Florida State University Study on Nutrient Removal in Onsite Sewage Treatment and Disposal Systems in Karst Areas

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Executive Summary

Please note that this report is preliminary. The final nutrient data set was received from the lab on 6/22/2009 and this report was finalized on 6/30/2009 6 business days later. Preliminary conclusions are as follows:

1. The *Hydro-action* Nutrient Reducing Treatment System installed in 2004 at the Magnolia II campground exhibited total N-reduction ranging from 60 to 88%.
2. At Hickory Campground the *Micro-fast* Nutrient Reducing Treatment System exhibited Total N reduction ranging from 22 to 75%. This system was installed in March, 2009 and may have been still developing.
3. N-concentrations in campground wells were significantly lower than during phase I of the study, however the campgrounds were closed from April 13 to 29 due to flooding. Visitation was significantly reduced from May through early June

following the flood due to less than optimum conditions at the Park. Therefore nutrient loading was attenuated during this period by a lack of visitors.

1. Introduction

The Suwannee River Water Management District (SRWMD) has determined that the level of total nitrogen exceeds the water quality standard for surface waters in many parts of the Suwannee River. Studies by the US Geological Survey identified that onsite sewage treatment and disposal systems (OSTDS) contribute to the nutrient load to the Suwannee River basin. The Lower Suwannee River is listed as impaired in regard to nutrients and dissolved oxygen.

The Lower Suwannee River Basin is underlain by Ocala limestone, which is karst in nature. Karst geology is typified by the presence of solution channels, sinkholes and springs that are formed when acidic rainfall dissolves the underlying calcium carbonate bedrock. These features have been shown to rapidly transport contaminants to the underlying groundwater. Phase I of the study demonstrated that rapid transport of nutrients from septic systems located at Manatee Springs State Park to the groundwater. The conventional systems studied in Phase I have been replaced with onsite nutrient reducing treatment systems (NRTSs) for Phase II.

The goal of this study is to assess the performance of two NRTSs. Since karst conditions occur throughout most of Florida, the results of the study will shed light on the effectiveness of NRTSs in much of the state. A secondary goal is to establish the relation of the observed nutrient concentrations in the groundwater to the septic effluent concentrations.

The conventional septic tanks at both campgrounds were both converted into the initial or trash tank, where the raw sewage flows into the system. At Hickory, a MicroFast system was installed in the treatment tank. The system was installed on 23 March 2009. In this system a blower aerates the sewage in the treatment tank and a fixed media provides surface area for nitrifying bacteria to grow. The sewage then flow into a pump tank. At Magnolia II, a Hydroaction system was installed. This system was installed in 2004. In this system, the sewage flows from the trash tank into the treatment tank where a blower aerates the sewage. The nitrifying bacteria grow in solution without

any fixed media. After the treatment tank, the sewage flows into a pump tank. At both sites, the original drain fields were replaced with mounded drain fields away from the bathhouses. A valve was installed into the plumbing to allow the effluent to be re-directed to the original drain fields for this study. The original drainfields were surrounded by a series of monitoring wells.

It should be noted that the sampling of the monitoring wells was affected by a flood at the Park during the sampling interval. This flooding had two effects. First, it likely flushed the groundwater in the wells, lowering nutrient values. This was especially true for the Magnolia campground bathhouse where the drainfield was standing in water. Second, the park campgrounds were closed from April 13 to April 29, 2009. Thus the septic systems were not in use during this period. Swimming was not opened at the Spring until May 7th. So even following reopening of the campground, visitation at the park was very light. During our June sampling event, the campgrounds were only about half full.

Current laws governing the installation of OSTDSs in the 10-year floodway require that alternative disposal techniques be used. A common method of complying with this provision is to install an aerobic treatment unit prior to the drain field of the OSTDS. While these systems enhance pathogen reduction, reduce total suspended solid and biological oxygen demand; they convert nitrogen to the nitrate form, which is highly mobile in the environment. This form of nitrogen, in combination with other nutrients increases the likelihood of eutrophication in waterways.

2. Methods

2.1 Study Design

Environmental sampling

The conventional septic systems at Hickory and Magnolia were replaced by NRTS and the effluent pumped to new drain fields. A valve was installed so that the effluent could be re-directed to the original drain fields for this study. The first sampling event was timed to occur before the effluent was re-directed to the original drain fields in order to access the water quality in the wells surrounding the drain fields prior to the re-introduction of effluent. Three more sampling events occurred after effluent was diverted back to the original drain fields instrumented with the wells from Phase I. The same

parameters measured in Phase I, nitrite, nitrate, ammonia, TKN, total phosphorus and fecal coliforms were measured in this study. Additionally, a YSI was used to collect field water quality data. The tracers released in Phase I were analyzed in samples from the first two sampling events occurring after the systems were finalized.

At Magnolia II, 8 wells were sampled, with two wells M4 and M10 being omitted (Figure 1). These wells were shown by the nutrient and tracer data to be outside the septic plume in Phase 1. At Hickory 5 of the 10 monitoring wells were sampled. C6, one of the wells shown to elevated nitrate concentrations in Phase I, was damaged during construction of the new septic system. The 5 wells with the highest average nitrate concentrations in Phase I, S1, S2, C3, C4 and C5 were sampled in this study (Figure 2). The nitrate concentrations averaged less than 0.5 mg/L in the other 4 wells. One background well from Phase I was sampled in this study. The second background well from Phase I was substituted by SRWMD #4. The background well MB2 was shown to have elevated nitrate levels and therefore not an appropriate background sampling station. In addition to the groundwater samples, influent and effluent samples were taken from the two NRTS.

Figure 1. Magnolia site behind the Magnolia II campground bathhouse. Well M1 is in the lower portion of the drain mound slope. Wells M10, M4, M6 are just in front of the cypress marsh adjacent to the Suwannee River.

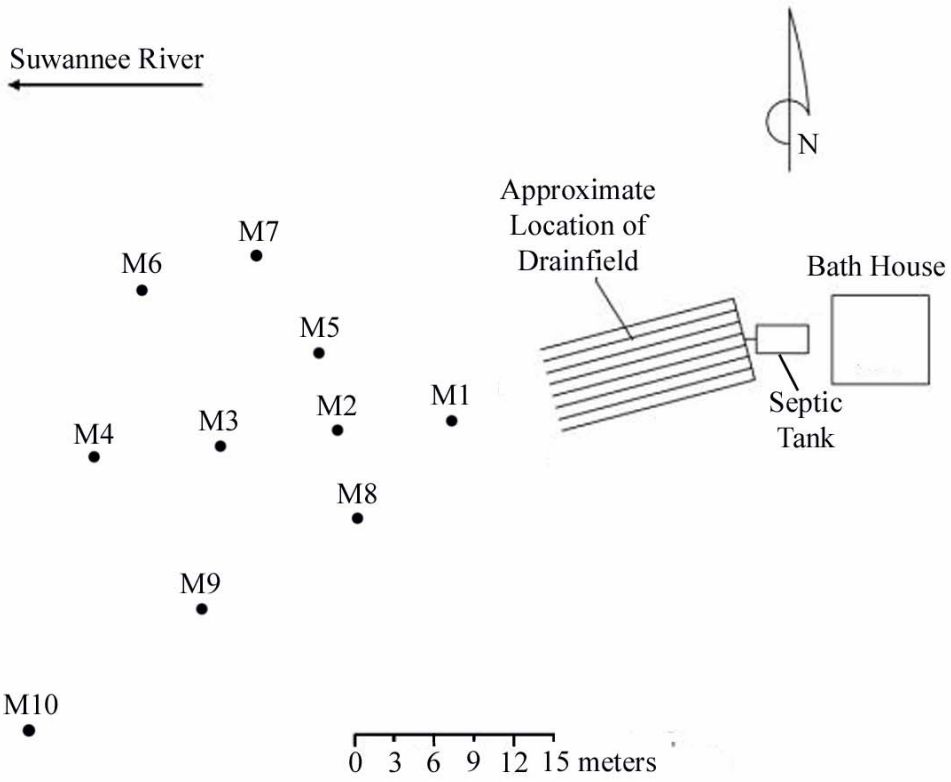
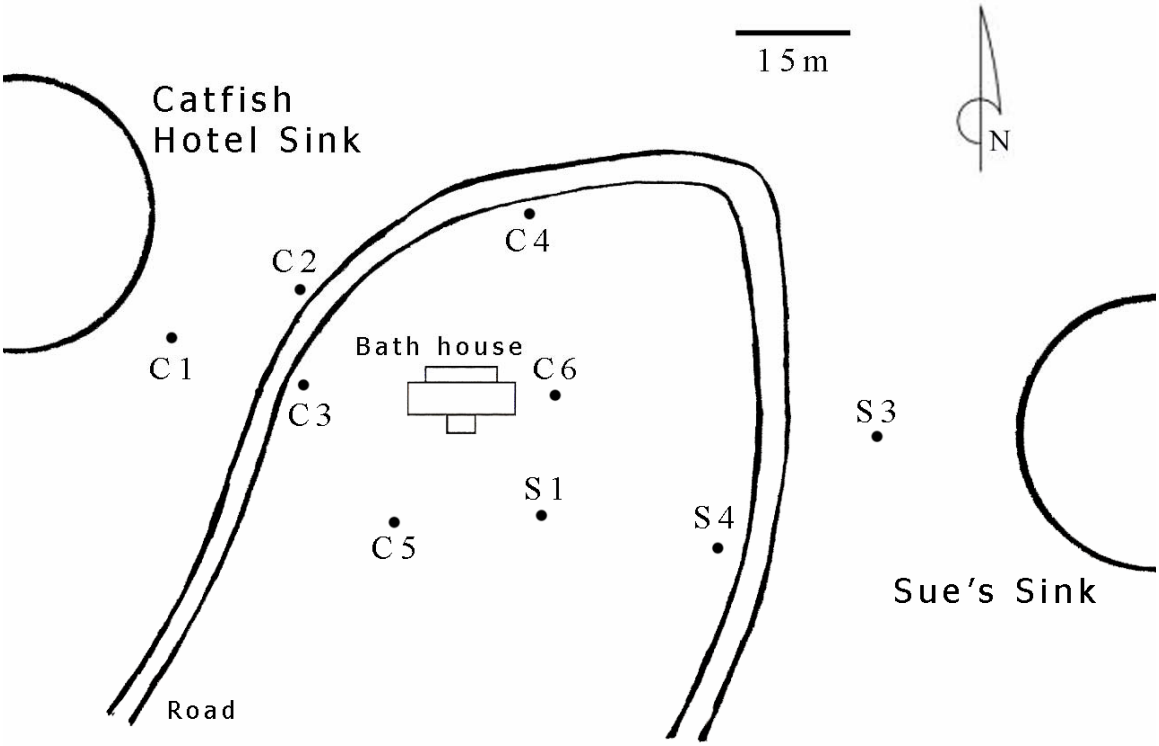


Figure 2. Study site at Hickory campground. Well S1 is installed in a Paleo-sink hole as determined by the GPR study. S2 was installed at the end of a drainfield line. C1 was installed on the lip of the slope leading down to Catfish Hotel. S3 was installed on the lip of the slope leading to Sue Sink.



Performance assessment

To assess diurnal and daily variability of performance, multiple samples of the influents and effluents were taken over a period of four consecutive days, consisting of both grab and 24 hour composite samples. The last environmental sampling event occurred on the last day of the performance assessment. YSI field measurements were also taken in addition to the same nutrients analyzed in the ground water samples.

2.2 Monitoring Well Sample Collection

All samples were collected using a submersible purge pump. At least three well volumes were pumped prior to any sampling. Samples for nutrients and fecal coliforms were collected from the wells in containers provided by the analytical laboratory. Sulfur hexafluoride samples were collected in 30-mL serum vials. The vial was allowed to overflow for at least three bottle volumes, and was then sealed with a rubber septum and a crimp cap. Fluorescein samples were collected and stored in 100-mL amber polycarbonate containers.

2.3 Septic System Sample Collection

Septic influent samples were taken from the first tank of the two systems; also know as a trash tank. At each campground, the original conventional septic tank served as the trash tank. A tube was placed in the filter chamber at the trash tank outflow pipe. Some treatment does occur in a conventional septic system, so these samples are a low estimate for the system inputs.

Septic tank effluent (STE) was sampled from a clean out between the pump tank and the drain field at the Hickory site. To take a sample the pump was manually turned on and a sample vessel was used to catch the flowing water. YSI measurements were taken by placing the probe into the collection vessel. At the Magnolia II site, the STE was sampled directly from the pump tank as no cleanout was available post pump tank. A peristaltic pump was used to take the sample through weighted tubing placed several inches below the effluent surface.

Only two automatic composite samplers were available at the time of the performance assessment. The other two composite samples consisted of 4 sub samples taken every 6 hours, held on ice and combined to make a composite sample.

