E. gallinararum,* and *E. hirae*). The lysates also were analyzed for the presence of several pathogens and markers of human fecal pollution.

Table 29 summarizes the PCR data for the May 2007 samples. It is in a similar format to the previous data summary table for the prior samples, except that PCR assays were added for a third human fecal marker (*Bacteroides* HuBac), for a dog marker (*Bacteroides* DogBac), and for an additional pathogenic bacteria (*Campylobacter jejuni*). Note that for environmental detection of human fecal sources, the *Bacteroides* HuBac marker is more sensitive than Enterococci esp or *Bacteroides* HF8 marker, and is potentially carried by a greater proportion of the human population (Sinigalliano 2007 personal communication). However, it may have some slightly greater cross-reactivity with dog fecal sources. For the dog marker, *Bacteroides* DogBac, it is not clear at this time just how prevalent this dog marker actually is among the wider domestic dog population, although studies are on-going. Thus it is not clear yet what sized dog population is required in the fecal input for environmental detection of this marker.

Table 29 - Summary of PCR analysis for various markers of human fecal pollution and pathogens from Taylor County samples collected on May 23, 2007.

Site ID	Site Description	IDEXX fecal indicators* (MPN/100mL)	Universal bacterial 16s rRNA gene	enterococci 23S rRNA gene	Human marker, enterococci *esp* gene	Human marker, *Bacteroides* HF8 gene cluster	Human marker, *Bacteroides* HuBac cluster	Dog marker, *Bacteroides* DogBac cluster	*Salmonella* spp., *ipaB* gene	*Campylobacter jejuni, HipO* gene	*E. coli* O157:H7, *rfb* gene	*Staphylococcus aureus, clfA* gene
070523AB1	Adams Beach	EC=ns ENT=ns	+	+	-	-	+	-	-	-	-	+
070523A1	Dekle Beach	EC=30 ENT=10	+	-	-	-	+	+	-	-	-	+
070523C1	Creek @ Dekle	EC=82 ENT=<10	+	-	-	-	+	-	-	-	-	+
070523F1	Keaton Beach	EC=92 ENT=20	+	+	-	-	+	-	-	-	-	+
070523G1	Blue Creek	EC=<10 ENT=20	+	+	+	-	+	+	-	-	-	+
070523I1	Cedar Island Beach	EC=41 ENT=<10	+	-	-	-	-	-	-	-	-	-
070523L1	Boggy Creek @51	EC=<10 ENT=86	+	+	-	+	+	-	-	-	-	+
070523FR1	Fenholloway River @98	EC=<10 ENT=72	+	+	-	-	-	-	-	-	-	-
070523PL1	Peterson's Landing	EC=41 ENT=97	+	+	-	-	-	-	-	-	-	-

*EC = *E. coli*; ENT = *Enterococcus*

Overall, the molecular data of the analyzed water samples do not suggest a fecal source of contamination, although Boggy Creek, Fenholloway River, and Peterson's Landing are certainly over the recommended single-sample full-body contact exposure limit. However, while all three of these sites showed Enterococci detection by PCR, only Boggy Creek showed relatively high Enterococci abundance plus evidence of human-source fecal contamination (by two independent human-source *Bacteroides* markers). Thus Boggy Creek (site 070523L1) may warrant some closer scrutiny. Actual human fecal pathogens were not detected in any of the PCR samples. Six of the nine samples again contained enough Enterococci DNA to generate successful amplification, and in general these samples with detectable Enterococci DNA corresponded to the higher concentrations observed by the IDEXX EnteroLert assays collected on the other sampling days at these same sites. Unlike the previous SLWT event in December 2006, there was greater evidence of potential human-fecal-source contamination, although it could not be quantified, but one site showed the presence of human-source Enterococci esp gene, another sample showed the presence of human source *Bacteroides* HF8, and six of nine samples contained human-source *Bacteroides* HuBac. In addition, two samples also indicated positive dog-source fecal contamination. It is interesting to note that the same six samples indicating presence of human source HuBac also coincidentally show presence of coagulase-postive *Staphylococcus aureus* clfA gene, which is considered a marker for the potentially antibiotic-resistant skin pathogen *S. aureus*. This is a striking difference from the December 2006 SLWT, as the presence of this putative skin pathogen was not seen in DNA extracts from previous Taylor County sampling events. No other pathogens were detected by PCR. In general (with the exception of Boggy Creek), most of the samples showing the presence of human-source *Bacteroides* were samples that had Enterococci levels (by IDEXX EnteroLert) well below the recommended exposure limits. However, in this assay, the abundance of the *Bacteroides* in the positive detects were not quantified.

September 2007 Results

Given the potentially promising results from the SLWT in December 2006 and May 2007, expanding the source-tracking PCR analysis to include the SHWT in September 2007 seems reasonable.

Table 30 summarizes the analysis from September 2007 SHWT testing with presence/absence PCR results for human source fecal contamination markers and pathogens. In general, no humans pathogens were detected in any samples were detected, but some samples were positive for markers suggesting human fecal contamination. Four samples (Fenholloway River, Blue Creek, Boggy Creek, and Petersons Landing) show the presence of some detectable *Enterococcus*, but this is not necessarily of human origin. One sample (Dekle Beach) had a hit for human-source HF8 for *Bacteroides*. This suggests the presence of human fecal contamination, another sample (Blue Creek) had a hit for the human-source enterococci esp. gene. Three samples (Blue Creek, Boggy Creek, and Petersons Landing) showed the presence of the human-source *Bacteroides* HuBac marker. Both HF8 and enterococci esp. are relatively rare in the human population, so environmental detection may suggest possible sewage contamination. The finding of HF8 in Dekle Beach is not unexpected since the relatively large density of septic tanks discharges directly in this area. However, it is surprising to find enterococci esp. marker at Blue Creek, which is a background site. Nevertheless, the Blue Creek site is located relatively close to the wastewater infiltration basin, which may be influencing the surface water quality of the Blue Creek headwaters during certain times of the year.

Table 30 - Summary of PCR analysis for various markers of human fecal pollution and pathogens from Taylor County samples collected on September 19, 2007.

Site ID	Site Description	IDEXX fecal indicators* (MPN/100mL)	Universal bacterial 16s rRNA gene	enterococci 23S rRNA gene	Human marker, enterococci *esp* gene	Human marker, *Bacteroides* HF8 gene cluster	Human marker, *Bacteroides* HuBac cluster	Dog marker, *Bacteroides* DogBac cluster	*Salmonella* spp., *ipaB* gene	*Campylobacter jejuni, HipO* gene	*E. coli* O157:H7, *rfb* gene	*Staphylococcus aureus, clfA* gene
070919AB1	Adams Beach	EC = 11199 ENT = <10	+	-	-	-	-	nr	-	-	-	-
070919A1	Dekle Beach	EC = 528 ENT = <10	+	-	-	+	-	nr	-	-	-	-
070919C1	Creek @ Dekle	EC = 2367 ENT = 20	+	-	-	-	-	nr	-	-	-	-
070919F1	Keaton Beach	EC = 1951 ENT = 20	+	-	-	-	-	nr	-	-	-	-
070919G1	Blue Creek	EC = 496 ENT = 253	+	+	+	-	+	nr	-	-	-	-
070919I1	Cedar Island Beach	EC = 1459 ENT = 40	+	-	-	-	-	nr	-	-	-	-
070919L1	Boggy Creek @51	EC = 178±78 ENT = 204±199	+	+	-	-	+	nr	-	-	-	-
070919FR1	Fenholloway River @98	EC = <10 ENT = 269	+	+	-	-	-	nr	-	-	-	-
070919PL1	Peterson's Landing	EC = 1025±170 ENT = 188±60	+	+	-	-	+	nr	-	-	-	-

*EC = *E. coli*; ENT = *Enterococcus*

Compared to HF8 and enterococci esp., HuBac is much more common in the human population, so detection may suggest the presence of human fecal contamination, but this may be an individual point-source and might not represent actual sewage contamination (i.e. may be from a single latrine, septic tank, boat toilet, etc, although it may also be found in sewage as well). Keep in mind also, that PCR detection only signals the presence of gene markers, it does not discriminate if the detected cells are actually viable.

None of the PCR assays truly discriminate between septic or sewer as sources of contamination. They are only capable of determining differences between host organism sources, such as distinguishing between human, dog, cow, etc., which can potentially reflect differences in sources, such as terrestrial runoff containing domestic animal/livestock markers versus groundwater seepage contaminated with human-source markers from sewage or septic tanks. Therefore, it must be clearly stated that these molecular assays cannot distinguish if the human source marker in the environment is from a sewered source or a septic tank, or an untreated cesspit, or from baby diapers on the beach, for instance.

Nitrogen Isotope Ratio

Nitrogen isotope ratio experiments will follow the procedures outlined in Heikoop et al. 2000; Sammarco et al. 1999; Risk and Erdmann 2000; Costanzo et al. 2004; among others. Samples for $\delta^{15}N$ were collected in 1.0 L sterile Whirl-Pak bags without preservative. They were field filtered using sterile 0.2 µm cellulose acetate syringe filters (VWR P/N 28145-477) and sterile 30 cc Leur-lok tip syringes (BD #309650, Franklin Lakes, NJ). These were transferred to precleaned 100 mL plastic sample bottles and immediately frozen on dry ice. The samples were transported to: Mark Altabet at SMAST/U Massachusetts Dartmouth, 706 S. Rodney French Blvd., New Bedford, MA 02744-1221. Dr. Altabet has developed a new experimental technique for testing source tracking hypotheses in water samples based on nitrogen isotopes in aqueous ammonia and nitrates. The samples are analyzed after the nutrient analyses are completed. This provides a starting point to determine which isotopes of nitrogen and oxygen from nitrate and nitrite or just nitrogen from ammonium should be analyzed for based on the concentration levels in the sample.

The results of the May 2007 SLWT sampling event are summarized in Table 31. Briefly, seven (7) reliable analyses of the $\delta^{15}N$ and $\delta^{18}O$ of nitrate were possible.

Table 31 - Summary of isotopic testing for May 2007 SLWT sampling event.

No.	Sample	Site	Reported NH_4^+(μM)	Reported NO_3^- (μM)	Instrument NO_3^- (μM)	NO_3^- $\delta^{15}N$	NO_3^- $\delta^{18}O$
1	070523AB1	Adams Beach	4.10	0.82	6.26	7.66	25.12
2	070523A1	Dekle Beach	0.07	0.07	3.83	8.26	24.66
3	070523C1	Creek at Dekle	2.10	0.48	1.57	3.71	22.01
4	070523F1	Keaton Beach	0.53	0.15	1.26	4.30	21.94
5	070523G1	Blue Creek	6.40	6.93	5.33	-0.63	7.03
6	070523I1	Cedar Island Beach	0.13	0.33	3.01	5.64	24.84
7	070523L1	Boggy Creek @ 51	5.10	1.60	2.01	2.52	15.35
8	070523FR1	Fenholloway River @ 98	163.70	21.00	0.71	na	na
9	070523PL1	Petersons Landing	27.80	21.60	*	na	na

* = insufficient sample volume; na = not analyzed

As far as interpretation, samples 1 to 4 and 6 (Adams Beach, Dekle Beach, Creek at Dekle, Keaton Beach, and Cedar Island Beach) have moderate $\delta^{15}N$ and high $\delta^{18}O$. This signature is most consistent with a commercial nitrate fertilizer source. Their $\delta^{18}O$ when plotted against $\delta^{15}N$ fall near a 1:1 line (Figure 36) showing the variation amongst them is likely due to algal utilization increasing both together. Most commercial fertilizer products are around 89% ammonia. Thus, these sites should also have elevated levels of ammonia, if fertilizers are an important source. Note these samples have fairly high (>0.07 mg N/L) ammonium levels (refer to Table 31), which is also consistent with relatively recent fertilizer inputs. Samples 5 and 7 (Blue Creek and Boggy Creek) clearly fall below the 1:1 line and are more likely to have nitrate produced from nitrification that is mixing in with the fertilizer source to varying degrees.

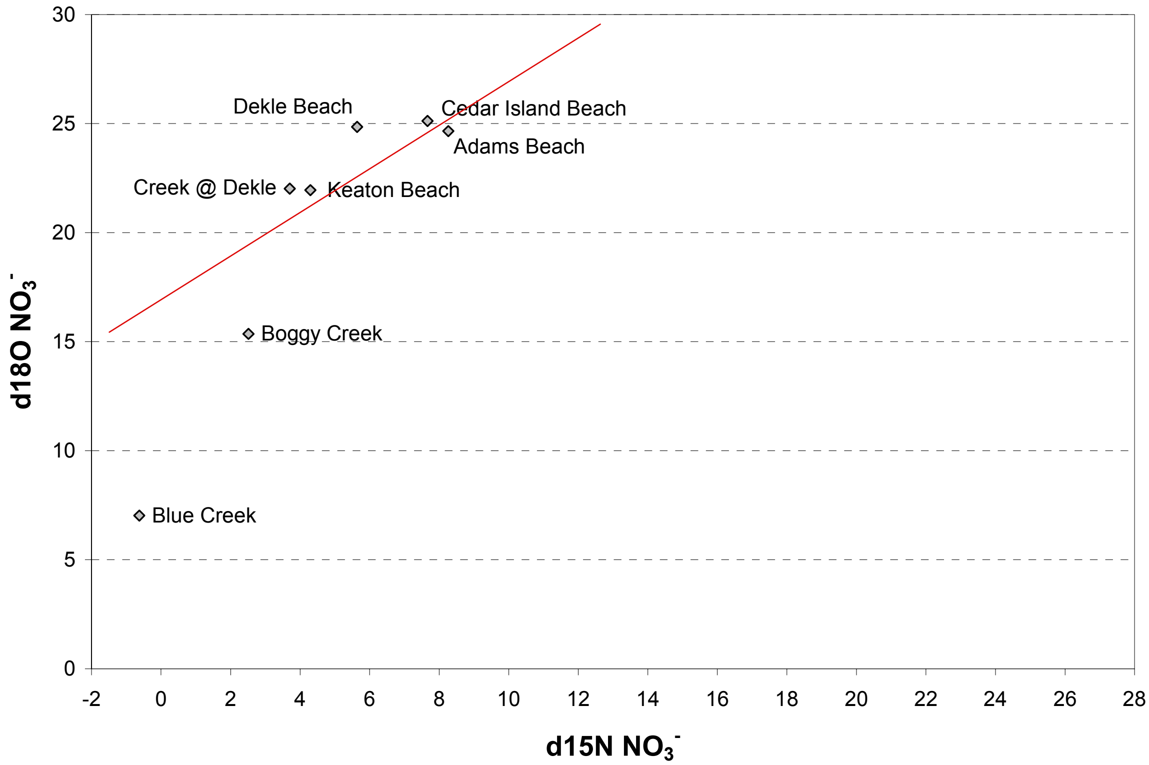

Figure 36 - Plot of $\delta^{18}O$ versus $\delta^{15}N$ for isotopic samples from May 2007 SLWT sampling event.

The ammonium analyses were inconclusive for the Fenholloway River and Petersons Landing sites for reasons unknown; however, there was insufficient sample to perform follow up testing. Although these samples were clearly heavy with humic material, it could not be determined if that might have caused a problem with the analysis. In the future more than 125 mL of sample should be collected. The isotope testing also revealed a higher nitrate level than those reported in samples 1-4 (Adams Beach, Dekle Beach, Creek @ Dekle, and Keaton Beach) and 6-7 (Cedar Island Beach and Boggy Creek). Since nitrate contamination was not found, it is possible that the reported nitrate levels were actually lower than what was found in the sample; however, the nutrient testing was performed with different methods by two different laboratories, which could account for the discrepancy. In addition, a third party analysis of the total nitrogen levels seems to support the reported values. Thus, the enhanced levels found in the isotope analysis may have resulted from column bleed from the humic acid, color-rich samples which had nitrogen levels that were 20 times higher than the other samples. This column bleed enrichment could not be verified because of insufficient sample volume remaining after the analysis. During the September event, this will be remedied by using dilutions, blind standards, and replicates.

Shallow Sediment Re-Growth Studies

During May 2006 SHWT sampling at Cedar Island, 2 out of 2 samples showed indications of human sources. This sample set was too small to draw any meaningful conclusions. However, when all of the Ec/Es ratio data (n = 21) was compiled for Cedar Island for the first three sampling events (May 2006, September 2006, and December 2006), all sites show signs of human pollution, despite being converted to a sewer network from septic tanks during the course of the study. This potentially indicates that another source, such as possible regrowth in warm, shallow, stagnant waters may be responsible (Solo-Gabriele et al. 2000). The coastal areas in this study are characterized by Bayvi soil, which is a relatively deep, poorly-drained, sandy soil. This type of material is similar to the soils that have been found to harbor pathogen indicator regrowth in studies conducted in South Florida (Solo-Gabriele et al. 2000). To identify if shallow regrowth is acting as a legacy reservoir of microbial pathogen indicators, studies of persistence under harsh environmental conditions were conducted.

For shallow sediment studies, microbial indicators were extracted from soil samples using a modified version of the procedure outlined by Van Elsas and Smalla (1997). First suitable soil samples were collected in sterile Whirl-Pak bags using sterile gloves. Approximately half of the bag contained sediment and overlying water. Samples were immediately stored at 4°C and kept overnight for analysis the next day. To enumerate the organisms in the sediment samples, two preliminary steps were performed. The first step was to measure the moisture content of the sand by recording the mass difference before and after drying (105°C for 24 h) approximately 50 – 60 g of sample on pre-weighed dishes. Samples were placed in the dessicator for at least one hour prior to measuring the final mass. The second step was to extract the microorganisms from the sand particles to a predetermined volume of sterile water. To accomplish this, 50 – 60 g (1/8 cup) of wet sand was aseptically removed from the sterile sample bag using a stainless steel scoop that was flamed in ethanol for sterilization. This material was placed into a new sterile Whirl-Pak bag using a sterilized sample spoon to remove the sediment from the scoop, as needed. Sterile phosphate buffer solution was prepared in 1.0 Liters of reagent water with the following added to it: 1 mL/L of phosphate buffer solution prepared by dissolving 42.5 g KH_2PO_4 crystals and 1.7 g NH_4Cl in 700 mL of reagent water and adjusting to pH 7.2 with 30% NaOH before diluting to 1.0 L; 1 mL/L of magnesium sulfate solution prepared by dissolving 22.5 g $MgSO_4 \cdot 7H_2O$ in 1.0 L of reagent water; 1.0 mL/L of calcium chloride solution prepared by dissolving 27.5 g of $CaCl_2$ in 1.0 L of reagent water; and 1.0 mL/L of ferric chloride solution prepared by dissolving 0.25 g of $FeCl_3 \cdot 6H_2O$ in 1.0 L of reagent water. After mixing, the solution was sterilized in the autoclave and brought to room temperature. Then 50 mL of sterile phosphate buffer dilution water (PBS) was added to each container using sterile 10 mL serological pipets and manually shaken vigorously for 120 seconds. Then the slurry was decanted into a pre-sterilized coffee filter (#4 grade), which were sterilized using an ultraviolet lamp for 30 minutes on each side (May 2007) or autoclaved after being wrapped in aluminum foil (September 2007). The filtrate was collected into another sterile Whirl-Pak bag. An additional 50 mL of PBS was used to remove the sand from the container. All of the additional liquid and sand were filtered and combined. The final volume of filtrate was recorded, and this filtrate was analyzed for re-growth of microbial indicators. Samples were stored at 4°C, and the procedure was then repeated again 120-168 hours (5-7 days) later. A summary of the initial results from sediment regrowth studies is found in Table 32 and Table 33.

Table 32 - Summary of sediment regrowth studies for the May 2007 SLWT sampling event.

Sample	Site	Solids content (%)	*E. coli* (MPN/100mL per g dry solids)			*Enterococcus* (MPN/100mL per g dry solids)		
			05/24/07	05/29/07	Ratio*	05/24/07	05/29/07	Ratio*
070523AB	Adams Beach	75.1	3.2	4.7	1.5	3.1	0.5	0.2
070523A	Dekle Beach	77.3	10.5	26.7	2.5	0.7	<0.2	<0.3
070523F	Keaton Beach	82.9	4.0	8.3	2.1	0.2	<0.2	<1.0
070523I	Cedar Island Beach	80.7	3.5	149.5	42.7	0.4	1.1	2.8

*Ratio = 2nd day value divided by initial value

If the ratio of the second day value to the initial value is greater than unity, then the sample exhibits a capability for regrowth. For the May 2007 SLWT event, all four *E. coli* samples showed signs of potential regrowth with ratios greater than one. In particular, the

Cedar Island Beach site shows the strongest regrowth with almost 50 times more colonies per gram of dry sediment. In terms of Enterococcus, only Cedar Island Beach shows any potential for harboring these pathogen indicators and protecting them from dessication during the tidal cycle.

For the September 2007 SHWT event, none of the sediments from any of the four sites tested showed signs of regrowth potential for either microorganism indicator. This could suggest a seasonal phenomenon, although the sample size is too small to make a definitive conclusion. Further study is warranted.

Table 33 - Summary of sediment regrowth studies for the September 2007 SHWT sampling event.

Sample	Site	Solids content (%)	*E. coli* (MPN/100mL per g dry solids)			*Enterococcus* (MPN/100mL per g dry solids)		
			09/19/07	09/26/07	Ratio*	09/19/07	09/26/07	Ratio*
070920AB	Adams Beach	82.6	8.8	<0.2	<0.02	<0.2	<0.2	<1.0
070920A	Dekle Beach	71.5	41.9	<0.3	<0.01	0.5	<0.3	<0.5
070920F	Keaton Beach	80.2 ± 0.4	4.6	<0.2	<0.05	<0.4	<0.2	<0.5
070920I	Cedar Island Beach	84.9	1.9	<0.2	<0.12	0.2	<0.2	<1.0

*Ratio = 2nd day value divided by initial value

Existing Infrastructure Assessment

Information regarding the hydraulic regime of the Blue Creek estuary, the existing sewer network and OSTDS in the study area (which may include types of systems, ages, depths to ground water table elevation, catalog of sewer leak events, and septic failures), and any existing upstream industrial wastewater discharges will be collected through literature review, record review at the Taylor County Health Department and Taylor Coastal Utilities, and interviews. This work is ongoing, and results will be forthcoming.

Summary of Wastewater Treatment Plant Site Visit:

On May 25, 2007, the FAU team met with David Morgan (Wastewater Treatment Plant Operator) and drove to the facility located on 18820 Beach Road, Perry, FL, roughly between Keaton Beach and Cedar Island just inland of Beach Road off Spoonbill Road. Mr. Morgan informed us that the collection system consists of two major lift stations (Keaton Beach and Blue Creek church) and a pressurized sewer network with grinder pumps at each household connection. Typical flowrates are on the order of 12,000 gpd with annual maximum daily flows up to 80,000 gpd in summer (Memorial Day weekend). The treatment facility consists of a package activated sludge plant with integrated aeration system, clarifier, and chlorine bleach (NaOCl) disinfection, a holding pond, a spray irrigation field, an office/work-shop, and a back-up power generator.

Figure 37. Photos from the Taylor Coastal Centralized Wastewater System Phase 1 Wastewater Treatment Facility (May 24, 2007) showing the package activated sludge plant (top left), holding pond (top right), spray field disposal system (bottom left), and office/workshop (bottom right).

According to Mr. Morgan, the sewer networks were installed in the following order during Phase 1 improvements: 1) Keaton Beach, 2) Ezell Beach, and 3) Cedar Island. Phase 2 will address Dekle Beach, Dark Island, and Fish Creek, which remain on OSTDS. The collection network consists of 1-1/4-inch pipe at the home connecting to 3-inch or 4-inch mains within the neighborhoods that connect to larger 6-inch or 8-inch force mains to the plant. In the winter, the package plant is fed with corn due to extremely low flows from few winter residents. Construction of Phase 1 of the conversion-to-sewer process (for about 450 customers) began approximately in January 2006. The engineering consultant for the job is JEA (Jones, Edmunds, and Associates).

Information that is still to be collected includes the following:

1. Timeline of construction and installation activities
2. Number of tanks replaced
3. Number of customers served

On the potable water side, the drinking water source is groundwater from three coastal wells that pump about 92,000 gpd each from the Floridan Aquifer. The Florida Department of Environmental Protection (FDEP) has performed a source water assessment on the system, which indicated no potential sources of contamination near the wells. The assessment results are available on the FDEP Source Water Assessment and Protection Program website at www.dep.state.fl.us/swapp. According to the 2005 Consumer Confidence Report, no violations were detected from 2003 to 2005, although As, Ba, Cr, Ni, Na and nitrate were detected (but below the maximum contaminant level).

FURTHER DATA ANALYSIS

E. coli/ Enterococcus Ratio (Ec/Es)

It has been suggested that the quantities of fecal coliform (FC) and fecal streptococci (FS) that are discharged by humans are significantly different from those discharged by animals (Tchobanoglous et al. 2003). Coyne and Howell (1994) reported that the FC/FS ratio is typically less than 0.7 for animal-derived pollution and greater than 4.0 for human-derived pollution, when the fecal streptococcus counts exceed 100 CFU/100 mL. Ratios in the range from 1 to 2 typically indicate a mixed contribution. Use of the FC/FS ratio in the field has been criticized (i.e. Mara and Oragui 1981, Pourcher et al. 1991, Sinton et al. 1998) due to an inconsistent relationship between the FC/FS ratio and pollution sources. The authors admit that these types of ratios have demonstrated limited value as an effective tracer; however, when taken in context with a multiple tracer approach, the ratio may provide some insight. Fecal coliform and fecal streptococci were not analyzed for in this study. However, since *E. coli* is a fecal coliform and *Enterococcus* is a fecal streptococcus, an *E. coli* to *Enterococcus* (Ec/Es) ratio was used. Thus, a variant of the FC/FS ratio, i.e. the Ec/Es ratio is presented here to see if it supports the findings from the multiple tracers discussed in detail earlier.

Coyne and Howell (1994) reported some success with a fecal coliform/fecal streptococcus (FC/FS) ratio method for indicating probable sources of fecal contamination. The technique is not considered definitive; however, the following guidelines are recommended (Geldreich and Kenner, 1969; Coyne and Howell, 1994):

1. The pH range should be between 4.0 and 9.0 because fecal coliforms die off quicker than fecal streptococci in acid or alkaline water.
2. Sampling should occur within 24 hours after waste deposition. The faster die-off rate of fecal streptococci will alter the ratio as time from contamination increases.
3. Sample near the point of discharge or as close as possible to the pollution source. Pollution from several sources can be confounding.
4. FC/FS ratios are of limited value in waters where regrowth can occur.
5. Ratios should not be used when fecal streptococcal counts are less than 100 MPN/100 mL. It becomes difficult to distinguish fecal streptococci in wastes from those that occur naturally in soil and water.

Although fecal coliform and fecal streptococci were not used in this study, the same guidelines stated above are applied for the *E. coli* and *Enterococcus* ratios in this study. For this sampling campaign, criterion number 1 is met.

For the most part, criterion number 1 was met for all sites, criterion number 2 was not possible to control for in this study because it was not possible to determine the time of contamination or the point of discharge without knowing the source ahead of time, criterion number 3 was followed in the selection of sites, criterion number 4 was not possible to control for but was a subject of further study detailed later, and criterion number 5 was followed. For the last criterion, *Enterococcus* densities met the minimum 100 MPN/100 mL value in 14% of the samples (22/153) in 2006 and 24% of the samples (34/139) in 2007.

A large number of samples were below detection for either *E. coli* or *Enterococcus* or both, during the five sampling events. For purposes of estimating the ratio for samples that were outside the analytical range of the method, *E. coli* and *Enterococcus* concentrations that were lower than 10 MPN/100mL were estimated to be equal to 5 MPN/100mL and concentrations higher than 24,196 MPN/100mL were considered to be equal to 24,196 MPN/100mL. Ratio data are included in the attached raw data tables in the appendix. Although, the Ec/Es ratio is not an absolute method due to the difference in the die-off rate of the contaminants, the results can be used for screening purposes by evaluating the frequency with which the ratios fall within certain indicative values. This is believed to be a more accurate predictor of fecal contamination source than the controversial ratio alone. Thus, the Ec/Es ratio data that met the *Enterococcus* >100 MPN/100 mL criterion in 2006 was evaluated in Table 34.

Table 34 – Summary of *E. coli/Enterococcus* ratio data organized by site for 2006.

Site Code	Site Name	Ratio	Source	Frequency/Number
Dekle Beach (OSTDS)				
060504B1	Dekle Beach Canal	8.5	Human	4/4
060926B1	**Dekle Beach Canal**	**7.4**	**Human**	
060928B1	**Dekle Beach Canal**	**44**	**Human**	
060926C1	**Creek at Dekle Beach**	**7.0**	**Human**	
Steinhatchee (OSTDS)				
060926J1	**Main Street & Steinhatchee (Roy's)**	**2.7**	**Mixed**	0/10
060505K1	Third Ave. Fork	0.3	Non Human	
060926K1	**Third Ave. Fork**	**1.1**	**Mixed**	
060927K1	**Third Ave. Fork**	**0.9**	**Non Human**	
060926L1	**Boggy Creek @ 51**	**1.0**	**Non Human**	
060927L1	**Boggy Creek @ 51**	**0.9**	**Non Human**	
060928L1	**Boggy Creek @ 51**	**0.5**	**Non Human**	
061212L1	Boggy Creek @ 51	0.5	Non Human	
061213L1	Boggy Creek @ 51	1.5	Mixed	
061214L1	Boggy Creek @ 51	1.9	Mixed	
060927N1	**Steinhatchee Falls**	**0.2**	**Non Human**	
Keaton Beach (Sewer)				
060503E1	Cortez Road Canal - Upstream	0.8	Non Human	3/4
060926D1	**Cortez Road Canal - Pump station**	**10**	**Human**	
060927D1	**Cortez Road Canal - Pump station**	**15**	**Human**	
060928D1	**Cortez Road Canal - Pump station**	**5.5**	**Human**	
Cedar Island (Sewer)				
060926I1	**Cedar Island Beach**	**57**	**Human**	2/2
060927H1	**Heron Road Canal**	**8.5**	**Human**	
Additional Sites				
None				0/0

Values in **bold** are from SHWT

It is interesting to note that during the SLWT, only 1 of 6 ratio values were above the human-derived input cut-off (ratio > 4). However, during the SHWT sampling events, more than 50 percent of the ratios were indicative of human contributions, and the sewered communities had a higher percentage of hits indicating human contributions when the two OSTDS sites are combined. The expectation was that during the SLWT there would be fewer human source indicators, and the data support that supposition with only 1 of 6 samples indicating human contributions. In SHWT, when OSTDS are not expected to operate as efficiently, we see a much larger frequency of potentially human contributions, but we also see those at the two sewered areas. These findings suggest a sewage leak or a legacy source, such as shallow sediment regrowth.

In 2006, the majority of the data meeting the threshold correspond to sites with OSTDS. Dekle Beach has 4 out of 4 ratios of human origin during May and September. Steinhatchee however, shows only non-human or mixed ratios for all ten ratios that met the criterion. For the sites that converted to sewer networks (Keaton Beach and Cedar Island), only 6 ratios met the criterion. At Keaton Beach, the three ratios that indicate human sources coincided with the September sampling event in which a pump station leak may have occurred. At Cedar Island, 2 out of 2 samples showed signs of human sources. This sample set is too small to draw any definitive conclusions. However, when all of the ratio data, including those below the 100 MPN/100 mL threshold (n = 21), is compiled for Cedar Island, all sites show signs of human pollution, despite being converted to sewer network from septic tanks during the course of the study. This potentially indicates that another source, such as possible regrowth in warm, shallow, stagnant waters may be responsible (Solo-Gabriele et al. 2000).