2.4 Nutrient and Fecal Coliform Analysis

Samples were transported on ice to the laboratory and analyzed for fecal coliforms (SM9222D), total phosphorus (EPA 365.3), total ammonia (EPA 350.2), total Kjeldahl nitrogen (TKN) (EPA 351.3), nitrite-nitrogen (SM 4500NO2B), and nitrate-nitrogen (EPA 353.3).

2.4 Sulfur Hexafluoride Sample Analysis

Sulfur hexafluoride samples were extracted as described by Dillon et al. (1999) and Harden et al. (2003). A small headspace of 4 ml of ultra-high purity nitrogen was added to the samples using a syringe. Simultaneously, 3 mL of water from the sample was removed and discarded to allow room for the headspace. The serum vials were slightly over-pressurized with 1 cc of nitrogen to allow for several injection volumes (100 uL or less) for the gas chromatograph (GC). After shaking for at least two minutes, this method extracts 95+% of the SF_6 from a water sample. The lower limit of this technique is 0.1 pM (Dillon et al., 2000). Samples were analyzed with a Shimadzu model 8A gas chromatograph equipped with an electron capture detector as described in Harden et al. (2003). Head space concentrations in ppmv (parts per million by volume, = µL/L) of SF_6 were determined by reference to a 1.04 ppmv standard (Scott Specialty Gases). Headspace concentrations were converted to dissolved concentrations in pM.

2.5 Fluorescein Dye Analysis

The fluorescein samples were analyzed using a Turner Designs TD-700 Fluorometer, which provides exact concentrations after calibration. The fluorometer used a 10-089 blue mercury vapor lamp, 10-105 excitation filter (486 nm), and 10-109R-C emission filter (510-700 nm), as specified by the manufacturer. The fluorometer was initially calibrated using fluorescein standards made using DI water in the laboratory with

a lower detection limit of 0.0005 mg/L. Calibration was checked several times daily by use of solid state standards.

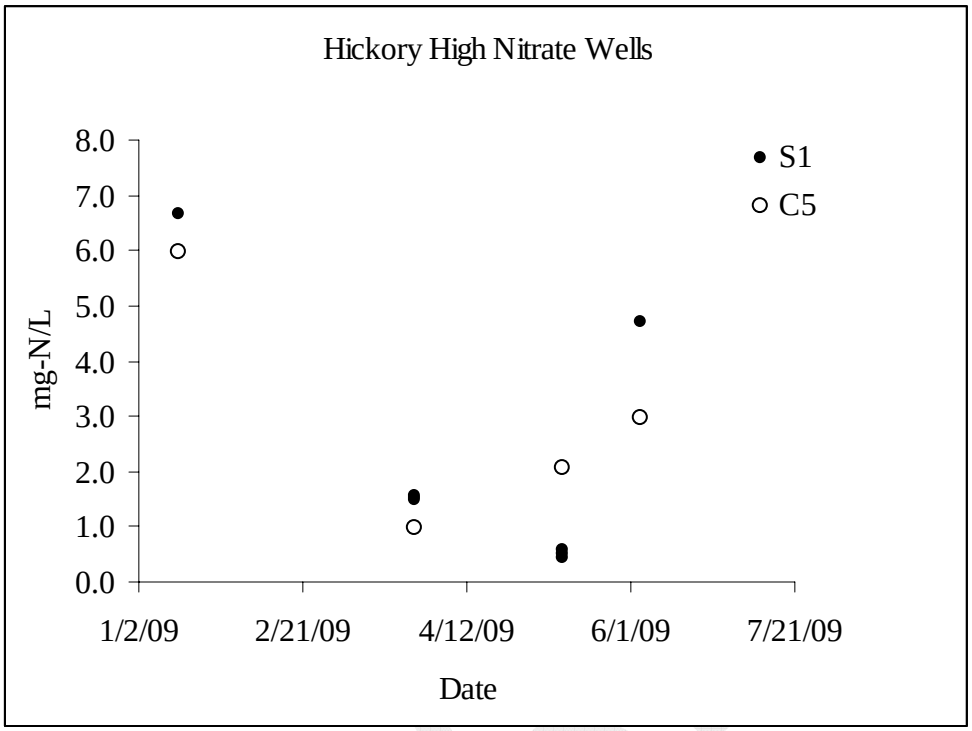
3. Results & Discussion

3.1 Environmental Monitoring

Hickory Campground

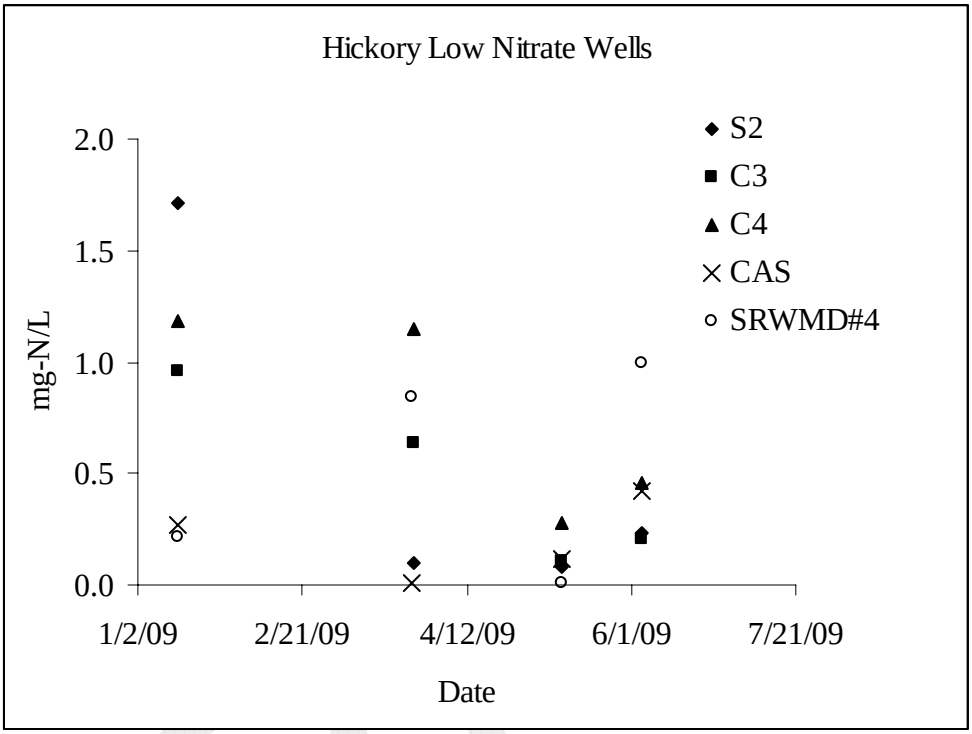
In all 5 wells at Hickory campground the highest nitrate levels were observed in samples from the first sampling event on 01/14/09 (Figure 3). This sampling event was intended to indicate the water quality surrounding the drain fields before the effluent was re-directed. Unfortunately, issues with the new systems required the old drain fields to be used during repairs prior to the start of the study. Wells S1 and C5 had the highest observed nitrate concentrations observed at the Hickory site. Nitrate concentrations were lower in the next two sampling events on 3/24/09 and 05/11/09. On the last sampling event on 06/04/09, the concentrations increased.

Figure 3. Nitrate concentrations from wells S1 and C5 taken on 01/14/09, 3/27/09, 05/11/09 and 06/04/09. The Suwannee River flooded in early April closing the State Park campgrounds from April 13 to April 29.



On 01/14/09, the nitrate concentrations in wells S2, C3, and C4 were above the levels found in the two background wells, 0.20 ± 0.18 mg-N/L in CAS and 0.52 ± 0.48 mg-N/L in SRWMD #4, yet much lower than S1 and C5 (Figure 4). Concentrations decreased on 3/27/09, but were still above background levels in wells C3 and C4. In the last two sampling events on 5/11/09 and 6/4/09 wells S2, C3, and C4 were near or below back ground well concentrations.

Figure 4. Nitrate concentrations from wells S2, C3, C4 and background wells CAS and SRWMD #4 taken on 01/14/09, 3/27/09, 05/11/09 and 06/04/09. . The Suwannee River flooded in early April closing the State Park campgrounds from April 13 to April 29.



Total phosphorus in wells S2, C3, C4, and C5 were less than half the concentration of 0.13 ± 0.14 mg-N/L (n=8) observed in the two background wells. The total phosphorus observed in well S1 was 0.76 ± 0.40 mg-N/L (n=4). The highest concentration of 1.32 mg-N/L was the only sample above background levels.

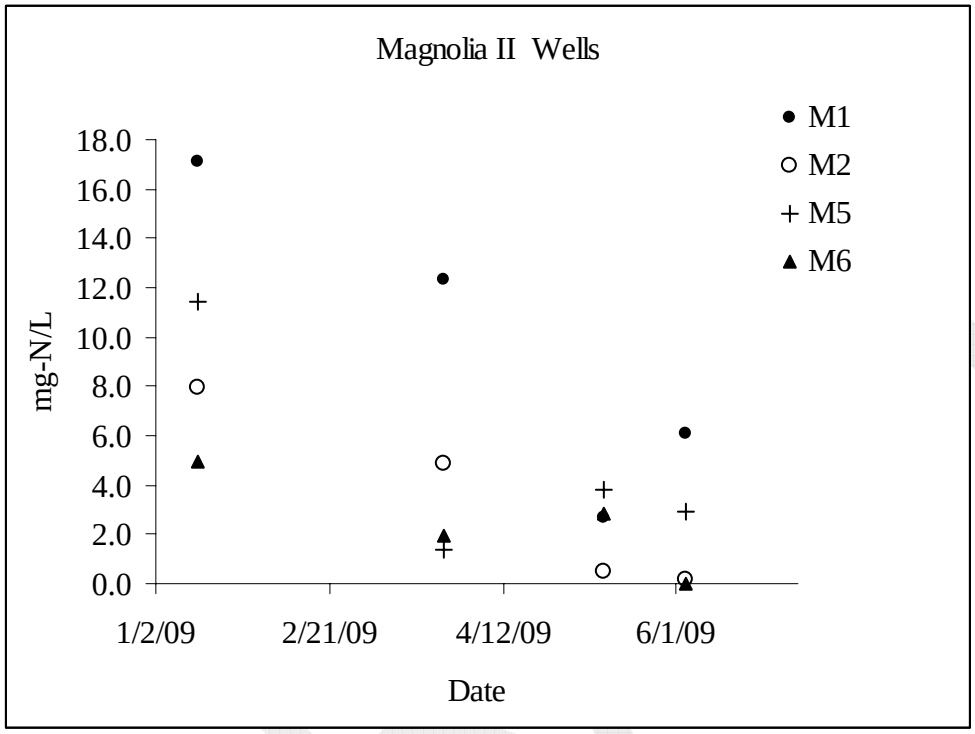
Fecal coliform was found sporadically throughout the well field. All wells had zero colonies in two of the four sampling events. The highest counts were 120 colonies/100 ml in C5, 76 colonies/100 ml in C4, and 18 and 25 colonies/100 ml in well S2. No fecal coliform colonies were found in the background wells

Magnolia II Campground

In wells M1, M2, M5 and M6 the highest concentrations were observed on the first sampling event, 01/14/09 and then concentrations decreased over the next three sampling events. In well M2, the nitrate concentrations observed on the last two

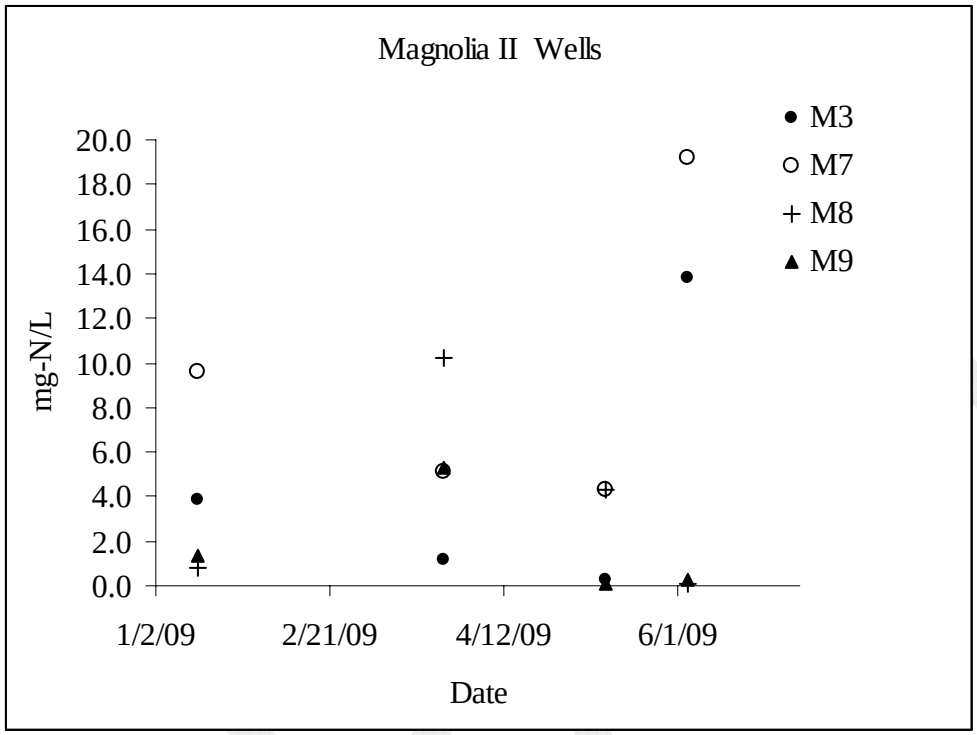
sampling events were below the levels in the background wells. Well M6, nitrate concentrations was also below background levels on the last sampling event on 6/47/09.

Figure 5. Nitrate concentrations from wells M1, M2, M5 and M6 sampled on 01/14/09, 3/26/09, 05/11/09 and 06/04/09. The Suwannee River flooded in early April closing the park on April 13th and flooding the well field at Magnolia II. .



On 01/14/09, nitrate levels observed in wells M3 and M7 were above background well concentrations, and wells M8 (0.77 mg-N/L) and M9 (1.36 mg-N/L) were near background levels. On 3/26/09, the nitrate concentrations in M8 and M9 increased and decrease in wells M3 and M7 to near background concentrations. On 05/11/09, concentrations of nitrate decreased to near background levels in wells M3 and M10, and also decreased in M7 and M8 but were well above background well concentrations. The highest concentrations of nitrate in wells M7 and M3 were observed on 06/04/09 and concentrations in M8 and M9 were below background well concentrations.

Figure 6. Nitrate concentrations from wells M3, M7, M8 and M9 were taken on 01/14/09, 3/26/09, 05/11/09 and 06/04/09. The Suwannee River flooded in early April closing the State Park on April 13th and flooding the well field at Magnolia II. Campground usage was still below normal on the 05/11/09 and 06/04/09 sampling events.



Total phosphorus in the wells at magnolia were between a low of 0.09 ± 0.03 mg-P/L (n=4) in well M9 to a high of 0.34 ± 0.04 mg-P/L (n=4) in well M2. All wells, except M9, were above the concentrations observed in the background wells, 0.13 ± 0.14 mg-P/L (n=8). .

Fecal coliform was found sporadically throughout the well field. All wells had zero colonies in at least one of the four sampling events. The highest counts were 93 colonies/100 ml in M9, 67 and 32 colonies/100 ml in M2, and 32 colonies/100 ml in well M6. No fecal coliform colonies were found in the background wells.

Comparison with Phase 1

At Hickory campground the wells most impacted by the septic system in Phase 1, S1 and C5 had the highest nitrate concentrations in Phase 2. The concentrations in these

wells were much lower Phase 2 than in Phase 1. The concentrations in wells S2, C3, and C4 had nitrate concentrations that were very similar to those in Phase 1 (Table 1).

At Magnolia II campground, the nitrate concentrations were much lower in Phase 2 than in Phase 1 (Table 1). In the weeks prior to the sampling event of 05/11/09, the well field was flooded from the Suwannee River. This flooding appears to have washed out much of the nitrate as indicated by the relatively low nitrate concentrations compared to the other sampling events. On 06/04/09, concentrations are again higher in many wells, especially M7, M3, M1 and M5 (Figures 5 and 6). Indicating these wells are most effected by the septic system at Magnolia II. The flow of septic effluent was altered during Phase 2. During construction of the NRTS at Magnolia the drain field mound was re-shaped. This is thought to have changed the flow away from well M8, which had low nitrate concentrations in the last two sampling events. Additionally, the septic effluent was pumped into the drain field, in the conventional system the effluent was gravity feed, likely changing the dispersal pattern in the drain filed mound.

Table 1. The high and average nitrate concentrations from both Phase 1 and Phase 2 at Hickory campground. Nitrate concentrations are given in mg-N/L. The background well SRWMD #4 in Phase 2 was substituted for MB2 from Phase 1. Note that concentrations were generally greater in Phase I of the study. Interpretation of the data is not straight-forward however, due to flooding at the site during the middle of the study. We recommend re-sampling the groundwater wells.

Well ID	High NO_3 **Phase 1**	Average NO3 **Phase 1**		High NO_3 **Phase 2**	Average NO3 **Phase 2**
	Background				
CA1	0.15	0.07 ± 0.06		0.42	0.20 ± 0.18
MB2	1.61	0.61 ± 0.74	SRWMD# 4	1.00	0.52 ± 0.48
	Hickory				
S1	56.1	21.9 ± 16.1		6.67	3.35 ± 2.84
S2	1.1	0.58 ± 0.38		1.71	0.53 ± 0.79
C3	1.1	0.59 ± 0.30		0.96	0.48 ± 0.40
C4	1.23	0.71 ± 0.33		1.18	0.77 ± 0.47
C5	41.3	11.7 ± 14.7		5.96	2.99 ± 2.14
	Magnolia				
M1	49.8 ± 18.8	29.4 ± 9.8		17.14	10.71 ± 6.44
M2	63.2	22.8 ± 17.5		8.15	3.36 ± 3.70
M3	33.9	14.9 ± 11.2		13.78	4.76 ± 6.21
M5	62.6	26.1 ± 15.2		11.47	4.89 ± 4.50
M6	51.4	17.5 ± 14.5		4.92	2.42 ± 2.04
M7	63.3	19.4 ± 17.7		19.22	9.54 ± 6.86
M8	54.6 ± 14.7	30.1 ± 17.1		10.26	3.87 ± 4.65
M9	35.9	6.9 ± 12.6		5.28	1.75 ± 2.42

Tracers

Samples for tracers released in Phase I were sampled collected during the sampling events of 03/26-27/09 and 05/11/09. Neither tracer was detected in any of the samples, indicating that the tracers are no longer present in the groundwater.

3.2 Septic System Performance Assessment

The septic influent was sampled from the filter chamber in the outflow of the first tank in the system or trash tank. At Magnolia II the 4 trash tank composite samples were taken using an automatic sampler. The first composite trash tank sample at Hickory employed a composite sampler. The automatic composite sampler took a sample every three hours for 24 hours. Composite trash tank samples 2-4 at Hickory were manually combined and consisted of 4 100 ml samples, each taken 6 hours apart and stored on ice. Septic tank effluent (STE) was sampled directly form the pump tank at Magnolia II, with the first composite sample manually combined and composite samples 2-3 were sampled with an automatic sampler. At Hickory, the STE was sampled from a cleanout between the pump and drain field. All Hickory composite STE samples were manually combined. In addition to the composite samples, 2 grab samples were taken during each of 24 hour period over the 4 days. On the last day, the final environmental sampling event was performed which included an additional grab sample from each septic sampling station.

At Magnolia II, composite and grab sample results were very similar. The Magnolia II trash tank samples had total N values of 143.33 ± 25.27 mg-N/L (n=4) for the composite samples and for the grab samples 141.61 ± 27.89 mg-N/L (n=4). The STE values for total N at Hickory were also in close agreement between the 4 composite samples (44.52 ± 12.53 mg-N/L) and the 9 grab samples (42.49 ± 8.24 mg-N/L). The % reduction of total nitrogen calculated from the composite samples was 68.9% and from the grab samples 70.0%.

Higher TN concentrations were observed in the STE at Magnolia II on the environmental sampling events of 03/26/09 and 05/11/09, yet the influent TT samples were lower, yielding higher % reduction of TN (Table 2).

Table 2. Nutrient results from the performance assessment composite and grab samples at Magnolia campground. TT indicates a trash tank sample, serving as influent concentrations. STE indicates a septic tank effluent sample. The composite samples are 24 hour samples taken over a 4 day period from 05/31/09 to 06/04/09. The grab samples include the septic samples from the final environmental sampling event. The septic grab samples from the other 3 environmental sampling events are also given. The % N reduction by the system is highlighted in yellow for the different sampling dates.

			Nitrate+Nitrite	Ammonia		TKN	TN
5/31 to 6/4			mg/L	mg/L	mg/L	mg/L	mg/L
Mag TT	**Comp**	**Ave.**	**6.45**	**97.27**	**136.88**	**143.33**	**4.05**
		Stdev	12.60	20.91	27.38	25.27	0.30
Mag STE	**Comp**	**Ave.**	**18.39**	**21.38**	**26.13**	**44.52**	**3.47**
		Stdev	15.07	5.31	4.20	12.53	0.39
				% TN Reduction		***68.9***	
5/31 to 6/4							
Mag TT	**Grab**	**Ave.**	**3.59**	**103.31**	**138.02**	**141.61**	**3.85**
		Stdev	*6.99*	*21.30*	*31.16*	*27.89*	*0.38*
Mag STE	**Grab**	**Ave.**	**12.95**	**22.17**	**29.54**	**42.49**	**3.66**
		Stdev	*10.18*	*6.56*	*14.74*	*8.24*	*0.30*
				% TN Reduction		***70.0***	
Mag STE	**01/014/09**		**63.48**	**2.02**	**3.00**	**66.49**	**20.80**
Mag TT	**03/26/09**		**7.76**	**83.64**	**202.89**	**210.65**	**0.13**
Mag STE	**03/26/09**		**12.24**	**1.68**	**14.16**	**26.40**	**0.11**
				% TN Reduction		***87.5***	
Mag TT	**05/11/09**		**0.06**	**39.56**	**177.88**	**177.94**	**1.50**
Mag STE	**05/11/09**		**6.94**	**10.70**	**12.92**	**19.86**	**1.75**
				% TN Reduction		***88.8***	

At Hickory campground the difference between composite samples and grab samples was more pronounced. The trash tank composite samples had total nitrogen concentrations of 79.83 ± 17.64 (n=4), while the total nitrogen in the grab samples, 110.68 ± 31.83 mg-N/L (n=9), were more variable they were in the same range. The STE total nitrogen concentrations of the composite samples, 61.34 ± 9.97 mg-N/L (n=4) and grab samples, 50.09 ± 20.79 mg-N/L (n=9) were in good agreement. The % reduction of nitrogen by the system was less clear for the composite samples than the grab samples. The grab samples indicate a total nitrogen reduction of 54.7%. The % reduction of total nitrogen calculated from composite samples was less clear as the second set of composite samples yielded a higher effluent total nitrogen (61.0 mg-N/L) value than the effluent total nitrogen (52.5 mg-N/L), yielding a negative % reduction (Table 3). Note that this system was only installed on March 23, 2009.

Table 3. Nutrient results from the performance assessment composite and grab samples at Hickory campground. TT indicates a trash tank sample, serving as influent concentrations. STE indicates a septic tank effluent sample. The composite samples are 24 hour samples. The grab samples include the septic samples from the final environmental sampling event. The septic grab samples from the environmental sampling events on 03/27/09 and 05/11/09 are also given. The % N reduction by the system is highlighted in yellow for the different sampling dates. The second set of composite samples, C2, had higher TN in the STE than the TT sample, yielding a negative % reduction.

			Nitrate+Nitrite	Ammonia	TKN	TN	Total P
5/31 to 6/4			mg/L	mg/L	mg/L	mg/L	mg/L
Hick TT	**Comp**	**Ave.**	**0.52**	**65.85**	**78.41**	**78.93**	**3.50**
		Stdev	*0.37*	*18.63*	*18.00*	*17.64*	*0.38*
Hick STE	**Comp**	**Ave.**	**34.26**	**27.90**	**27.08**	**61.34**	**3.35**
		Stdev	*18.79*	*17.04*	*15.44*	*9.91*	*0.42*
				% TN Reduction		***22.3***	*n=4*
			Without C2	***% TN Reduction***		***30.7***	*n=3*
5/31 to 6/4							
Hick TT	**Grab**	**Ave.**	**3.08**	**80.54**	**107.60**	**110.68**	**4.05**
		Stdev	*8.03*	*28.46*	*30.54*	*31.83*	*1.25*
Hick STE	**Grab**	**Ave.**	**22.50**	**25.20**	**27.59**	**50.09**	**3.29**
		Stdev	*21.41*	*16.92*	*19.40*	*20.79*	*0.32*
				% TN Reduction		***54.7***	*n=4*
Hick TT	**03/27/09**		**0.12**	**61.70**	**173.31**	**173.43**	**13.50**
Hick STE	**03/27/09**		**2.42**	**42.34**	**106.70**	**109.13**	**12.99**
				% TN Reduction		***37.1***	*n=4*
Hick TT	**05/11/09**		**0.09**	**59.41**	**235.16**	**235.25**	**2.92**
Hick STE	**05/11/09**		**6.31**	**33.60**	**52.54**	**58.84**	**2.73**
				% TN Reduction		***75.0***	*n=4*

The field parameters measured with an YSI probe were very consistent over the course of the performance assessment. The influent trash tank samples were characterized by a high conductivity, low dissolved oxygen, and a highly negative oxidation/reduction potential compared to the STE samples with lower conductivity, higher dissolved oxygen, and a positive oxidation/reduction potential (Table 4).