Taking a look at the data collected from 2007 follow-up testing in Table 35, it is interesting to note that during the SLWT, none of the seven (7) ratio values were above the human-derived input cut-off (ratio > 4). However, during the SHWT sampling events, 8 of 26 of the ratios (31%) were indicative of human contributions, and the sewered communities had a higher percentage of hits indicating human contributions when the two OSTDS sites are combined, just as seen in 2006. The data also support the supposition that during the SLWT there are fewer human source indicators (0%). In SHWT, when OSTDS are not expected to operate as efficiently, we see a much larger frequency of potentially human contributions, but we also see those at the two sewered areas. These findings are similar to those observed in 2006.

Table 35 – Summary of *E. coli/Enterococcus* ratio data organized by site for 2007.

Site Code	Site Name	Ratio	Source	Frequency/Number
Dekle Beach (OSTDS)				
070920JI1	**Jugg Island Road Canal**	**0.5**	**Non-Human**	3/4
070919B1	**Dekle Beach Canal**	**19**	**Human**	
070920B1	**Dekle Beach Canal**	**27**	**Human**	
070920C1	**Creek at Dekle Beach**	**92**	**Human**	
Steinhatchee (OSTDS)				
070522K1	Third Ave. Fork	0.3	Non Human	0/6
070523K1	Third Ave. Fork	0.2	Non Human	
070919K1	**Third Ave. Fork**	**2.9**	**Mixed**	
070918L1	**Boggy Creek @ 51**	**0.1**	**Non Human**	
070919L1	**Boggy Creek @ 51**	**0.7**	**Non Human**	
070920L1	**Boggy Creek @ 51**	**0.6**	**Non Human**	
Keaton Beach (Sewer)				
070918MR1	**Marina Road**	**64**	**Human**	2/5
070919D1	**Cortez Rd - Pump Station**	**26**	**Human**	
070524G2	Blue Creek @ Beach Road	0.03	Non Human	
070918G1	**Blue Creek @ Beach Road**	**2.4**	**Mixed**	
070919G1	**Blue Creek @ Beach Road**	**2.0**	**Mixed**	
070920G1	**Blue Creek @ Beach Road**	**3.8**	**Mixed**	
070920G2	**Blue Creek @ Beach Road**	**1.6**	**Mixed**	
Cedar Island (Sewer)				
070920SL1	**Seahawk Lane**	**7.1**	**Human**	1/6
070524G2	Blue Creek @ Beach Road	0.03	Non Human	
070918G1	**Blue Creek @ Beach Road**	**2.4**	**Mixed**	
070919G1	**Blue Creek @ Beach Road**	**2.0**	**Mixed**	
070920G1	**Blue Creek @ Beach Road**	**3.8**	**Mixed**	
070920G2	**Blue Creek @ Beach Road**	**1.6**	**Mixed**	
Additional Sites				
070920AB1	**Adam's Beach**	**11 ± 0.8**	**Human**	4/15
070918FR1	**Fenholloway River**	**0.03**	**Non Human**	
070919FR1	**Fenholloway River**	**0.02**	**Non Human**	
070920FR1	**Fenholloway River**	**0.02**	**Non Human**	
070522HS1	Hampton Springs	0.1	Non Human	
070524HS1	Hampton Springs	0.2	Non Human	
070918HS1	**Hampton Springs**	**0.2**	**Non Human**	
070919HS1	**Hampton Springs**	**0.3**	**Non Human**	
070920HS1	**Hampton Springs**	**0.6**	**Non Human**	
070522PL1	Petersons Landing	0.1	Non Human	
070524PL1	Petersons Landing	0.2	Non Human	
070918PL1	**Petersons Landing**	**5.9**	**Human**	
070918PL2	**Petersons Landing**	**6.5**	**Human**	
070919PL1	**Petersons Landing**	**3.9**	**Mixed**	
070919PL1	**Petersons Landing**	**7.9**	**Human**	

Values in bold are from SHWT

In general for both years, the inland background sites had low ratios, many of which were less than 1.0, which is indicative of non-human sources. On the other hand, nearly all of the beach sites for both years showed ratios that were well above 4.0, indicative of human sources. Insufficient data is available to draw a complete conclusion from this phenomenon; however, the authors have postulated some potential reasons that will be investigated in future research. First, in this study, the Dekle Beach site (OSTDS) is located upstream of the Keaton Beach (sewer) and Cedar Island (sewer) sites, along the general bulk flow transport of the prevailing ocean current. As a result the twice daily tides tend to mix ground water and runoff contributions. At the same time, a portion of the contaminants are lost each tidal cycle to the coastal ocean and made available for transport downstream. After tidally influenced transport, the ground water and runoff contributions for a given area do not return to exactly the same water quality level from which they originated. This daily periodicity can be termed as a “slosh” effect, which may play an important role here in cycling nutrients and pathogen indicators. This could be investigated with daily intensive sampling for bacteria and nutrients.

A second possibility is that during the SHWT, the soils and canals in the sewered areas may be flushed less effectively, and therefore do not show the same concentrations of bacteria as the septic areas that would tend to leach even more bacteria into the soil. This may be difficult to test. Affluent communities tend to use more water for landscaping and lawn care (with increased use of fertilizers). If these areas are on sewer network and experiencing heavy water use for irrigation purposes for instance, it is possible that they have maintained the higher water table elevations for the whole year, and thus the adjacent canals may show discernable differences from the sewered and non-sewered test sites during the SLWT.

Analysis of OSTDS vs. Sewer (Horizontal Analysis)

This section summarizes the general comparison of the data for each analyte from areas served by sewers and areas served by OSTDS during both the SHWT and SLWT. The mean values were calculated using results from all sites grouped by classification -

sewered sites versus sites served by septic tanks (background sites were included). Results for field duplicates and lab replicates were not included. Geometric means were used for comparison of the bacterial results, since it is the preferred statistic for summarizing microbiological data (Standards Methods 19th edition 1995). This is appropriate because the collected data was constrained as being non-negative and as such, the assumption of normally-distributed, non-skewed data was not possible. The geometric mean is better at showing where most of the data points lie by lowering the weight of outliers. The other parameters, such as nitrate and ammonia, were compared using arithmetic means. When using arithmetic means, values that were recorded to be below detectable levels were assumed to be zero because of widely varying detection limits across the data set. Bacterial results that were recorded higher than the 24,196 MPN/100mL limit were considered equal to 24,196 MPN/100mL, and those results below 10 MPN/100mL were considered equal to 5 MPN/100mL. These comparisons are summarized in Table 36. Standard deviations are also included in the table.

Table 36 - Comparison of Results for Sewered and Non-Sewered Sites

	SLWT (May 2006)	SHWT (Sept 2006)	SLWT (Dec 2006)	SLWT (May 2007)	SHWT (Sept 2007)
	E. coli (MPN/100mL)				
Sewer	490 ± 2613	1121 ± 5804	105 ± 100	138 ± 641	1626 ± 1994
OSTDS	127 ± 740	301 ± 1715	72 ± 92	34 ± 49	429 ± 6104
	Enterococcus (MPN/100mL)				
Sewer	15 ± 140	44 ± 136	7.3 ± 6.8	11 ± 10	53 ± 59
OSTDS	28 ± 55	73 ± 106	23 ± 79	14 ± 41	44 ± 147
	TOC (mg/L as C)				
Sewer	10 ± 4.7	37 ± 28	10 ± 5.4	7.3 ± 3.1	
OSTDS	12 ± 3.4	22 ± 21	15 ± 8.2	8.8 ± 2.7	
	TN (mg/L as N)				
Sewer	0.46 ± 0.17	0.70 ± 0.19	0.35 ± 0.11	0.52 ± 0.16	
OSTDS	0.57 ± 0.34	0.51 ± 0.25	0.36 ± 0.08	0.50 ± 0.13	
	Ammonia (mg/L as N)				
Sewer	0.20 ± 0.24	0.05 ± 0.03	0.06 ± 0.05	0.02 ± 0.02	0.05 ± 0.03
OSTDS	0.26 ± 0.22	0.06 ± 0.05	0.06 ± 0.03	0.03 ± 0.03	0.05 ± 0.03
	Nitrate (mg/L as N)				
Sewer	0.01 ± 0.02	0.01 ± 0.01	0.02 ± 0.02	0.01 ± 0.01	0.02 ± 0.02
OSTDS	0.01 ± 0.01	0.01 ± 0.02	0.03 ± 0.03	0.01 ± 0.02	0.03 ± 0.03

The bacteriological results reveal that *E. coli* counts levels are generally lower in OSTDS areas as compared to sewered areas, but *Enterococcus* counts behave oppositely and were higher by a factor of about 1.5, independent of season. The *Enterococcus* and *E. coli* densities were plotted as geometric means of the sites in the downstream direction in

Figure 38. A general increasing trend from upstream to downstream is apparent. As noted previously, *Enterococcus* counts were higher in the SHWT period when compared to the SLWT, by a factor of 2 – 3. However, *E. coli* was found to be consistently higher in the sewered areas, which was not expected. When taken in context with the *Enterococcus* results, these higher levels of *E. coli* may not be necessarily of human origin.

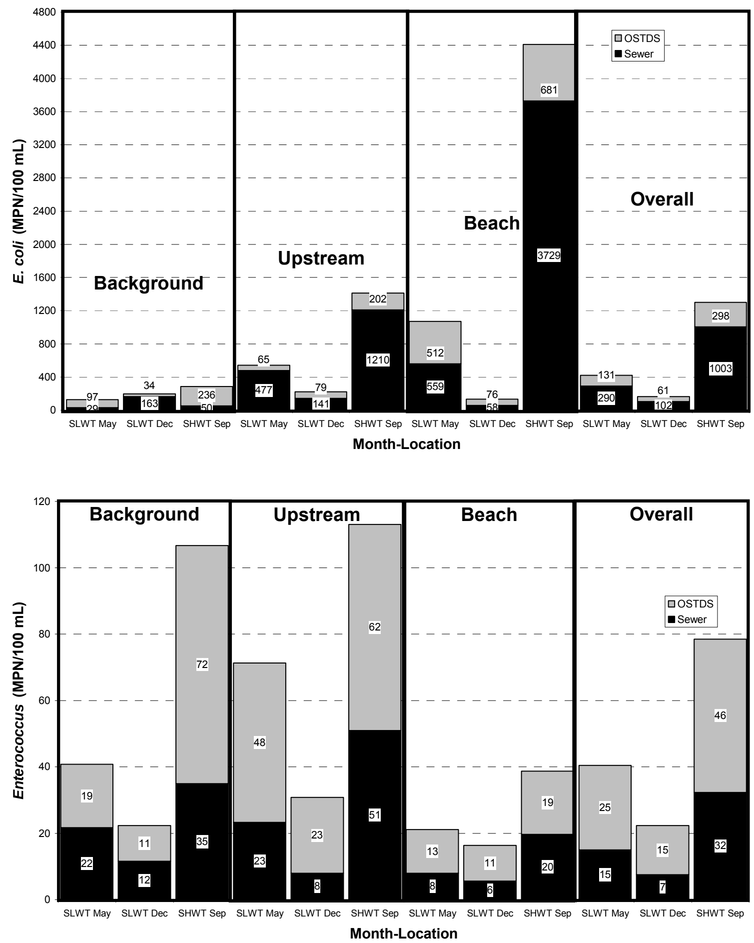

Figure 38 - Spatial trends in bacteriological indicators between OSTDS sites and sewer sites (Top-*E. coli*; Bottom-Enterococci)

The results indicate that the *Enterococcus* and *E. coli* densities correlated as expected with the change from SLWT to SHWT. However, the actual numbers may be misleading due to several very high *E. coli* results (> 5000 MPN/100 mL) from sewered areas that occurred during both seasons at Cedar Island Beach and Dekle Beach Canal.

Comparison of 2006 data from the seasonal high water table event (September 2006) and the seasonal low water table events (May and December 2006) revealed the following:

- *Enterococcus* results are not higher in OSTDS areas when compared to sewered areas. In fact, the values are slightly less but very similar.
- *Enterococcus* results are higher in the SHWT period compared to the SLWT, by at least a factor of two.
- *E. coli* was higher in sewered areas than in non-sewered areas in the SHWT and SLWT events (by a factor of two), except in December when the levels were similar and very low. It should be noted that the *E. coli* results do not indicate that the additional colony forming units are necessarily of human origin.
- TOC values are higher in the SHWT period as opposed to the SLWT events, by a factor of 2-3. December and May (SLWT) were similar to each other.
- Total nitrogen remains fairly constant between all events (slightly lower in December)
- Ammonia is 4 times higher in the May SLWT, but the SHWT and December SLWT events were similar.
- Ammonia levels as a percent of total nitrogen are higher in the SLWT events.
- Nitrate is negligible at all periods.

From this analysis, the total nitrogen and *Enterococcus* parameters would tend to implicate a greater contribution of nutrients to coastal waters from septic systems. However, runoff (TOC and higher ammonia in the SLWT) may also be an important factor.

In 2007:

- *Enterococcus* results are higher in OSTDS areas when compared to sewered areas, by at least a factor of two.
- *Enterococcus* results are higher in the SHWT period compared to the SLWT, by at least a factor of two, similar to what was observed in 2006.

- *E. coli* was higher in sewered areas than in non-sewered areas in the SHWT and SLWT events (by a factor of two), just as seen in 2006.
- Ammonia levels in 2007 behaved similarly as compared to the last two sampling events in 2006.
- Nitrate remains negligible at all periods.

Intervention Analysis

As stated earlier, two of the beach communities (Keaton Beach and Cedar Island) were recently converted (January 2006) to a sewer network from OSTDS. An analysis of the temporal variations between these two sites and the site that remained on OSTDS (Dekle Beach) over the same time period was performed using the microbial indicators *Enterococcus* and *E. coli*. The purpose was to see if a change in the slope of the cumulative densities could be observed. If so, this would indicate factors affecting the concentration trend (i.e. a positive impact from switching to sewer). The plot was created using historical data from the weekly FDOH Beach Monitoring Program. Data were taken from Dekle Beach, Keaton Beach, and Cedar Island, from 2000 to 2007, and normalized to the Dekle Beach data, which remained on OSTDS for the entire time period under investigation.

For the *Enterococcus* sampling (Figure 39), no obvious departure in slope was observed during the period of time coinciding with the retrofit of OSTDS to sewer network at Cedar Island, although there is the possibility of a sharp increase in slope for the Keaton Beach site during the transition period, but shortly thereafter the previous slope appears to be restored.

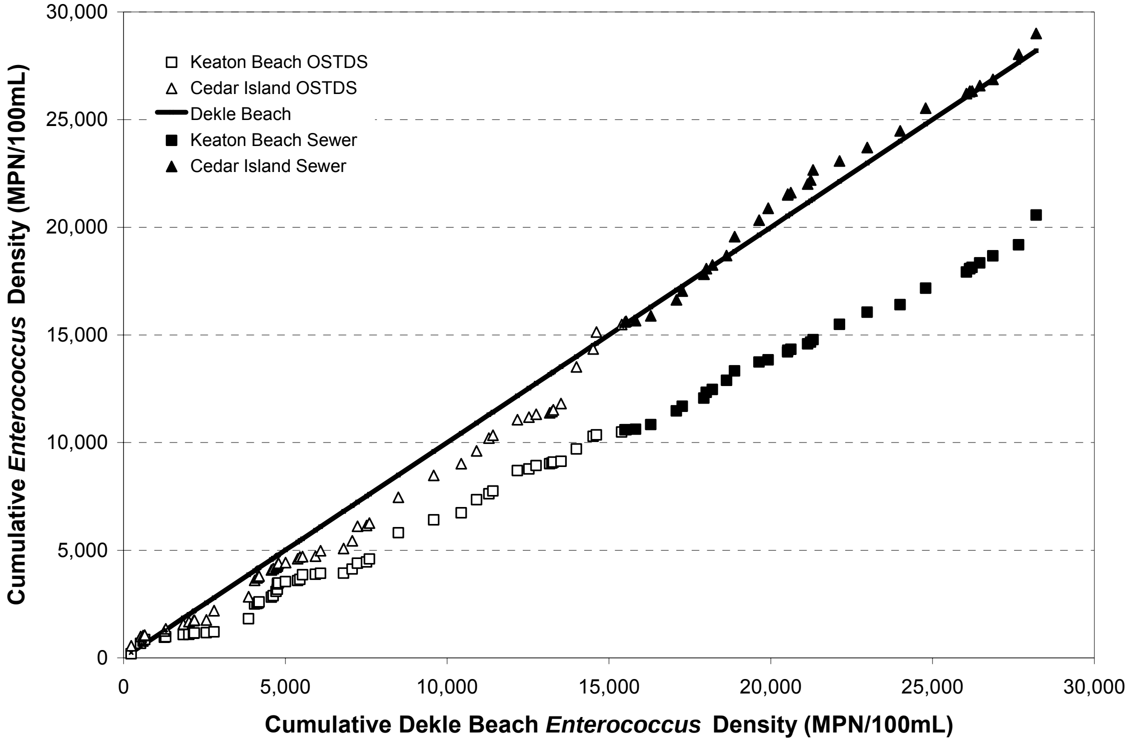

Figure 39 – *Enterococcus* correlation of Keaton Beach and Cedar Island sites with Delke Beach from January 2000 to July 2007.

However, the fecal colifom data (Figure 40) had an abrupt change in slope detected during the summer of 2003. While this may signal a change in sampling or analytical methodology, an unexplained isolated event of fecal coliform input at Keaton Beach may also have occurred from July 14 – 21, 2003, which is prior to sewer conversion. Also between August 2005 and August 2006, the fecal coliform slope at Keaton Beach is relatively flat, but thereafter returns to mirror the Dekle Beach curve after that period. This change in slope would indicate a marked improvement in fecal coliform levels possibly due to conversion to sewer, but the return of the slope to the pre-sewer level after August 2006 cannot be explained.

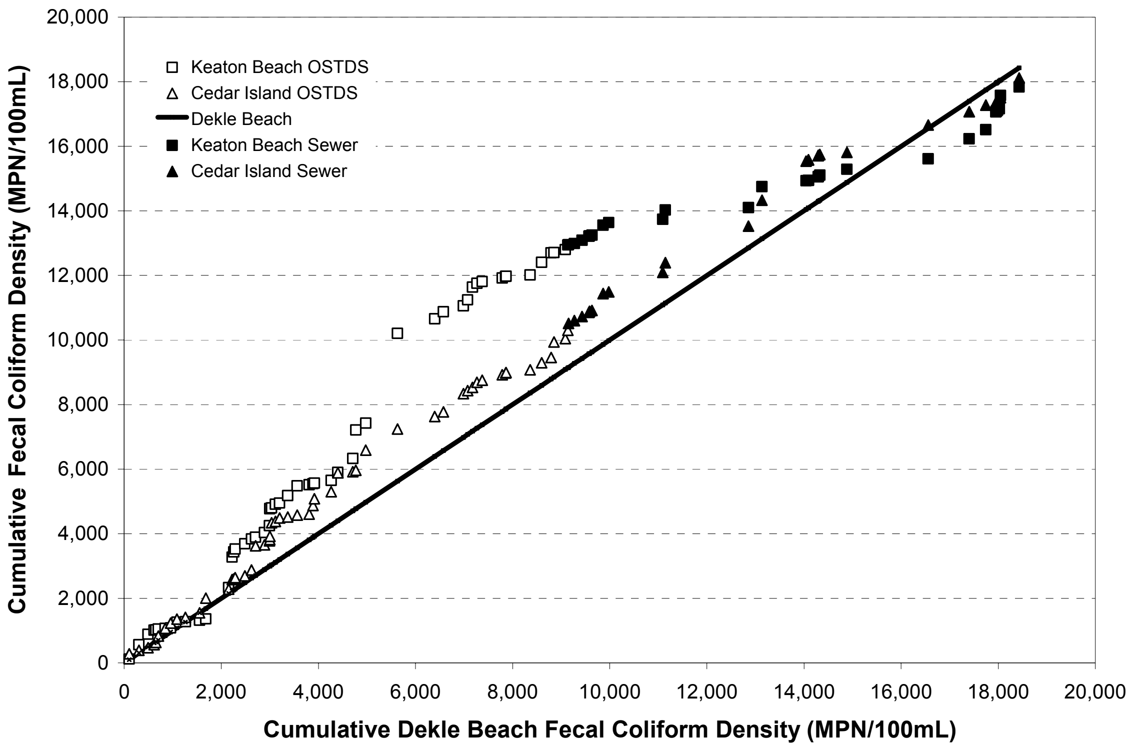

Figure 40 – Fecal coliform correlation of Keaton Beach and Cedar Island sites with Dekle Beach January 2000 to July 2007.

Correlation of Analytes

The strategy in this analytical approach was to compare specific analytes to quantify the strength of their relationship with other parameters. Relationships were tested using scatter plots, in order to confirm correlations by identifying structural patterns in the plots.

Salinity Effects

Although recognized relationships exist between salinity, temperature, and bacteria die-off rate, no observable correlations were seen on the scatter plots when temperature, turbidity, and several other physical parameters were correlated with *Enterococcus*, *E. coli* or the *E. coli/Enterococcus* ratio (Appendix A). However, at first glance, salinity appears to influence some of the bacteriological results. In general, the brackish and marine sites sampled tend to have higher colony counts of *E. coli* and *Enterococcus*.

Therefore, box plots of salinity were constructed using all of the available data from 2006 to 2007 to investigate this influence of salinity regime on the bacteriological parameters (Figure 41). The box plot of *Enterococcus* densities showed that microbial densities were slightly higher on average for the sites with freshwater (<10‰) compared to sites with brackish/salt water (<10‰), but overall differences were minimal. The same plot for *E. coli* densities showed the opposite effect. The *E. coli* counts were higher at the sites with higher salinity, even though salinity is expected to increase the die-off rate of *E. coli*. It is possible that this trend is artificial given the fact that most of the freshwater sites were characterized as background. As such, *E. coli* inputs were expected to be lower at these sites. Also most of the developed area is along the coast, which would likely have higher levels of *E. coli* near the higher sinity regimes of the beaches.

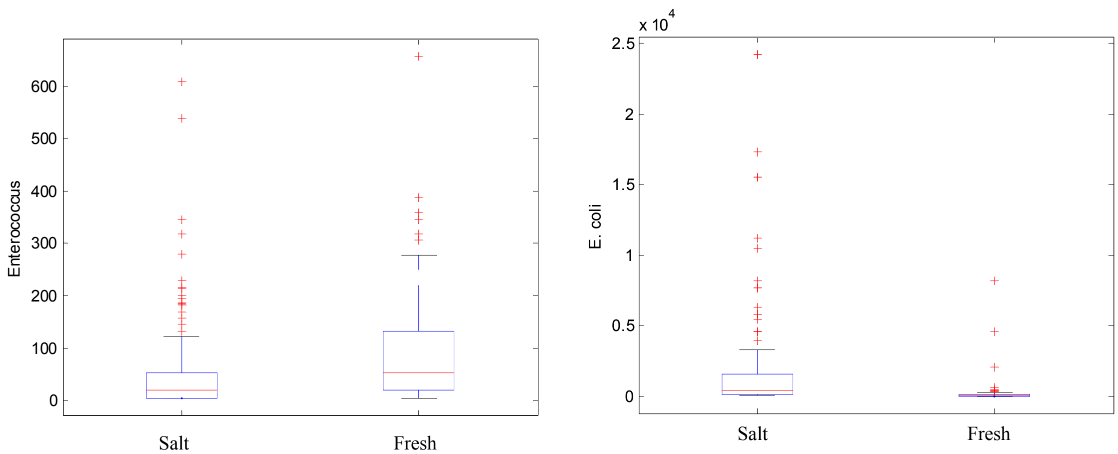

Figure 41 – Box plots of microbial concentration in fresh and salt waters (*Enterococcus* on left and *E. coli* on right).

The box plot of the *E. coli/Enterococcus* ratio shows a larger ratio for brackish/marine environments compared to the freshwater sites. In Figure 42, the *E. coli/Enterococcus* ratio was plotted against salinity using only those data points that met the minimum *Enterococcus* threshold (>100 MPN/100 mL). Freshwater sites (background sites) tend to be closer to zero (<1), suggesting a natural or animal contribution, while the average ratio is higher for samples collected in marine environments. Again, this effect is likely enhanced by the fact that most of the freshwater sites (inland) were classified as background, but an increased die-off of *E. coli* with respect to *Enterococcus* would tend to skew the ratios downward. However, the higher salinity sites (brackish/salt water) showed a higher ratio. Thus, the expected salinity induced die-off is not observed. This could be caused by microbial acclimation to local salinity conditions, or it could be the result of recent or legacy inputs of pathogens and nutrients. Thus, the implication is that either the pollution is of marine origin or, more likely, the majority of the coastal pollution originates from the shore because this is where the more dense human population lives.

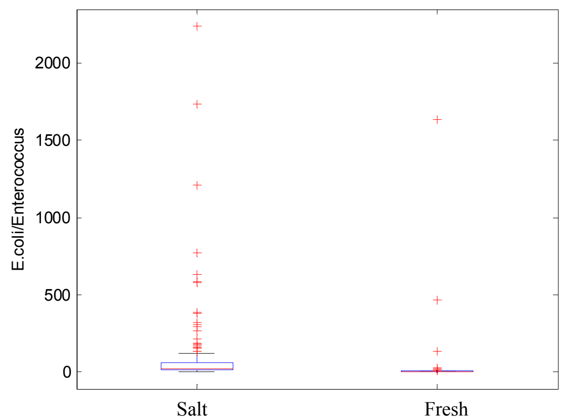

Figure 42 – *E.coli/Enterococcus* ratio in fresh and salt waters.

Using 2006 data, *E. coli* densities do not seem to be correlated with salinity over the broad range tested (0.1 – 37‰) using linear and log scale plots (Figure 43). However, when the freshwater and brackish water outliers are removed, the data no longer appear randomly scattered and the *E. coli* counts decrease in the direction of the higher salinity regime. All the data points except for two fit in the 95% confidence interval for the generally decreasing trend line ($r^2 = 0.435$)

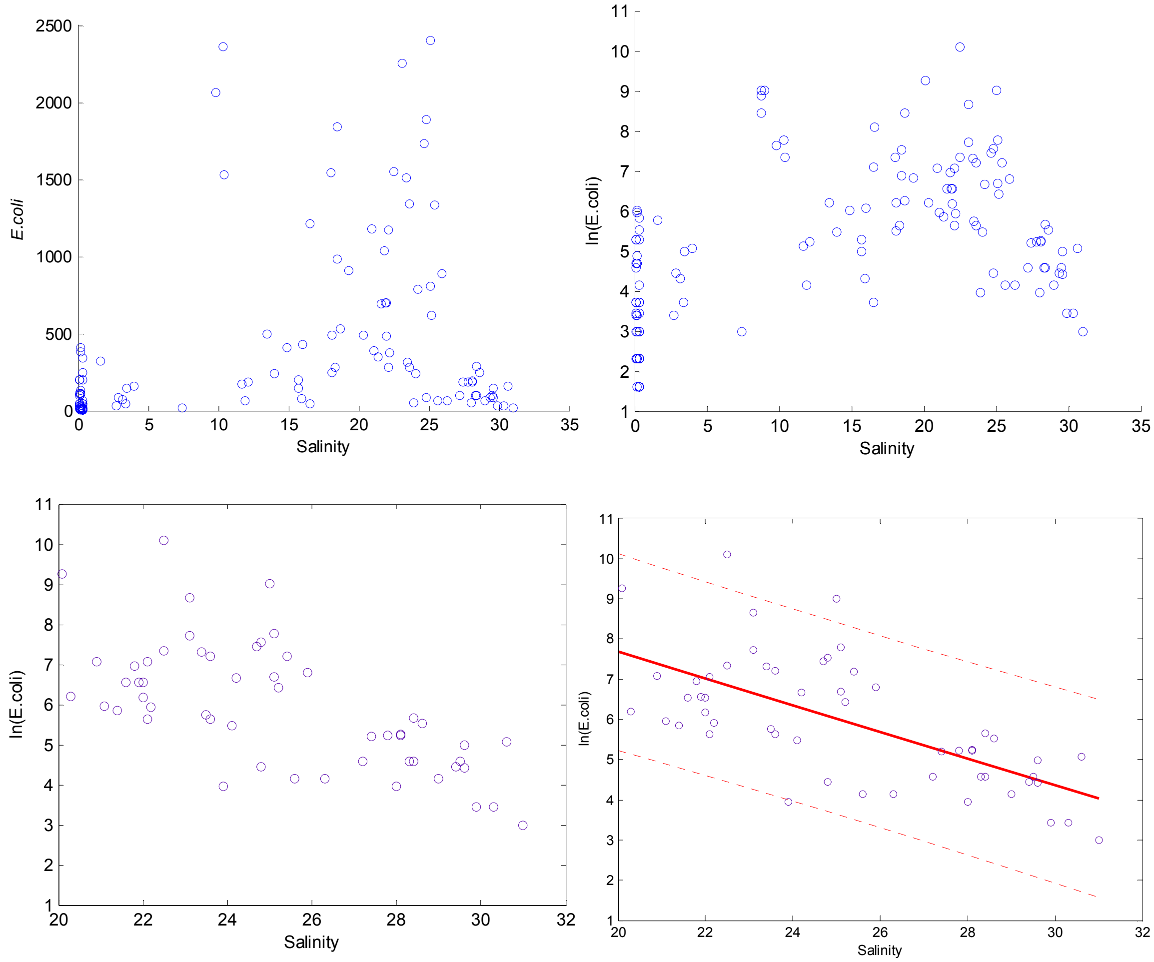

Figure 43 – Plots of *E. coli* with salinity for 2006. Linear scatter plot of *E. coli* density vs. salinity (top left). Log scatter plot of *E. coli* density vs. salinity (to right). Log scatter plot of *E. coli* density vs. salinity for all sites with salinity > 20 ‰ (bottom left). Log scatter plot of *E. coli* density vs. salinity for all sites with salinity > 20 ‰ with a plot of linear regression (r^2 = 0.435) and the 95% confidence interval plotted (bottom right).

A decreasing trend supports the existence of a salinity induced die-off for *E. coli*, only if the slope for a similar plot of *Enterococcus* is different. Therefore, the same analysis is performed for *Enterococcus* in Figure 44. When the log of microbial density is plotted against salinity >10‰, both *E. coli* (m = -0.084) and *Enterococcus* (m = -0.081) have very similar slopes, indicating a similar die-off from brackish to marine environments. Although, if the salinity regime is limited to values greater than 20‰, the slope for *E. coli* increases to m = -0.33 becoming more steep (greater die-off), whereas the corresponding *Enterococcus* slope for this same salinity range does not change as much (m = -0.19).

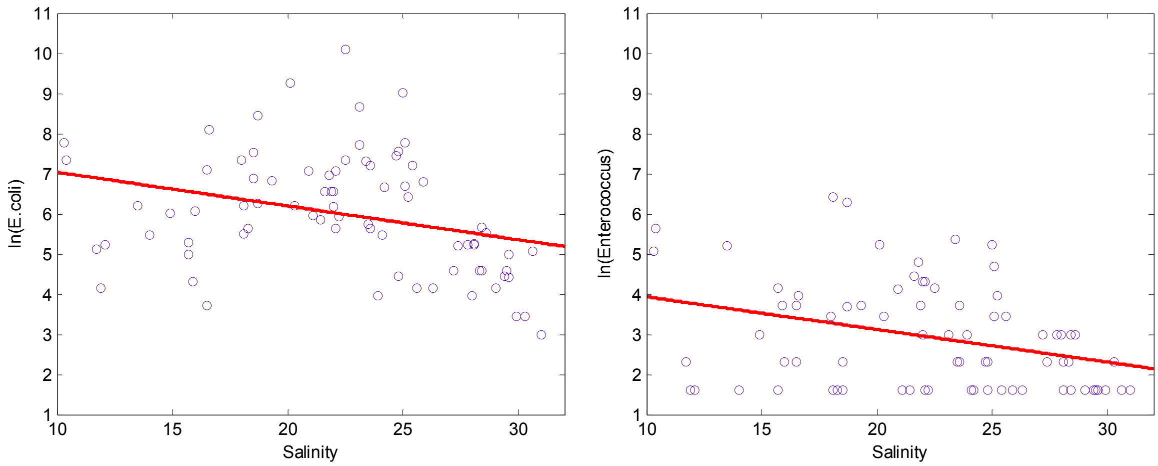

Figure 44 – Plot of *E. coli* (left) and *Enterococcus* (right) with salinity for 2006. Values are plotted as the natural log (*ln*) of microbial density versus salinity >10‰.