Table 4. Field parameters from the performance assessment of the septic systems conducted from 05/31/09 to 6/4/09.

Site	Calc	Water T	COND	COND	Salinity	%SAT	DO	PH	ORP
		Celsius	µS/cm	mS/cm	ppt	%	mg/L	mg/L	mg/L
Hick TT	**Ave.**	**25.62**	**1312.67**	**1.33**	**0.65**	**9.07**	**0.74**	**6.94**	**-141.55**
	Stdev	0.16	23.77	0.03	0.01	7.37	0.60	0.13	28.04
Hick STE	**Ave.**	**25.46**	**972.56**	**0.98**	**0.48**	**36.08**	**2.90**	**7.74**	**26.36**
	Stdev	0.49	82.65	0.09	0.04	10.73	0.85	0.21	17.69
Mag TT	**Ave.**	**27.15**	**1469.79**	**1.53**	**0.73**	**8.26**	**0.65**	**6.92**	**-142.48**
	Stdev	0.13	7.46	0.01	0.00	5.48	0.43	0.22	22.05
Mag STE	**Ave.**	**26.72**	**1123.13**	**1.16**	**0.55**	**41.64**	**3.32**	**6.82**	**19.53**
	Stdev	0.22	16.89	0.02	0.01	7.84	0.62	0.36	26.75

Nitrification and De-nitrification in Septic Systems

Nitrification occurs in the treatment tank of the NRTS by the addition of air into the septic effluent. In the two environmental STE grab samples on 03/27/09 and 05/11/09 and 5 grab samples of the performance assessment indicate that nitrification is limited, as the TKN values are greater that the nitrite + nitrate concentrations The last 4 grab samples indicate that the majority of the TKN had been converted to nitrate. (Figure

7). . Note the trend in the data towards lower Total N values and more oxidized forms of N in Figure 7. Nitrate concentration increase relative to TKN. Note that the system had only been running 3 days when the first sample was collected on 3/27.

At Magnolia II, nitrate seems to be limited in many of the samples, with TKN being the major N species in the effluent. A notable exception is the STE sample taken on 01/14/09, which is mostly nitrite + nitrate (Figure 8). This may be due to limitation of nitrification (nitrate formation) or it could have been due to consumption of nitrate (denitrification).

Figure 7. TKN and nitrite + nitrate are given for the STE grab samples at Hickory campground. In samples with more TKN than nitrite + nitrate, nitrification is limited, or the else the nitrate was removed by denitrification. Note the trend in the data towards lower Total N values and more oxidized forms of N. Nitrate concentration increase relative to TKN. Note that the system had only been running 3 days when the first sample was collected on 3/27.

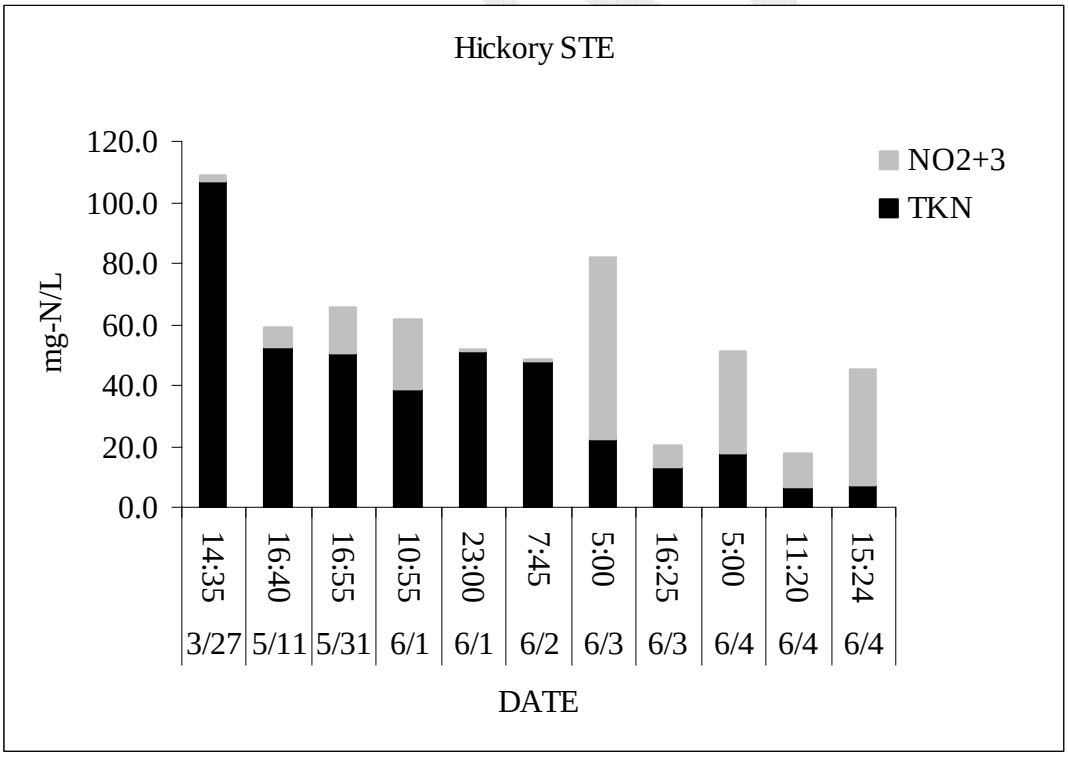
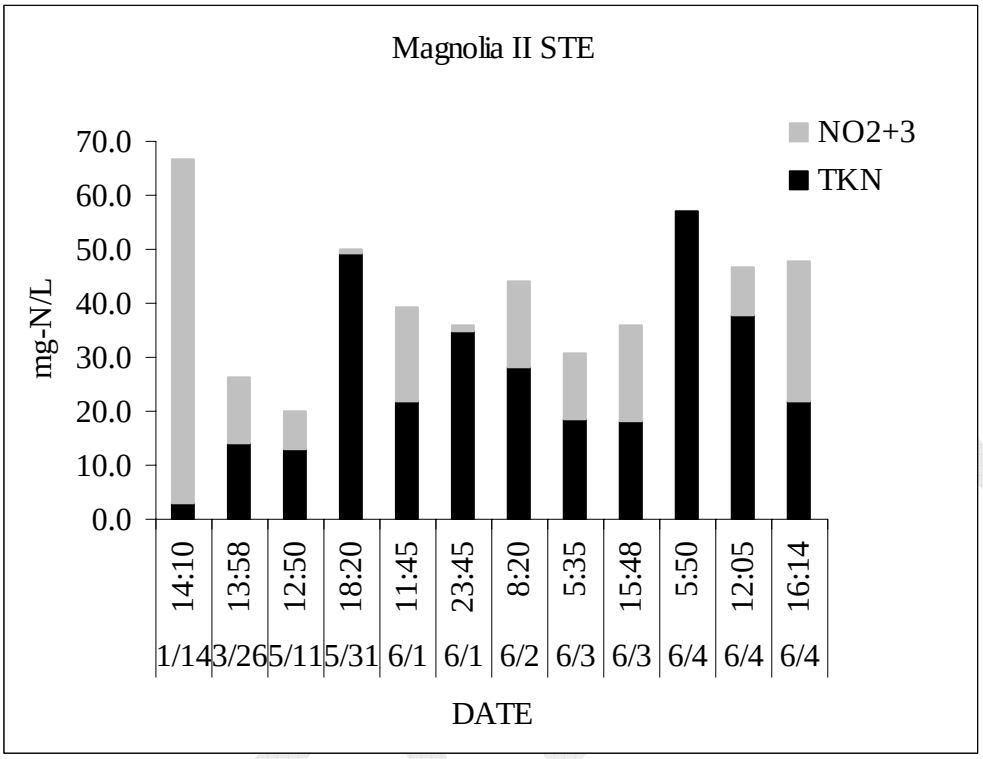


Figure 8. TKN and nitrite + nitrate are given for the STE grab samples at Magnolia II campground. In samples with more TKN than nitrite + nitrate, nitrification is limited, or the else the nitrate was removed by denitrification.



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The significant reduction in total nitrogen during treatment, strongly suggests that de-nitrification is occurring (Figures 9 and 10). The dissolved oxygen numbers in the STE of approximately 40% saturation (Table 4) are not favorable for de-nitrification to occur. However micro-environments are likely to present which do allow for de-nitrification to occur.

Figure 9. Total nitrogen concentrations of influent samples (TT) and effluent samples (STE) at Hickory campground. E are grab samples from the environmental monitoring and G are grab samples from the performance assessment. . Note that in every instance the TT bar is higher in concentration than the STE bar it is paired with. The amount of this decrease is the % N reduction in the system as reported in Table 3, % TN Reduction.

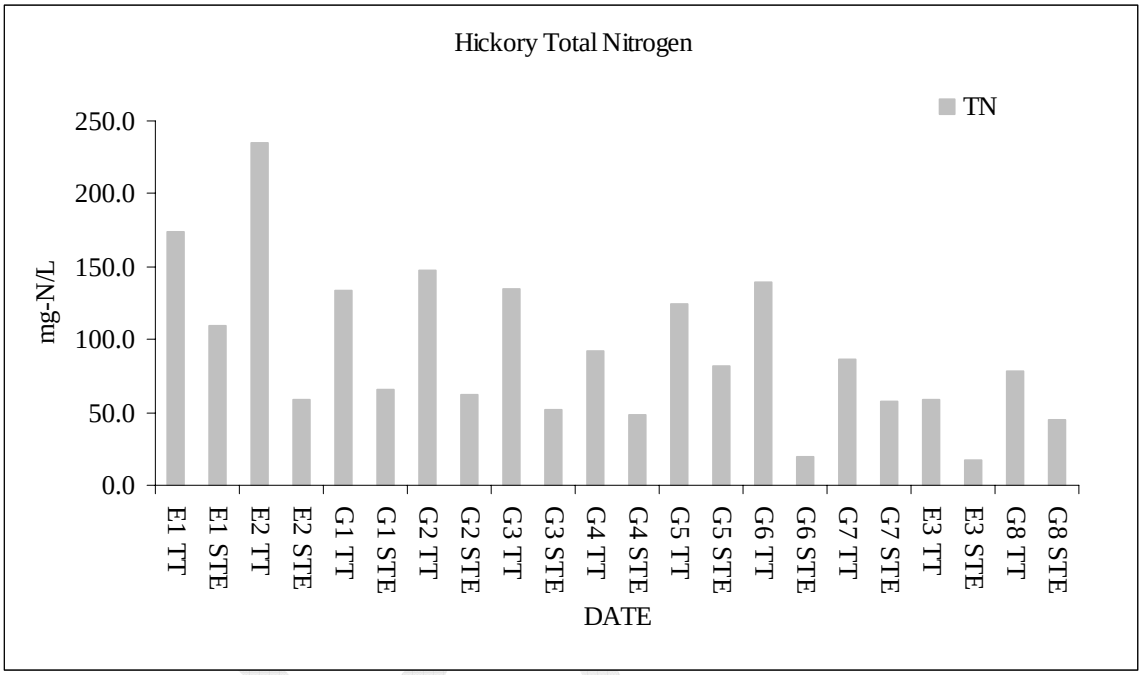
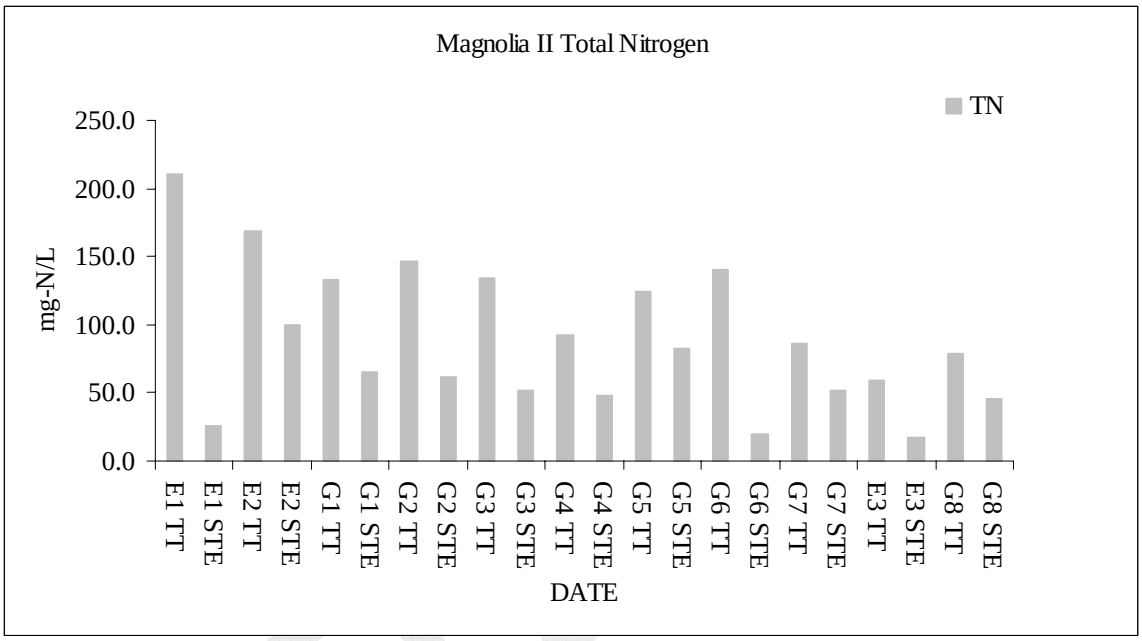


Figure 10. Total nitrogen concentrations of influent samples (TT) and effluent samples (STE) at Magnolia campground. E are grab samples from the environmental monitoring and G are grab samples from the performance assessment. Note that in every instance the TT bar is higher in concentration than the STE bar it is paired with. The amount of this decrease is the % N reduction in the system as reported in Table 2, % TN Reduction.



Water meter data can be found in the appendix.

4. Conclusions

Significant reduction of total nitrogen is occurring in both NRTS studied, greatly reducing the nutrient loading of the groundwater by the effluent from the two bath houses. At Magnolia, the % reduction in Total N ranged from 88 to 69%, while at Hickory it ranged from 22 to 75%. The Magnolia system, a hydroaction system, installed in 2004 seems to be operating quite well and reducing the N-loading at the site. It is unclear why Hickory has a lower level of performance. One possibility is that the Hickory site was problematic in its installation due to site limitations, and was finalized on 3/23, just prior to the 03/27/09 sampling event. However, as shown in Figure 7, the trend of the total N data was downward over the course of the study, and the nitrate content of the effluent increased relative to ammonia (TKN). This suggests that the system was coming on line. Issues with system have caused numerous delays in this

project and it may have been premature to evaluate the system at Hickory. Thus the current data set may not be the best possible for the evaluation of the performance of a MicroFast system.

Groundwater samples collected from wells were lower in the Phase II portion of this study, following the installation of the NRTS systems, relative to concentrations in Phase I. However interpretation of this result is somewhat tentative. The first sampling event was intended give nutrient concentrations in the groundwater prior the effluent being re-directed to the original drain fields, however effluent had been diverted to the drainfields in the vicinity of those wells prior to sampling. This was not supposed to have occurred. The flooding that occurred in the middle of the study also complicated the interpretation of the groundwater data as both campgrounds were closed and the Magnolia II well field submerged. The campgrounds were closed from April 13 to April 29, 2009. Thus the septic systems were not in use during this period. Swimming was not opened at the Spring until May 7th. So even following reopening of the campground, visitation at the park was very light. During our June sampling event, visitation was observed to be very light. We recommend re-sampling the groundwater wells during a period of active usage.

Appendix A Performance Assessment
Field Data

Station	Date	Time *YSI*	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	DO %SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L	PH *Probe* units
Hick STE	5/31/2009	17:06	27.13	1077	1.121	0.53	43.3	3.03	8.02	50.2	8.0
Hick STE	5/31/2009	22:56	25.48	1094	1.104	0.54	43.3	3.48	7.60	38.0	8.0
Hick STE	6/1/2009	4:55									7.7
Hick STE	6/1/2009	5:07	25.29	1117	1.124	0.55	44.2	3.36	7.15	13.0	7.7
Hick STE	6/1/2009	11:00	25.58	1076	1.088	0.53	49.3	3.98	7.07	63.1	8.1
Hick STE	6/1/2009	17:02	25.53	1053	1.064	0.52	53.7	4.39	7.99	59.1	8.0
Hick STE	6/1/2009	23:07	25.37	1015	1.022	0.50	39.1	3.19	8.09	29.9	7.9
Hick STE	6/2/2009	7:49	25.14	1003	1.006	0.49	32.1	2.64	8.29	14.9	7.3
Hick STE	6/2/2009	11:04	25.50	982	0.991	0.48	36.2	2.96	8.40	18.4	
Hick STE	6/2/2009	17:04	25.51	967	0.976	0.47	33.5	2.72	8.17	43.8	7.7
Hick STE	6/2/2009	23:03	25.43	944	0.951	0.46	38.2	3.12	8.20	10.3	7.7
Hick STE	6/3/2009	5:05	25.03	935	0.934	0.46	25.7	2.12	8.34	10.7	7.7
Hick STE	6/3/2009	11:03	25.73	922	0.935	0.45	21.6	1.75	8.57	8.5	7.6
Hick STE	6/3/2009	16:28	25.49	902	0.910	0.44	39.3	3.21	8.05	20.9	7.6
Hick STE	6/3/2009	17:03	25.44	900	0.908	0.44	29.9	2.44	8.14	6.4	7.6
Hick STE	6/3/2009	23:02	25.50	885	0.894	0.43	42.3	3.45	8.05	24.3	7.6
Hick STE	6/4/2009	5:07	24.62	885	0.879	0.43	15.5	1.27	7.93	26.0	
Hick STE	6/4/2009	11:24	25.41	874	0.881	0.43	45.0	3.68	7.77	26.3	
Hick STE	6/4/2009	15:30	25.15	875	0.878	0.43	17.2	1.42	7.70	10.6	7.6
	average		**25.46**	**972.56**	**0.98**	**0.48**	**36.08**	**2.90**	**7.97**	**26.36**	**7.74**
	stdev		*0.49*	*82.65*	*0.09*	*0.04*	*10.73*	*0.85*	*0.40*	*17.69*	*0.21*

Appendix A Performance Assessment
Field Data (continued)

Station	Date	Time *YSI*	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	DO %SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L	PH *Probe* units
Hick TT	5/31/2009	17:23	25.62	1335	1.351	0.66	3.9	0.32	7.16	-203.0	7.2
Hick TT	5/31/2009	19:26	25.50	1330	1.342	0.66	4.0	0.33	6.98	-159.0	7.1
Hick TT	5/31/2009	22:37	25.51	1312	1.324	0.65	4.3	0.34	6.74	-177.8	7.1
Hick TT	6/1/2009	10:49	25.72	1271	1.289	0.63	2.9	0.24	7.00	-190.0	
Hick TT	6/1/2009	17:13	25.53	1261	1.275	0.63	2.9	0.24	7.03	-108.9	7.1
Hick TT	6/1/2009	23:18	25.39	1266	1.275	0.63	7.8	0.64	7.16	-139.0	6.9
Hick TT	6/2/2009	7:58	25.38	1295	1.304	0.64	4.1	0.33	7.51	-125.2	7.0
Hick TT	6/2/2009	11:15	25.58	1340	1.355	0.67	25.5	2.08	7.45	-130.6	
Hick TT	6/2/2009	17:13	25.54	1332	1.346	0.66	8.2	0.66	7.32	-136.2	6.9
Hick TT	6/2/2009	23:12	25.51	1324	1.337	0.66	6.8	0.55	7.28	-121.7	6.8
Hick TT	6/3/2009	5:13	25.40	1326	1.336	0.66	8.0	0.64	7.54	-119.0	6.9
Hick TT	6/3/2009	11:08	25.86	1323	1.345	0.66	4.3	0.35	7.55	-113.9	6.9
Hick TT	6/3/2009	16:42	25.73	1319	1.338	0.66	11.3	0.92	7.42	-116.0	6.9
Hick TT	6/3/2009	17:13	25.76	1323	1.342	0.66	9.2	0.75	7.44	-112.3	6.9
Hick TT	6/3/2009	23:15	25.86	1317	1.339	0.66	17.5	1.42	7.40	-164.0	6.8
Hick TT	6/4/2009	5:15	25.81	1323	1.343	0.66	11.4	0.93	7.23	-156.8	
Hick TT	6/4/2009	11:31	25.85	1309	1.330	0.65	27.4	2.22	6.98	-146.8	6.8
Hick TT	6/4/2009	15:36	25.63	1322	1.339	0.66	3.8	0.31	6.97	-127.7	6.8
Hick TT	**average**		**25.62**	**1312.67**	**1.33**	**0.65**	**9.07**	**0.74**	**7.23**	**-141.55**	**6.94**
	stdev		*0.16*	*23.77*	*0.03*	*0.01*	*7.37*	*0.60*	*0.24*	*28.04*	*0.13*

Appendix A Performance Assessment
Field Data (continued)

Station	Date	Time *YSI*	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	DO %SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L	PH *Probe* units
Mag STE	5/31/2009	18:07	26.73	1168	1.207	0.58	30.8	2.45	6.72	79.6	
Mag STE	5/31/2009	23:48	26.90	1146	1.189	0.57	43.0	3.44	6.27	31.3	7.0
Mag STE	6/1/2009	5:48	26.65	1142	1.178	0.56	32.1	2.56	6.41	10.9	
Mag STE	6/1/2009	5:55									7.2
Mag STE	6/1/2009	11:56	26.61	1132	1.166	0.56	39.6	3.08	6.07	42.4	7.2
Mag STE	6/1/2009	18:02	26.85	1124	1.164	0.55	34.9	2.79	6.87	55.1	7.1
Mag STE	6/1/2009	23:46	26.76	1120	1.158	0.55	36.9	2.95	6.88	-2.9	7.1
Mag STE	6/2/2009	8:21	26.58	1117	1.151	0.55	40.0	3.21	7.26	3.6	7.0
Mag STE	6/2/2009	15:14	27.15	1112	1.158	0.55	57.7	4.56	7.00	24.4	
Mag STE	6/2/2009	16:10									7.2
Mag STE	6/2/2009	18:02	27.18	1111	1.157	0.55	48.9	3.86	6.74	48.9	6.6
Mag STE	6/3/2009	5:34	26.74	1111	1.147	0.55	46.0	3.68	6.94	-3.3	6.6
Mag STE	6/3/2009	15:51	26.56	1110	1.143	0.55	34.7	2.77	6.88	16.7	6.5
Mag STE	6/3/2009	16:10									7.0
Mag STE	6/3/2009	18:25	26.70	1111	1.148	0.55	41.2	3.29	6.87	5.0	6.5
Mag STE	6/4/2009	5:50	26.49	1114	1.146	0.55	41.9	3.36	6.41	-10.4	6.3
Mag STE	06/04/09	12:04	26.50	1113	1.145	0.55	55.7	4.47	6.21	-2.5	6.2
Mag STE	6/4/2009	16:13	26.41	1116	1.146	0.55	41.2	3.3	6.31	-5.9	
Mag STE	**average**		**26.72**	**1123.13**	**1.16**	**0.55**	**41.64**	**3.32**	**6.66**	**19.53**	**6.82**
	stdev		**0.22**	**16.89**	**0.02**	**0.01**	**7.84**	**0.62**	**0.35**	**26.75**	**0.36**

Appendix A Performance Assessment
Field Data (continued)

Station	Date	Time *YSI*	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	DO %SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L	PH *Probe* units
Mag TT	5/31/2009	18:44	27.46	1458	1.527	0.73	1.8	0.14	6.93	-177.0	7.2
Mag TT	5/31/2009	23:23	27.39	1473	1.537	0.73	6.2	0.46	6.21	-176.9	7.1
Mag TT	6/1/2009	12:07	27.23	1472	1.535	0.73	3.2	0.25	5.78	-179.9	7.0
Mag TT	6/1/2009	18:12	27.13	1471	1.530	0.73	4.9	0.38	6.76	-137.6	6.9
Mag TT	6/1/2009	23:59	27.10	1465	1.524	0.73	3.5	0.28	6.77	-140.6	7.0
Mag TT	6/2/2009	8:33	27.04	1465	1.522	0.73	4.7	0.39	7.18	6.-126.9	6.9
Mag TT	6/2/2009	15:22	27.13	1473	1.533	0.74	15.6	1.23	7.13	-150.7	
Mag TT	6/2/2009	16:15									7.3
Mag TT	6/2/2009	18:15	27.09	1481	1.541	0.74	19.6	1.54	6.95	-134.6	6.7
Mag TT	6/3/2009	5:44	27.16	1477	1.538	0.74	6.8	0.54	7.09	-115.4	6.7
Mag TT	6/3/2009	15:40	27.11	1464	1.523	0.73	5.7	0.45	7.24	-128.8	6.7
Mag TT	6/3/2009	16:05									7.2
Mag TT	6/3/2009	18:13	27.05	1473	1.531	0.74	7.7	0.62	7.36	-130.6	6.7
Mag TT	06/04/09	11:54	27.07	1463	1.521	0.73	16.5	1.30	6.94	-125.9	6.7
Mag TT	6/4/2009	5:42	27.18	1460	1.521	0.73	11.8	0.93	6.97	-134.1	6.8
Mag TT	6/4/2009	15:58	26.96	1482	1.538	0.74	7.7	0.61	6.89	-120.2	
Mag TT	**average**		**27.15**	**1469.79**	**1.53**	**0.73**	**8.26**	**0.65**	**6.87**	**-142.48**	**6.92**
	stdev		**0.13**	**7.46**	**0.01**	**0.00**	**5.48**	**0.43**	**0.42**	**22.05**	**0.22**