Given that *Enterococcus* is generally recommended for marine waters due to a lower salinity die-off compared with the fecal coliform group or *E. coli* (USEPA 1986), the previous analysis initially appears to yield unexpected results. However, one needs to take into account the fact that the majority of the homeowners live closer to the saltwater and therefore, the freshwater appears more pristine in terms of microbial densities. Thus, rather than use either *E. coli* or *Enterococcus* as a tracer, it is suggested that a ratio between *E. coli* and *Enterococcus* be used. In Figure 45, the Ec/Es ratio was also plotted against salinity using only those data points that the met the minimum enterococci threshold (>100 MPN/100 mL). The plot is generally increasing towards higher salinity. Combining the data from 2006 and 2007 does not change the slope of the curve noticeably. Thus, the general trend holds true for both years. The implication here is that either the *E. coli* is of marine origin transported from some upstream source or, more likely, the majority of the homeowners (particularly those with OSTDS) live along the shore, although shallow sediment re-growth without external input cannot be discounted.

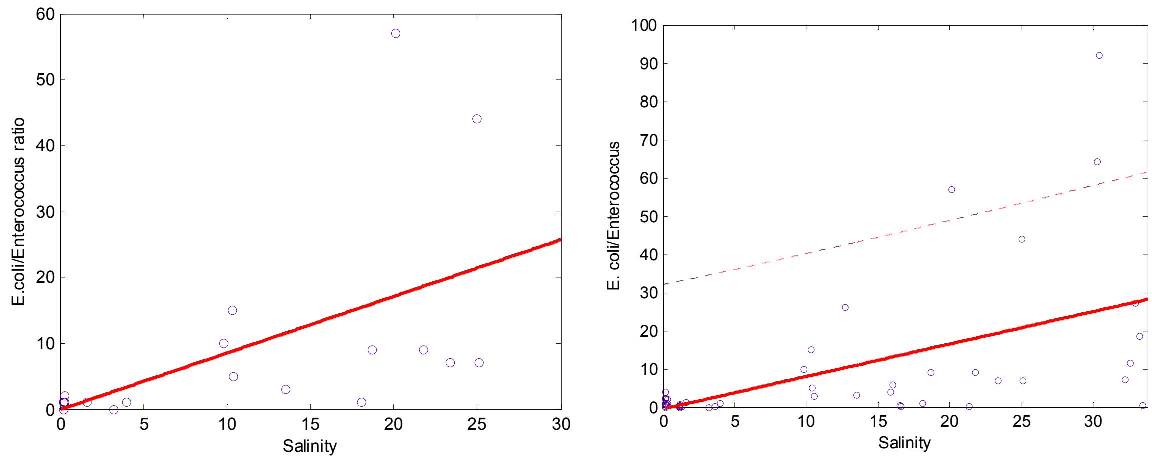

Figure 45 – Plot of the *E. coli/Enterococcus* ratio against salinity for 2006 (left) and all data (right). Note that only the ratios with *Enterococcus* > 100 MPN/100 mL were plotted.

Now when all of the data is combined from 2006 and follow-up testing in 2007, and we repeat the previous analysis with the scatter plots, the previous relationship and the slope disappears (Figure 46).

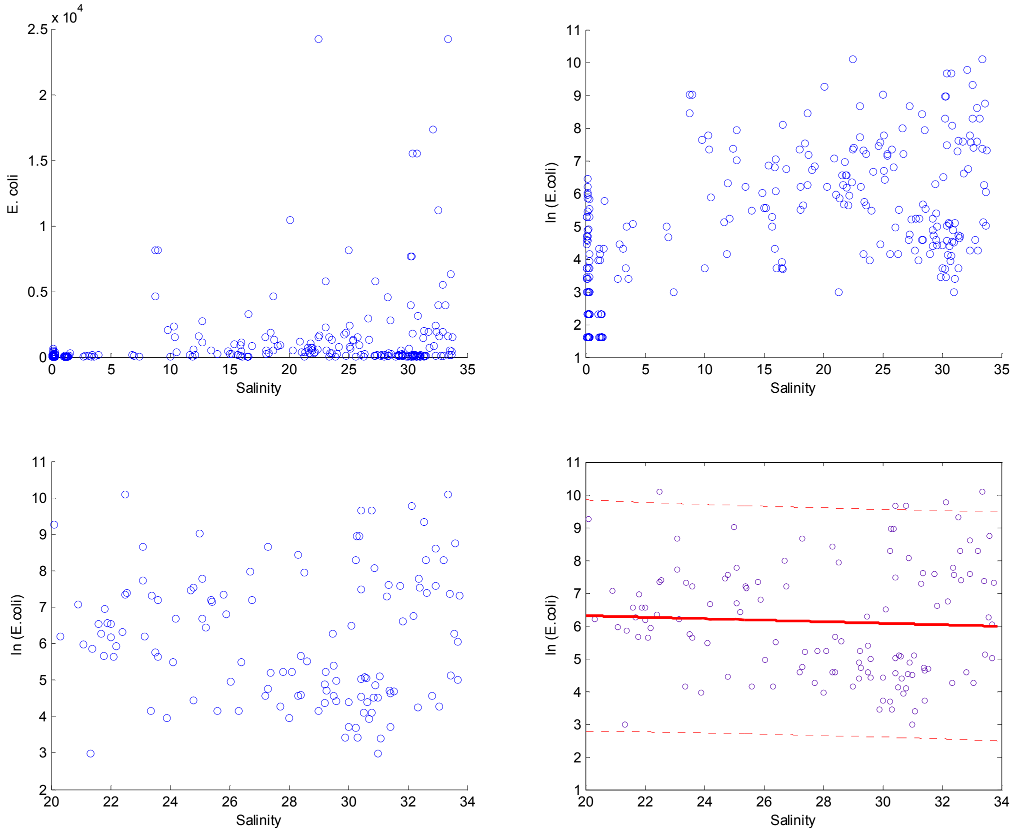

Figure 46 – Plots of *E. coli* with salinity for 2006 and 2007 combined. Linear scatter plot of *E. coli* density vs. salinity (top left). Log scatter plot of *E. coli* density vs. salinity (to right). Log scatter plot of *E. coli* density vs. salinity for all sites with salinity >20‰ (bottom left). Log scatter plot of *E. coli* density vs. salinity for all sites with salinity >20‰ with a plot of linear regression (r^2 = 0.003) and the 95% confidence interval plotted (bottom right).

Furthermore, the slopes of the lines for the *E. coli* and *Enterococcus* plots with salinity are actually different. When the two years worth of sampling is compiled we see that the *E. coli* appear to have acclimated to the salinity conditions, while the enterococci show less environmental resistance, although the correlations are not strong for either data set ($r^2 < 0.1$).

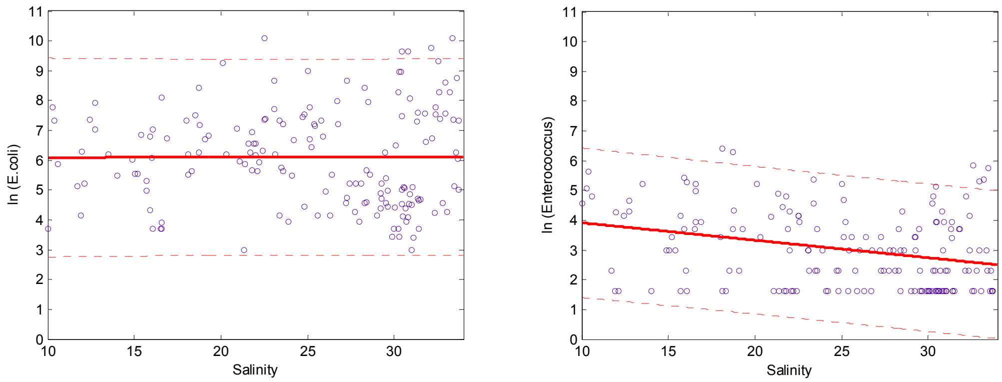

Figure 47 – Plot of *E. coli* (left) and *Enterococcus* (right) with salinity for 2006 and 2007 combined. Values are plotted as the natural log (*ln*) of microbial density versus salinity >10‰.

Nutrients

From the speciation of nitrogen containing parameters (ammonia, nitrate, nitrite, and total nitrogen), it was determined that most of the nitrogen detected was in the form of organic nitrogen. If this nitrogen was mostly incorporated in microbial or algal biomass, it would correlate closely with TOC. Thus, TOC and TN are plotted together in Figure 48. The combined data set from 2006 and 2007 (r^2 = 0.75) correlates more closely than the 2006 data alone (r^2 = 0.40).

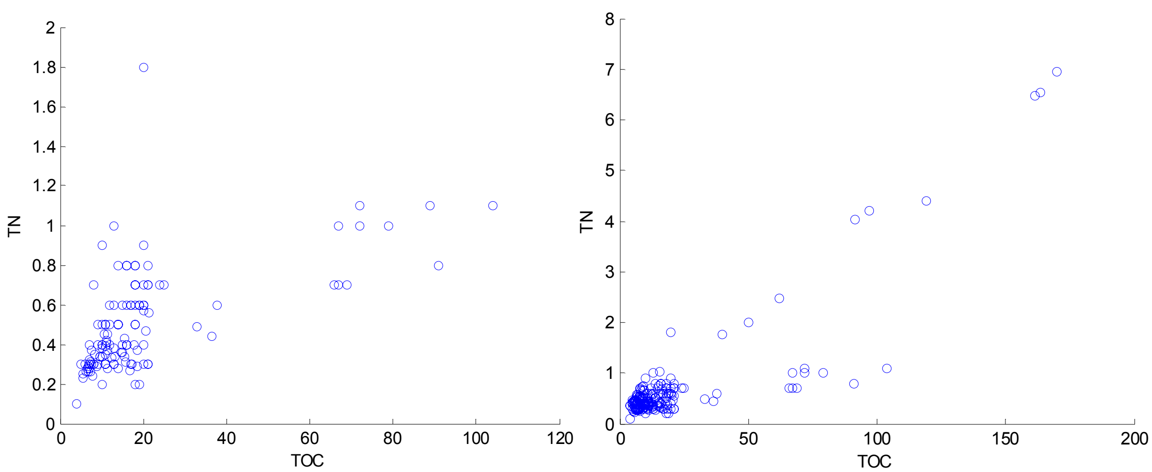

Figure 48 – Plot of Total Nitrogen (TN in units of mg N/L) against Total Organic Carbon (TOC in units of mg C/L). Data for 2006 only is plotted on the left and the combined data from 2006 and 2007 is plotted on the right.

If the TOC/TN is indeed found mostly in the form of biomass, it will also correlate closely with microbial parameters. Thus, both *E. coli* and *Enterococcus* were plotted against TOC in Figure 49. Neither of the microbial indicators correlated well with TOC. What is more likely is that the TOC/TN correlation is more the product of natural organic color than microbial biomass.

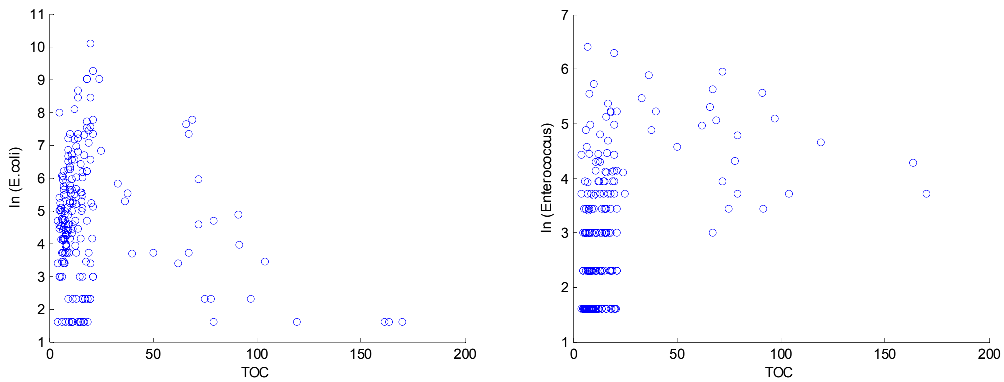

Figure 49 – Plot of *E. coli* (left) and *Enterococcus* (right) with TOC using both 2006 and 2007 data sets. Values are plotted as the natural log (*ln*) of microbial density versus total organic carbon content in mg C/L.

CONCLUSIONS

In general, the measured physical parameters fell within the expected ranges (see Table 37). A summary of the water quality trigger levels with the range of results collected for each parameter is found in Table 37 and Table 38.

Table 37 – Summary of field results for 2006 and 2007 sampling events.

Parameter	Analytical Method/SOP	Trigger Level	Expected Level	Encountered Range
pH	FDEP FT1100	N/A	6.0 – 8.5	7.0 – 8.6
Conductivity	FDEP FT1200	N/A	5 – 55 mS/cm	0.1 – 51 mS/cm
Salinity	FDEP FT1300	N/A	9,000 – 40,000 mg/L	100 – 41,000 mg/L
Temperature	FDEP FT1400	N/A	15 – 25°C	11 – 30°C
Dissolved oxygen	FDEP FT1500	< 4.0 mg/L	< 9.0 mg/L	0.5 – 10.5 mg/L
Turbidity	FDEP FT1600	>29 NTU	< 10 NTU	0.1 – 21.1 NTU
Optical Brighteners	FAU LT9200	N/A	Absent	Absent – Inconclusive

Table 38 – Summary of laboratory results for 2006 and 2007 sampling events.

Parameter	Analytical Method/SOP	Trigger Level	Expected Level	Encountered Range
***E. coli* (& Total coliforms)**	Standard Methods SM9223B FAU LT6100	> 400 CFU/100 mL	BDL – 800 CFU/100 mL	BDL – 24000 CFU/100 mL
Enterococcus	Standard Methods SM9223C FAU LT6200	> 104 CFU/100 mL	BDL – 2,000 CFU/100 mL	BDL – 610 CFU/100 mL
Caffeine	FLEnviro SOP	> 0.10 µg/L	BDL	BDL – 0.32 µg/L
Nitrate	EPA 353.2 (FLEnviro SOP)	None*	< 5.0 mg/L	BDL – 1.0 mg/L
Ammonia-nitrogen	EPA 350.1 (FLEnviro SOP)	9.15 mg/L** @pH 7.9, T = 25°C	< 5.0 mg/L	BDL – 3.2 mg/L
TOC	EPA 415.1 FAU LT5200	None	1 – 200 mg C/L	BDL – 170 mg/L
TN	EPA 415.1 FAU LT5200	None	< 10.0 mg/L	BDL – 7.0 mg/L

*0.07 mg/L as N (nitrate and ammonia) has been suggested as a human-impacted threshold level by NOAA-AOML
**From National Ambient Water Quality Criteria for Saltwater (www.epa.gov/waterscience/criteria/wqcriteria.html), EPA 440/5-88-004

The trigger levels for only three of the parameters were violated in this study. These were dissolved oxygen, *Enterococcus*, and *E. coli*. These were investigated for seasonal effects in Table 39, which lists the percentage of violations by season for sewered and non-sewered sites. As expected, the percentage of violations for dissolved oxygen, *Enterococcus*, and *E. coli* are all higher in the SHWT season. For non-sewered areas, 8% of the *Enterococcus* samples violated the trigger levels in SLWT, but 35% violated in SHWT. Similarly *E. coli* violations increased from SLWT (14%) to the SHWT (19%). Keaton Beach had 2-3 isolated cases of extreme microbial contamination recorded during the May 2006 SLWT, which skewed the average results but did not mask the general trend because this was repeated in May 2007 SLWT. Unexpectedly, *E. coli* violations are nearly four times more frequent at sewered sites compared to those served by OSTDS. Even more alarming is that the number of *E. coli* violations for the sewered sites was much higher in 2007 compared to 2006. Since the sewer system was only just recently installed, water quality conditions monitored may still reflect previous contamination from older OSTDS, but since the frequency of violations increased in 2007, it is more likely that microbial regrowth in warm, shallow, stagnant waters may be causing this signal.

Table 39 – Summary of trigger level violations from sampling events in 2006 and 2007.

	Dissolved oxygen*				Enterococci**				*E. coli***			
	SLWT		SHWT		SLWT		SHWT		SLWT		SHWT	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
OSTDS	10/75	13%	26/51	51%	6/74	8%	18/51	35%	10/74	14%	13/69	19%
Sewer	0/69	0%	25/48	52%	3/69	4%	14/48	29%	24/51	47%	40/48	83%

*Dissolved oxygen: Class III waters, marine > 4.0 mg/L; freshwater > 5.0 mg/L
***Enterococcus*: > 104 MPN/100 mL
****E. coli*: > 400 MPN/100 mL (fecal coliforms)

Results for nutrients such as ammonia and nitrate were all below regulatory trigger levels as seen in Table 38; however, many individual results were considered high for marine environments. Nitrate can be an indicator of a runoff contribution, but in this study, the average nitrate readings were measured at below elevated levels at the paired sites for both seasons. On the other hand, ammonia is a better indicator of more recent nutrient inputs, and in this study, many individual ammonia results were considered high for coastal marine environments. The Fenholloway River set of samples showed elevated nutrient levels that were 1-2 orders of magnitude higher than those measured at the paired sites. Further investigation into the significance of the nitrogen species levels is warranted to determine if a water quality impact is in fact occurring and if the source is related to the industrial discharge from the Fenholloway River.

Compared to the SLWT, water quality (as evidenced by violations in DO and microbial pathogen indicators) decreased during the SHWT as expected. In addition, more pressure was put on the assimilation capacity of the environment during the SHWT because the end of summer coincides with the peak of the scalloping season, when the tourist population at the sampling sites tends to increase and more wastewater is generated. Water temperatures are also higher in September, which increases bacterial growth rates and reduces DO. Although the DO exhibited large decreases during SHWT, microbial activity generally increased simultaneously. This may have accounted for the observed dissolved oxygen depletion and frequency of trigger level violations.

Higher TOC and ammonia in the SLWT indicate that runoff may be considered an important input in the region. The nitrogen isotope analysis from May 2007 supports this supposition for the beach communities. Differences in water quality parameters measured between sewered and non-sewered areas were also observed in terms of microbial pathogen indicators. Elevated levels of total nitrogen (which was indicative of organic-N) and enterococci tend to implicate a greater contribution of nutrients to coastal waters from septic systems, but this combination was not seen consistently. OSTDS are expected to perform better during the SLWT event, with the likelihood of failure increasing in the SHWT event. This field study demonstrates that the magnitude of water quality degradation in the area may have a contribution from OSTDS, but outlines other potentially more important inputs. The analysis indicates that the source of the differences may be due to human-derived inputs. It is suggested that further monitoring of these rural coastal developments continue, so that the results can be compared to other parts of the United States to determine if the methods employed here are universally applicable.

In summary, the results of the five sampling events indicate the following:

- Although the DO exhibited large decreases during September 2006 SHWT, microbial activity generally increased during this period, which could have accounted for the observed consumption of dissolved oxygen, even after temperature effects are taken into account. The opposite occurred during the December 2006 SLWT event (i.e. DO increased dramatically and microbial activity was lower than observed in the other two sampling events of 2006).

- During the September 2006 SHWT event, ammonia levels were substantially lower in comparison to the May 2006 SLWT, but nearly one-quarter of the samples were considered high for coastal marine environments (>0.07 mg/L as N). The December 2006 SLWT event showed very low ammonia levels.
- The lowest ammonia levels were encountered in Steinhatchee during the SHWT, but during the SLWT, Steinhatchee had some of the highest ammonia readings measured. Ammonia is an indicator of recent nutrient inputs. However, no noticeable differences in ammonia trends are observed between sites with sewer and sites with OSTDS.
- On average, nitrate levels were below the concentrations considered high for coastal marine environments for the OSTDS and sewered paired sites for all sampling events in both years.
- *Enterococcus* and *E. coli* correlated with the change from SLWT to SHWT. However, the actual microbial densities appear to be misleading due to several very high *E. coli* results from sewered areas that occurred during both seasons, at Cedar Island Beach, Cortez Road Pump Station and Dekle Beach Canal. The high *E. coli* densities were replicated during both SHWT and SLWT (May) in 2006 at the Cortez Road site (Site E). Further investigation of this phenomenon is suggested to determine if a sewer leak is responsible.
- For both *Enterococcus* and *E. coli*, the microbial densities were generally higher for the SHWT, especially for the OSTDS areas, but this was also largely true of the newer sewered areas as well. Keaton Beach had 2-3 isolated cases of extreme microbial contamination recorded during the 2006 SLWT (possible pump station leak), which skewed the average results but did not mask the general trend. The elevated microbial counts were repeated in May 2007 SLWT, which may indicate a persistent local source, such as sediment reservoirs of pathogen indicators.
- Although sewer sites presented higher *E. coli* concentrations, it is worth reminding that the sewer system was just recently installed and conditions monitored may still reflect previous contamination, particularly at Cedar Island, where the findings

suggest microbial regrowth in warm, shallow, stagnant waters as a possible source rather than an external input.

- Between 5-10% of all *Enterococcus* samples violated the trigger levels in SLWT, but 30-35% violated in SHWT. A similar pattern was observed for *E. coli*.
- High total nitrogen (which was indicative of organic-N) in conjunction with higher *Enterococcus* concentrations would tend to indicate a greater contribution of nutrients to coastal waters from septic systems as opposed to runoff contributions.
- TOC and higher ammonia in the 2006 SLWT (May and December) data may indicate anthropogenic background sources from lawn fertilizers or an industrial source, but this requires further research. The nitrogen isotope analysis seems to implicate fertilizers at the beach communities, but a possible industrial source signal could not be discounted upstream at the background site locations in May 2007.
- The background sites, with the exception of the Creek at Dekle Beach, consistently produced *E. coli/Enterococcus* ratios below approximately 1.0, a possible indication of a contribution from non-human sources of pollution. Conversely, nearly all of the beach sites showed *E. coli/Enterococcus* ratios that were well above 4.0, indicative of human-derived sources of pollution, within the documented limits of this parameter.
- Sewered areas (Keaton Beach and Cedar Island) have not shown improved water quality in comparison to areas that remain on OSTDS. Thus, in sewered areas, the possibility that remnant OSTDS inputs have not been fully flushed from the surficial soils cannot be discounted. This finding is also supported by the absence of a change in slope in the bacteriological densities over time at the sewered sites.
- Caffeine was not shown to be an effective tracer for Taylor County, since very little material was detectable. High dilution and low development intensity are suspected as reasons for this result.
- Similarly, optical brighteners were also ineffective for the same reasons as caffeine. The qualitative method is not refined enough to be as sensitive as required to be considered an effective tracer.

Over the course of the investigation, a great deal of information has been collected and analyzed. The findings indicate that to resolve the different sources of pollution to the coastal Taylor County communities, the following additional work is necessary:

1. Monitor sewered areas with respect to OSTDS areas for a longer time period to see if the system stabilizes to a point in which water quality improvements are observable. Indications from the December 2006 SLWT sampling are that this may be happening, but the conditions were found to degrade again in 2007. To better accomplish this, it is recommended to add more representative background sites, particularly for Dekle Beach, and to go further upstream for Blue Creek.
2. Monitor during the secondary SHWT. Taylor County has four seasonal events (i.e. two SHWT and two SLWT events) with a bimodal distribution over the course of the year. In this study, only the primary SHWT, which occurs in September was monitored (twice), while both the primary (December) and secondary (May) SLWT events were monitored. Some differences were noted between the primary and secondary SLWT events, and it would add to the completeness of the study, to evaluate if differences can be observed between the primary and secondary SHWT.
3. More station density is required at the beach communities to help resolve upstream – downstream influences.
4. Sewer leaks in the newly installed areas must be cataloged to remove this possibility as a confounding factor.
5. Studies of shallow sediments are recommended to determine regrowth patterns of microbial indicators. The results from this study were largely inconclusive because of the relatively small sample size. The potential for regrowth was recorded in May 2007 but the results were not reproducible in sediments collected in September 2007.
6. Monitor the Fenholloway River input with respect to proposed new industrial treatment upgrades and pipelines coming on line (intervention analysis).
7. Investigate the water quality from the coastal estuary downstream of Blue Creek. Keaton Beach and Cedar Island are located on opposite sites of the estuary into which Blue Creek discharges. The estuary consistently contained high *Enterococcus* counts. As a result, further analysis of Blue Creek inputs should be undertaken to determine

the contributions to the estuary caused by anthropogenic activities upstream of the estuary. Hydraulic studies could be utilized to determine how current move nutrients in the estuary to help identify other sources of contamination and limitations caused by stagnant waters due to marine structures.

8. It is recommended that nitrogen isotopic ratios be monitored to separate fertilizer inputs from OSTDS inputs. In May 2007, runoff was implicated at the beach sites, but the upstream background sites showed a possible contribution from an industrial source. More data is needed to make a stronger conclusion.
9. Molecular techniques require much larger sample sizes than first anticipated. It is recommended to attempt additional tests with greater sensitivity to help resolve the human vs. animal input issue.
10. The first several sample sets for molecular techniques conducted in this study focused on enterococci esp., HF8, and most recently added in May 2007, HuBac and DogBac from direct DNA filter extracts. One way to potentially improve sensitivity would be to move the assays from a PCR/electrophoresis detection system (which were used for all samples in this study) to a fluorescent real-time qPCR detection system. The drawback is that reagents for qPCR are more expensive than for regular PCR and gel electrophoresis. It may be possible in the future to add independent qPCR assays based on commercially available primers for another human enterococci marker, a dog enterococci marker, a human *Bacteroides* marker, a cow *Bacteroides* marker, and a dog *Bacteroides* marker. These additional tests may be costly due to the proprietary nature of these newly available markers.
11. Direct DNA filters used in molecular techniques allow for the testing of a wide range of targets from the same filters, but it also limits detection sensitivity, especially if targets are in low abundance in relation to a large background microbial assemblage. Sensitivity can potentially be increased with culture pre-enrichment before extraction (this is basically the approach with the MFC and mEI media filters). Basically, in addtion to direct DNA filters, MFC filters and mEI filters, two more filters could be collected. One from an azide dextrose broth culture incubated overnight to enrich for enterococci (while limiting enzyme inhibition due to media dyes as can happen with

mEI), and the other from a filter that is incubated under anaerobic conditions on BBE plates to enrich for *Bacteroides*.

12. Another recommendation to improve the sensitivity of molecular techniques would be to consider using media enrichment filters in addition to direct DNA extraction filters. For instance, a *Bacteroides* specific media filter could be added, although this would require anaerobic incubation. This can be accomplished inexpensively in the field using small disposable GasPak EZ pouches.
13. Expanding the microbial screening to include other known human pathogens such as *Giardia*, *Cryptosporidium*, and viruses could potentially be added to the investigation, but these tests are progressively more expensive and labor intensive. The *Giardia* and *Cryptosporidium* testing requires filtering on site with a pump filter rig for water volumes ranging from 60 to 100 liters, then the filters are analyzed for IMS/IMF capture and enumeration. Tissue culture *Cryptospordium* viability/infectivity analysis is required after enumeration to determine how many of the oocysts are actually alive. Screening for viruses also involves filtering a large volume of water sample; however, qPCR enumeration of viruses does not take into account infectivity. Enumeration for noroviruses, enteroviruses, human adenovirus, and Hepatitis A can be done simultaneously. However, the expense and labor for these tests is partly why protozoans and viruses are not routinely measured in environmental water quality monitoring programs.

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Appendix A

Analytical Parameters and Sampling Sites

Table A-1- List of Parameters and Analytical Method Information.

Parameter	Method/SOP	Analyzed By	Detection Range	Method Precision
E. coli (& Total coliform)	Standard Methods SM9223B FAU LT6100	Lab-EES	10 – 24,190 MPN/100 mL	2 MPN/100 mL or see published 95% confidence limits
Enterococcus	Standard Methods SM9223C FAU LT6200	Lab-EES	10 – 24,190 MPN/100 mL	2 MPN/100 mL or see published 95% confidence limits
Caffeine	(FLEnviro SOP)	FLEnviro	2.5 – 5000 ng/L	--
Nitrate	EPA 353.2 (FIU SOP)	FLEnviro US-Biosystems NOAA- AOML	0.003 – 10 mg N/L	See page 228 of QAPP
Ammonia-nitrogen	EPA 350.1 (FIU SOP)	FLEnviro US-Biosystems NOAA- AOML	0.01 – 2.0 mg N/L	See page 188 of QAPP
TOC	EPA 415.1 FAU LT5200	Lab-EES	Medium: 20 – 750 mg C/L Low: 1.0 – 25 mg C/L	± 3% or ± 50 ppb/C whichever is greater
TN	EPA 415.1 FAU LT5200	Lab-EES	Medium: 1.0 – 20 mg N/L Low: 0.06 – 1.2 mg N/L	± 3% or ± 25 ppb/N whichever is greater

Table A-2 – Sampling sites information list

Site Cod	Site Name	Category	Latitude	Longitude	Sewer/ Septic tank	Beach Monitoring	Health Dept.	Beach Advisories*
AB	Adam's Beach	Beach	29^o 52 53.0	83^o 38 09.5	Septic tank		X	
A	Dekle Beach	Beach	29^o 50 56.8	83^o 37 20.6	Septic tank	X	X	155
JI	Jugg Island Road	Beach	29^o 50 51.7	83^o 37 05.6	Septic tank			
B	Dekle Beach Canal	Upstream	29^o 50 56.7	83^o 37 07.3	Septic tank	X		
C	Creek at Dekle Beach	Background	29^o 50 55.0	83^o 36 57.6	Septic tank	X		
F	Keaton Beach	Beach	29^o 49 06.7	83^o 35 37.3	Sewer	X	X	133
MR	Marina Road	Beach	29^o 49 14.7	83^o 35 32.1	Sewer			
E	Cortez Road Canal – Upstream	Upstream	29^o 49 31.3	83^o 35 29.7	Sewer			
D	Cortez Road Canal - Pump station	Upstream	29^o 49 45.4	83^o 35 29.3	Sewer			
G	Blue Creek @ Beach Road	Background	29^o 49 28.9	83^o 34 34.9	Sewer	X		
I	Cedar Island Beach	Beach	29^o 48 57.2	83^o 35 14.4	Sewer	X	X	147
SL	Seahawk Lane	Beach	29^o 48 59.7	83^o 35 10.3	Sewer			
H	Heron Road Canal	Upstream	29^o 48 42.7	83^o 34 50.4	Sewer	X		
J	Main Street & Steinhatchee (Roy's)	Downstream	29^o 40 23.2	83^o 23 42.2	Septic tank			
K	Third Ave. Fork	Upstream	29^o 40 09.0	83^o 22 00.3	Septic tank			
L	Boggy Creek @ 51	Upstream	29^o 44 00.8	83^o 21 32.9	Septic tank			
M	Boggy Creek @ Airstrip Drive	Upstream	29^o 43 29.9	83^o 20 47.5	Septic tank			
N	Steinhatchee Falls	Background	29^o 44 47.6	83^o 20 33.5	Septic tank			
FR	Fenholloway River	River Source	30^o 03 56.6	83^o 33 28.6	Sewer			
HS	Hampton Springs	Upstream	30^o 04 16.7	83^o 39 44.3	Sewer			
PL	Petersons Landing	Downstream	29^o 59 45.8	83^o 46 34.9	Septic Tank			

* Number of Beach Advisories posted from August 1, 2000 to July 9, 2007.

Table A-3 – Results of comparison field measurements on September 28, 2006.