Appendix A Performance Assessment
Nutrient Data

	C	Composite sample			**F Coli**	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
	G	Grab Sample			SM	EPA	EPA	calc	EPA	EPA		EPA
	E3	Event 3 sample			9222D	354.1	353.3		350.3	351.4	calc	365.2
				MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
				PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**ID**	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Hick STE	G1	05/31/09	16:55	1			14.917		40.114	50.612	65.529	3.535
Hick STE	C1	06/01/09	11:30	1			17.006		48.684	45.222	62.228	3.712
Hick STE	G2	06/01/09	10:55	1			23.271		41.359	38.587	61.857	3.364
Hick STE	G3	06/01/09	23:00	1			0.608		33.511	51.175	51.783	3.489
Hick STE	C2	06/02/09	12:30	1			26.526		34.401	34.423	60.949	3.659
Hick STE	G4	06/02/09	7:45	1			0.211		52.014	48.029	48.240	3.676
Hick STE	C3	06/03/09	12:00	1		2.695	32.794	30.099	17.775	16.175	48.969	2.836
Hick STE	G5	06/03/09	5:00	1		3.069	59.643	56.575	20.328	22.583	82.227	3.162
Hick STE	G6	06/03/09	16:25	1		3.848	7.140	3.292	14.535	12.977	20.116	3.071
Hick STE	G7	06/03/09	17:00	1		3.556	48.217	44.661	12.654	10.342	58.558	3.198
Hick STE	G7	06/03/09	17:00	F2		33.314	46.872	13.558	12.264	10.764	57.637	2.981
Hick STE	C4	06/04/09	13:30	1		0.583	62.333	61.749	10.685	11.341	73.674	2.958
Hick STE	C4	06/04/09	13:35	F2		0.398	59.103	58.704	10.790	13.646	72.749	3.396
Hick STE	E3	06/04/09	11:20	1	6200	4.607	10.785	6.179	5.759	6.783	17.569	2.668
Hick STE	G8	06/04/09	15:24	1		0.146	38.381	38.234	6.729	7.010	45.391	3.541

Appendix A Performance Assessment
Nutrient Data (continued)

	C	Composite sample			**F Coli**	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
	G	Grab Sample			SM	EPA	EPA	calc	EPA	EPA		EPA
	E3	Event 3 sample			9222D	354.1	353.3		350.3	351.4	calc	365.2
				MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
				PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**ID**	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Hick TT	G1	05/31/09	19:15	1			0.226		27.374	133.164	133.390	4.311
Hick TT	C1	06/01/09	14:30	1			0.400		76.632	91.178	91.578	3.733
Hick TT	C1	06/01/09	14:30	F2			0.400		84.853	84.009	84.408	3.741
Hick TT	G2	06/01/09	10:50	1			0.878		129.518	146.016	146.895	3.959
Hick TT	G3	06/01/09	23:15	1			24.464		95.909	110.214	134.677	3.786
Hick TT	C2	06/02/09	12:45	1			1.052		50.668	51.474	52.526	3.896
Hick TT	G4	06/02/09	7:55	1			0.665		64.654	91.979	92.644	7.259
Hick TT	C3	06/03/09	11:50	1		0.135	0.211	0.076	83.149	88.735	88.946	3.270
Hick TT	G5	06/03/09	5:10	1		0.135	0.155	0.020	82.778	124.724	124.878	3.397
Hick TT	G6	06/03/09	16:34	1		0.151	0.161	0.010	96.803	139.712	139.873	3.397
Hick TT	G7	06/03/09	17:10	1		0.135	0.068	0.000	90.928	86.397	86.465	3.325
Hick TT	C4	06/04/09	13:14	1		0.117	0.401	0.283	56.022	93.552	93.953	2.759
Hick TT	C4	06/04/09	13:20	F2		0.112	0.401	0.289	41.630	78.160	78.561	3.409
Hick TT	E3	06/04/09	11:32	1	15400	0.115	0.099	0.000	61.506	58.459	58.558	3.321
Hick TT	G8	06/04/09	15:38	1		0.137	0.984	0.847	75.388	77.748	78.732	3.661

Appendix A Performance Assessment
Nutrient Data (continued)

	C	Composite sample			**F Coli**	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
	G	Grab Sample			SM	EPA	EPA	calc	EPA	EPA		EPA
	E3	Event 3 sample			9222D	354.1	353.3		350.3	351.4	calc	365.2
				MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
				PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**ID**	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mag STE	G1	05/31/09	18:20	1			0.806		24.848	49.333	50.139	3.864
Mag STE	C1	06/01/09	12:40	1			9.697		28.513	26.151	35.848	3.066
Mag STE	G2	06/01/09	11:45	1			17.528		28.368	21.862	39.390	4.002
Mag STE	G3	06/01/09	23:45	1			1.023		27.169	34.973	35.997	3.676
Mag STE	C2	06/02/09	16:10	1			12.090		19.490	33.525	45.615	4.037
Mag STE	C2	06/02/09	16:10	F2			10.028		27.528	26.149	36.176	3.888
Mag STE	G4	06/02/09	8:20	1			16.214		22.027	28.009	44.223	3.964
Mag STE	C3	06/03/09	16:10	1		3.069	6.356	3.287	18.177	27.590	33.946	3.470
Mag STE	G5	06/03/09	5:35	1		3.556	12.181	8.625	17.305	18.609	30.790	3.307
Mag STE	G6	06/03/09	15:48	1		4.156	17.559	13.402	14.931	18.240	35.798	3.252
Mag STE	C4	06/04/09	16:30	1		0.000	46.455	46.455	15.318	20.942	67.397	3.396
Mag STE	E3	06/04/09	12:05	1	6700	3.000	25.002	22.003	11.734	17.042	42.044	3.535
Mag STE	E3	06/04/09	12:05	F2	10700	0.022	25.330	25.308	11.848	14.407	39.737	3.314
Mag STE	G7	06/04/09	5:50	1		0.117	0.068	0.000	31.648	57.116	57.183	3.488
Mag STE	G8	06/04/09	16:14	1		0.002	26.000	25.998	21.432	21.962	47.962	3.966

Appendix A Performance Assessment
Nutrient Data (continued)

	C	Composite sample		**F Coli**	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
	G	Grab Sample		SM	EPA	EPA	calc	EPA	EPA		EPA
	E3	Event 3 sample		9222D	354.1	353.3		350.3	351.4	calc	365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**ID**	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mag TT	G1	05/31/09	18:35	1			0.168		97.367	156.863	157.031	4.215
Mag TT	C1	06/01/09	15:25	1			25.359		95.403	120.824	146.183	4.481
Mag TT	G2	06/01/09	12:05	1			20.138		76.243	89.330	109.468	4.567
Mag TT	G3	06/01/09	23:55	1			10.028		138.813	139.081	149.108	4.100
Mag TT	C2	06/02/09	16:15	1			0.039		77.420	121.218	121.257	3.820
Mag TT	G4	06/02/09	8:30	1			0.909		84.492	135.452	136.361	3.477
Mag TT	C3	06/03/09	16:05	1		0.087	0.130	0.043	89.717	177.664	177.794	3.886
Mag TT	G5	06/03/09	5:42	1		0.151	0.173	0.022	94.663	188.665	188.839	3.669
Mag TT	G6	06/03/09	15:35	1		0.175	0.214	0.038	86.564	130.690	130.904	3.524
Mag TT	G6	06/03/09	15:35	F2		0.161	0.155	0.000	89.316	143.493	143.647	3.796
Mag TT	C4	06/04/09	16:20	1		0.072	0.289	0.216	126.541	127.799	128.088	3.992
Mag TT	E3	06/04/09	11:55	1	102100	0.115	0.075	0.000	100.784	102.330	102.405	3.435
Mag TT	G7	06/04/09	5:40	1		0.118	0.068	0.000	127.163	169.553	169.621	3.597
Mag TT	G8	06/04/09	16:00	1		0.109	0.588	0.479	122.302	123.809	124.396	3.913

Appendix B Environmental Monitoring
Field Data

Station	Date	**Well**	**Time**	**Water T**	**COND**	**COND**	**Salinity**	**DO %SAT**	**DO**	**PH**	**ORP**	**PH**
		FSU	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
		(m)		Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
Background												
CAS	1/14/09	3.40	12:14	21.65	41.83			27.4	2.21	8.06		
CAS	03/26/09	6.40	13:31	21.00	41.83			27.4	2.2	8.06		
CAS	05/11/09	2.52	12:35	20.83	53				1.65	3.48		
CAS	06/04/09	2.79	11:04	21.33	277				2.19	4.48		
	average			**21.20**	**103.42**				**2.07**	**6.02**		
	stdev			*0.36*	*115.84*				*0.28*	*2.39*		
SRWMD #4	1/14/09	5.46	12:56	22.21	157.9			14.9	0.60	7.71		
SRWMD #4	03/26/09	6.77	13:12	22.21	157.9			14.9	0.6	7.71		
SRWMD #4	05/11/09	4.61	12:59	21.37	299				1.39	3.36		
SRWMD #4	06/04/09	4.90	11:43	21.48	206				1.45	8.46		
	average			**21.82**	**205.20**				**1.01**	**6.81**		
	stdev			*0.46*	*66.52*				*0.47*	*2.33*		

Appendix B Environmental Monitoring
Field Data (continued)

Station	Date	Well	Time	Water T	COND	COND	Salinity	DO %SAT	DO	PH	ORP	PH
		FSU	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
		(m)		Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
Hickory												
S1	1/14/09	4.36	9:44	21.86	634	0.596	0.31	21.7	1.89	7.57	219.1	
S1	03/27/09	4.20	14:20	21.96	589.00	0.555	0.29	28.2	2.46	6.75	101.9	
S1	05/11/09	3.75	16:19	21.57	645	0.602	0.31	5.6	0.49	4.00	36.3	
S1	06/04/09	3.73	11:09	21.62	660	0.618	0.32	3.2	0.29	7.37	29.7	7.2
	average			**21.75**	**632.00**	**0.59**	**0.31**	**14.68**	**1.28**	**6.42**	**96.75**	
	stdev			*0.19*	*30.58*	*0.03*	*0.01*	*12.20*	*1.06*	*1.65*	*87.84*	
S2	1/14/09	4.26	10:05	21.58	553	0.518	0.27	39.3	3.47	7.47	218.2	
S2	03/27/09	4.08	12:15	21.32	536	0.499	0.26	46.9	4.15	5.79	108.5	
S2	05/11/09	3.445	14:18	21.22	548	0.508	0.27	11.6	1.02	4.13	12.9	
S2	06/04/09	3.64	10:12	21.13	532	0.493	0.26	4.8	0.43	7.51	33.4	7.3
	average			**21.31**	**542.25**	**0.50**	**0.27**	**25.65**	**2.27**	**6.23**	**93.25**	
	stdev			*0.19*	*9.88*	*0.01*	*0.01*	*20.58*	*1.82*	*1.61*	*92.89*	
C3	1/14/09	4.30	10:55	21.46	588	0.548	0.29	57.0	5.03	7.34	243.7	
C3	03/27/09	4.12	13:30	21.07	566	0.523	0.27	62.1	5.51	6.60	105.0	
C3	05/11/09	3.475	15:24	20.85	555	0.511	0.27	31.3	2.79	4.03	35.6	
C3	06/04/09	3.66	10:44	20.83	550	0.506	0.27	27.0	2.50	7.41	32.6	7.2
	average			**21.05**	**564.75**	**0.52**	**0.28**	**44.35**	**3.96**	**6.35**	**104.23**	
	stdev			*0.29*	*16.88*	*0.02*	*0.01*	*17.76*	*1.53*	*1.59*	*98.82*	

Appendix B Environmental Monitoring
Field Data (continued)

Station	**Date**	**Well**	**Time**	**Water T**	**COND**	**COND**	**Salinity**	**DO %SAT**	**DO**	**PH**	**ORP**	**PH**
		FSU	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
		(m)		Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
C4	1/14/09	4.37	11:12	21.33	573	0.533	0.27	69.7	6.16	7.31	250.1	
C4	03/27/09	4.18	12:45	20.98	563	0.520	0.27	70.1	6.25	6.43	107.5	
C4	05/11/09	3.54	14:59	20:57	541	0.495	0.26	36.3	3.26	4.08	33.1	
C4	06/04/09	3.73	10:32	20.96	542	0.500	0.26	30.6	2.71	7.49	32.6	7.2
	average			**16.04**	**554.75**	**0.51**	**0.27**	**51.68**	**4.60**	**6.33**	**105.83**	
	stdev			*10.11*	*15.84*	*0.02*	*0.01*	*21.17*	*1.87*	*1.57*	*102.42*	
C5	1/14/09	4.30	10:35	21.91	696	0.655	0.34	40.6	3.55	7.39	240.8	
C5	03/27/09	4.13	13:50	21.86	639	0.600	0.31	28.1	2.46	6.67	96.6	
C5	05/11/09	3.475	15:50	21.33	641	0.596	0.31	10.9	0.96	4.00	34.7	
C5	06/04/09	3.66	10:59	21.41	658	0.613	0.32	32.4	2.87	7.38	31.7	7.2
	average			**21.63**	**658.50**	**0.62**	**0.32**	**28.00**	**2.46**	**6.36**	**100.95**	
	stdev			*0.30*	*26.41*	*0.03*	*0.01*	*12.52*	*1.10*	*1.61*	*97.91*	

Appendix B Environmental Monitoring
Field Data (continued)

Station	**Date**	**Well**	**Time**	**Water T**	**COND**	**COND**	**Salinity**	**DO %SAT**	**DO**	**PH**	**ORP**	**PH**
		FSU	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
		(m)		Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
M1	1/14/09	2.52	13:44	21.88	959	0.897	0.47	7.2	0.63	7.11	158.9	
M1	03/26/09	2.50										
M1	05/11/09	1.41	12:34	21.52	827	0.773	0.41	5.6	0.49	3.94	43.5	
M1	06/04/09	1.97	14:54	21.16	839	0.778	0.41	2.3	0.21	7.33	13.7	7.1
	average			**21.52**	**875.00**	**0.82**	**0.43**	**5.03**	**0.44**	**6.13**	**72.03**	
	stdev			*0.36*	*72.99*	*0.07*	*0.03*	*2.50*	*0.21*	*1.90*	*76.69*	
M2	1/14/09	2.04	13:12	19.64	719	0.645	0.35	18.0	1.64	7.09	165.7	
M2	03/26/09	2.04										
M2	05/11/09	0.93	12:04	19.95	492	0.445	0.24	5.4	0.49	3.98	23.1	
M2	06/04/09	1.45	14:31	21.04	616	0.569	0.3	3.3	0.29	7.48	10.3	7.1
	average			**20.21**	**609.00**	**0.55**	**0.30**	**8.90**	**0.81**	**6.18**	**66.37**	
	stdev			*0.74*	*113.66*	*0.10*	*0.06*	*7.95*	*0.73*	*1.92*	*86.26*	
M3	1/14/09	1.70	12:16	20.45	763	0.697	0.37	7.4	0.66	7.20	178.6	
M3	03/26/09	1.69										
M3	05/11/09	0.62	10:55	19:55	619	0.554	0.3	6.5	0.6	3.97	43.6	
M3	06/04/09	1.115	12:28	20.03	663	0.600	0.32	4.0	0.36	7.35	10.2	7.2
	average			**13.77**	**681.67**	**0.62**	**0.33**	**5.97**	**0.54**	**6.17**	**77.47**	
	stdev			*11.21*	*73.79*	*0.07*	*0.04*	*1.76*	*0.16*	*1.91*	*89.16*	
M5	1/14/09	2.00	13:00	21.36	886	0.824	0.44	8.0	0.71	7.10	163.8	
M5	03/26/09	1.98										
M5	05/11/09	0.91	11:54	20.64	748	0.686	0.37	4.2	0.38	3.93	43.0	
M5	06/04/09	1.39	14:21	20.59	745	0.682	0.36	4.9	0.44	7.76	14.0	7.2
	average			**20.86**	**793.00**	**0.73**	**0.39**	**5.70**	**0.51**	**6.26**	**73.60**	
	stdev			*0.43*	*80.55*	*0.08*	*0.04*	*2.02*	*0.18*	*2.05*	*79.45*	

Appendix B Environmental Monitoring
Field Data (continued)

Station	Date	Well	Time	Water T	COND	COND	Salinity	DO %SAT	DO	PH	ORP	PH
		FSU	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
		(m)		Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
M6	1/14/09	1.44	12:32	20.93	869	0.801	0.43	5.6	0.51	7.15	172.3	
M6	03/26/09	1.935										
M6	05/11/09	0.41	11:20	20.49	805	0.73	0.4	2	0.17	3.86	45.7	
M6	06/04/09	0.815	12:35	20.39	778	0.710	0.38	3.7	0.33	7.26	11.6	7.2
	average			**20.60**	**817.33**	**0.75**	**0.40**	**3.77**	**0.34**	**6.09**	**76.53**	
	stdev			*0.29*	*46.74*	*0.05*	*0.03*	*1.80*	*0.17*	*1.93*	*84.67*	
M7	1/14/09	1.63	12:46	21.36	894	0.832	0.44	7.1	0.63	7.12	165.8	
M7	03/26/09	1.605										
M7	05/11/09	0.565	11:37	20.32	810	0.738	0.4	2.7	0.24	3.80	43.4	
M7	06/04/09	1.03	12:43	20.57	744	0.681	0.36	4.3	0.37	7.33	11.5	7.2
	average			**20.75**	**816.00**	**0.75**	**0.40**	**4.70**	**0.41**	**6.08**	**73.57**	
	stdev			*0.54*	*75.18*	*0.08*	*0.04*	*2.23*	*0.20*	*1.98*	*81.45*	
M8	1/14/09	1.98	13:28	21.02	715	0.660	0.35	5.9	0.53	7.17	159.6	
M8	03/26/09	1.96										
M8	05/11/09	0.87	12:14	19.89	667	0.602	0.33	4.3	0.39	4.00	33.8	
M8	06/04/09	1.375	14:43	20.24	638	0.580	0.32	2.5	0.23	7.47	13.3	7.2
	average			**20.38**	**673.33**	**0.61**	**0.33**	**4.23**	**0.38**	**6.21**	**68.90**	
	stdev			*0.58*	*38.89*	*0.04*	*0.02*	*1.70*	*0.15*	*1.92*	*79.21*	
M9	1/14/09	1.84	11:50	20.67	689	0.633	0.34	11.3	1.02	7.39	180.7	
M9	03/26/09	1.82										
M9	05/11/09	0.735	10:44	19.65	562	0.505	0.27	6.9	0.63	4.12	42.6	
M9	06/04/09	1.24	12:11	20.22	566	0.515	0.27	4.0	0.36	7.46	9.9	7.1
	average			**20.18**	**605.67**	**0.55**	**0.29**	**7.40**	**0.67**	**6.32**	**77.72**	
	stdev			*0.51*	*72.20*	*0.07*	*0.04*	*3.68*	*0.33*	*1.91*	*90.67*	

Appendix B Environmental Monitoring
Field Data (continued)

Station	**Date**	**Time**	**Water T**	**COND**	**COND**	**Salinity**	**DO %SAT**	**DO**	**PH**	**ORP**	**PH**
		YSI	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*Probe*
			Celsius	µS/cm	mS/cm	ppt	%	mg/L	units	mg/L	units
Hick TT	03/27/09	14:45	23.29	1087	1.051	0.54	2.2	0.18	8.22	-79.6	
Hick TT	05/11/09	16:59	25.91	1611	1.639	0.81	8.9	0.72	4.40	-241.2	
Hick TT	06/04/09	11:31	25.85	1309	1.330	0.65	27.4	2.22	6.98	-146.8	6.8
Hick STE	05/11/09	16:44	25.96	1403	1.429	0.7	52.6	4.28	4.44	37.2	
Hick STE	06/04/09	11:24	25.41	874	0.881	0.43	45.0	3.68	7.77	26.3	
Mag TT	05/11/09	13:07	26.91	1430	1.482	0.71	1.6	0.11	3.78	-249.4	
Mag TT	06/04/09	11:54	27.07	1463	1.521	0.73	16.5	1.30	6.94	-125.9	6.7
Mag STE	1/14/09	14:10	18.50	1136	0.996	0.570	40.7	3.80	6.79	163.30	
Mag STE	05/11/09	12:48	26.15	1237	1.264	0.61	9.9	0.8	3.78	55.3	
Mag STE	06/04/09	12:04	26.50	1113	1.145	0.55	55.7	4.47	6.21	-2.5	6.2