Site Name	Time	FAU Lab-EES					FDOH					Comparison				
		Water Temp.	pH	SC	Salinity	DO	Water Temp.	pH	SC	Salinity	DO	Water Temp.	pH	SC	Salinity	DO
		00010 °C	00400	00094 mS/cm	00480 ppt	00299 mg/L O_2	00010 °C	00400	00094 mS/cm	00480 ppt	00299 mg/L O_2	00010 °C	00400	00094 mS/cm	00480 ppt	00299 mg/L O_2
Dekle Beach	6:11	23.09	8.3	38.7	24.7	4.5	23.05	8.1	41.5	25.7	4.1	0.2%	2.7%	-6.9%	-4.0%	10.4%
Dekle Beach Canal	6:25	25.41	8.2	39.3	25.0	4.3	25.50	8.3	45.3	25.7	4.2	-0.4%	-1.3%	-14.3%	-2.7%	1.6%
Creek at Dekle Beach	6:37	23.84	8.5	36.9	23.1	4.7	23.69	8.3	39.0	24.8	4.6	0.6%	2.0%	-5.3%	-7.2%	1.9%
Keaton Beach	7:00	24.79	8.4	41.0	25.9	5.6	24.72	8.5	42.6	27.3	5.4	0.3%	-1.1%	-3.8%	-5.2%	3.9%
Cortez Road Canal - Upstream	7:25	26.06	8.2	34.9	21.9	4.8	26.21	8.4	36.7	23.2	5.1	-0.6%	-3.3%	-4.9%	-5.4%	-5.7%
Cortez Road Canal - Pump station	7:40	25.27	7.8	17.6	10.4	1.9	25.24	8.0	18.2	10.8	1.7	0.1%	-3.0%	-3.5%	-3.8%	15.4%
Blue Creek @ Beach Road	7:57	23.00	7.6	0.3	0.1	5.0	22.94	7.7	0.3	0.1	4.4	0.3%	-1.4%	-3.8%	-8.0%	13.0%
Cedar Island Beach	8:17	25.00	8.2	36.5	23.1	5.3	24.92	8.3	37.8	24.0	4.7	0.3%	-1.3%	-3.6%	-3.7%	12.1%
Heron Road Canal	8:35	25.04	8.0	30.0	18.5	4.3	25.02	8.2	31.0	19.2	4.3	0.1%	-2.9%	-3.3%	-3.7%	0.6%
Main Street & Steinhatchee (Roy's)	9:00	24.61	7.9	23.1	14.0	5.4	24.63	8.0	24.1	14.6	5.7	-0.1%	-1.6%	-4.0%	-4.2%	-5.1%
Third Ave. Fork	9:13	24.36	7.4	6.2	3.4	1.6	24.30	7.8	6.3	3.5	1.5	0.2%	-4.4%	-2.5%	-2.8%	5.8%
Boggy Creek @ 51	9:50	21.00	7.6	0.4	0.2	2.4	20.96	7.3	0.4	0.2	2.7	0.2%	3.8%	-2.8%	-4.9%	-13.0%
Boggy Creek @ Airstrip Drive	9:40	21.91	7.4	0.5	0.3	2.8	21.91	7.7	0.6	0.3	2.7	0.0%	-2.7%	-3.2%	-3.8%	3.0%
Steinhatchee Falls	10:08	21.77	7.3	0.5	0.2	1.4	21.78	7.4	0.5	0.2	1.5	-0.1%	-1.6%	-3.5%	-4.3%	-9.2%
										Correlation		1.00	0.88	1.00	1.00	0.98

49.54	1.58	32.39	100.80	44.30	3.01	0.08 5.60	0.01 0.51	0.01 0.62	0.00 0.11	0.31 11.20	0.00 0.00 J3	7.2	45	21	10	1892		10:55	1:09	49	46	10	19863		6	0	10	63		11:00	1:09	30.0
48.18	0.71	31.37	101.40	56.80	3.94	0.07 5.20	0.02 1.22	0.02 1.40	0.00 0.18	0.28 9.80	2.48 0.08 J3	5.0	44	26	10	1993		11:02	1:12	49	47	10	24196		4	1	10	52		11:02	1:12	38.3
49.81	0.30	32.64	97.70	71.10	5.01	0.01 0.52	0.00 0.24	0.00 0.27	0.00 0.03	0.00 0.00	0.00 0.00 J3	6.5	42	24	10	1602		11:10	1:15	49	37	10	9208		0	0	10	<10		11:09	1:15	320.4
46.87	2.24	30.28	100.55	65.05	4.48	0.04 2.90	0.01 0.53	0.01 0.65	0.00 0.12	0.42 15.10	0.31 0.01 J3	5.3	49	34	10	7701		11:52	1:18	49	42	10	12997		9	2	10	120		11:49	1:18	64.2
a	na	na	na	na	na	na	na	na	na	na	na J3		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
43.94	3.32	28.30	103.60	48.40	3.31	0.04 3.00	0.01 0.56	0.01 0.70	0.00 0.14	0.58 20.80	5.58 0.18 J3		48	31	10	4569		11:08	1:22	49	39	10	10462		2	2	10	41		11:06	1:22	111.4
20.81	3.88	12.43	111.20	13.30	0.99	0.09 6.70	0.00 0.31	0.01 0.48	0.00 0.17	2.87 102.10	0.00 0.00 J3		45	15	10	1576		11:05	1:25	49	37	10	9208		6	0	10	63		11:03	1:25	25.0
0.31	2.61	0.15	109.60	68.80	5.84	0.09 6.20	0.06 4.34	0.06 4.50	0.00 0.16	2.62 93.40	25.40 0.82 J3		24	2	10	345		11:13	1:30	49	26	10	4884		12	1	10	146		11:12	1:30	2.4
46.70	1.35	30.37	102.40	56.75	3.96	0.01 0.38	0.00 0.22	0.00 0.31	0.00 0.09	0.17 5.90	34.07 1.10 J3		49	34	10	7701		11:23	1:33	49	48	10	>24196		1	0	10	10		11:21	1:33	770.1
44.25	2.55	28.52	100.90	67.50	4.75	0.04 3.20	0.01 0.48	0.01 0.59	0.00 0.11	0.55 19.50	1.86 0.06 J3		47	25	10	2809		11:54	1:40	49	43	10	14136		6	1	10	74		11:53	1:40	38.0
39.86	3.40	25.41	107.90	55.20	3.87	0.01 0.96 -101%	0.01 0.49 28%	0.01 0.56 24%	0.00 0.07 0%	0.55 19.70 -1%	4.34 0.14 J3		43	13	10	1281		11:17	1:43	49	35	10	8164		2	0	10	20		11:15	1:43	64.1
39.91	4.00	25.43	103.20	55.70	3.93	0.04 2.90	0.01 0.37	0.01 0.44	0.00 0.07	0.56 19.90	1.86 0.06 J3		42	19	10	1408	-9%	11:20	1:46	49	36	10	8664		0	0	10	<10	67%	11:18	1:46	281.6
37.05	0.63	23.15	-190.10	80.50	5.55	0.04 3.10	0.02 1.35	0.02 1.60	0.00 0.25	1.14 40.50	12.39 0.40 J3		28	6	10	488		11:27	1:49	49	35	10	8164		0	1	10	10		11:25	1:49	48.8
11.95	0.61	6.82	nr	87.90	6.84	0.05 3.60	0.06 4.55	0.07 4.80	0.00 0.25	1.87 66.70	17.04 0.55 J3		13	0	10	148		11:28	1:52	49	39	10	10462		6	0	10	63		11:30	1:52	2.3
0.62	1.20	0.30	nr	103.90	8.88	0.03 2.30 -12%	0.04 2.79 -4%	0.04 2.90 -3%	0.00 0.11 0%	2.63 93.50 5%	1.24 0.04 J3		0	0	10	<10		11:37	2:00	49	17	10	2909		5	1	10	63		11:35	2:00	0.1
a	na	na	na	na	na	0.04 2.60	0.04 2.89	0.04 3.00	0.00 0.11	2.50 89.10	6.50 0.21 J3		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
0.44	0.82	0.21	nr	108.90	9.47	0.02 1.70	0.04 2.77 O	0.04 3.00 O	0.00 0.23	3.48 124.00 O	1.86 0.06 O, J3		7	2	10	96		11:34	2:04	49	31	10	6488		33	8	10	657		11:32	2:04	0.1
0.56	1.15	0.27	nr	106.40	9.17	0.04 3.10	0.02 1.58	0.02 1.70	0.00 0.12	2.40 85.40	6.81 0.22 J3		1	1	10	20		11:40	2:08	49	15	10	2755		4	0	10	41		11:37	2:08	0.5
2.65	3.72	1.36	nr	73.60	5.54	3.21 229.40	O	O	0.48 34.60	5.47 194.90	1554.88 50.20 J3		1	0	10	10		11:58	2:12	49	48	10	>24196		21	4	10	318		11:55	2:12	0.0
2.37	2.33	1.21	nr	85.40	6.78	2.57 183.20	0.08 5.55	0.19 13.85	0.12 8.30	5.31 189.00	1369.04 44.20 J3		5	1	10	63		12:01	2:23	49	43	10	14136		17	6	10	278		11:59	2:23	0.2
26.30	1.80	16.04	nr	87.00	6.40	0.41 29.40	0.24 17.10	0.37 26.10	0.13 9.00	2.56 91.20	607.09 19.60 J3		43	9	10	1145		12:05	2:27	49	48	10	>24196		13	4	10	195		12:03	2:27	5.9
26.30	1.80	16.04	nr	87.00	6.40								45	12	10	1439	-23%	12:07	2:30	49	48	10	>24196		14	5	10	221	-13%	12:06	2:30	6.5
49.69	1.66	32.55		100.10	7.02	0.00 0.07 J3	0.04 3.15	0.04 3.20	0.00 0.05	0.51 18.10	0.62 0.02	9.3	49	40	10	11199		2:43	4:33	49	48	10	>24197		0	0	10	<10		2:40	4:42	2239.8
51.07	1.12	33.58	96.40	59.40	4.21	0.01 0.46 J3	0.05 3.87	0.05 3.90	0.00 0.03	0.27 9.60	0.93 0.03	10.5	27	10	10	528		11:57	12:49	49	40	10	11199		0	0	10	<10		11:57	12:53	105.6
51.30	1.94	33.74	96.30	38.00	2.65	0.02 1.70 J3	0.00 0.20	0.00 0.25	0.00 0.05	0.33 11.60	4.34 0.14	5.7	43	19	10	1510	Q	1:11	1:12	49	38	10	9804	Q	0	0	10	<10	Q	1:10	1:50	302.0
50.66	1.46	33.20	99.20	29.50	2.00	0.07 5.10 J3	0.01 0.40	0.01 0.52	0.00 0.12	0.57 20.40	0.62 0.02	10.5	48	28	10	3968	Q	12:50	12:52	49	35	10	8164	Q	16	2	10	213	Q	12:47	12:53	18.6
49.47	1.81	32.37	97.00	68.00	4.66	0.06 4.50 J3	0.01 1.00	0.02 1.10	0.00 0.10	0.42 14.80	0.93 0.03	4.9	44	32	10	2367	Q	1:33	1:33	48	41	10	7215	Q	2	0	10	20	Q	1:32	1:34	118.4
50.22	0.90	32.94	95.30	58.50	4.20	0.01 0.53 J3	0.00 0.12	0.00 0.16	0.00 0.04	0.08 2.80	0.31 0.01	6.9	45	22	10	1951		1:07	4:27	49	38	10	9804		2	0	10	20		1:05	4:40	97.6
48.44	1.10	31.75	98.80	61.70	4.27	0.03 2.20 J3, 37%	0.01 0.78 20%	0.01 0.87 16%	0.00 0.09 -11%	0.34 12.00 14%	0.62 0.02 0%	4.2	45	22	10	1951		2:45	4:33	49	42	10	12997		4	0	10	41	Q	2:45	4:46	47.6
a	na	na	na	na	na	0.04 3.20 J3	0.01 0.64	0.01 0.74	0.00 0.10	0.29 10.40	0.62 0.02		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
46.60	1.33	30.24	100.60	53.90	3.68	0.04 3.20 J3	0.01 0.71	0.01 0.82	0.00 0.11	1.89 67.20	1.86 0.06		48	28	10	3968	Q	2:01	4:33	49	41	10	12033	Q	8	1	10	97	Q	2:00	4:30	40.9
21.27	3.14	12.73	109.80	23.20	1.74	0.08 5.50 J3	0.00 0.35	0.01 0.55	0.00 0.20	2.99 106.60	0.00 0.00		49	16	10	2755		1:48	4:33	49	44	10	15531		6	4	10	106		1:46	4:30	26.0
0.31	3.04	0.15	106.70	69.60	5.91	0.09 6.70 J3	0.08 5.45	0.08 5.50	0.00 0.05	2.67 95.20	22.92 0.74		29	5	10	496		1:12	4:27	49	24	10	4352		17	4	10	253		1:10	4:40	2.0
47.96	1.92	31.30	100.00	59.70	4.31	0.02 1.30 J3	0.01 0.48	0.01 0.58	0.00 0.10	0.29 10.40	or or or		41	23	10	1459		1:21	4:33	49	34	10	7701		3	1	10	40		2:20	4:40	36.5
45.36	2.67	29.47	100.50	69.70	4.95	0.06 4.20 J3	0.01 0.52	0.01 0.59	0.00 0.07	0.49 17.50	2.17 0.07		39	8	10	530		2:52	4:43	49	24	10	4352		4	0	10	41		2:50	4:46	12.9
41.57	3.22	26.76	100.70	57.27	4.04	0.02 1.60 J3	0.01 0.51	0.01 0.58	0.00 0.07	0.53 19.00	5.27 0.17		44	12	10	1334		2:18	4:27	49	34	10	7701		2	0	10	20		2:17	4:40	66.7
34.75	1.16	21.77	nr	90.50	6.54	0.02 1.60 J3	0.13 9.25	0.13 9.40	0.00 0.15	1.07 38.10	8.98 0.29		15	9	10	284		12:48	1:00	49	28	10	5475		0	0	10	<10		12:48	12:57	56.8
18.53	1.14	10.58	nr	85.90	6.49	0.05 3.30 J3	0.06 4.38	0.06 4.60	0.00 0.22	1.97 70.20	15.80 0.51		23	4	10	355	Q	1:45	1:45	49	47	10	24196	Q	10	1	10	121	Q	1:45	4:30	2.9
0.62	1.98	0.30	nr	104.60	8.96	0.03 2.00 J3	0.04 2.88 -7%	0.04 3.00 -6%	0.00 0.12 18%	2.50 88.9 -6%	7.43 0.24 -29%		2	0	10	20	Q	1:52	4:33	47	14	10	1850	Q	5	0	10	52	Q	1:50	4:30	0.4
0.62	1.92	0.30	nr	104.30	8.95	0.03 2.00 J3	0.04 3.10	0.04 3.20	0.00 0.10	2.64 94.1	9.91 0.32		0	1	10	10	67%	1:57	4:33	47	10	10	16070	-159%	5	0	10	52	Q	1:55	4:30	0.2
0.45	1.80	0.22	nr	107.90	9.35	0.02 1.60 J3	0.05 3.33	0.05 3.60	0.00 0.27	2.09 74.30	0.93 0.03		14	6	10	233	Q	2:30	4:33	49	32	10	6867	Q	21	6	10	345	Q	2:25	4:42	0.7
0.46		0.22	nr	110.30	9.63								49	22	10	3873		17:20	17:21	11	0	10	122		5	2	10	63		5:21	5:21	61.5
0.56	1.80	0.27	nr	106.50	9.18	0.04 3.00 J3	0.03 1.81	0.03 1.90	0.00 0.09	2.33 82.80	0.31 0.01		4	0	10	41	Q	2:35	4:33	46	7	10	1333	Q	1	0	10	10	Q	2:33	4:42	4.1
2.63	3.92	1.35	nr	75.50	5.74	2.85 203.50 J3	0.52 37.40	1.12 80.00	0.60 42.60	6.29 223.80	1338.07 43.20		0	0	10	<10	Q	3:01	4:43	49	48	10	>24196	Q	18	4	10	269	Q	3:00	4:46	0.0
2.38	3.64	1.22	nr	88.10	7.08	2.52 179.70 J3	0.20 14.60	0.34 24.60	0.14 10.00	5.30 188.80	1406.21 45.40		5	0	10	52		3:03	4:43	49	41	10	12033		11	4	10	168		3:02	4:47	0.3
26.15	1.78	15.90	nr	89.60	6.66	0.44 31.40 J3	0.25 17.70	0.36 25.40	0.11 7.70	2.54 90.40	591.60 19.10		42	30	10	905		3:11	4:43	49	47	10	>24196		13	7	10	230		3:10	4:47	3.9
a	na	na	na	na	na	na	na	na	na	na	na		43	9	10	1145	-23%	3:15	4:43	49	48	10	10112	82%	11	2	10	145	45%	3:13	4:47	7.9
49.76	2.48	32.60	100.50	85.55	6.08	O	O	O	O	O	O	9.1	48	28	10	3968		1:55	2:15	49	48	10	10112		21	6	10	345		1:53	2:31	11.5
a	na	na	na	na	na	na	na	na	na	na	na		48	24	10	3282	19%	1:58	2:15	49	48	10	10112	0%	20	5	10	315	9%	1:57	2:31	10.4
51.10	1.31	33.60	98.00	53.80	3.84	0.01 0.54	0.00 0.15	0.00 0.15	0.00 0.00	0.10 3.40	0.62 0.02 J3	8.2	48	38	10	6294		12:30	2:11	49	41	10	12033		1	0	10	10		12:26	2:08	629.4
50.88	1.30	33.44	99.70	31.40	2.26	0.03 1.90	0.01 0.37	0.01 0.37	0.00 0.00	0.53 18.90	5.89 0.19 J3	6.0	12	3	10	169		11:49	2:00	49	27	10	5172		21	4	10	318		1:30	2:28	0.5
50.26	1.78	32.95	98.20	36.80	2.56	0.14 9.80	0.02 1.24	0.02 1.30	0.00 0.06	0.58 20.80	1.55 0.05 J3		49	28	10	5475		12:39	2:02	49	36	10	8664		16	1	10	201		12:38	2:08	27.2
46.79	1.22	30.43	96.05	49.70	3.53	0.11 8.00	0.03 1.86	0.03 1.90	0.00 0.04	0.51 18.30	4.65 0.15 J3		49	44	10	15531		12:44	2:02	49	48	10	>24196		12	3	10	169		12:42	2:08	91.9
50.86	0.70	33.41	96.00	51.10	3.64	0.02 1.40	0.00 0.17	0.00 0.17	0.00 0.00	0.12 4.20	0.00 0.00 J3	6.2	46	12	10	1565		1:09	2:11	49	31	10	6488		1	0	10	10		1:07	2:26	156.5
47.42	1.47	30.89	97.70	71.10	5.04	0.05 3.50	0.01 0.67	0.01 0.67	0.00 0.00	0.26 9.30	2.17 0.07 J3	4.9	47	28	10	3169		1:43	2:15	49	46	10	19863		4	2	10	52		1:41	2:28	60.9
48.71	1.78	31.84	97.30	59.13	4.12	0.11 7.60	0.01 0.77	0.02 1.10	0.00 0.33	0.71 25.30	4.34 0.14 J3		38	21	10	737		1:02	2:02	49	43	10	14136		4	0	10	41		1:00	2:26	18.0
21.30	1.52	12.76	107.45	31.35	2.39	0.07 5.00	0.01 0.62	0.01 0.68	0.00 0.06	2.92 103.80	0.00 0.00 J3		44	6	10	1119		12:49	2:02	49	33	10	7270		6	1	10	74		12:47	2:08	15.1
0.31	3.26	0.15	104.40	73.00	6.21	0.10 7.00 3%	0.09 6.40 6%	0.09 6.40 6%	0.00 0.00	2.36 84.00 4%	n/a n/a		22	1	10	638		1:16	2:21	49	26	10	4884		10	5	10	166		1:13	2:24	3.8
0.31	3.19	0.15	107.90	74.80	6.39	0.10 6.80	0.08 6.00	0.08 6.00	0.00 0.00	2.26 80.60	13.63 0.44 J3		17	2	10	216	99%	1:23	2:21	47	26	10	2924	50%	9	3	10	131	24%	1:19	2:26	1.6
46.80	1.72	30.44	100.40	71.45	5.13	0.04 2.50	0.01 0.83	0.01 0.83	0.00 0.00	0.40 14.20	26.33 0.85 J3		46	16	10	1782		1:32	2:21	49	40	10	11199		5	0	10	52		1:30	2:28	34.3
48.63	3.67	32.19	96.70	77.00	5.42	0.11 7.80	0.01 0.75	0.01 0.75	0.00 0.00	0.98 34.80	0.00 0.00 J3		33	18	10	852		1:50	2:15	49	29	10	5794		9	2	10	120		1:48	2:31	7.1
35.74	2.45	22.55	104.80	56.50	4.17	0.04 3.00	0.01 0.59	0.01 0.59	0.00 0.00	0.96 34.10	1.55 0.05 J3		44	19	10	1631		1:29	2:21	49	37	10	9208		3	2	10	51		1:25	2:28	32.0
42.44	1.65	27.29	nr	86.30	5.94	0.06 4.50	0.02 1.70	0.02 1.70	0.00 0.00	1.13 40.20	19.51 0.63 J3		49	29	10	5794	Q	1:37	2:21	49	33	10	7270	Q	1	0	10	10		11:48	2:34	579.4
12.22	1.13	6.99	nr	94.40	7.51	0.08 5.90	0.08 5.49	0.08 5.50	0.00 0.01	1.53 54.50	20.13 0.65 J3		7	3	10	107		11:54	2:00	49	40	10	11199		8	0	10	86		11:51	2:34	1.2
0.62	1.90	0.30	nr	106.20	9.15	0.04 3.10	0.06 4.20	0.06 4.20	0.00 0.00	2.39 85.10	7.12 0.23 J3		1	0	10	10		11:58	2:00	48	11	10	1860		2	1	10	30		11:55	2:34	0.3
0.46	1.68	0.23	nr	109.60	9.54	0.05 3.40 0%	0.09 6.20 -14%	0.09 6.20 -14%	0.00 0.00	1.92 68.40 ####	9.29 0.30 J3, 79%		12	0	10	135		12:02	2:00	49	29	10	5794		14	6	10	233		12:00	2:34	0.6
a	na	na	na	na	na	0.05 3.40	0.10 7.10	0.10 7.10	0.00 0.00	2.03 72.20	4.03 0.13 J3		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
0.56	1.70	0.27	nr	107.30	9.28	0.06 4.10	0.03 2.23	0.04 2.50	0.00 0.27	2.11 75.10	8.36 0.27 J3		1	0	10	10		12:10	2:11	46	11	10	1515		4	1	10	52		12:04	2:34	0.2
2.59	3.60	1.33	nr	78.80	6.08	2.63 187.70	0.53 38.00	1.15 82.20	0.62 44.20	5.66 201.60	###### 41.00 J3		0	0	10	<10		12:12	2:11	48	48	10	10112		17	2	10	228		12:09	2:34	0.0
2.31	2.58	1.18	nr	89.90	7.27	2.10 150.00 3%	0.27 19.30 5%	0.45 31.80 5%	0.18 12.50 7%	4.98 177.30 3%	###### 38.90 ####		7	0	10	75		12:17	2:11	48	39	10	6586		8	3	10	119		12:15	2:08	0.6
a	na	na	na	na	na	2.03 145.00	0.26 18.40	0.42 30.10	0.16 11.70	4.83 172.00	###### 39.20		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
20.09	2.19	11.96	nr	95.00	7.36	0.67 48.00 17%	0.38 26.90 1%	0.50 35.70 0%	0.12 8.80 -3%	3.18 113.20 2%	768.15 24.80 5%		29	8	10	545		12:15	2:11	49	45	10	17329		3	4	10	72		12:20	2:08	7.6
a	na	na	na	na	na	0.56 40.30	0.37 26.70	0.50 35.80	0.13 9.10	3.12 111.00	730.98 23.60		na	na	na	na		na	na	na	na	na	na		na	na	na	na		na	na	na
58.44	0.08	39.09	95.85	93.50	6.75	0.00 0.30	0.00 0.21	0.00 0.21	0.00 0.00	0.00 0.00	0.93 0.03		0	0	10	<10		2:02	2:15	47	20	10	2310		0	0	10	<10		2:01	2:31	1.0

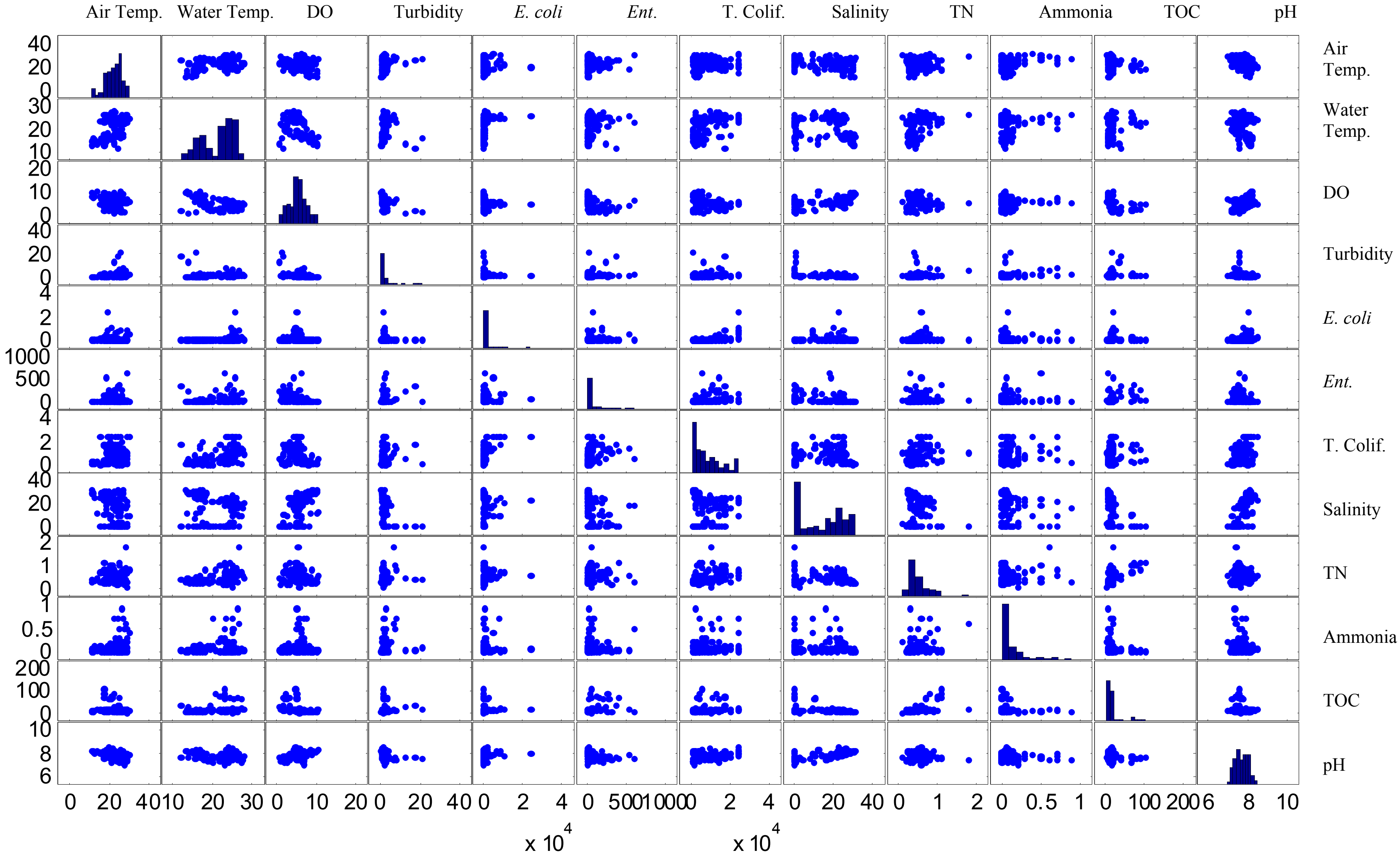
9	2.81	29.27	17.00	87.40	6.32	0.04 2.60	0.01 0.94 J3	0.02 1.10 J3	0.00 0.16 J3	0.71 25.40	0.01 0.36 J3	6.75	0.58 J3i	1	10	10	111	3:05	3:17	49	36	10	8664	2	0	10	20	3:05	3:17	5.6	
8	3.38	26.41	18.20	84.30	6.13	0.00 0.00 U	0.00 0.00 U	0.00 0.00 U	0.00 0.17 ?	0.62 22.10	0.00 0.14 J3	8.03	0.68 J3i	1	23	10	245	2:23	2:55	49	35	10	8164	3	0	10	31	2:21	2:55	7.9	
6	1.15	15.04	17.40	79.50	6.05	0.00 0.00 U	0.01 0.36 J3	0.01 0.48 J3	0.00 0.12 J3	0.63 22.50	0.01 0.18 J3	15.40	1.02 J3i	1	24	10	256	2:11	2:55	49	48	10	>24196 L	1	1	10	20	2:09	2:55	12.8	
8	2.29	0.13	28.90	94.90	8.37	0.08 5.70	0.02 1.11 J3	0.02 1.30 J3	0.00 0.19 J3	0.54 19.10	0.04 1.20 J3	4.94	0.46 J3i	7	1	10	85	2:35	2:55	49	19	10	3255	1	0	10	10	2:34	2:55	8.5	
a	na	na	na	na	na	na na	na na	na na	na na	na na	na na	na	na	0	0	10	<10 U	2:37	3:17	49	20	10	1355	2	2	10	41	2:32	2:55	0.1	K
2	2.25	30.78	18.50	82.00	5.77	0.00 0.00 U	0.00 0.20 J3	0.00 0.34 J3	0.00 0.14 J3	0.22 7.90	0.04 1.20 J3	6.61	0.52 J3i	0	6	10	60	2:51	3:17	49	35	10	8164	0	0	10	<10 U	2:49	3:17	12.0	
5	2.26	30.80	14.80	81.70	5.74	0.00 0.00 U	0.00 0.06 J3	0.00 0.16 J3	0.00 0.10 J3	0.24 8.70	0.01 0.26 J3	6.56	0.57 J3i	1	10	10	111		3:17	49	39	10	10462	0	0	10	<10 U	2:54	3:17	22.2	
2	1.97	31.06	17.00	83.40	5.89	0.00 0.00 U	0.00 0.29 J3	0.01 0.40 J3	0.00 0.11 J3	0.39 14.00	0.02 0.50 J3	5.76	0.43	2	14	10	164	3:25	3:48	49	37	10	9208	0	0	10	<10 U	3:25	3:48	32.8	
1	3.10	26.05	18.10	84.00	6.12	0.05 3.30	0.00 0.24 J3	0.01 0.39 J3	0.00 0.15 J3	0.76 26.90	0.01 0.34 J3	5.81	0.47	2	12	10	143	2:44	3:17	49	44	10	15531	2	0	10	20	2:41	2:55	7.2	
3	3.25	29.21	8.30	80.15	5.65	0.03 2.10	0.01 0.88 J3	0.02 1.10 J3	0.00 0.22 J3	0.51 18.30	0.01 0.22 J3	9.00	0.65 J3i	0	8	10	80	3:01	3:17	49	35	10	8164	0	0	10	<10 U	2:59	3:17	16.0	
8	1.03	16.56	17.60	81.10	6.16	0.04 2.90	0.05 3.69 J3	0.06 4.00 J3	0.00 0.31 J3	1.17 41.50	0.01 0.38 J3	8.17	0.67	1	4	10	50	3:10	3:17	49	46	10	19863	12	1	10	146	3:10	3:17	0.3	
5	1.40	0.30	24.50	92.70	8.10	0.00 0.00	0.01 0.90 J3	0.01 1.00 J3	0.00 0.10 J3	2.38 84.60	0.01 0.40 J3	9.37	0.36	1	0	10	10	3:17	3:48	46	8	10	1376	0	0	10	<10 U	3:18	3:48	2.0	
1	7.31	0.25	3.50	97.00	8.63	0.09 6.40	0.01 0.73 J3	0.01 0.94 J3	0.00 0.21 J3	0.17 6.10	0.01 0.36 J3	14.50	0.71	0	0	10	<10 U	3:13	3:48	0	0	10	<10 O	5	0	10	52	3:14	3:48	0.1	O
6	3.14	0.27	21.90	95.80	8.49	0.04 3.10	0.01 0.65 J3	0.01 0.74 J3	0.00 0.09 J3	2.62 93.40	0.01 0.38 J3	9.78	0.39	0	0	10	<10 U	3:20	3:48	39	4	10	789	0	0	10	<10 U	3:21	3:48	1.0	K
4	4.86	1.36	16.50	64.40	4.93	2.49 177.80	0.35 25.30 J3	0.50 35.40 J3	0.14 10.10 J3	5.27 187.70	1.44 46.40 J3	169.78	6.95	0	0	10	<10 U	3:29	3:48	47	48	10	6910	2	2	10	41	3:27	3:48	0.1	K
5	2.76	1.10	7.20	76.10	6.19	1.60 114.60	0.36 25.70 J3	0.42 29.90 J3	0.06 4.20 J3	4.67 166.20	1.19 38.40 J3	97.20 J3i	4.21	1	0	10	10	3:35	3:48	49	46	10	19863	9	6	10	164	3:33	3:48	0.1	
2	2.75	3.61	6.60	70.60	5.51	0.55 39.20	1.00 71.30 J3	1.09 77.90 J3	0.09 6.60 J3	3.36 119.80	0.82 26.60 J3	62.21 J3i	2.48	0	3	10	30	3:39	3:48	49	48	10	10112	10	3	10	144	3:37	3:48	0.2	
3	ns	30.19	10.40	94.80	7.02	0.06 4.10 J3	0.01 0.82 J3	0.01 1.00 J3	0.00 0.18 J3	0.35 12.40 J3	0.00 0.11 J3	8.20 J3i	0.52	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns O	ns	ns	ns	ns O	ns	ns	ns	O
9	1.23	31.09	14.30	90.70	6.58	0.00 0.07 J3	0.00 0.07 J3	0.00 0.13 J3	0.00 0.06 J3	0.08 2.80 J3	0.00 0.04 J3	7.46 J3i	0.47	0	3	10	30	3:00	3:38	49	46	10	19863	1	0	10	10	2:58	3:36	3.0	
1	1.88	30.24	16.80	93.60	6.90	0.01 0.54 J3	0.00 0.00 U	0.00 0.15 J3	0.00 0.21 ?	0.30 10.70 J3	0.01 0.22 J3	7.27 J3i	0.49	1	3	10	40	3:26	3:38	49	47	10	24196	0	0	10	<10 U	3:23	3:36	8.0	
4	1.97	30.71	16.30	91.20	6.67	0.04 2.50 J3	0.01 0.44 J3	0.01 0.55 J3	0.00 0.11 J3	0.40 14.30 J3	0.00 0.01 J3	7.77 J3i	0.56	2	3	10	51		3:38	49	38	10	9804	1	0	10	10	3:29	3:36	5.1	
3	2.58	30.81	16.10	92.10	6.73	0.06 4.00 J3	0.00 0.19 J3	0.01 0.38 J3	0.00 0.19 J3	0.30 10.60 J3	0.00 0.06 J3	7.82 J3i	0.57	2	3	10	51	3:09	3:38	49	41	10	12033	2	0	10	20	3:05	3:36	2.6	
4	2.26	30.02	14.90	84.50	6.03	0.03 2.10 J3	0.01 0.48 J3	0.01 0.54 J3	0.00 0.06 J3	0.41 14.50 J3	0.00 0.02 J3	7.90	0.55	3	5	10	82	3:37	3:49	49	46	10	19863	0	0	10	<10 U	3:34	3:36	16.4	
6	1.25	30.85	13.90	84.90	6.04	0.01 0.53 J3	0.00 0.15 J3	0.00 0.16 J3	0.00 0.01 J3	0.14 5.10 J3	0.00 0.01 J3	5.62	0.34	3	6	10	92	3:40	3:49	49	34	10	7701	2	0	10	20	3:39	3:49	4.6	
2	2.30	27.29	16.70	84.30	6.11	0.05 3.60 J3	0.01 0.95 J3	0.02 1.20 J3	0.00 0.25 J3	0.99 35.20 J3	0.01 0.19 J3	6.37	0.46	6	5	10	116	4:06	4:16	49	18	10	3076	3	0	10	31	4:07	4:42	3.7	
2	3.36	27.73	12.40	82.00	5.87	0.00 0.04 J3	0.00 0.09 J3	0.00 0.14 J3	0.00 0.05 J3	0.78 27.70 J3	0.01 0.36 J3	7.76	0.54	1	6	10	71	3:47	3:49	49	38	10	9804	1	0	10	10	3:44	3:49	7.1	
8	1.32	15.20	10.60	7.73	5.83	0.00 0.29 J3	0.00 0.13 J3	0.00 0.18 J3	0.00 0.05 J3	0.54 19.10 J3	0.00 0.01 J3	14.99	0.74	1	24	10	256	4:11	4:18	49	46	10	19863	3	0	10	31	4:10	4:40	8.3	
9	2.47	0.14	15.30	90.50	7.86	0.09 6.40 J3	0.10 6.93 J3	0.10 7.00 J3	0.00 0.07 J3	1.95 69.40 J3	or, L	6.23	0.44	0	0	10	<10 U	3:57	4:15	49	12	10	2247	1	1	10	20	3:56	4:44	0.3	K
7	2.01	31.41	12.20	80.20	5.58	0.00 0.13 J3	0.00 0.33 J3	0.00 0.33 J3	0.00 0.00 U	0.27 9.50 J3	0.03 1.00 J3	6.01	0.37	4	0	10	41	4:44	4:54	49	32	10	6867	0	0	10	<10 U	4:41	5:03	8.2	
0	2.12	30.42	14.50	81.20	5.71	0.01 0.88 J3	0.00 0.32 J3	0.01 0.47 J3	0.00 0.15 J3	0.35 12.60 J3	0.03 0.87 J3	4.78	0.39	5	4	10	94	4:59	5:02	49	30	10	6131	0	0	10	<10 U	4:55	5:08	18.8	
4	3.44	26.69	13.80	80.10	5.74	0.04 2.70 J3	0.01 0.44 J3	0.01 0.47 J3	0.00 0.03 J3	0.63 22.60 J3	0.01 0.24 J3	4.74	0.40	49	17	10	2909	4:15	4:20	49	35	10	8164	0	0	10	<10 U	4:14	4:40	581.8	
7	1.48	30.52	14.30	78.90	5.49	0.04 2.60 J3	0.01 0.60 J3	0.01 0.63 J3	0.00 0.03 J3	0.52 18.40 J3	or, L	5.74 J3i	0.39 J3i	3	3	10	61	3:53	4:10	49	38	10	9804	4	1	10	52	nr	4:44	1.2	
9	1.48	21.34	15.60	80.90	5.98	0.04 2.70 J3	0.06 4.49 J3	0.06 4.60 J3	0.00 0.11 J3	1.07 38.10 J3	0.02 0.57 J3	6.21 J3i	0.37 J3i	2	0	10	20	4:50	5:01	49	31	10	6488	10	2	10	132	4:48	5:03	0.2	
3	2.15	0.30	17.60	90.30	7.82	0.01 0.40 J3	0.01 0.66 J3	0.01 0.66 J3	0.00 0.00 U	2.17 77.30 J3	0.00 0.07 J3	11.22 J3i	0.36	0	1	10	10	4:28	4:31	49	27	10	5172	0	0	10	<10 U	4:20	4:39	2.0	
a	na	na	na	na	na	na na	na na	na na	na na	na na	na na	na	na	0	1	10	10	4:29	4:32	49	31	10	6488	2	1	10	30	4:23	4:39	0.3	
1	8.16	0.25	9.80	93.00	8.15	0.07 5.10 J3	0.02 1.60 J3	0.02 1.70 J3	0.00 0.10 J3	0.42 15.10 J3	0.00 0.15 J3	16.41 J3i	0.69	0	0	10	<10 U	4:39	4:54	49	43	10	14136	8	0	10	86	4:38	4:38	0.1	K
6	3.48	0.27	18.80	94.30	8.30	0.08 5.50 J3	0.00 0.29 J3	0.00 0.29 J3	0.00 0.00 U	2.26 80.30 J3	0.00 0.05 J3	7.92	0.32	0	0	10	<10 U	4:35	4:37	29	1	10	432	0	0	10	<10 U	4:33	4:38	1.0	K
8	5.45	1.37	15.00	66.00	5.10	2.29 163.70 J3	0.29 21.00 J3	0.40 28.30 J3	0.10 7.30 J3	5.30 188.80 J3	1.42 45.90 J3	163.48	6.53	0	0	10	<10 U	5:08	5:09	49	48	10	>24196 L	4	3	10	72	5:06	5:08	0.1	K
8	3.06	1.11	17.00	78.80	6.48	1.59 113.80 J3	0.32 22.90 J3	0.37 26.60 J3	0.05 3.70 J3	4.44 158.20 J3	1.13 36.50 J3	91.41 J3i	4.03	4	1	10	52 Q	2:55	3:38	48	40	10	6893 Q	3	0	10	31 Q	2:52	3:36	1.7	Q
2	2.32	10.05	17.30	88.20	7.17	0.39 27.80 J3	0.30 21.60 J3	0.37 26.40 J3	0.07 4.80 J3	1.81 64.60 J3	0.33 10.80 J3	50.12 J3i	2.00	2	2	10	41	2:49	3:38	48	47	10	9606	8	1	10	97	2:48	3:36	0.4	
0	3.57	30.64	-4.70	105.90	7.37	ns O	ns O	ns O	ns O	ns O	ns O	8.64 J3i	0.50 J3i	1	8	10	81	3:33	3:24	49	38	10	9804	0	0	10	<10 U	3:32	3:21	16.2	
9	1.45	33.05	4.30	97.50	6.84	0.00 0.11	0.00 0.31	0.00 0.35	0.00 0.04	0.14 5.00	0.00 0.06 J3	8.44 J3i	0.45 J3i	2	5	10	71	3:37	3:23	49	38	10	9804	0	0	10	<10 U	3:33	3:21	14.2	
0	1.80	32.82	5.60	99.60	7.05	0.01 0.67	0.00 0.00 U	0.02 1.50	0.04 2.60 ?	0.21 7.60	0.44 14.30 J3	8.44	0.49	1	8	10	97	3:40	3:54	49	45	10	17329	0	1	10	10	3:38	3:54	9.7	
9	1.82	32.33	6.40	103.00	7.39	0.00 0.00	0.01 0.81	0.01 0.90	0.00 0.09	0.32 11.50	0.00 0.06 J3	8.63	0.51	0	7	10	70	3:42	3:54	49	37	10	9208	1	0	10	10	3:41	3:54	7.0	
6	2.29	31.39	4.60	91.00	6.31	0.04 2.87	0.01 1.01	0.02 1.10	0.00 0.09	0.48 17.10	0.00 0.06 J3	7.50	0.53	2	9	10	112	3:46	3:54	49	43	10	14136	2	1	10	30	3:44	3:54	3.7	
8	1.56	33.70	5.90	94.40	6.53	0.00 0.19	0.01 0.94	0.01 0.95	0.00 0.01	0.21 7.50	0.00 0.02 J3	4.75	0.39	7	7	10	150	3:50	3:54	48	28	10	4160	0	0	10	<10 U	3:48	3:54	30.0	
1	2.14	29.25	7.20	91.00	6.38	0.00 0.31	0.00 0.33	0.01 0.44	0.00 0.11	0.81 28.80	0.00 0.11 J3	5.22	0.43	9	8	10	187	3:58	4:03	49	38	10	9804	3	0	10	31	3:57	4:03	6.0	
5	4.81	30.00	6.80	90.20	6.28	0.00 0.00 U	0.00 0.17	0.00 0.25	0.00 0.08	0.70 24.90	0.01 0.40 J3	6.62	0.53	2	2	10	41	3:55	3:54	49	35	10	8164	0	0	10	<10 U	3:51	3:54	8.2	
9	1.40	16.06	4.20	86.80	6.47	0.00 0.09	0.01 0.59	0.01 0.65	0.00 0.06	0.48 17.20	0.00 0.04 J3	9.76	0.65	1	3	10	41	4:01	4:03	49	48	10	>24196 L	0	0	10	<10 U	4:00	4:03	8.2	
0	2.25	0.14	9.00	100.70	8.64	0.09 6.10	0.08 5.85	0.08 6.00	0.00 0.15	2.03 72.20	0.02 0.62 J3	3.93	0.35	0	0	10	<10 U	4:04	4:03	49	30	10	6131	6	2	10	84	4:02	4:03	0.1	K
0	2.15	0.14	10.80	100.70	8.64	0.08 6.00	0.08 5.67	0.08 5.80	0.00 0.13	1.96 69.70	or, L	4.74	0.39	0	0	10	<10 U	4:06	4:03	49	31	10	6488	9	6	10	164	4:05	4:03	0.0	K
8	1.41	33.69	4.20	89.30	6.06	0.00 0.00 U	0.00 0.24	0.00 0.24	0.00 0.00 U	0.20 7.20	0.02 0.75 J3	6.44 J3i	0.37 J3i	1	40	10	425	4:09	4:18	49	48	10	>24196 L	0	0	10	<10 U	4:08	4:11	85.0	
8	1.88	31.42	3.70	92.50	6.44	0.02 1.40	0.01 0.47	0.01 0.65	0.00 0.18	0.49 17.60	or, L	6.74 J3i	0.43 J3i	4	6	10	104	4:33	4:29	49	43	10	14136	0	0	10	<10 U	4:32	4:28	20.8	
7	4.20	29.51	5.40	92.10	6.48	0.02 1.30	0.02 1.36	0.02 1.40	0.00 0.04	0.52 18.50	0.01 0.17 J3	4.91	0.42	8	12	10	218	4:28	4:29	49	43	10	14136	1	0	10	10	4:26	4:25	21.8	
7	1.55	31.54	6.70	87.90	6.02	0.03 1.90	0.01 0.89	0.01 0.95	0.00 0.06	0.50 17.70	0.01 0.29 J3	4.15	0.35	9	1	10	109	4:25	4:22	49	22	10	3873	0	0	10	<10 U	4:23	4:25	21.8	
7	0.81	23.36	5.00	93.10	6.81	0.04 3.20	0.05 3.22	0.05 3.40	0.00 0.18	0.99 35.10	0.06 1.80 J3	6.50	0.39	5	1	10	63	4:12	4:18	49	45	10	17329	8	1	10	97	4:11	4:11	0.6	
6	1.65	0.32	10.40	101.30	8.70	0.01 0.58	0.02 1.60	0.02 1.60	0.00 0.00 U	2.40 85.50	0.00 0.10 J3	10.69 J3i	0.32 J3i	0	0	10	<10 U	4:20	4:22	46	9	10	1421	0	0	10	<10 U	4:18	4:25	1.0	K
4	9.68	0.35	-16.80	105.00	9.14	0.07 5.20	0.02 1.39	0.02 1.50	0.00 0.11	0.44 15.60	0.00 0.12 J3	12.42	0.58	3	2	10	51	4:16	4:18	49	44	10	15531	4	1	10	52	4:13	4:11	1.0	
a	na	na	na	na	na	0.07 5.20	0.02 1.39	0.02 1.50	0.00 0.11	0.44 15.70	0.00 0.06 J3	na	na	3	0	10	31	4:17	4:18	49	46	10	19863	3	0	10	31	4:14	4:25	1.0	
9	3.03	0.28	10.70	107.80	9.47	0.08 5.60	0.01 0.47	0.01 0.47	0.00 0.00 U	2.39 85.10	0.00 0.02 J3	11.16	0.40	0	0	10	<10 U	4:22	4:22	35	5	10	663	1	1	10	20	4:21	4:25	0.3	K
3	5.60	1.46	6.90	76.00	5.87	2.63 188.20	0.23 16.40	0.29 20.60	0.06 4.20	5.25 186.90	1.32 42.70 J3	161.48	6.48	0	0	10	<10 U	4:39	4:29	49	48	10	>24196 L	ns	ns	ns	ns O	ns	ns	ns	O
1	3.21	1.18	-0.90	91.30	7.52	2.98 213.10	0.30 21.10	0.34 24.00	0.04 2.90	4.54 161.60	1.18 38.10 J3	119.16	4.41	0	0	10	<10 U	10:16	10:45	49	45	10	17329	6	4	10	106	10:17	10:45	0.0	K
9	2.61	16.57	6.80	100.70	7.85	0.30 21.20	0.42 30.00	0.46 32.60	0.04 2.60	2.02 72.10	0.12 3.80 J3	39.86	1.76	1	3	10	40	10:14	10:45	49	45	10	17329	15	1	10	187	10:13	10:45	0.2	
7	0.24	40.02	6.40	111.10	7.81	0.00 0.00 U	0.00 0.32	0.01 0.42	0.00 0.10	0.01 0.24	0.00 0.05 J3	0.40	0.07	0	0	10	10	nr	4:29	1	0	10	10	0	0	10	<10 U, J4	4:31	4:29	2.0	

13.0	11.9	10.3	0.2	0.029	0.004	0.005	0.001	1.109	0.005	20.6		0.47			6	0	10	63	1:10	3:36	47	30	10	3436	0	0	10	<10	1:12	3:36	13
0.2	0.1	8.0	2.1	0.125	0.050	0.052	0.001	1.298	0.021	12.5		0.33			9	1	10	109	1:28	3:41	31	5	10	546	0	0	10	<10	1:30	3:42	22
29.7	29.6	10.0	0.4	0.018	0.011	0.012	0.001	1.140	0.002	6.5		0.28			6	2	10	84	1:34	3:45	38	40	10	1768	0	0	10	<10	1:36	3:44	17
24.7	24.1	7.2	0.9	0.064	0.005	0.006	0.001	1.202	0.009	6.9		0.26			17	3	10	241	1:37	3:42	49	27	10	5172	0	0	10	<10	1:39	3:44	48
28.2	28.0	9.7	0.4	0.035	0.015	0.015	0.001	1.163	0.006	7.7		0.24			5	0	10	52	1:46	3:46	46	11	10	1515	2	0	10	20	1:47	3:47	3
16.8	15.9	5.7	1.0	0.064	0.129	0.132	0.002	1.264	0.028	10.8		0.35			7	0	10	75	1:52	3:47	49	43	10	14136	4	0	10	41	1:54	3:48	2
8.4	7.4	6.0	1.0	0.088	0.047	0.050	0.004	1.264	0.020	14.6		0.36			2	0	10	20	1:56	3:53	49	34	10	7701	4	0	10	41	1:57	3:53	0
0.4	0.3	1.6	17.8	0.028	0.008	0.009	0.001	1.781	0.012	36.5		0.44			14	3	10	197	2:04	3:49	49	45	10	17329	24	3	10	359	2:05	3:51	1
0.4	0.3	1.6	17.8	ns	ns	ns	ns	ns	ns	ns		ns			13	1	10	160	2:10	3:56	49	44	10	15531	28	0	10	395	2:12	3:56	0
0.4	0.3	3.3	2.4	0.053	0.018	0.020	0.001	1.870	0.013	15.0	h	0.36			6	0	10	63	2:16	3:59	47	16	10	1989	1	0	10	10	2:17	4:00	6
0.3	0.3	2.2	2.4	0.129	?	0.015	or	1.646	0.031	18.6		0.29			0	0	10	<10	2:18	3:57	26	4	10	414	0	0	10	<10	2:19	3:58	1
1.6	1.3	7.6	8.7	3.881	0.324	0.642	0.318	0.941	1.666	74.8	Q, g	nr			1	0	10	10	2:19	4:00	49	48	10	>24196	3	0	10	31	2:19	4:00	0
34.8	34.8	11.7	0.0	U	0.001	0.001	U	0.567	0.002	1.6		0.06			0	0	10	<10	1:05	3:34	6	2	10	84	0	0	10	<10	1:07	3:34	1
28.5	28.4	7.0	0.7	0.005	0.004	0.004	U	1.239	0.002	11.4		0.28			9	0	10	98	12:57	4:14	33	25	10	1000	0	0	10	<10	12:59	4:15	20
28.1	27.8	6.0	1.1	0.057	0.010	0.011	U	1.328	0.003	11.2		0.42			15	1	10	187	1:03	4:16	41	32	10	1815	2	0	10	20	1:05	4:17	9
27.7	27.4	7.5	0.7	0.050	0.009	0.009	U	1.123	0.006	12.8		0.38			13	3	10	183	1:06	4:19	43	35	10	2318	1	0	10	10	1:07	4:18	18
29.9	29.9	8.3	0.4	0.004	0.007	0.007	U	1.045	0.002	6.2		0.26			3	0	10	31	1:10	4:25	33	28	10	1066	0	0	10	<10	1:11	4:23	6
24.5	23.9	6.3	1.1	0.109	0.020	0.021	0.001	1.401	0.009	8.4		0.35			5	0	10	52	1:15	4:23	45	21	10	1892	2	0	10	20	1:16	4:23	3
12.7	11.7	8.4	0.5	0.039	0.010	0.010	U	1.208	0.006	21.3		0.56			12	3	10	169	1:18	4:22	48	34	10	5247	1	0	10	10	1:19	4:21	17
0.2	0.1	6.6	2.2	0.125	0.068	0.069	U	1.230	0.012	15.4		0.43			15	2	10	199	1:24	4:19	41	7	10	959	3	0	10	31	1:25	4:20	6
29.7	29.6	8.9	0.3	0.007	0.005	0.005	U	1.269	0.002	7.3		0.26			11	2	10	145	1:28	4:28	42	32	10	1961	0	0	10	<10	1:29	4:27	29
24.1	23.5	5.9	1.2	0.064	0.010	0.010	U	1.494	0.007	7.1		0.32			20	5	10	315	1:33	4:26	47	37	10	4541	1	0	10	10	1:34	4:26	32
24.1	23.5	5.9	1.2	ns	ns	ns	ns	ns	ns	5.8		0.27			ns	ns	na	ns	na	na	ns	ns	na	ns	ns	ns	na	ns	na	na	ns
26.0	25.6	8.0	0.4	0.041	0.025	0.025	U	0.708	0.007	7.6		0.37			6	0	10	63	1:38	4:29	46	30	10	2878	3	0	10	31	1:39	4:30	2
16.6	15.7	4.5	0.7	0.050	0.060	0.060	0.001	1.500	0.025	10.9		0.39			12	1	10	146	1:42	4:33	49	44	10	15531	5	1	10	63	1:43	4:34	2
4.2	3.5	4.9	1.0	0.057	0.063	0.063	U	1.550	0.034	15.4		0.34			13	0	10	148	1:45	4:33	49	29	10	5794	4	2	10	62	1:43	4:32	2
0.4	0.3	0.5	12.7	0.029	0.011	0.011	U	2.165	0.009	32.9		0.49			23	3	10	341	1:59	4:36	48	38	10	6294	15	5	10	235	2:00	4:36	1
0.4	0.3	0.5	12.7	ns	ns	ns	ns	ns	ns	ns		ns			21	2	10	292	2:03	4:41	45	35	10	2933	18	1	10	231	2:03	4:39	1
0.4	0.3	2.6	1.9	0.085	0.029	0.029	U	1.870	0.013	17.3		0.30			1	0	10	10	1:50	4:31	41	9	10	1014	2	0	10	20	1:51	4:30	1
0.4	0.3	2.5	1.9	0.090	0.025	0.025	U	1.960	0.015	16.8		0.27			4	0	10	41	1:53	4:35	41`	8	10	987	2	0	10	20	1:54	4:34	2
0.5	0.3	2.0	2.8	0.130	?	0.028	or	1.500	0.347	15.8		0.31			1	0	10	10	2:06	4:41	19	3	10	272	3	0	10	31	2:07	4:42	0
1.6	1.2	6.3	8.2	3.364	0.604	0.933	0.329	1.185	1.524	79.2	Q, g	nr			0	0	10	<10	2:10	4:43	49	48	10	>24196	4	0	10	41	2:10	4:43	1
29.5	29.5	7.8	0.5	0.007	0.003	0.003	0.001	1.020	0.002	9.5		0.34	J3i	few bright spots	8	1	10	97	2:58	2:42	30	13	10	657	0	0	10	<10	2:59	2:43	19
29.5	29.4	8.5	0.7	0.006	0.003	0.004	0.001	0.961	0.002	9.6		0.34	J3i	ns	7	1	10	85	3:03	3:24	36	12	10	845	0	0	10	<10	3:04	3:24	17
28.8	28.6	5.2	0.8	0.063	0.007	0.009	0.002	0.851	0.002	10.6		0.45	J3i	half the pad with low intensity britheness and fev	16	5	10	250	3:07	3:26	45	39	10	3325	2	0	10	20	3:08	3:25	13
28.5	28.3	7.0	0.7	0.056	0.012	0.013	0.001	1.143	0.004	9.2		0.40	J3i	not detectable	8	1	10	97	3:09	3:27	41	25	10	1532	1	0	10	10	3:10	3:28	10
30.9	31.0	9.3	0.4	0.007	0.004	0.004	U	1.039	U	5.5		0.25	J3i	few bright spots	2	0	10	20	3:15	3:29	29	23	10	805	0	0	10	<10	3:16	3:28	4
26.7	26.3	6.2	0.9	0.081	0.014	0.015	0.001	1.093	0.005	7.2		0.31	J3i	low intensity britheness	5	1	10	63	3:18	3:30	47	11	10	1664	0	0	10	<10	3:19	3:31	13
13.1	12.1	10.5	0.6	0.025	0.005	0.007	0.001	0.946	0.003	20.2		0.57	J3i	some spots of low intensity bightners	15	1	10	187	3:22	3:33	48	36	10	5748	0	0	10	<10	3:23	3:31	37
0.2	0.1	6.7	4.0	0.134	0.063	0.064	0.002	1.275	0.009	11.3		0.45	J3i	nr	15	2	10	199	3:29	3:33	43	6	10	1050	1	0	10	10	3:30	3:34	20
30.5	30.6	8.8	1.7	0.050	0.017	0.018	0.001	1.157	0.002	5.6		0.23	J3i	not detected	12	2	10	158	3:33	3:36	39	13	10	1010	0	0	10	<10	3:35	3:34	32
22.9	22.2	5.2	1.4	0.084	0.012	0.013	0.001	1.446	0.003	6.7		0.29	J3i	low intensity britheness and very few very bright	24	4	10	373	3:42	3:39	49	35	10	8164	0	0	10	<10	3:43	3:39	75
27.5	27.2	7.9	0.4	0.048	0.028	0.029	0.002	1.390	0.005	7.5		0.30	J3i	not detected	8	1	10	97	3:37	3:36	48	21	10	2851	2	0	10	20	3:38	3:37	5
27.5	27.2	7.9	0.4	ns	ns	ns	ns	ns	ns	7.4		0.29	J3i	ns	ns	ns	na	ns	na	na	ns	ns	na	ns	ns	ns	na	ns	na	na	ns
17.4	16.5	5.3	0.5	0.055	0.107	0.109	0.002	1.438	0.021	8.8		0.29	J3i	not detected	2	2	10	41	3:46	3:41	49	46	10	19863	3	1	10	41	3:45	3:40	1
3.5	2.9	4.9	0.6	0.053	0.055	0.057	0.002	1.227	0.016	14.0		0.28	J3i	low intensity britheness and few very bright spot:	7	1	10	85	3:49	3:42	49	32	10	6867	3	0	10	31	3:50	3:42	3
0.4	0.3	3.3	1.7	0.049	0.005	0.006	0.001	2.112	0.004	37.8		0.60	J3i	low intensity britheness and few very bright spot:	20	0	10	249	3:55	3:44	48	39	10	6586	10	2	10	132	3:57	3:46	2
0.4	0.3	1.4	21.2	0.098	0.024	0.025	0.002	1.775	0.007	17.7		0.40	J3i	nr	3	0	10	31	3:53	3:44	39	5	10	813	1	0	10	10	3:54	3:43	3
0.3	0.3	1.8	2.3	0.129	0.011	0.013	0.001	1.767	0.018	18.6		0.37	J3i	low intensity britheness and few very bright spot:	0	1	10	10	3:59	3:47	29	3	10	464	1	0	10	10	4:00	3:46	1
0.3	0.3	1.8	2.3	ns	ns	ns	ns	ns	ns	ns		ns	J3i	ns	0	1	10	10	4:02	3:48	30	2	10	471	2	0	10	20	4:04	3:48	1
1.6	1.3	7.0	7.7	3.175	0.632	0.982	0.350	1.135	1.852	77.7	Q, g	nr	J3i	ns	1	0	10	10	4:08	3:49	49	48	10	>24196	7	0	10	75	4:09	3:49	0

32.2	31.8	20.9	20.1	4.8	1.9	0.038		0.014	I, Q	0.014	U	U	21	J	0.7	h	nr	49	39	10	10462	12:52	12:58	49	48	10	>24196	14	2	10	185	12:52	12:58	57
31.3	32.3	20.3	19.3	3.2	3.2	0.057		0.014	I, Q	0.014	U	ns	25	J	0.7	h	nr	38	11	10	910	12:47	12:58	49	6	10	1720	4	0	10	41	12:48	12:58	22
27.0	28.3	17.5	16.5	5.3	2.5	0.047		0.014	I, Q	0.014	U	ns	19	J	0.6	h	nr	40	18	10	1212	12:42	12:52	49	42	10	12997	1	0	10	10	12:43	12:52	121
22.5	22.6	14.6	13.5	4.6	2.7	0.13	I	0.023	I, Q	0.023	U	ns	18	J	0.5	h	nr	29	5	10	496	12:56	1:04	49	45	10	17329	13	3	10	183	12:57	1:04	3
3.0	3.0	2.0	1.6	3.3	1.0	0.012	I	0.044	I, Q	0.044	0.0005	U	10	J	0.2	h	nr	19	7	10	324	1:01	1:04	49	39	10	10462	11	16	10	307	1:01	1:04	1.1
0.4	0.4	0.3	0.2	3.3	1.0	0.028		0.033	I, Q	0.033	U	ns	72	J,g	1.1	h	nr	23	6	10	383	1:05	1:12	49	40	10	11199	24	5	10	388	1:06	1:12	1.0
					1.5											h		19	4	10	285	1:10	1:12	49	41	10	12033	23	4	10	355	1:11	1:12	0.8
0.6	0.5	0.4	0.3	2.7	1.6	U		0.017	I, Q	0.017	U	ns	19	J	0.2	h	nr	3	1	10	41	1:16	1:19	49	21	10	3654	4	1	10	52	1:17	1:19	0.8
0.5	0.5	0.3	0.2	1.1	1.9	U		0.0073	I, Q	0.0083	0.001	ns	18	J	0.2	h	nr	8	2	10	108	1:23	1:31	49	24	10	4352	4	0	10	41	1:24	1:31	3
						U		U	Q	U	U	ns	1	J	0.8	h	nr	0	0	10	<10	1:27	1:31	0	0	10	<10	0	0	10	<10	1:27	1:31	1
38.8	37.4	25.2	24.8	4.4	2.5	0.13		U	Q	U	U	ns	20	h	0.7		nr	39	40	10	1887	11:55	12:50	49	47	10	24196	0	0	10	<10	11:52	12:50	377
39.3	40.1	25.6	25.1	3.6	1.4	0.067		0.018	I, Q	0.018	U	ns	21	h	0.8		nr	47	21	10	2400	12:02	12:50	49	44	10	15531	3	0	10	31	11:57	12:50	77
35.6	35.0	23.2	22.5	4.6	1.3	0.07		0.015	I, Q	0.015	U	ns	21	h	0.7		nr	43	20	10	1552	12:05	12:59	49	45	10	17329	6	0	10	63	12:04	12:59	25
40.4	41.2	26.3	25.8	5.2	1.0	0.11		U	Q	U	U	ns	14	h	0.5		nr	44	17	10	1541	12:03	12:59	49	47	10	24196	1	0	10	10	12:06	12:59	154
																		45	18	10	1726	12:08	1:05	49	47	10	24196	0	0	10	<10	12:09	1:05	345
33.4	34.4	21.7	20.9	4.7	1.2	0.056		0.017	I, Q	0.017	U	ns	19	h	0.6		nr	40	17	10	1182	12:13	1:05	49	44	10	15531	4	2	10	62	12:11	1:05	19
17.4	17.8	11.3	10.3	1.7	3.5	U		U	Q	U	U	U	69	h,g	0.7		nr	49	13	10	2359	12:16	1:12	49	45	10	17329	12	2	10	158	12:13	1:12	15
0.3	0.2	0.2	0.1	4.8	1.0	U		U	Q	0.015	0.01	ns	104	h,g	1.1		nr	3	0	10	31	12:19	1:12	49	27	10	5172	3	1	10	41	12:18	1:12	1
0.3	0.2	0.2	0.1	4.9	1.1	0.016	I	U	Q	0.015	0.01	ns	89	h,g	1.1		nr	1	0	10	10	12:23	1:17	49	22	10	3873	2	1	10	30	12:21	1:17	0
35.8	36.1	23.3	22.5	4.9	1.3	0.067		0.015	I, Q	0.015	U	ns	20	h	0.6		nr	49	48	10	>24196	12:28	1:24	49	48	10	>24196	5	1	10	63	12:27	1:24	384
30.2	30.6	19.7	18.7	4.3	1.6	0.043		U	Q	U	U	ns	20	h	0.6		nr	49	25	10	4611	12:52	1:30	49	43	10	14136	19	23	10	540	12:52	1:30	9
24.5	24.4	15.9	14.9	5.2	1.3	0.021		0.015	I, Q	0.015	U	U	16	h	0.4		nr	23	8	10	411	12:45	1:24	49	39	10	10462	1	1	10	20	12:47	1:24	21
7.2	7.2	4.7	4.0	1.7	1.0	0.044		0.047	I, Q	0.053	0.006	U	16	h	0.4		nr	13	1	10	160	1:02	1:40	49	37	10	9208	12	3	10	169	1:03	1:40	1
0.4	0.4	0.3	0.2	2.4	1.3	U		U	Q	U	U	ns	79	h,g	1.0		nr	9	1	10	109	12:57	1:30	49	45	10	17329	9	2	10	120	12:55	1:30	1
0.5	0.5	0.4	0.3	2.6	1.3	U		U	Q	U	U	ns	21	h	0.3		nr	2	0	10	20	12:32	1:17	48	17	10	2382	2	0	10	20	12:33	1:17	1
0.5	0.5	0.3	0.2	1.4	1.5	U		U	Q	U	U	ns	20	h	0.4		nr	2	1	10	30	1:01	1:30	49	10	10	2046	12	1	10	146	1:00	1:30	0
38.7	37.3	25.2	24.7	4.5	2.3	0.082		0.023	I	0.023	U	U	19		0.6	J,h	lot recovere	41	30	10	1730	11:42	2:20	49	48	10	>24196	1	0	10	10	11:41	2:20	173
39.3	39.6	25.5	25.0	4.3	1.2	0.037		U		U	U	U	18		0.7	J,h	Negative	49	35	10	8164	11:48	2:20	49	45	10	17329	14	2	10	185	11:46	2:20	44
36.9	36.1	23.6	23.1	4.7	1.5	0.053		0.017	I	0.017	U	U	18		0.6	J,h	Negative	46	23	10	2254	11:55	2:31	49	48	10	>24196	2	0	10	20	11:54	2:31	113
41.0	40.8	26.7	25.9	5.6	0.7	0.067		0.018	I			U	14		0.5	J,h	Negative	35	16	10	891	11:57	2:31	49	38	10	9804	0	0	10	<10	11:56	2:31	178
34.9	35.6	22.7	21.9	4.8	1.2	0.055		0.020	I	0.02	U	U	20		0.9	J,h	Negative	32	12	10	700	12:01	2:36	49	41	10	12033	2	2	10	41	12:00	2:36	17
35.1	35.9	22.8	22.1	5.0	1.2	0.05		0.02	I	0.02	U	U	18		0.7	J,h	Negative	39	19	10	1174	12:04	2:36	49	47	10	24196	6	1	10	74	12:03	2:36	16
17.6	17.7	11.4	10.4	1.9	3.0	0.095		U		U	U	U	67	g	0.7	J,h	Negative	45	14	10	1529	12:13	2:40	49	43	10	14136	21	1	10	279	12:13	2:40	5
0.3	0.2	0.2	0.1	5.0	1.3	U		0.0057	I			U	67	g	1.0	J,h	Negative	4	0	10	41	12:11	2:40	49	23	10	4106	1	1	10	20	12:09	2:40	2
36.5	36.5	23.8	23.1	5.3	1.0	0.072		0.014	I			U	14		0.5	J,h	Negative	49	29	10	5794	12:17	2:44	49	48	10	>24196	1	1	10	20	12:16	2:44	290
30.0	30.0	19.5	18.5	4.3	1.5	0.056		0.011	I			U	18		0.8	J,h	Negative	46	17	10	1842	12:28	2:48	49	45	10	17329	1	0	10	10	12:25	2:48	184
																J,h		39	12	10	984	12:33	2:48	49	41	10	12033	0	0	10	<10	12:30	2:48	197
23.1	23.0	15.1	14.0	5.4	1.2	0.019	I	0.012	I			U	16		0.4	J,h	Negative	17	3	10	241	12:24	2:44	49	37	10	9208	0	0	10	<10	12:21	2:44	48
6.2	6.1	4.0	3.4	1.6	0.6	U		0.051				U	13		0.3	J,h	Negative	3	1	10	41	12:40	2:52	49	35	10	8164	3	1	10	41	12:39	2:52	1
0.4	0.4	0.3	0.2	2.4	1.5	0.045		0.014	I			U	91	g	0.8	J,h	ıresced a lit	10	2	10	132	12:44	2:55	49	42	10	12997	20	1	10	262	12:42	2:55	1
0.5	0.5	0.4	0.3	2.8	1.5	U		0.015	I			U	21		0.3	J,h	ıresced a lit	2	0	10	20	12:38	2:52	48	18	10	2489	1	0	10	10	12:34	2:52	2
0.5	0.4	0.3	0.2	1.4	1.5	U		U				0.321	20		0.3	J,h	Negative	1	0	10	10	12:47	2:55	49	22	10	3873	6	2	10	84	12:47	2:55	0

00	slack	nr	7.54	29.2	19.0	28.1	2.7	18.1	6.2	0.5	U	ns	7	K	0.3	K	negative	28	6	10	488	3:39	3:43	48	35	10	5493	32	7	10	609	3:39	3:43	1
00	slack	nr	7.83	15.0	9.8	14.9	2.1	8.8	5.9	0.4	U	ns	14	K	0.8	K	negative	49	25	10	4611	3:47	3:46	49	48	10	>24196	1	0	10	10	3:47	3:46	461
00	slack	out	7.40	0.3	0.2	0.3	1.7	0.1	6.8	0.2	0.043	ns	5	K, d	0.3	K, d	negative	2	0	10	20	3:53	3:51	48	19	10	2603	2	0	10	20	3:53	3:51	1
00	slack	out	7.40	0.3	0.2	0.3	1.7	0.1	6.8	ns	ns	ns	8	K	0.5	K	ns	ns	ns	na	ns	na	na	ns	ns	na	ns	ns	ns	na	ns	na	na	ns
00	nr	out	7.86	33.6	21.8	32.4	1.3	21.1	6.1	0.4	U	ns	ns	K	ns	K	negative	22	8	10	391	4:01	3:57	49	30	10	6131	0	0	10	<10	4:01	3:57	78
00	nr	out	7.69	34.1	22.1	32.7	1.6	21.4	6.1	0.3	U	ns	8	K	0.7	K	negative	19	9	10	350	4:09	4:03	49	34	10	7701	0	0	10	<10	4:09	4:06	70
00	nr	out	7.47	27.5	17.9	27.3	2.2	16.9	5.6	0.2	U	ns	ns		ns		negative	34	16	10	850	4:16	4:12	49	37	10	9208	5	0	10	52	4:14	4:16	16
00	ebb	out	7.77	25.8	16.8	25.8	0.6	15.7	5.4	0.2	U	ns	10	K	0.9	K	negative	15	2	10	199	4:22	4:17	49	27	10	5172	0	0	10	<10	4:21	4:19	40
00	ebb	out	7.65	5.0	3.2	5.0	1.4	2.7	5.8	0.2	0.039	ns	4	K	0.1	K	negative	2	1	10	30	4:28	4:26	49	39	10	10462	4	0	10	41	4:26	4:27	1
00	ebb	nr	7.43	0.5	0.4	0.5	6.4	0.2	5.3	0.6	U	ns	20	K	1.8	K	negative	1	0	10	10	4:25	4:23	49	39	10	10462	5	0	10	52	4:24	4:24	0
00	ebb	out	7.37	0.6	0.4	0.6	1.3	0.3	6.5	0.2	0.026	ns	14	K	0.5	K	negative	0	0	10	<10	4:30	4:30	46	7	10	1333	1	0	10	10	4:30	4:32	1
00	nr	out	6.99	0.5	0.3	0.3	1.7	0.2	6.9	0.2	0.016	ns	16	K	0.6	K	negative	2	0	10	20	4:33	4:33	40	9	10	959	0	0	10	<10	4:33	4:33	4
00	ebb	out	7.75	35.0	22.8	32.8	3.9	22.1	6.7	0.2	U	ns	11		0.3		negative	13	11	10	278	2:26	3:41	48	38	10	6294	0	0	10	<10	2:26	3:42	56
00	ebb	out	7.62	34.6	22.5	33.2	1.7	21.8	6.2	0.2	U	ns	13		0.6		negative	40	12	10	1039	2:31	3:45	49	27	10	5172	11	0	10	122	2:31	3:46	9
00	ebb	out	7.49	29.1	18.9	27.8	2.7	18	6.4	0.3	U	ns	10	Q, Y	0.4	Q, Y	negative	44	17	10	1541	2:37	3:49	48	35	10	5493	3	0	10	31	2:37	3:50	50
00	nr	nr	7.70	38.1	24.8	36.8	1.7	24.2	6.1	0.2	U	ns	9		0.3		negative	28	24	10	790	2:43	3:52	49	43	10	14136	0	0	10	<10	2:43	3:53	158
00	slack	out	7.54	29.3	19.0	28.6	5.5	18.1	5.9	0.2	U	ns	12		0.5		negative	14	7	10	245	2:46	3:55	49	33	10	7270	0	0	10	<10	2:46	3:56	49
00	slack	out	7.54	29.3	19.0	28.6	5.5	18.1	5.9	ns	ns	ns	12		0.5		ns	ns	ns	na	ns	na	na	ns	ns	na	ns	ns	ns	na	ns	na	na	ns
00	slack	out	7.92	15.2	9.9	15.1	2.1	8.8	5.7	U	U	ns	24		0.7		negative	49	35	10	8164	2:49	3:58	49	47	10	24196	3	3	10	61	2:49	3:59	134
00	slack	out	7.91	15.2	9.9	15.1	1.8	8.8	5.8	0.7	U	ns	20		0.6		negative	49	33	10	7270	2:51	4:00	49	48	10	>24196	1	0	10	10	2:53	4:01	727
00	slack	out	8.01	0.3	0.2	0.3	2.4	0.1	6.8	U	0.05	ns	8		0.3		negative	3	1	10	41	2:55	4:15	49	23	10	4106	1	0	10	10	2:55	4:16	4
00	slack	out	7.71	34.5	22.4	34.0	1.5	21.7	5.6	U	U	ns	9		0.4		negative	25	13	10	527	2:59	4:19	47	24	10	2700	0	0	10	<10	2:59	4:19	105
00	nr	out	nr	25.2	16.4	25.1	3.3	15.4	5.6	U	U	ns	9		0.3		negative	31	27	10	956	3:03	4:22	49	41	10	12033	2	0	10	20	3:03	4:22	48
00	ebb	out	7.70	27.1	17.6	27.0	1.8	16.6	5.6	U	U	ns	12		0.4		negative	48	24	10	3282	3:09	4:24	49	41	10	12033	4	1	10	52	3:09	4:25	63
00	slack	nr	7.68	2.9	1.9	2.9	1.6	1.5	6.6	0.1	U	ns	8		0.3		negative	7	0	10	75	3:11	4:27	49	44	10	15531	7	1	10	85	3:11	4:28	1
00	slack	weak	7.37	0.5	0.3	0.5	8.1	0.2	6.9	0.7	U	ns	16	Q, Y	0.8	Q, Y	negative	1	0	10	10	3:25	4:33	49	43	10	14136	3	3	10	61	3:25	4:33	0
00	ebb	out	7.25	0.6	0.4	0.5	2.1	0.3	6.6	0.2	0.011	ns	13	Q, Y	0.3	Q, Y	negative	1	0	10	10	4:09	4:38	41	5	10	906	1	0	10	10	4:09	4:39	1
00	ebb	out	7.25	0.6	0.4	0.5	2.1	0.3	6.6	ns	ns	ns	ns		ns		negative	0	0	10	<10	3:21	4:30	47	10	10	1607	2	0	10	20	3:21	4:32	0
00	nr	out	7.24	0.5	0.3	0.5	2.8	0.2	6.6	0.1	U	ns	17		0.3		negative	0	0	10	<10	3:27	4:35	45	8	10	1274	3	1	10	41	3:27	4:36	0
00	ebb/high	out/moderate	7.75	33.7	21.9	32.9	0.9	21.1	5.8	0.1	U	U	11	J3	0.5	J3	negative	19	12	10	390	3:51	3:48	47	40	10	5099	0	0	10	<10	3:51	3:34	78
00	ebb/high	out/moderate	7.75	33.7	21.9	32.9	0.9	21.1	5.8	ns	ns	ns	ns		ns		negative	17	15	10	393	6:08	4:46	47	40	10	5099	na	na	na	ns	na	na	ns
00	ebb/high	out/weak	7.70	34.9	22.7	34.1	1.1	22	5.8	0.1	U	U	11	J3	0.5	J3	negative	22	29	10	698	3:56	3:35	49	41	10	12033	6	1	10	74	3:56	3:39	9
00	ebb/high	weak	7.45	30.6	20.0	30.6	2.6	19.1	5.4	0.3	U	U	11	J3	0.6	J3	negative	32	18	10	815	4:00	3:41	49	41	10	12033	1	0	10	10	4:00	3:42	82
00	ebb/high	moderate	7.86	35.5	23.1	22.4	1.1	22.4	5.3	0.1	U	U	10	J3	0.5	J3	negative	18	26	10	560	4:03	3:43	49	45	10	17329	0	0	10	<10	4:03	3:44	112
00	ebb	nr	7.49	29.6	19.2	29.6	3.7	18.3	5.4	U	U	U	10	J3	0.5	J3	negative	18	5	10	281	4:10	3:45	46	20	10	2035	0	0	10	<10	4:08	3:50	56
00	ebb	nr	7.49	29.6	19.2	29.6	3.7	18.3	5.4	ns	ns	ns	7	J3	0.3	J3	ns	ns	ns	na	ns	na	na	ns	ns	na	ns	ns	ns	na	ns	na	na	ns
00	slack	nr	7.99	15.5	10.1	15.9	1.2	9	5.1	U	U	U	18	J3	0.7	J3	negative	49	35	10	8164	4:07	3:51	49	48	10	<24196	0	0	10	<10	4:09	3:52	1633
00	slack	nr	7.75	0.3	0.2	0.3	1.5	0.1	5.7	U	0.048	U	7	J3	0.4	J3	negative	2	1	10	30	4:13	3:52	49	23	10	4106	3	2	10	51	4:12	3:53	1
00	ebb/high	out/moderate	7.68	37.2	24.2	37.5	1.2	23.6	5.1	0.5	U	0.04	9	J3	0.5	J3	negative	38	27	10	1338	4:15	3:54	49	40	10	11199	1	0	10	10	4:15	3:56	134
00	high	out/weak	7.34	26.2	17.0	26.8	2.4	16	5.0	0.9	U	U	6	J3	0.3	J3	negative	24	8	10	431	4:20	3:56	47	16	10	1989	1	0	10	10	4:18	3:58	43
00	ebb/high	out/weak	7.70	30.1	19.6	30.6	1.1	18.7	5.1	U	U	U	10	J3	0.4	J3	negative	29	7	10	528	4:24	3:58	49	32	10	6867	1	3	10	40	4:24	4:00	13
00	ebb/high	stagnant	7.47	6.0	3.9	6.0	0.4	3.2	5.8	0.2	0.027	0.03	8	J3	0.3	J3	negative	6	1	10	74	4:28	4:00	49	40	10	11199	18	3	10	256	4:28	4:01	0
00	ebb/high	stagnant	7.55	0.5	0.3	0.5	7.4	0.2	6.1	0.5	U	U	13	Q, Y, J3	1.0	Q, Y, J3	negative	23	8	10	411	4:48	4:40	49	44	10	15531	6	1	10	74	4:47	4:36	6
00	ebb/high	stagnant	7.55	0.5	0.3	0.5	7.4	0.2	6.1	ns	ns	ns	ns		ns	J3	negative	33	6	10	620	6:11	4:49	49	46	10	19863	ns	ns	na	ns	na	na	ns
00	ebb/high	out/stagnant	nr	0.6	0.4	0.6	1.4	0.3	6.4	0.1	0.01	U	15	J3	0.4	J3	negative	0	0	10	<10	4:41	4:12	40	10	10	985	1	1	10	20	4:41	4:10	0
00	ebb/high	out/stagnant	nr	0.6	0.4	0.6	1.4	0.3	6.4	ns	ns	ns	ns		ns		negative	2	0	10	20	4:44	3:37	45	5	10	1162	2	0	10	20	4:52	4:42	1
00	ebb/high	ou/stagnant	7.26	0.6	0.4	0.5	1.4	0.3	6.4	U	0.012	U	11	Q, Y, J3	0.3	Q, Y, J3	negative	1	0	10	10	4:41	4:38	39	4	10	789	1	0	10	10	4:44	4:14	1
00	na	na	7.55	0.0	0.0	0.0	0.1	0.1	or	0.2	U	ns	0	Q, Y, J3	U	Q, Y, J3	negative	0	0	10	<10	4:34	4:09	0	0	10	<10	0	0	10	<10	4:31	4:07	1
00	ebb/high	weak	7.16	0.5	0.3	0.5	1.8	0.3	6.5	U	U	0.03	11	Q, Y, J3	0.3	Q, Y, J3	negative	0	0	10	<10	4:53	4:42	44	9	10	1223	0	1	10	10	4:50	4:40	1

Table A-8. Correlation Matrix of Water Quality Parameters



Appendix B

Sampling Site Information

Developed with Septic Tank

Dekle Beach

The Dekle Beach area is classified as "developed" and is currently served by on site sewage treatment and disposal systems (OSTDS). The FDOH Beach Monitoring Program has conducted water quality analyses on this beach (Site A) since 2000. From the beginning of the program until October 2006, 139 beach advisories have been posted. The Taylor County Health Department has conducted bacterial analyses on the beach sites since 2004. The sampling sites for Dekle Beach are summarized in Table B-1.

Table B-1 – Sampling site designations for Dekle Beach

Code	Site Name	Latitude	Longitude
A	Dekle Beach	29^{o} 50.948'	83^{o} 37.178'
JI	Jugg Island Road		
B	Dekle Beach Canal	29^{o} 50.944'	83^{o} 37.119'
C	Creek at Dekle Beach	29^{o} 50.908'	83^{o} 36.964'

A) Dekle Beach: Along the shore, the remains of old septic tank units were observed during all sampling events. These treatment structures served residences that were destroyed during the "*No Name Storm*" event in March 1993. The beach is narrow and located just at the side of the road. Across the road, along the east side, the residences rely on septic tanks for disposal of their wastewater. Samples were collected by walking into the water up to knee high and using a pole sampler. The probe readings were done by attaching the probe to the pole.

JI) Jugg Island Road: This beach site is located along the border of the Dekle Beach canal inlet and south of the Dekle Beach site (A). This site has a private cluster of four single family homes bordering the ocean. There are two very long piers that extend out into the ocean from the two of the homes, and a small dock on the canal side of the shallow inlet. This site was added in 2007, and the samples were collected by reaching the pole outwards from one of the small stepped piers. The probe readings were done by dropping the probe in the water from the edge of the pier.

B) Dekle Beach Canal: This site is located along the border of the Mexico Road canal in an empty lot between two single family residences. The canal is directly connected to the ocean and surrounded by homes on both sides. Some neighbors have boats in the canal. The samples were collected by reaching the pole towards the middle of the canal. The probe readings were done by dropping the probe in the water right at the edge of the canal.

C) Creek at Dekle Beach: A background site, this creek connects a marsh area to the end of the canal. A two-lane bridge passes over the creek. The water seemed stagnant during the first sampling trip in May (SLWT) although strong outgoing movement was noticed in September on all sampling days. The samples were collected from the road using the pole. The probe readings were done by dropping the probe directly into the water.

Steinhatchee

Steinhatchee is a fairly developed area served by OSTDS, with approximately 1,500 inhabitants, according to OnBoard LLC (http://www.onboardllc.com). The sampling sites for the Steinhatchee basin are summarized in Table B-2.

Table B-2 – Sampling site designations for Steinhatchee

Code	Site Name	Latitude	Longitude
J	Main Street & Steinhatchee (Roy's)	29^{o} 40.385'	83^{o} 23.705'
K	Third Ave. Fork (Japanese Garden)	29^{o} 40.161'	83^{o} 22.011'
L	Boggy Creek @ 51	29^{o} 44.004'	83^{o} 21.542'
M	Steinhatchee @ Airstrip Drive	29^{o} 43.503'	83^{o} 20.789'
N	Steinhatchee Falls	29^{o} 44.792'	83^{o} 20.542'

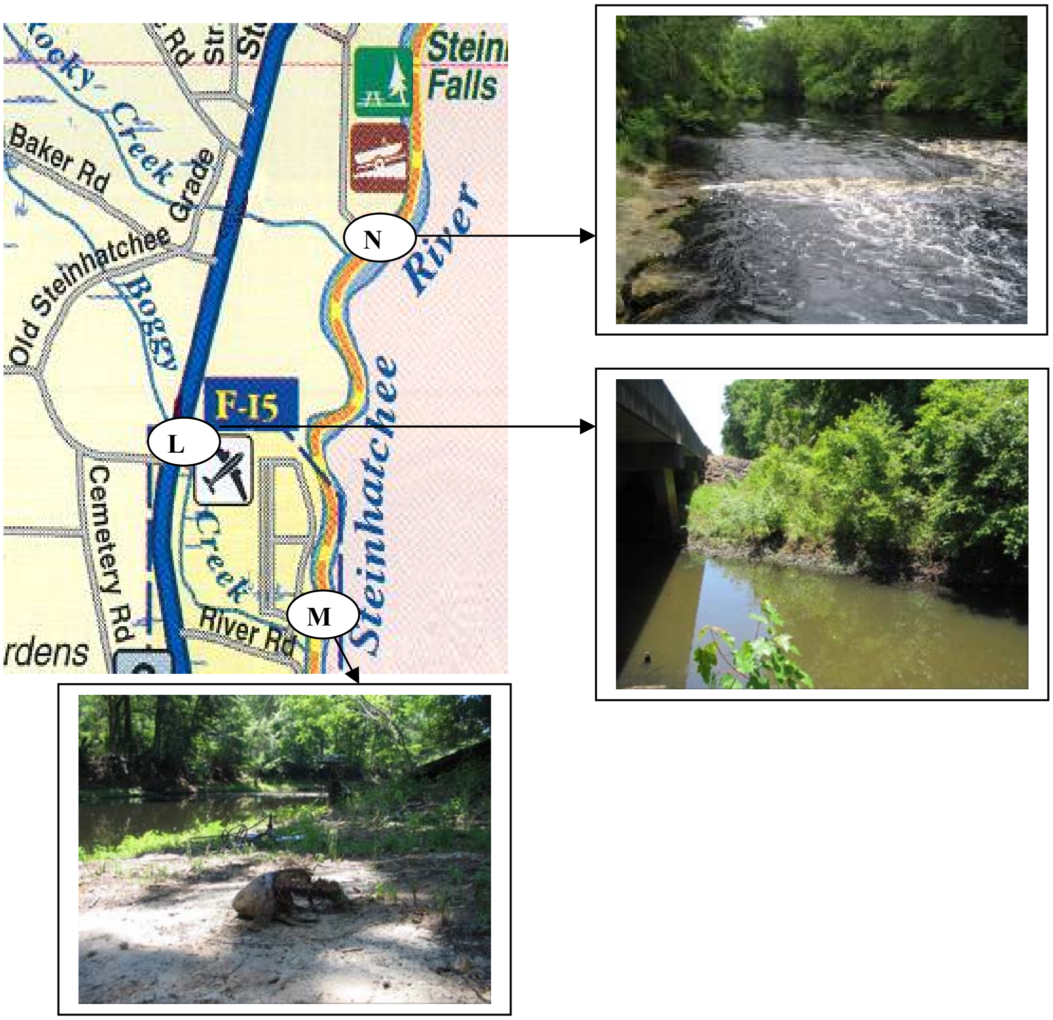
J) Main Street & Steinhatchee (Roy's): This site is located along the north side of the mouth of the Steinhatchee River, at Main Street, just east of the restaurant known as Roy's. There is a large septic tank on the property, with an infiltration field and mound located on the other side of the road. During the first trip in May, the samples were collected from the first pier close to the restaurant. During the second trip in September, this pier was in very shallow water, so the samples were collected from a second pier a few meters east of the previous sampling point. Samples were collected using the pole sampler. The probe readings were done by dropping the probe directly into the water from the edge of the pier.

K) Third Ave. Fork (Japanese Gardens): This site is located at the end of the street along an isolated finger of the Steinhatchee River. The site is close to private property. It was noted that some people go to the site during lunch time to eat. The samples were collected using a pole sampler. The probe readings were done by dropping the probe directly into the water.

L) Boggy Creek @ 51: This site represents the tributary structure upstream of the Steinhatchee River. The samples were collected from the bridge at highway 51 using the pole sampler. The probe readings were done by dropping the probe directly into the water.

M) Steinhatchee @ Airstrip Drive: This site is located in a small community development, with no sewer network. The owners of the nearby homes do not inhabit them year-round, and several homeowners were not present in the area for the entire sampling event. The samples were collected at the Steinhatchee River from a concrete boat ramp using the pole sampler. The probe readings were done by dropping the probe directly into the water, or by attaching to the pole sampler during periods of low flow.

N) Steinhatchee Falls: This site represents the natural background condition for the Steinhatchee River basin. The water velocity is rapid at this site due to a relatively important elevation drop and narrow channel. The samples were collected in the Steinhatchee Falls Park just upstream from the falls using the pole sampler. The probe readings were done by dropping the probe directly in the water.



Falls
Baker Rd
Creek
Old Steinhatchee Grade
Boggy
River
Steinhatchee
F-15
Cemetery Rd
Creek
River Rd
N
L
M

Developed with Sewer Being Installed

Keaton Beach

Keaton Beach is a developed residential community with a sewer system installed during 2005/2006. The FDOH Beach Monitoring Program has been sampling at this site (Site F) since 2000, and 115 advisories have been posted since the beginning of the sampling program. The Taylor County Health Department also has data for these sites dating back to 2004. The sampling sites for the Keaton Beach location are summarized in Table B-3.

Table B-3 – Sampling site designations for Keaton Beach

Code	Site Name	Latitude	Longitude
F	Keaton Beach	29^o 49.130’	83^o 35.610’
MR	Marina Road		
E	Cortez Road Canal – Mid-stream	29^o 49.524’	83^o 35.520’
D	Cortez Road Canal - Pump station	29^o 49.749’	83^o 35.492’
G	Blue Creek @ Beach Road	29^o 49.485’	83^o 34.579’

F) Keaton Beach: The beach has calm waters and is located in a delta. Across the delta is the Cedar Island Beach site, approximately 0.70 km in a straight line. The samples were collected in shallow waters along the north side of the pier, by walking out to knee-high depth and using the pole sampler. The probe readings were done by attaching the probe to the end of the pole and dropping it into the water in front of the sampler.

MR) Marina Road: This site is located at the ocean end of the Keaton Beach canal that runs parallel to Marina Road and Cortez Road. To the south across the bay is Cedar Island and east is the Blue Creek estuary. This site was added in 2007 and is located south of the Keaton Beach site (F). Samples were collected using the pole sampler from a floating double dock. The probe readings were done by dropping the probe directly into the water.

E) Cortez Road Canal: This site is located in the middle of a canal that leads out to the ocean, directly below a residential pier. There were two jet skis stored hanging out of the canal in May and a small motor boat in September. At no point during the sampling effort, did the team encounter any of the residents of the home, suggesting that it may be a holiday house. The water is shallow and mucky. The samples were collected using the pole sampler. The probe readings were done by dropping the probe directly into the water.

D) Cortez Road Canal: This site is located at the inland end of the Cortez Road Canal, less than 100 feet from a new pump station. According to our analysis of the collection system layout, no sewer pipes are located within a 100 ft distance from the sampling site. The water is shallow and looks stagnant. The samples were collected using the pole sampler. The probe readings were done by dropping the probe directly into the water, or by attaching to the pole sampler during periods of extremely shallow depth.

G) Blue Creek @ Beach Road: This is a background site, with freshwater flow. It allows assessment of further inland sources. The water has a dark tea color, presumably from humic, fulvic, and tannic substances. Samples were taken from the Beach Road bridge using the sampling pole and placing the probe directly into the water.


Ezell Beach Dr
K LEE
ISLAND
Klumbis R
Keaton Beach Dr
Blue Creek
Cortez Rd
Ellis Moore Dr
Pine Isle Dr
Keaton
Beach
Marina Rd
Gulf Rd
Beach Villa Dr
G
D
E
F
MR
TAYLOR COASTAL CENTRALIZED
WASTEWATER SYSTEM - PHASE 1
USDA

Cedar Island

Cedar Island is a residential community development, and during this study the sewer system was in the process of installation. The background site for these points is also Blue Creek @ Beach Road (Site G). The FDOH Beach Monitoring Program has conducted sampling there, and 129 advisories have been posted since 2000. It is also a site studied by the Taylor County Health Department. The sampling sites for the Cedar Island location are summarized in Table B-4.

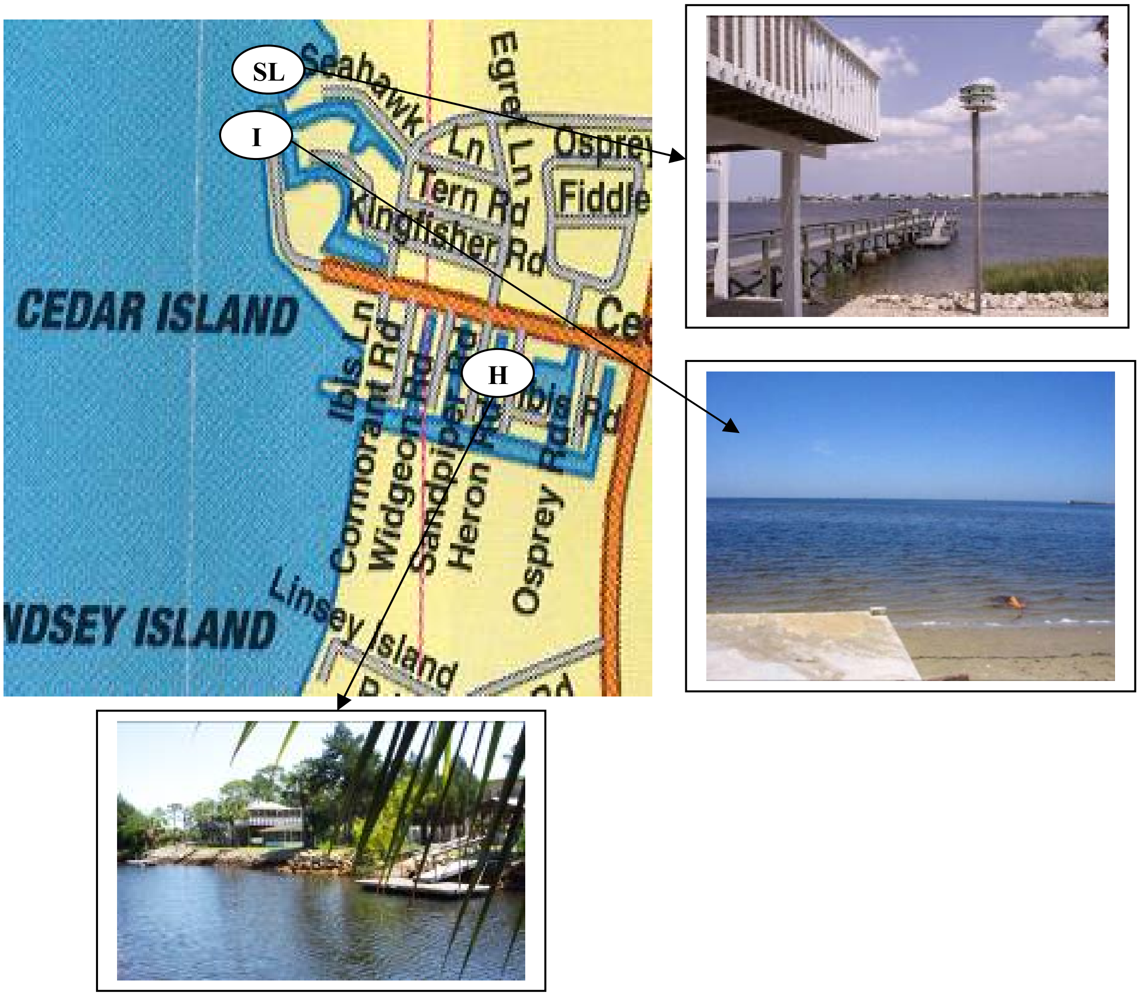
Table B-4 – Sampling site designations for Cedar Island

Code	Site Name	Latitude	Longitude
I	Cedar Island Beach	29° 48.946’	83° 35.238’
SL	Seahawk Lane		
H	Heron Road Canal	29° 48.708’	83° 34.839’

I) Cedar Island Beach: This site has very calm shallow water and resembles a bay. The site is well protected, and the width of the channel leads to seemingly stagnant water. The site is on the beach in front of the concrete foundation of a beach house located at the end of a road adjacent to an inlet. The beach house is now connected to a sewer network. Samples were taken with a sampling pole after wading out to a knee-high depth.

SL) Seahawk Lane: This site is located on the ocean just east of the Cedar Island Beach site (I) and west of the Blue Creek estuary (G). This site was added in 2007, and the samples were collected from a private pier of an unoccupied home. The pier extends out into the bay between Keaton Beach and Cedar Island. Samples were collected using the pole sampler from the end of the pier. The probe readings were done by dropping the probe directly into the water.

H) Heron Road Canal: This site is located on a dead-end canal surrounded by residential development. The sampling location was a small dock accessed through the yard of an unoccupied home. The channel is shallow even during high tide. The bottom is usually visible, and the soil is muck suitable for mangroves.



SL
I
H
Seahawk
Egret Ln
Tern Rd
Fiddle
Kingfisher Rd
CEDAR ISLAND
Ibis Ln
Cormorant Rd
Widgeon Rd
Heron
Ibis Rd
Osprey
NDSEY ISLAND
Linsey Island

Appendix C

Field Calibration Logs

Field Calibration Log (May 2006)

FIELD INSTRUMENT RECORDS

INSTRUMENT (MAKER/MODEL#): YSI 556

STANDARDS:

Standard A: 7.03
Standard B: 4.00
Standard C: 10.07
Standard D: 50.00

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
06/05/05	8:25	pH	A	7.07		YES	GOOD	TB
06/05/05	8:25	pH	B	4.00	—	YES	GOOD	TB
06/05/05	8:25	pH	C	10.05		YES	GOOD	TB
06/05/05	8:45	Conduct.	D	49.26		YES	GOOD	TB

Field Calibration Log (September 2006)

FIELD INSTRUMENT RECORDS

INSTRUMENT (MAKER/MODEL#): YSI 556

STANDARDS:

Standard A: 7.01
Standard B: 10.03
Standard C: 4.00
Standard D: 54.60

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
06/09/25	17:00	pH	A	7.00		YES	GOOD	EB
06/09/25	17:00	pH	B	10.03	–	YES	GOOD	EB
06/09/25	17:00	pH	C	3.88		YES	GOOD	EB
06/09/25	17:15	Conductivity	D	50.05		YES	GOOD	EB
06/09/26	13:45	pH	A	7.08		YES	GOOD	EB
06/09/26	13:45	pH	B	9.97		YES	GOOD	EB
06/09/26	13:45	pH	C	3.97		YES	GOOD	EB
06/09/26	14:00	Conductivity	D	54.70		YES	GOOD	EB
06/09/27	14:30	pH	A	6.98		YES	GOOD	DM
06/09/27	14:30	pH	B	10.00		YES	GOOD	DM
06/09/27	14:30	pH	C	4.00		YES	GOOD	DM
06/09/27	14:30	Conductivity	D	54.24		YES	GOOD	DM

Field Calibration Log (December 2006)

FIELD INSTRUMENT RECORDS

INSTRUMENT (MAKER/MODEL#): YSI 556 PROBE

STANDARDS:

Standard A: 9.47 (06/12/11), 9.51 (06/12/12), 9.33 (06/12/13)
Standard B: 7.00
Standard C: 4.00
Standard D: 10.00

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	TEMP (°C)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
06/12/11	14:50	Cond.	A	22.20	9.06	9.4	YES	GOOD	DM
06/12/11	14:55	pH	B	22.24	7.14	2.0	YES	GOOD	DM
06/12/11	14:58	pH	C	22.07	3.78	5.5	YES	GOOD	DM
06/12/11	15:05	pH	D	21.60	9.96	0.4	YES	GOOD	DM
06/12/11	15:10	DO	100%	23.13	106%	6.0	YES	GOOD	DM
06/12/12	18:00	Cond	A	22.66	9.56	0.5	YES	GOOD	DM
06/12/12	18:06	pH	B	22.60	7.06	0.9	YES	GOOD	TB
06/12/12	18:11	pH	C	22.66	3.92	2.0	YES	GOOD	TB
06/12/12	18:15	pH	D	22.84	9.89	1.1	YES	GOOD	TB
06/12/12	18:20	DO	100%	22.95	95.2%	4.8	YES	GOOD	TB
06/12/13	15:44	Cond.	A	21.50	9.48	1.6	YES	GOOD	TB
06/12/13	15:50	pH	B	21.82	7.05	0.7	YES	GOOD	TB
06/12/13	15:53	pH	C	21.98	3.99	0.3	YES	GOOD	TB
06/12/13	15:56	pH	D	21.21	10.01	0.1	YES	GOOD	TB
06/12/13	16:00	DO	100%	21.88	98%	2.0	YES	GOOD	TB

Field Calibration Log (May 2007)

INSTRUMENT (MAKER/MODEL#): YSI 556 MPS probe

STANDARDS:

Standard A: 4.0 pH (A7051 x 2/2011)
Standard B: 7.0 pH (2606712 x 6/2008)
Standard C: 10.0 pH (2606743 x 12/2007)
Standard D: 10 mS/cm (YSI 3163 Lot 06F1911 x 06/2007)

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
07/05/22	05:00	COND	D	10.19	+1.9%	Yes	Good	ARR
07/05/22	05:30	pH	A	4.01	+0.3%	Yes	Good	ARR
07/05/22	05:36	pH	B	7.03	+0.4%	Yes	Good	ARR
07/05/22	05:39	pH	C	10.00	0	Yes	Good	ARR
07/05/22	05:48	DO	100%	100.5%	0.5%	Yes	Good	ARR
07/05/24	05:00	COND	D	10.0	0	Yes	Good	ARR
07/05/24	05:15	pH	A	4.01	+0.3%	Yes	Good	ARR
07/05/24	05:17	pH	B	7.00	0	Yes	Good	ARR
07/05/24	05:21	pH	C	10.00	0	Yes	Good	ARR
07/05/24	05:30	DO	100%	87.7%	-13%	—	Recalibrated - out of range DM	
07/05/24	05:40	DO	100%	101.2%	+1.2%	Yes	Good	

Field Calibration Log (September 2007)

FIELD INSTRUMENT RECORDS

INSTRUMENT (MAKER/MODEL#): YSI Model 556 MPS probe #A

STANDARDS:

Standard A: 7.01 pH
Standard B: 10.03 pH
Standard C: 4.00 pH
Standard D: 10 mS/cm

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
07/09/18	21:35	COND	D	10.00	0	Yes	GOOD	AR
07/09/18	21:44	pH	A	6.96	-0.7%	Yes	GOOD	AC
07/09/18	21:58	pH	B	10.01	-0.2%	Yes	GOOD	AC
07/09/18	21:59	pH	C	4.00	-0.3%	Yes	GOOD	AC
07/09/18	22:15	DO	100%	100.2%	+0.2%	Yes	GOOD	AC
07/09/19	20:44	COND	D	10.15	+1.5%	Yes	GOOD	AC
07/09/19	20:59	pH	A	7.00	0	Yes	GOOD	AC

FIELD INSTRUMENT RECORDS

INSTRUMENT (MAKER/MODEL#): YSI 556 MPS probe #B

STANDARDS:

Standard A: 7.01 pH
Standard B: 10.03 pH
Standard C: 4.00 pH
Standard D: 10 mS/cm Conductivity

DATE (yy/mm/dd)	TIME (hr:min)	PARAMETER (pH, Cond., DO)	STD (A,B,C,D)	VALUE	DEV %	CALIBRATED (Yes, No)	INSTRUMENT RESPONSE	SAMPLER ID
07/09/18	21:30	COND	D	10.00	0	Yes	GOOD	AR
07/09/18	21:40	pH	A	7.02	+0.1%	Yes	Good	AR
07/09/18	21:42	pH	B	9.98	-0.2%	Yes	Good	AR
07/09/18	21:52	pH	C	4.01	+0.3%	Yes	Good	AR
07/09/18	21:59	DO	100%	100.2%	+0.2%	Yes	Good	AR
07/09/19	20:42	COND	D	10.12	+1.2%	Yes	Good	AR
07/09/19	20:49	pH	A	7.05	+0.7%	Yes	Good	AR

Laboratory Calibration Curves (TOC)

Standards (mg/L)	Raw data			
	May 2006 Med. Range	May 2006 Low Range	Sept. 2006	Dec. 2006
TOC 0	26114	28902	15638	45901
TOC 0	36127	27894	16138	47215
TOC 0	24700	28118	17826	45527
TOC 2 (10)	(443362)	222659	127949	147639
TOC 2 (10)	(419725)	219415	126248	138558
TOC 2 (10)	(411890)	209785	128424	138237
TOC 5 (250)	(2647386)	531953	265617	275935
TOC 5 (250)	(2535373)	531147	257699	279470
TOC 5 (250)	(2549455)	537043	260987	290070
TOC 10 (500)	(5911233)	1020014	494926	550447
TOC 10 (500)	(5692625)	1015825	484313	562799
TOC 10 (500)	(5720239)	1046196	486045	663978
TOC 20 (750)	(9021675)	1704599	979327	819496
TOC 20 (750)	(9174521)	1732395	959557	832820
TOC 20 (750)	(9037390)	1722255	961031	833148
TOC 25	-	-	1241020	-
TOC 25	-	-	1230676	-
TOC 25	-	-	1235555	-
Slope	11706.199	84941.331	48073.430	54009.769
Intercept	338072.646	76647.484	19295.420	34088.114
Correlation	0.995	0.990	0.999	0.997

Laboratory Calibration Curves (TN)

Standards (mg/L)	Raw data			
	May 2006 Med. Range	May 2006 Low Range	Sept. 2006	Dec. 2006
TN 0	-8215	17477	41776	27582
TN 0	-13254	20751	51903	30511
TN 0	4666	40856	48596	23422
TN 0.1 (5)	(842273)	191717	238642	254989
TN 0.1 (5)	(844085)	201831	280106	245572
TN 0.1 (5)	(850000)	177926	237925	
TN 0.2 (10)	(1677074)	324844	395354	537441
TN 0.2 (10)	(1660912)	390106	367380	570448
TN 0.2 (10)	(1653877)	421179	413070	456515
TN 0.3 (15)	(2557918)	-	496664	-
TN 0.3 (15)	(2533799)	-	548890	-
TN 0.3 (15)	(2519171)	-	495322	-
TN 0.4	-	-	-	876527
TN 0.4	-	-	-	884558
TN 0.4	-	-	-	
TN 0.5	-	919428	808822	-
TN 0.5	-	898600	779485	-
TN 0.5	-	913781	792148	-
TN 0.7	-	-	-	1539769
TN 0.7	-	-	-	1603082
TN 0.7	-	-	-	1632136
TN 1	-	1688402	125837	2219708
TN 1	-	1691493	83679	2256257
TN 1	-	1671675	72529	2264578
Slope	149041.500	1664940.665	1346747.430	2208641.962
Intercept	-6234.500	38625.761	117461.790	39074.616
Correlation	1.000	0.998	0.990	0.999

Appendix D

QA/QC Tables

QA/QC Tables for Microbial Parameters and TOC/TN

Matrix	Surface Water
Analytical Parameter	*Enteroccocus*
Analytical SOP	FAU LT6200 (Standard Methods SM9223C)
Number of sampling locations	14 (2006); 21 (2007)

Field QC:	**Frequency/Number**	**Method SOP QC Acceptance Limits**	**Results Fail/Number**	**Corrective Action (CA)**
Trip Blanks	5/252	< MDL = 10	0/5	Not applicable
Method Blanks	-	-	-	-
Field Duplicates	15/252	<20%	2/15	None taken
Laboratory Replicates	15/252	<20%	1/15	None taken
Cal Checks (ICV)	-	-	-	-

Matrix	Surface Water
Analytical Parameter	Total Coliform
Analytical SOP	FAU LT6100 (Standard Methods SM9223C)
Number of sampling locations	14 (2006); 21 (2007)

Field QC:	**Frequency/Number**	**Method SOP QC Acceptance Limits**	**Results Fail/Number**	**Corrective Action (CA)**
Trip Blanks	5/252	< MDL = 10	5-Jan	None taken
Method Blanks	-	-	-	-
Field Duplicates	15/252	<20%	2/15	None taken
Laboratory Replicates	15/252	<20%	1/15	None taken
Cal Checks (ICV)	-	-	-	-

Matrix	Surface Water
Analytical Parameter	*E. coli*
Analytical SOP	FAU LT6100 (Standard Methods SM9223C)
Number of sampling locations	14 (2006); 21 (2007)

Field QC:	**Frequency/Number**	**Method SOP QC Acceptance Limits**	**Results Fail/Number**	**Corrective Action (CA)**
Trip Blanks	5/252	< MDL = 10	0/5	Not applicable
Method Blanks	-	-	-	-
Field Duplicates	15/252	<20%	9/15	None taken
Laboratory Replicates	15/252	<20%	7/15	None taken
Cal Checks (ICV)	-	-	-	-

Matrix	Surface Water
Analytical Parameter	TN
Analytical SOP	FAU LT5200 (EPA415.1)
Number of sampling locations	14 (2006); 21 (2007)

Field QC:	**Frequency/Number**	**Method SOP QC Acceptance Limits**	**Results Fail/Number**	**Corrective Action (CA)**
Trip Blanks	4/189	< MDL	0/4	Not applicable
Method Blanks	14/189	< MDL	0/14	Not applicable
Field Duplicates	12/189	<20%	1/12	Data flagged
Laboratory Replicates	4/189	<20%	0/4	Not applicable
Cal Checks (ICV)	14/189	<15%	4/14	Ran a new cal check, otherwise data flagged

Matrix	Surface Water
Analytical Parameter	TOC
Analytical SOP	FAU LT5200 (EPA415.1)
Number of sampling locations	14 (2006); 21 (2007)

Field QC:	**Frequency/Number**	**Method SOP QC Acceptance Limits**	**Results Fail/Number**	**Corrective Action (CA)**
Trip Blanks	4/208	< MDL	1/4	
Method Blanks	12/208	< MDL	2/12	Ran a new blank, otherwise data flagged
Field Duplicates	12/208	<20%	2/12	Data flagged
Laboratory Replicates	4/208	<20%	0/4	Not applicable
Cal Checks (ICV)	14/208	<15%	1/14	Ran a new cal check, otherwise data flagged

QA/QC Summary Tables for Nutrient Analyses Conducted by NOAA-AOML

Ammonia

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/175	< MDL	0/3	na
Lab Replicates	7/175	< MDL	0/7	na
Field Duplicate	6/175	<20%	1/6	Data flagged

Nitrate+Nitrite

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/174	< MDL	0/3	na
Lab Replicates	7/174	< MDL	0/7	na
Field Duplicate	6/174	<20%	3/6	Data flagged

Nitrite

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/174	< MDL	0/3	na
Lab Replicates	7/174	< MDL	0/7	na
Field Duplicate	6/174	<20%	2/6	Data flagged

Silicate

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/175	< MDL	0/3	na
Lab Replicates	7/175	< MDL	0/7	na
Field Duplicate	6/175	<20%	1/6	Data flagged

Phosphate

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/169	< MDL	0/1	na
Lab Replicates	7/169	< MDL	4/7	Data flagged
Field Duplicate	6/169	<20%	5/6	Data flagged

Nitrate

Field QC:	Frequency/Number	Acceptance Limits	Results Fail/Number	Corrective Action (CA)
Trip Blank	3/174	< MDL	0/3	na
Lab Replicates	5/174	< MDL	0/5	na
Field Duplicate	3/174	<20%	1/3	Data flagged

FLORIDA ENVIRONMENTAL
QA/QC Summary Report For...

Submission#:605000250
Client Name:Florida Atlantic University
Project#:Taylor County
Site Location:Taylor County
Date Received:05/08/06
Project Manager:Daniel E. Meeroff

Legend

LCS = Laboratory Control Sample (Standard reference material purchased from certified external source to verify accuracy of instrument calibration.)
Method Blank = Lab pure water run through applicable analysis procedure prior to analysis.
Background = Concentration of analyte present in the parent sample prior to spiking.
Spike Amount Added = Actual concentration of respective analyte added and used to determine accuracy.
RPD = Relative Percent Difference (Represent's precision between duplicate analysis)
RPD Precision Limit = Acceptable percent difference allowed between duplicate analysis of the same sample, based upon method defined limits.
Lower and Upper Control Limit = Acceptable target range in which LCS and Spike % Recovery should fall, based upon method defined limits.
Set# = The physical file location in which the raw data resides at Florida Environmental's QC file room.

*QC Codes Legend:

P = All QA/QC target limits acceptable.
F = %LCS Recovery and/or Matrix Spike % Recovery and/or RPD fall outside of target limits.
M = Precision is acceptable, however accuracy may be affected by matrix interference.
I = Data is not applicable/available for all fields.

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6237

Florida Atlantic University
Taylor County

060503A1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6238

Florida Atlantic University
Taylor County

060503B1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6239

Florida Atlantic University
Taylor County

060503C1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6240

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6241

Florida Atlantic University
Taylor County

060503E1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6242

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6243

Florida Atlantic University
Taylor County

060503G1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6244

Florida Atlantic University
Taylor County

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060503H1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6245

Florida Atlantic University
Taylor County

060503I1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250   ORDER#:6246

Florida Atlantic University
Taylor County

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060503J1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6247

Florida Atlantic University
Taylor County

060503K1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6248

Florida Atlantic University
Taylor County

060503L1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6249

Florida Atlantic University
Taylor County

060503M1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6250

Florida Atlantic University
Taylor County

060503N1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6251

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2520	1.0000	25.2	U	0.00	1.0880	1.1060	1.0000	108.80	110.60	0.00	90.00	110.00	30.00	1109	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6252

Florida Atlantic University
Taylor County

060504A1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 605000250   ORDER#: 6253

Florida Atlantic University
Taylor County

060504B1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6254

Florida Atlantic University
Taylor County

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060504C1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	9.1200	9.1500	10.0000	91.20	91.50	0.55	90.00	110.00	30.00	1094	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6255

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250   ORDER#:6256

Florida Atlantic University
Taylor County

060504D2

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6257

Florida Atlantic University
Taylor County

060504E1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6258

Florida Atlantic University
Taylor County

060504F1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250   ORDER#:6259

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6260

Florida Atlantic University
Taylor County

060504H1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250   ORDER#:6261

Florida Atlantic University
Taylor County

060504I1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6262

Florida Atlantic University
Taylor County

060504J1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 605000250   ORDER#: 6263

Florida Atlantic University
Taylor County

060504K1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6264

Florida Atlantic University
Taylor County

060504L1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6265

Florida Atlantic University
Taylor County

060504M1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6266

Florida Atlantic University
Taylor County

060504N1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
50.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250   ORDER#:6267

Florida Atlantic University
Taylor County

060505A1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6268

Florida Atlantic University
Taylor County

060505B1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6269

Florida Atlantic University
Taylor County

060505C1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6270

Florida Atlantic University
Taylor County

060505D1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6271

Florida Atlantic University
Taylor County

Page:36
060505E1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6272

Florida Atlantic University
Taylor County

060505F1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6273

Florida Atlantic University
Taylor County

060505G1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6274

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	4.6300	5.0000	92.6	U	0.00	8.4100	9.1200	10.0000	84.10	91.20	8.22	90.00	110.00	30.00	1095	M
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

0.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
33.3% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6275

Florida Atlantic University
Taylor County

060505K1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
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QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6276

Florida Atlantic University
Taylor County

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060505TB (K1)

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F

50.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6277

Florida Atlantic University
Taylor County

Page:42
060505J1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6278

Florida Atlantic University
Taylor County

060505I1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6279

Florida Atlantic University
Taylor County

060505L1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6280

Florida Atlantic University
Taylor County

060505M1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6281

Florida Atlantic University
Taylor County

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060505M2

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
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QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:605000250 ORDER#:6282

Florida Atlantic University
Taylor County

060505N1

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Nitrogen (Ammonia) as N	5.1200	5.0000	102.4	U	0.20	9.8100	9.6700	10.0000	96.10	94.70	1.34	90.00	110.00	30.00	1096	P
Nitrate (as N)	0.2590	1.0000	25.9	U	0.00	1.1480	1.1390	1.0000	114.80	113.90	0.79	90.00	110.00	30.00	1156	F
Caffeine	0.0500	0.2000	25.0	U	0.00	0.0900	0.0800	0.2000	45.00	40.00	11.76	80.00	120.00	30.00	1202	F

33.3% of all QA/QC Target Limits passed the specified acceptable control criteria.
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QA/QC Signature

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060926A	L213390-1	09/26/06
060926B	L213390-2	09/26/06
060926C	L213390-3	09/26/06
060926D	L213390-4	09/26/06
060926E	L213390-5	09/26/06
060926F	L213390-6	09/26/06
060926G	L213390-7	09/26/06
060926H	L213390-8	09/26/06
060926H2	L213390-9	09/26/06
060926I	L213390-10	09/26/06

Log No.L213390

12 pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060926J	L213390-11	09/26/06
060926K	L213390-12	09/26/06
060926L	L213390-13	09/26/06
060926M	L213390-14	09/26/06
060926N	L213390-15	09/26/06
060926TB	L213390-16	09/26/06
060927A	L213390-17	09/27/06
060927B	L213390-18	09/27/06
060927C	L213390-19	09/27/06
060927D	L213390-20	09/27/06

Log No.L213390

N/A pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060927E	L213390-21	09/27/06
060927F	L213390-22	09/27/06
060927G	L213390-23	09/27/06
060927G2	L213390-24	09/27/06
060927H	L213390-25	09/27/06
060927I	L213390-26	09/27/06
060927J	L213390-27	09/27/06
060927K	L213390-28	09/27/06
060927L	L213390-29	09/27/06
060927M	L213390-31	09/27/06

Log No.L213390

N/A pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060927N	L213390-32	09/27/06
060928A	L213390-33	09/28/06
060928B	L213390-34	09/28/06
060928C	L213390-35	09/28/06
060928D	L213390-36	09/28/06
060928E	L213390-37	09/28/06
060928E2	L213390-38	09/28/06
060928F	L213390-39	09/28/06
060928G	L213390-40	09/28/06
060928H	L213390-41	09/28/06

Log No.L213390

N/A pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060928I	L213390-42	09/28/06
060928J	L213390-43	09/28/06
060928K	L213390-44	09/28/06
060928L	L213390-45	09/28/06
060928M	L213390-46	09/28/06
060928N	L213390-47	09/28/06

Log No.L213390

N/A pages (including cover sheet)

Qa Information for Login
usb_qa_export.idxl
L213390

Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-1
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-1
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-10
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-10
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-11
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-11
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-12
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-12
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-13
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-13
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-14
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-14
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-15
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-15
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-16
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-16
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-17
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-17
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-18
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-18
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-19
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-19
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-2
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-2
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-20
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-20
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-21
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-21

Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-22
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-22
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-23
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-23
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-24
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-24
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-25
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-25
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-26
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-26
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-27
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-27
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-28
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-28
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-29
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-29
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-3
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-3
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-31
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-31
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-32
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-32
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-33
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-33
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-34
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-34
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-35
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-35

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Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-36
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-36
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-37
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-37
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-38
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-38
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-39
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-39
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-4
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-4
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-40
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-40
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-41
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-41
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-42
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-42
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-43
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-43
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-44
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-44
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-45
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-45
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-46
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-46
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-47
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-47
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-5
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-5

Qa Information for Login
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Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-6
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-6
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-7
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-7
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-8
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-8
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-9
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-9

US BIOSYSTEMS

GENERAL CHEMISTRY BLANK RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Matrix	Units	Concentration Found	PQL	MDL	Flags
AMMONIA	Liquid	mg/l	U	0.020	0.010	
AMMONIA	Liquid	mg/l	U	0.020	0.010	
AMMONIA	Liquid	mg/l	U	0.020	0.010	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	

Form No. WC3

US BIOSYSTEMS

GENERAL CHEMISTRY LABORATORY CONTROL SAMPLE RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Matrix	Units	TrueValue	LCS Result	LCS Rec. %	LCS Dup Result	LCS Dup Rec.%	Recovery Limits	% RPD	RPD Limit	Flags
AMMONIA	Liquid	mg/l	2.50	2.7	108	2.7	108	90-110	0.0	20	
AMMONIA	Liquid	mg/l	2.50	2.6	104	2.6	104	90-110	0.0	20	
AMMONIA	Liquid	mg/l	2.50	2.6	104	2.6	104	90-110	0.0	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.50	100	0.52	104	90-110	4.0	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.51	102	0.48	96	90-110	6.1	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.51	102	0.48	96	90-110	6.1	20	

Spike Recovery: 0 out of 12 outside limits

Duplicate RPD: 0 out of 0 outside limits

Form No. WC5

US BIOSYSTEMS

GENERAL CHEMISTRY SPIKE/SPIKE DUPLICATE SAMPLE RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Number	Sample Matrix	Units	Sample Result	Spike Conc.	Spiked Result	Spike Rec. %	Spike Dup Result	Spike Dup Rec.%	Recovery Limits	% RPD	RPD Limit	Flags
AMMONIA	L213390-17	Liquid	mg/l	0.13	5.00	5.1	99	5.2	101	90-110	2.0	20	
AMMONIA	L213390-27	Liquid	mg/l	0.021	5.00	4.8	96	4.8	96	90-110	0.0	20	
AMMONIA	L213390-38	Liquid	mg/l	0.052	5.00	5.1	101	5.2	103	90-110	2.0	20	
AMMONIA	L213406-1	Liquid	mg/l	ND	5.00	4.5	90	4.5	90	90-110	0.0	20	
AMMONIA	L213390-1	Liquid	mg/l	0.17	5.00	5.0	97	5.0	97	90-110	0.0	20	
AMMONIA	L213390-12	Liquid	mg/l	0.012 I	5.00	5.0	100	4.9	98	90-110	2.0	20	
NITRATE (AS N)	L213298-2	Liquid	mg/l	ND	1.00	1.0	100	1.0	100	90-110	0.0	20	
NITRATE (AS N)	L213390-8	Liquid	mg/l	0.014 IQ	1.00	1.0	99	1.0	99	90-110	0.0	20	
NITRATE (AS N)	L213390-18	Liquid	mg/l	0.018 IQ	1.00	0.99	97	0.99	97	90-110	0.0	20	
NITRATE (AS N)	L213390-28	Liquid	mg/l	0.047 IQ	1.00	1.0	95	1.0	95	90-110	0.0	20	
NITRATE (AS N)	L213390-39	Liquid	mg/l	0.018 I	1.00	1.0	98	1.0	98	90-110	0.0	20	

Spike Recovery: 0 out of 22 outside limits

Duplicate RPD: 0 out of 11 outside limits

Form No. WC4

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060926A	L213390-1	09/26/06
060926B	L213390-2	09/26/06
060926C	L213390-3	09/26/06
060926D	L213390-4	09/26/06
060926E	L213390-5	09/26/06
060926F	L213390-6	09/26/06
060926G	L213390-7	09/26/06
060926H	L213390-8	09/26/06
060926H2	L213390-9	09/26/06
060926I	L213390-10	09/26/06

Log No.L213390

12 pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060926J	L213390-11	09/26/06
060926K	L213390-12	09/26/06
060926L	L213390-13	09/26/06
060926M	L213390-14	09/26/06
060926N	L213390-15	09/26/06
060926TB	L213390-16	09/26/06
060927A	L213390-17	09/27/06
060927B	L213390-18	09/27/06
060927C	L213390-19	09/27/06
060927D	L213390-20	09/27/06

Log No.L213390

NA pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060927E	L213390-21	09/27/06
060927F	L213390-22	09/27/06
060927G	L213390-23	09/27/06
060927G2	L213390-24	09/27/06
060927H	L213390-25	09/27/06
060927I	L213390-26	09/27/06
060927J	L213390-27	09/27/06
060927K	L213390-28	09/27/06
060927L	L213390-29	09/27/06
060927M	L213390-31	09/27/06

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NA pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

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Field Sample ID	Laboratory Sample ID	Date of Collection
060927N	L213390-32	09/27/06
060928A	L213390-33	09/28/06
060928B	L213390-34	09/28/06
060928C	L213390-35	09/28/06
060928D	L213390-36	09/28/06
060928E	L213390-37	09/28/06
060928E2	L213390-38	09/28/06
060928F	L213390-39	09/28/06
060928G	L213390-40	09/28/06
060928H	L213390-41	09/28/06

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NA pages (including cover sheet)

US Biosystems, Inc.

Level I QA

FOR

FAU CIVIL ENGINEERING DEPT

FAU CIVIL ENGINEERING DEPT

Field Sample ID	Laboratory Sample ID	Date of Collection
060928I	L213390-42	09/28/06
060928J	L213390-43	09/28/06
060928K	L213390-44	09/28/06
060928L	L213390-45	09/28/06
060928M	L213390-46	09/28/06
060928N	L213390-47	09/28/06

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Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-1
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-1
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-10
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-10
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-11
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-11
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-12
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-12
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-13
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-13
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-14
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-14
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-15
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-15
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-16
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-16
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-17
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-17
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-18
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-18
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-19
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-19
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-2
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-2
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-20
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-20
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-21
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-21

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Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-22
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-22
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-23
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-23
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-24
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-24
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-25
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-25
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-26
Inorganics Anal	GW	AMMONIA	10056NH3A	1NH310056/10056NH3A	390-26
Inorganics Anal	GW	NITRATE	09296NO3E	16NO309296/09296NO3E	390-27
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-27
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-28
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-28
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-29
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-29
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-3
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-3
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-31
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-31
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-32
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-32
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-33
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-33
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-34
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-34
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-35
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-35

Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-36
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-36
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-37
Inorganics Anal	GW	AMMONIA	10056NH3A	2NH310056/10056NH3A	390-37
Inorganics Anal	GW	NITRATE	09296NO3E	17NO309296/09296NO3E	390-38
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-38
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-39
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-39
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-4
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-4
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-40
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-40
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-41
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-41
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-42
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-42
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-43
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-43
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-44
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-44
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-45
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-45
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-46
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-46
Inorganics Anal	GW	NITRATE	09296NO3F	19NO309296/09296NO3F	390-47
Inorganics Anal	GW	AMMONIA	10056NH3B	3NH310056/10056NH3B	390-47
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-5
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-5

Qa Information for Login
usb_qa_export.idxl
L213390

Dept	Matrix	Product	Workgroup	RunID	
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-6
Inorganics Anal	GW	AMMONIA	10046NH3D	7NH310046/10046NH3D	390-6
Inorganics Anal	GW	NITRATE	09296NO3D	14NO309296/09296NO3D	390-7
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-7
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-8
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-8
Inorganics Anal	GW	NITRATE	09296NO3D	15NO309296/09296NO3D	390-9
Inorganics Anal	GW	AMMONIA	10046NH3D	8NH310046/10046NH3D	390-9

US BIOSYSTEMS

GENERAL CHEMISTRY BLANK RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Matrix	Units	Concentration Found	PQL	MDL	Flags
AMMONIA	Liquid	mg/l	U	0.020	0.010	
AMMONIA	Liquid	mg/l	U	0.020	0.010	
AMMONIA	Liquid	mg/l	U	0.020	0.010	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	
NITRATE (AS N)	Liquid	mg/l	U	0.050	0.0052	

Form No. WC3

US BIOSYSTEMS

GENERAL CHEMISTRY LABORATORY CONTROL SAMPLE RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Matrix	Units	TrueValue	LCS Result	LCS Rec. %	LCS Dup Result	LCS Dup Rec.%	Recovery Limits	% RPD	RPD Limit	Flags
AMMONIA	Liquid	mg/l	2.50	2.7	108	2.7	108	90-110	0.0	20	
AMMONIA	Liquid	mg/l	2.50	2.6	104	2.6	104	90-110	0.0	20	
AMMONIA	Liquid	mg/l	2.50	2.6	104	2.6	104	90-110	0.0	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.50	100	0.52	104	90-110	4.0	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.51	102	0.48	96	90-110	6.1	20	
NITRATE (AS N)	Liquid	mg/l	0.500	0.51	102	0.48	96	90-110	6.1	20	

Spike Recovery: 0 out of 12 outside limits

Duplicate RPD: 0 out of 0 outside limits

Form No. WC5

US BIOSYSTEMS

GENERAL CHEMISTRY SPIKE/SPIKE DUPLICATE SAMPLE RESULTS

Test Report No.: L213390

Client Name : FAU CIVIL ENGINEERING DEPT

Parameter	Sample Number	Sample Matrix	Units	Sample Result	Spike Conc.	Spiked Result	Spike Rec. %	Spike Dup Result	Spike Dup Rec.%	Recovery Limits	% RPD	RPD Limit	Flags
AMMONIA	L213390-17	Liquid	mg/l	0.13	5.00	5.1	99	5.2	101	90-110	2.0	20	
AMMONIA	L213390-27	Liquid	mg/l	0.021	5.00	4.8	96	4.8	96	90-110	0.0	20	
AMMONIA	L213390-38	Liquid	mg/l	0.052	5.00	5.1	101	5.2	103	90-110	2.0	20	
AMMONIA	L213406-1	Liquid	mg/l	ND	5.00	4.5	90	4.5	90	90-110	0.0	20	
AMMONIA	L213390-1	Liquid	mg/l	0.17	5.00	5.0	97	5.0	97	90-110	0.0	20	
AMMONIA	L213390-12	Liquid	mg/l	0.012 I	5.00	5.0	100	4.9	98	90-110	2.0	20	
NITRATE (AS N)	L213298-2	Liquid	mg/l	ND	1.00	1.0	100	1.0	100	90-110	0.0	20	
NITRATE (AS N)	L213390-8	Liquid	mg/l	0.014 IQ	1.00	1.0	99	1.0	99	90-110	0.0	20	
NITRATE (AS N)	L213390-18	Liquid	mg/l	0.018 IQ	1.00	0.99	97	0.99	97	90-110	0.0	20	
NITRATE (AS N)	L213390-28	Liquid	mg/l	0.047 IQ	1.00	1.0	95	1.0	95	90-110	0.0	20	
NITRATE (AS N)	L213390-39	Liquid	mg/l	0.018 I	1.00	1.0	98	1.0	98	90-110	0.0	20	

Spike Recovery: 0 out of 22 outside limits

Duplicate RPD: 0 out of 11 outside limits

Form No. WC4

Sample	No3+NO2	No2	**No3**
L213390-1	0	0	**0**
L213390-2	0	0	**0**
L213390-3	0.017	0	**0.017**
L213390-4	0	0	**0**
L213390-5	0.016	0	**0.016**
L213390-6	0	0	**0**
L213390-7	0.01	0.01	**0**
L213390-8	0.014	0	**0.014**
L213390-9	0.014	0	**0.014**
L213390-10	0.014	0	**0.014**
L213390-11	0.023	0	**0.023**
L213390-12	0.044	0.0005	**0.0435**
L213390-13	0.033	0	**0.033**
L213390-14	0.017	0	**0.017**
L213390-15	0.0083	0.001	**0.0073**
L213390-16	0	0	**0**
L213390-17	0	0	**0**
L213390-18	0.018	0	**0.018**
L213390-19	0.015	0	**0.015**
L213390-20	0	0	**0**
L213390-21	0.017	0	**0.017**
L213390-22	0	0	**0**
L213390-23	0.015	0.01	**0.005**
L213390-24	0.015	0.01	**0.005**
L213390-25	0	0	**0**
L213390-26	0.015	0	**0.015**
L213390-27	0.015	0	**0.015**
L213390-28	0.053	0.006	**0.047**
L213390-29	0	0	**0**
L213390-31	0	0	**0**
L213390-32	0	0	**0**
L213390-33	0.023	0	**0.023**
L213390-34	0	0	**0**
L213390-35	0.017	0	**0.017**
L213390-36	0	0	**0**
L213390-37	0.02	0	**0.02**
L213390-38	0.02	0	**0.02**
L213390-39	0.018	0	**0.018**
L213390-40	0.015	0.0093	**0.0057**
L213390-41	0.011	0	**0.011**
L213390-42	0.014	0	**0.014**
L213390-43	0.012	0	**0.012**
L213390-44	0.051	0	**0.051**
L213390-45	0.022	0.008	**0.014**
L213390-46	0.016	0.001	**0.015**
L213390-47	0	0	**0**

9/29/2006 TB
NO3+NO2 BY 353.2
NO2 BY 354.1

FAU_061212; 061213; (

Analyzed: 12.14.06

Analyzed: 01.18.07

OR=out of range

Samp	Site	Description	N+N uM	NO2 uM	Si uM	P uM
061212	A1	Dekle Bch 6:52AM	0.53	0.05	38.8	0
061212	B1	Canal @ Dekle Bch	0.62	0.1	35.7	0.01
061212	C1	Creek @ Dekle Bch	0.71	0.06	40	0.78
061212	C2-dup		0.56	0.08	42.3	0.17
061212	D1	Pump Sta	0.33	0.06	39.5	0.17
061212	E1	Jet Ski	1.1	0.1	44.3	0.32
061212	F1	Keaton Bch	0.22	0.03	41	0.01
061212	G1	Blu Crk	3.7	0.1	46.2	0.68
061212	H1	Heron Rd	0.45	0.07	42.8	0.29
061212	I1	Cedar Is	0.85	0.04	40.6	0.07
061212	J1	Roys	1.1	0.06	41.4	0.2
061212	K1	Gardens	9.4	0.16	45	0.9
061212	L1	Boggy	0.65	0.07	63.4	0.4
061212	M1	Airstrip Rd	1.4	0.09	66.6	0.42
061212	N1	Falls	1.1	OR	58.6	1
061212	X1	Mid-Stein	3.6	0.26	45	0.66
061212	Z1	Fenhalloway	45.8	22.7	33.5	53.8
061212	TB	Trip Blk	0.08	0.02	20.2	0.07

Samp	Site	Description	N+N uM	NO2 uM	Si uM	P uM
061213	A1	Dekle Bch	0.27	0	44.1	0.07
061213	B1	Canal @ Dekle Bch	0.77	0.03	47.3	0.11
061213	C1	Creek @ Dekle Bch	0.66	0.01	40	0.2
061213	D1	Pump Sta	0.71	0.02	43	0.18
061213	E1	Jet Ski	1.5	0.04	49.9	0.29
061213	F1	Keaton Bch	0.48	0	37.2	0.05
061213	G1	Blu Crk	4.9	0.03	43.8	0.4
061213	H1	Heron Rd	0.71	0	53.2	0.24
061213	I1	Cedar Is	0.35	0	45.2	0.05
061213	J1	Roys	1.8	0	25.2	0.23
061213	K1	Gardens	4.3	0.05	53.4	0.8
061213	L1	Boggy	0.75	0	77.1	0.29
061213	M1	Airstrip Rd	2.1	0	66.6	0.41
061213	M2-dup		1.8	0	69.8	0.48
061213	N1	Falls	2	OR	53.4	11.2
061213	X1	Mid-Stein	4.5	0.01	55.2	1.1
061213	Z1	Fenhalloway	66.6	23.5	42.2	49.2

			N+N	NO2	Si	P
Samp	Site	Description	uM	uM	uM	uM
061214	A1	Dekle Bch	0.24	0.05	36.3	0.05
061214	A1-dup		0.27	0.04	34.2	0.06
061214	B1	Canal @ Dekle Bch	0.64	0.13	30.3	0.08
061214	C1	Creek @ Dekle Bch	0.92	0.09	40.7	0.13
061214	D1	Pump Sta	0.48	0.09	33.7	0.11
061214	E1	Jet Ski	1.1	0.1	38.9	0.17
061214	F1	Keaton Bch	0.28	0.03	37	0
061214	G1	Blu Crk	4.6	0.12	45.4	0.29
061214	H1	Heron Rd	0.96	0.1	51.5	0.11
061214	I1	Cedar Is	1.3	0.06	41.2	0.07
061214	J1	Roys	2.1	0.12	49.5	0.16
061214	K1	Gardens	7.8	0.15	51.2	0.67
061214	L1	Boggy	0.44	0.09	75.2	0.13
061214	M1	Airstrip Rd	1.8	0.12	63.2	0.21
061214	N1	Falls	0.91	0.09	62.9	0.59
061214	X1	Mid-Stein	4.1	0.15	43.7	0.53
061214	Z1	Fenhalloway	70.1	25	40.4	59.8

Ammonia

Field QC:	Frequency/Number	Acceptance Limits	Results	Corrective Action (CA)
Trip Blank	1/52	< MDL	0/1	na
Method Bla	1/52	< MDL	0/1	na
Field Dupli	3/52	<20%	0/3	na

Nitrate+Nitrite

Field QC:	Frequency/Number	Acceptance Limits	Results	Corrective Action (CA)
Trip Blank	1/52	< MDL	0/1	na
Method Bla	1/52	< MDL	0/1	na
Field Dupli	3/52	<20%	0/3	na

Nitrite

Field QC:	Frequency/Number	Acceptance Limits	Results	Corrective Action (CA)
Trip Blank	1/52	< MDL	0/1	na
Method Bla	1/52	< MDL	0/1	na
Field Dupli	3/52	<20%	0/3	na

Silicate

Field QC:	Frequency/Number	Acceptance Limits	Results	Corrective Action (CA)
Trip Blank	1/52	< MDL	0/1	na
Method Bla	1/52	< MDL	0/1	na
Field Dupli	3/52	<20%	0/3	na

Phosphate

Field QC:	Frequency/Number	Acceptance Limits	Results	Corrective Action (CA)
Trip Blank	1/52	< MDL	0/1	na
Method Bla	1/52	< MDL	0/1	na
Field Dupli	3/52	<20%	1/3	Data flagged as contamin

061214

NH4	
uM	
1	
2.7	
3.6	contamination of P
3.7	
2.1	
7.7	
0.76	
8.9	
4.6	
1.3	
2.5	
4.6	
2	
3.8	
9.2	
6.3	
277.1	
0	

NH4
uM
0.33
4.1
3.6
2.8
7.8
0.25
8.9
4.6
0.51
2.9
3.6
2.1
6.1
6.4
9.3
4.1
240.2

NH4
uM
0.5
0.44
4.5
4
1.8
5.8
0.5
9.6
6
3.6
3.4
3.9
3.5
7
9.2
3.8
226.7

ıation

SUBMISSION # 610-003		CHAIN OF CUSTODY RECORD	DUE DATE Requested
Logged in LIMS by MR CSM assigned ________	Florida Environmental	1460 W. McNab Road Ft Laud. FL 33309 Tel: (954) 978-6400 Fax: (954) 978-2233 940 Alt. 27 South Babson Park, FL 33827 Tel: (863) 638-3255 Fax: (863) 638-3637 630 Indian Street Savannah, GA 31401 Tel: (912) 238-5050 Fax: (912) 234-4815 528 Gooch Road Fort Meade, FL 33841 Tel: (863) 285-8145 Fax: (863) 285-7030	RUSH RESERVATION #
		Original-Return w/report / Yellow- Lab File Copy / Pink- Sampler Copy	*Rush Surcharges apply*

Report to: *(company name)* DAN MEEROFF	Report to Address: 777 Glades Road Bldg 36, Room 222
Invoice to: *(company name)* DAN MEEROFF/FAU — Purchase Order #	Invoice to Address: -Same-
Project Name and/or Number: TAYLOR COUNTY	Site Location: TAYLOR COUNTY for Dan Meeroff 10/13/08
Project Contact: -SAME- — Phone: 954 592 4796	Fax: 561 297 0493 — Email: dmeeroff@fau.edu
Sampler Name: (printed) -SAME-	Sampler Signature

ORDER # Lab Control Number	Sample ID	Date Sampled	Time Sampled	Matrix (DW SW GW WW S SED HW BIO SEA OIL X AIR)	Bottle & Pres. Combo Codes	Number of Containers Received & NELAC Letter Suffixes # A-?	CAFFEINE							TEMP -C	PH	COND	CHLOR
1 23614	060926 E	9/26/2006	7AM	SW	A		1										
2 23615	060926 I	9/26/2006	9 AM	SEA			1										
3 23616	060926 K	9/26/2006	10 AM	SW			1										
4 23617	060927 D Lift Station	9/27/2006	7AM	SW			1										
5 23618	060927 J Main St	9/27/2006	8 AM	SEA			1										
6 23619	060927 K	9/27/2006	9 AM	SW			1										
7 23620	060928 A	9/28/2006	6 AM	SEA			1										
8 23621	060928 B	9/28/2006	6:30 AM	SW			1										
9 23622	060928 C Creek @ bridge	9/28/2006	6:45 AM	SW			1										
10 23623	060928 D Lift Station	9/28/2006	7 AM	SW	V		1										

Special Comments:

"I waive NELAC protocol" (sign here) >

Deliverables: QA/QC Report Needed? Yes No *(additional charge)*

Total

	SAMPLE CUSTODY AND TRANSFER SIGNATURES	DATE / TIME
1	Relinquished by:	09/30/2006 12:00
1	Received by:	09/30/2006 12:06
2	Relinquished by:	
2	Received by:	
3	Relinquished by:	
3	Received by:	

Sample Custody & Field Comments	Bottle Type	Preservatives
Temp as received 4 C	A-liter amber	A-ascorbic acid / P-H3PO4
Custody Seals? Y N	B-Bacteria bag/bottle	C-HCL / S-H2SO4
Billable Field Time ______ hrs	F-500 ml O-125 ml	Cu-CuSO4 / T-Na2S2O3-H2O
Misc. Charges ________	L-liter bottle	H-HNO3 / U-Unpreserved
	S4- 4 oz soil jar / S8- 8 oz soil jar	M-MCAB / P-H3PO4
	T-250 ml	N-NaOH / Z-zinc acetate
	V-40 ml vial	NH4-NH4CL
	W-wide mouth	
	X-other TED=Tedlar Air Bag	

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SUBMISSION # 610-003

Logged in LIMS by [illegible]
CSM assigned

Florida Environmental

CHAIN OF CUSTODY RECORD

1460 W. McNab Road Ft Laud. FL 33309 Tel: (954) 978-6400 Fax: (954) 978-2233
940 Alt. 27 South Babson Park, FL 33827 Tel: (863) 638-3255 Fax: (863) 638-3637
630 Indian Street Savannah, GA 31401 Tel: (912) 238-5050 Fax: (912) 234-4815
528 Gooch Road Fort Meade, FL 33841 Tel: (863) 285-8145 Fax: (863) 285-7030

Original-Return w/report Yellow- Lab File Copy Pink- Sampler Copy

DUE DATE Requested

RUSH RESERVATION #

Rush Surcharges apply

Report to: (company name) DAN MEEROFF		Report to Address: 777 Glades Rd Bldg 36, Room 222	
Invoice to: (company name) DAN MEEROFF / FAU	Purchase Order #	Invoice to Address: -Same-	
Project Name and/or Number TAYLOR COUNTY		Site Location:	
Project Contact: -Same-	Phone: 954 592 4796	Fax: 561 297 0493	Email: dmeeroff@fau.edu
Sampler Name: (printed) -Same-		Sampler Signature [signature]	

ORDER # Lab Control Number (Shaded Areas For Laboratory Use Only)	Sample ID	Date Sampled	Time Sampled	Matrix (DW SW GW WW S SED HW BIO SEA OIL X AIR)	Bottle & Pres. Combo Codes	Number of Containers Received & NELAC Letter Suffixes # A-?	Analysis Required: CAFFEINE						Field Tests: TEMP-C	PH	COND	CHLOR
1 23624	060928E Cortez Rd	09/28/2006	7AM	SW	A		1									
2 23625	060928F Keaton Bch	09/28/2006	7AM	SEA			1									
3 23626	060928G Blue Crk	09/28/2006	7:15AM	SW			1									
4 23627	060928H Osprey		7:30 AM	SW			1									
5 23628	060928I Cedar Island		7:30 AM	SEA			1									
6 23629	060928J Roys		8 AM	SEA			1									
7 23630	060928K Gamper		8:20 AM	SW			1									
8 23631	060928L Boggy Crk		9 AM	SW			1									
9 23632	060928M Airship		10AM	SW			1									
10 23633	060928N Falls		10:30AM	SW			1									

Special Comments:

"I waive NELAC protocol" (sign here) >

Deliverables: QA/QC Report Needed? Yes No (additional charge)

Total

	SAMPLE CUSTODY AND TRANSFER SIGNATURES	DATE / TIME
1	Relinquished by: [signature]	09/30/2006 12:00
1	Received by: [signature]	09/30/2006 12:00
2	Relinquished by:	
2	Received by:	
3	Relinquished by:	
3	Received by:	

Sample Custody & Field Comments

Temp as received 4 C

Custody Seals? Y N

Billable Field Time ______ hrs

Misc. Charges ______

Bottle Type

A-liter amber
B-Bacteria bag/bottle
F-500 ml O-125 ml
L-liter bottle
S4- 4 oz soil jar / S8- 8 oz soil jar
T-250 ml
V-40 ml vial
W-wide mouth
X-other TED=Tedlar Air Bag

Preservatives

A-ascorbic acid P-H3PO4
C-HCL S-H2SO4
Cu-CuSO4 T-Na2S2O3-H2O
H-HNO3 U-Unpreserved
M-MCAB P-H3PO4
N-NaOH Z-zinc acetate
NH4-NH4CL

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Data Qualifier Codes

A Value reported is the mean (average) of two or more determinations.

B Results based upon colony counts outside the acceptable range. The code is to be used if the colony count is generated from a plate in which the total number of Coliform colonies exceeds the method indicated ideal ranges, which are:
Total Coliforms: 20-80 colonies
Fecal Coliforms: 20-60 colonies

C Result was confirmed by a separate analysis of the sample.

D Measurement was made in the field (i.e. in situ). This applies to any value (ex. pH, specific conductance, etc.) that was obtained under field conditions using approved analytical methods.

H Value based on field kit determination; results may not be accurate.

I The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

J Estimated value; value not accurate. This code shall be used in the following instances:
1. surrogate recovery limits have been exceeded.
2. no known quality control criteria exists for the component
3. the reported value failed to meet the established quality control criteria for either precision or accuracy.
4. the sample matrix interfered with the ability to make any accurate determination; or
5. if the data is questionable because of improper laboratory or field protocols (e.g. composite sample was collected instead of a grab sample).

N Presumptive evidence of presence of material. This qualifier shall be used if:
1. the component has been tentatively identified based on mass spectral library search.a
2. there is an indication that the analyte is present, but quality control requirements for confirmation were not met

O Sampled, but analysis lost or not performed; sample compromised.

Q Sample held beyond accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

R Significant rain in the past 48 hours. This code shall be used when the rainfall might contribute to a lower than normal value.

T Value reported is less than the laboratory method detection limit

U Indicated that the compound was analyzed for but not detected. This shall be used to indicate that the specified component <u>was not</u> detected. The value associated with the qualifier shall be the laboratory method detection limit

V Indicated that the analyte was detected in both the sample and the associated method blank. Note: the value in the blank shall not be subtracted from associated samples.

Y The laboratory analysis was from an unpreserved or improperly preserved sample. The data may not be accurate.

Z Too many colonies were present (TNTC), the numeric value represents the filtration volume.

? Data is rejected and should not be used. Some of all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.

* Not analyzed due to interference.

! Data deviates from historically established concentration ranges.

~ Analysis performed outside NELAP program. (e.g. State of Georgia, UCMR, ICR or other certification.)

Florida Environmental

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road
Boca Raton, FL 33431

Report Printed: 10/13/06
Submission # 610000003

Project: Taylor County
Site Location: Taylor County

Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

Caffeine

SAMPLE ID	Date	Time	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
060926E	09/26/06	07:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1214:37	10/1214:37	AC
060926I	09/26/06	09:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:53	10/12	AC
060926K	09/26/06	10:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060927D	09/27/06	07:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060927J	09/27/06	08:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060927K	09/27/06	09:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060928A	09/28/06	06:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060928B	09/28/06	06:30	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060928C	09/28/06	06:45	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060928D	09/28/06	07:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC
060928E	09/28/06	07:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928F	09/28/06	07:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928G	09/28/06	07:15	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928H	09/28/06	07:30	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928I	09/28/06	07:30	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928J	09/28/06	08:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928K	09/28/06	08:30	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928L	09/28/06	09:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC
060928M	09/28/06	10:00	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

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Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road
Boca Raton, FL 33431

Report Printed: 10/13/06
Submission # 610000003

Project: Taylor County
Site Location: Taylor County

Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

Caffeine

SAMPLE ID Date Time	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
060928N 09/28/06 10:30	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the samples.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Florida Environmental

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23614

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060926E
Collected: 09/26/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1214:37	10/1214:37	AC

QC=Qualifier Codes as defined by DEP 62-160
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Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23615

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060926I
Collected: 09/26/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:53	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23616

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060926K
Collected: 09/26/06 10:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

V. Castellano
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23617

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060927D
Collected: 09/27/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23618

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060927J
Collected: 09/27/06 08:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Eg Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23619

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060927K
Collected: 09/27/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

K. Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23620

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928A
Collected: 09/28/06 06:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

VG Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23621

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928B
Collected: 09/28/06 06:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23622

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928C
Collected: 09/28/06 06:45
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23623

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928D
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23624

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928E
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23625

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928F
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Ed Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
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Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23626

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928G
Collected: 09/28/06 07:15
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23627

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928H
Collected: 09/28/06 07:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23628

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928I
Collected: 09/28/06 07:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23629

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928J
Collected: 09/28/06 08:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
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Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

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Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23630

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928K
Collected: 09/28/06 08:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23631

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928L
Collected: 09/28/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

V. Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23632

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928M
Collected: 09/28/06 10:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23633

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928N
Collected: 09/28/06 10:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	0.321		ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

FLORIDA ENVIRONMENTAL
QA/QC Summary Report For...

Submission#:610000003
Client Name:Florida Atlantic University
Project#:Taylor County
Site Location:Taylor County
Date Received:09/30/06
Project Manager:Daniel E. Meeroff

Legend

LCS = Laboratory Control Sample (Standard reference material purchased from certified external source to verify accuracy of instrument calibration.)
Method Blank = Lab pure water run through applicable analysis procedure prior to analysis.
Background = Concentration of analyte present in the parent sample prior to spiking.
Spike Amount Added = Actual concentration of respective analyte added and used to determine accuracy.
RPD = Relative Percent Difference (Represent's precision between duplicate analysis)
RPD Precision Limit = Acceptable percent difference allowed between duplicate analysis of the same sample, based upon method defined limits.
Lower and Upper Control Limit = Acceptable target range in which LCS and Spike % Recovery should fall, based upon method defined limits.
Set# = The physical file location in which the raw data resides at Florida Environmental's QC file room.

*QC Codes Legend:

P = All QA/QC target limits acceptable.
F = %LCS Recovery and/or Matrix Spike % Recovery and/or RPD fall outside of target limits.
M = Precision is acceptable, however accuracy may be affected by matrix interference.
I = Data is not applicable/available for all fields.

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23614

Florida Atlantic University
Taylor County

060926E

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23615

Florida Atlantic University
Taylor County

060926I

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23616

Florida Atlantic University
Taylor County

060926K

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23617

Florida Atlantic University
Taylor County

060927D

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Munez
QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23618

Florida Atlantic University
Taylor County

060927J

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Nunez
QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 610000003   ORDER#: 23619

Florida Atlantic University
Taylor County

060927K

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23620

Florida Atlantic University
Taylor County

060928A

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23621

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23622

Florida Atlantic University
Taylor County

060928C

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23623

Florida Atlantic University
Taylor County

060928D

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 610000003   ORDER#: 23624

Florida Atlantic University
Taylor County

060928E

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23625

Florida Atlantic University
Taylor County

060928F

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Nunez
QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23626

Florida Atlantic University
Taylor County

060928G

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23627

Florida Atlantic University
Taylor County

060928H

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23628

Florida Atlantic University
Taylor County

060928I

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23629

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23630

Florida Atlantic University
Taylor County

060928K

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23631

Florida Atlantic University
Taylor County

060928L

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23632

Florida Atlantic University
Taylor County

Page:20
060928M

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Murray

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23633

Florida Atlantic University
Taylor County

060928N

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23614

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060926E
Collected: 09/26/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1214:37	10/1214:37	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23615

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060926I
Collected: 09/26/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:53	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23616

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060926K
Collected: 09/26/06 10:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23617

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060927D
Collected: 09/27/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23618

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060927J
Collected: 09/27/06 08:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Ed Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23619

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060927K
Collected: 09/27/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

K. Castellano
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23620

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928A
Collected: 09/28/06 06:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

VG Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23621

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928B
Collected: 09/28/06 06:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23622

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928C
Collected: 09/28/06 06:45
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

V.E. Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23623

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928D
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:54	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23624

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928E
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23625

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928F
Collected: 09/28/06 07:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Ed Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23626

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928G
Collected: 09/28/06 07:15
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23627

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928H
Collected: 09/28/06 07:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

E. Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23628

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928I
Collected: 09/28/06 07:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23629

Project: Taylor County
Site Location: Taylor County
Matrix: Sea Water

Sample I.D.: 060928J
Collected: 09/28/06 08:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23630

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928K
Collected: 09/28/06 08:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23631

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928L
Collected: 09/28/06 09:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

V. Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23632

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928M
Collected: 09/28/06 10:00
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	U	U	ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Authorized CSM Signature
Florida Environmental;Certification # E86006

Report To:
Daniel E. Meeroff
Florida Atlantic Univ.-EH&S
777 Glades Road ENG,222 BLDG 3
Boca Raton, FL 33431

Report Printed: 10/27/06 Rev. 1
Submission # 610000003
Order # 23633

Project: Taylor County
Site Location: Taylor County
Matrix: Surface Water

Sample I.D.: 060928N
Collected: 09/28/06 10:30
Received: 09/30/06 12:00
Collected by: Daniel E. Meeroff

LABORATORY ANALYSIS REPORT

PARAMETER	RESULT	QC	UNITS	MDL	PQL	METHOD	DATE EXT.	DATE ANALY.	ANALYST
Caffeine	0.321		ug/L	0.01	0.03	EARL SOP-2004-0	10/1218:55	10/12	AC

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported based on actual (wet) weight basis.
Analytes not currently NELAC certified denoted by *.
Work performed by outside (subcontract) labs denoted by Cert.ID in Analyst Field.
Results relate only to the sample.

Ed Castellanos
Authorized CSM Signature
Florida Environmental;Certification # E86006

FLORIDA ENVIRONMENTAL
QA/QC Summary Report For...

Submission#:610000003
Client Name:Florida Atlantic University
Project#:Taylor County
Site Location:Taylor County
Date Received:09/30/06
Project Manager:Daniel E. Meeroff

Legend

LCS = Laboratory Control Sample (Standard reference material purchased from certified external source to verify accuracy of instrument calibration.)
Method Blank = Lab pure water run through applicable analysis procedure prior to analysis.
Background = Concentration of analyte present in the parent sample prior to spiking.
Spike Amount Added = Actual concentration of respective analyte added and used to determine accuracy.
RPD = Relative Percent Difference (Represent's precision between duplicate analysis)
RPD Precision Limit = Acceptable percent difference allowed between duplicate analysis of the same sample, based upon method defined limits.
Lower and Upper Control Limit = Acceptable target range in which LCS and Spike % Recovery should fall, based upon method defined limits.
Set# = The physical file location in which the raw data resides at Florida Environmental's QC file room.

*QC Codes Legend:

P = All QA/QC target limits acceptable.
F = %LCS Recovery and/or Matrix Spike % Recovery and/or RPD fall outside of target limits.
M = Precision is acceptable, however accuracy may be affected by matrix interference.
I = Data is not applicable/available for all fields.

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23614

Florida Atlantic University
Taylor County

060926E

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23615

Florida Atlantic University
Taylor County

060926I

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Nunez

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 610000003   ORDER#: 23616

Florida Atlantic University
Taylor County

060926K

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23617

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Munoz
QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23618

Florida Atlantic University
Taylor County

060927J

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Nunez
QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23619

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23620

Florida Atlantic University
Taylor County

060928A

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23621

Florida Atlantic University
Taylor County

060928B

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducibility, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23622

Florida Atlantic University
Taylor County

060928C

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23623

Florida Atlantic University
Taylor County

060928D

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23624

Florida Atlantic University
Taylor County

060928E

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23625

Florida Atlantic University
Taylor County

060928F

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23626

Florida Atlantic University
Taylor County

060928G

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 610000003 ORDER#: 23627

Florida Atlantic University
Taylor County

060928H

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23628

Florida Atlantic University
Taylor County

Page:16
060928I

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducibility, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23629

Florida Atlantic University
Taylor County

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23630

Florida Atlantic University
Taylor County

060928K

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#: 610000003 ORDER#: 23631

Florida Atlantic University
Taylor County

060928L

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003 ORDER#:23632

Florida Atlantic University
Taylor County

060928M

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

Theresa Nunez

QA/QC Signature

FLORIDA ENVIRONMENTAL
QA/QC SUMMARY REPORT

SUBMISSION#:610000003   ORDER#:23633

Florida Atlantic University
Taylor County

060928N

ANALYTE	LCS Observed Value	LCS True Value	%LCS Recvry	Method Blank	Back-Ground (Parent)	Matrix SPK1 Observed	Matrix SPK2 Observed	Spike Amount Added	% SPK1 Recvry	% SPK2 Recvry	RPD	Lower % Control Limit	Upper % Control Limit	% RPD Precision Limit	Set#	*
Caffeine	0.2520	0.4000	63.0	U	0.00	0.0000	0.0000	0.0000	0.00	0.00	0.00	50.00	150.00	25.00	4465	I

100.0% of all QA/QC Target Limits passed the specified acceptable control criteria.
0.0% of Analytes show good reproducability, but Accuracy may be adversely affected by Matrix Interferences.

QA/QC Signature