Appendix B Environmental Monitoring
Nutrient Data

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
CAS	01/14/09	12:14	1	0	0.041	0.310	0.27	0.120	0.448	0.76	0.01
CAS	03/26/09	13:31	1	0	0.131	0.139	0.01	0.012	0.172	0.31	0.01
CAS	05/11/09	12:35	1	0	0.042	0.155	0.11	0.053	0.073	0.23	0.32
CAS	06/04/09	11:00	1	0	0.052	0.476	0.42	0.407	0.832	1.31	0.10
	average				**0.067**	**0.270**	**0.20**	**0.148**	**0.381**	**0.65**	**0.11**
	stdev				*0.043*	*0.157*	*0.18*	*0.178*	*0.340*	*0.50*	*0.15*
SRWMD #4	01/14/09	12:56	1	0	0.010	0.226	0.22	0.123	0.088	0.31	0.01
SRWMD #4	03/26/09	13:12	1	4	0.019	0.863	0.84	0.014	0.130	0.99	0.01
SRWMD #4	05/11/09	12:59	1	0	0.009	0.020	0.01	0.045	0.095	0.11	0.27
SRWMD #4	06/04/09	11:30	1	0	0.033	1.032	1.00	0.466	0.655	1.69	0.29
	average				**0.018**	**0.535**	**0.52**	**0.162**	**0.242**	**0.78**	**0.14**
	stdev				*0.011*	*0.488*	*0.48*	*0.208*	*0.276*	*0.71*	*0.15*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
S1	01/14/09	9:44	1	7	0.001	6.670	6.67	0.134	0.096	6.77	1.32
S1	03/27/09	14:20	1	1	0.006	1.504	1.50	0.006	0.048	1.55	0.39
S1	03/27/09	14:20	F2	1	0.006	1.562	1.56	0.006	0.053	1.61	0.39
S1	03/27/09	14:20	Ave	1	0.006	1.533	1.53	0.006	0.050	1.58	0.39
S1	05/11/09	16:10	1	0	0.005	0.575	0.57	0.041	0.072	0.65	0.57
S1	05/11/09	16:10	F2	0	0.006	0.453	0.45	0.040	0.069	0.52	0.55
S1	05/11/09	16:10	Ave	0	0.006	0.514	0.51	0.041	0.070	0.58	0.56
S1	06/04/09	11:10	1	0	0.133	4.841	4.71	0.264	0.565	5.41	0.78
	average				**0.036**	**3.390**	**3.35**	**0.111**	**0.195**	**3.59**	**0.76**
	stdev				*0.064*	*2.863*	*2.84*	*0.116*	*0.247*	*2.97*	*0.40*
S2	01/14/09	10:05	1	0	0.000	1.713	1.71	0.132	0.081	1.79	0.05
S2	03/27/09	12:15	1	18	0.009	0.104	0.10	0.008	0.169	0.27	0.07
S2	05/11/09	14:20	1	25	0.000	0.085	0.08	0.047	0.061	0.15	0.06
S2	06/04/09	10:14	1	0	0.010	0.245	0.23	0.335	0.445	0.69	0.02
	average				**0.005**	**0.537**	**0.53**	**0.131**	**0.189**	**0.73**	**0.05**
	stdev				*0.006*	*0.788*	*0.79*	*0.146*	*0.177*	*0.75*	*0.02*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
C3A	01/14/09	10:55	1	8	0.000	0.963	0.96	0.108	0.072	1.04	0.01
C3A	03/27/09	13:30	1	0	0.008	0.649	0.64	0.007	0.079	0.73	0.05
C3A	05/11/09	15:25	1	0	0.004	0.109	0.10	0.041	0.110	0.22	0.03
C3A	06/04/09	10:46	1	4	0.004	0.208	0.20	0.405	0.367	0.58	0.02
	average				**0.004**	**0.483**	**0.48**	**0.140**	**0.157**	**0.64**	**0.03**
	stdev				*0.003*	*0.397*	*0.40*	*0.181*	*0.141*	*0.34*	*0.02*
C4	01/14/09	11:12	1	0	0.000	1.180	1.18	0.109	0.084	1.26	0.02
C4	03/27/09	12:45	1	7	0.004	1.156	1.15	0.007	0.120	1.28	0.05
C4	05/11/09	15:05	1	0	0.001	0.281	0.28	0.044	0.113	0.39	0.05
C4	06/04/09	10:34	1	76	0.008	0.467	0.46	0.304	0.450	0.92	0.08
	average				**0.003**	**0.771**	**0.77**	**0.116**	**0.192**	**0.96**	**0.05**
	stdev				*0.004*	*0.465*	*0.47*	*0.132*	*0.173*	*0.41*	*0.03*
C5	01/14/09	10:35	1	120	0.026	5.984	5.96	0.118	0.220	6.20	0.03
C5	03/27/09	13:50	1	10	0.035	1.019	0.98	0.008	0.133	1.15	0.03
C5	05/11/09	15:50	1	0	0.003	2.064	2.06	0.040	0.081	2.15	0.05
C5	06/04/09	11:00	1	0	0.021	2.982	2.96	0.585	0.485	3.47	0.03
	average				**0.021**	**3.012**	**2.99**	**0.188**	**0.230**	**3.24**	**0.04**
	stdev				*0.014*	*2.137*	*2.14*	*0.269*	*0.180*	*2.19*	*0.01*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
M1	01/14/09	13:44	1	10	0.011	17.155	17.14	0.483	0.232	17.39	0.19
M1	03/26/09	13:40	1	7 *	0.006	13.243	13.24	0.116	0.361	13.60	0.13
M1	03/26/09	13:42	F2	8 *	0.008	11.372	11.36	0.117	0.348	11.72	0.14
M1	03/26/09	13:42	Ave	8	0.007	12.307	12.30	0.117	0.355	12.66	0.13
M1	05/11/09	12:38	1	0	0.008	2.698	2.69	0.050	0.120	2.82	0.39
M1	06/04/09	14:56	1	0	0.005	6.083	6.08	0.044	0.989	7.07	0.20
	average				**0.009**	**10.720**	**10.71**	**0.217**	**0.236**	**10.96**	**0.24**
	stdev				*0.002*	*6.440*	*6.44*	*0.209*	*0.389*	*6.37*	*0.11*
M2	01/14/09	13:12	1	67	0.005	8.157	8.15	0.127	0.136	8.29	0.37
M2	01/14/09	13:12	F2	67	0.005	7.674	7.67	0.128	0.155	7.83	0.33
M2	01/14/09	13:12	Ave	67	0.005	7.915	7.91	0.127	0.145	8.06	0.35
M2	03/26/09	12:45	1	32	0.013	4.846	4.83	0.016	0.161	5.01	0.34
M2	05/11/09	12:05	1	8	0.005	0.514	0.51	0.051	0.149	0.66	0.38
M2	06/04/09	14:32	1	0	0.004	0.184	0.18	0.042	0.665	0.85	0.29
	average				**0.006**	**3.365**	**3.36**	**0.059**	**0.280**	**3.65**	**0.34**
	stdev				*0.004*	*3.703*	*3.70*	*0.048*	*0.257*	*3.56*	*0.04*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
M3	01/14/09	12:16	1	0	0.023	3.899	3.88	0.125	0.237	4.14	0.38
M3	03/26/09	11:30	1	20	0.027	1.148	1.12	0.052	0.251	1.40	0.04
M3	05/11/09	11:00	1	5	0.002	0.266	0.26	0.042	0.109	0.38	0.25
M3	06/04/09	12:30	1	4	0.178	13.957	13.78	0.544	0.524	14.48	0.20
	average				**0.058**	**4.818**	**4.76**	**0.191**	**0.280**	**5.10**	**0.22**
	stdev				*0.081*	*6.286*	*6.21*	*0.238*	*0.175*	*6.45*	*0.14*
M5	01/14/09	13:00	1	0	0.006	11.474	11.47	0.124	0.127	11.60	0.42
M5	03/26/09	12:30	1	7	0.055	1.424	1.37	0.069	0.310	1.73	0.27
M5	05/11/09	11:55	1	0	0.003	3.787	3.78	0.051	0.138	3.92	0.18
M5	06/04/09	14:22	1	4	0.016	2.943	2.93	0.068	0.751	3.69	0.15
	average				**0.020**	**4.907**	**4.89**	**0.078**	**0.332**	**5.24**	**0.25**
	stdev				*0.024*	*4.486*	*4.50*	*0.032*	*0.292*	*4.35*	*0.12*
M6	01/14/09	12:32	1	0	0.081	5.005	4.92	0.125	0.333	5.34	0.09
M6	03/26/09	11:50	1	10	0.093	2.062	1.97	0.037	0.229	2.29	0.03
M6	05/11/09	12:50	1	5	0.064	2.864	2.80	0.051	0.112	2.98	0.58
M6	06/04/09	12:36	1	32	2.626	1.415	0.00	0.359	0.686	2.10	0.06
	average				**0.716**	**2.837**	**2.42**	**0.143**	**0.340**	**3.18**	**0.19**
	stdev				*1.274*	*1.562*	*2.04*	*0.149*	*0.248*	*1.49*	*0.26*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
M7	01/14/09	12:46	1	0	0.022	9.593	9.57	0.124	0.161	9.75	0.48
M7	03/26/09	12:15	1	29	0.063	5.151	5.09	0.037	0.229	5.38	0.09
M7	05/11/09	11:40	1	3	0.011	4.284	4.27	0.052	0.140	4.42	0.35
M7	06/04/09	12:45	1	14	0.202	19.425	19.22	0.373	0.562	19.99	0.22
	average				**0.075**	**9.613**	**9.54**	**0.146**	**0.273**	**9.89**	**0.29**
	stdev				*0.088*	*6.942*	*6.86*	*0.156*	*0.197*	*7.12*	*0.17*
M8	01/14/09	13:28	1	0	0.020	0.786	0.77	0.126	0.077	0.86	0.31
M8	03/26/09	13:20	1	2 *	0.026	10.284	10.26	0.015	0.157	10.44	0.09
M8	05/11/09	12:15	1	0	0.003	4.351	4.35	0.053	0.142	4.49	0.24
M8	06/04/09	14:44	1	0	0.002	0.102	0.10	0.036	0.705	0.81	0.17
	average				**0.013**	**3.881**	**3.87**	**0.058**	**0.270**	**4.15**	**0.20**
	stdev				*0.012*	*4.658*	*4.65*	*0.048*	*0.292*	*4.53*	*0.09*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
M9	01/14/09	11:50	1	13	0.009	1.370	1.36	0.110	0.127	1.50	0.08
M9	03/26/09	10:55	1	96	0.048	5.332	5.28	0.014	0.216	5.55	0.12
M9	03/26/09	10:55	L2	90	0.049	5.325	5.28	0.014	0.209	5.53	0.12
M9	03/26/09	10:55	Ave	93	0.049	5.329	5.28	0.014	0.213	5.54	0.12
M9	05/11/09	10:50	1	0	0.002	0.111	0.11	0.035	0.151	0.26	0.05
M9	06/04/09	12:15	1	2	0.017	0.239	0.22	0.419	0.562	0.80	0.16
M9	06/04/09	12:15	F2	2	0.019	0.297	0.28	0.401	0.471	0.77	0.06
M9	06/04/09	12:15	Ave	2	0.018	0.268	0.25	0.410	0.517	0.78	0.11
	average				**0.019**	**1.769**	**1.75**	**0.142**	**0.252**	**2.02**	**0.09**
	stdev				*0.021*	*2.438*	*2.42*	*0.183*	*0.180*	*2.40*	*0.03*

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Hick TT	03/27/09	14:45	1	26000	0.054	0.116	0.063	61.696	173.313	173.429	13.496
Hick TT	05/11/09	17:00	1	60000	0.062	0.092	0.031	59.414	235.162	235.254	2.919
Hick TT	06/04/09	11:32	1	15400	0.115	0.099	0.000	61.506	58.459	58.558	3.321
Hick STE	03/27/09	14:35	1	8060	0.125	4.600	4.475	44.640	116.386	120.986	12.789
Hick STE	03/27/09	14:35	F2	6760	0.129	0.248	0.119	40.043	97.017	97.265	13.193
Hick STE	05/11/09	16:40	1	3350	1.327	6.307	4.979	33.595	52.537	58.844	2.731
Hick STE	06/04/09	11:20	1	6200	4.607	10.785	6.179	5.759	6.783	17.569	2.668

Appendix B Environmental Monitoring
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.20
			MDL	*1*	*0.003*	*0.006*	*0.01*	*0.022*	*0.056*	*0.06*	*0.00*
			PQL	*4*	*0.012*	*0.024*	*0.02*	*0.088*	*0.224*	*0.22*	*0.02*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mag TT	03/26/09	14:20	1	10500	0.127	7.761	7.634	83.644	202.893	210.654	0.128
Mag TT	05/11/09	13:10	1	13520	0.071	0.055	0.000	38.718	168.989	169.045	1.842
Mag TT	05/11/09	13:10	F2	12410	0.070	0.070	0.000	40.402	186.769	186.839	1.150
Mag TT	06/04/09	11:55	1	102100	0.115	0.075	0.000	100.784	102.330	102.405	3.435
Mag STE	1/14/09	14:10	1	3780	0.371	63.484	63.113	2.025	3.003	66.487	20.802
Mag STE	03/26/09	13:58	1	2100	1.184	12.242	11.058	1.675	14.161	26.403	0.113
Mag STE	05/11/09	12:50	1	8000	1.512	6.943	5.431	10.199	13.160	20.102	1.743
Mag STE	05/11/09	12:50	F2	7610	1.819	6.943	5.124	11.211	12.675	19.618	1.763
Mag STE	06/04/09	12:05	1	6700	3.000	25.002	22.003	11.734	17.042	42.044	3.535
Mag STE	06/04/09	12:05	F2	10700	0.022	25.330	25.308	11.848	14.407	39.737	3.314

Appendix C Water meter data

Date and time	Hickory meter	gal/day	Date/Time	Magnolia meter	gal/day	
12/29/08 12:00	1013882		12/29/08 12:00	763991		Park staff, no time
1/5/09 12:00	1021590	1101	1/5/09 12:00	768874	698	Park staff, no time
1/12/09 12:00	1025574	569	1/12/09 12:00	771642	395	Park staff, no time
1/19/09 12:00	1028820	464	1/19/09 12:00	773974	333	Park staff, no time
1/26/09 12:00	1031736	417	1/26/09 12:00	777227	465	Park staff, no time
January 2009		638			473	
2/2/09 12:00	1036175		2/2/09 12:00	780145		Park staff, no time
2/9/09 12:00	1040051	554	2/9/09 12:00	783547	486	Park staff, no time
2/16/09 12:00	1044820	681	2/16/09 12:00	786390	406	Park staff, no time
2/23/09 12:00	1049580	680	2/23/09 12:00	789736	478	Park staff, no time
February 2009		638			457	
3/2/09 12:00	1053595		3/2/09 12:00	793866		Park staff, no time
3/9/09 12:00	1059670	868	3/9/09 12:00	799027	737	Park staff, no time
3/16/09 12:00	1066030	909	3/16/09 12:00	803084	580	Park staff, no time
3/23/09 12:00	1072963	990	3/23/09 12:00	807278	599	Park staff, no time
3/27/09 14:55	1077512	1104	3/26/09 10:00	808471	409	FSU
3/30/09 12:00	1079730	771	3/30/09 12:00	810920	600	Park staff, no time
March 2009		933			609	

Appendix C Water meter data
(continued)

Date and time	Hickory meter	gal/day	Date/Time	Magnolia meter	gal/day	
4/6/09 12:00	1088049		4/6/09 12:00	817026		Park staff, no time
4/14/09 12:00	1095200	894	4/14/09 12:00	823783	845	Park staff, no time
4/22/09 12:00	1095200	0	4/22/09 12:00	823900	15	Park staff, no time
April 2009		447			430	
5/4/09 12:00	1097500		5/4/09 12:00	826000		Park staff, no time
5/11/09 12:00	1102320	689	5/11/09 13:20	834365	1186	FSU
5/11/09 17:10	1102463	664	5/11/09 14:00	834440	2700	Park staff, no time
5/25/09 12:00	1111500	656	5/25/09 12:00	839262	346	Park staff, no time
5/31/09 16:30	1114825	537	5/31/09 18:30	841188	307	FDOH
5/31/09 19:30	1114900	600	5/31/09 19:06	841213	1000	FDOH
5/31/09 22:30	1115085	1480	5/31/09 23:30	842078	4718	FDOH
May 2009		641			585	
6/1/09 12:00	1115200		6/1/09 12:00	842200		Park staff, no time
6/4/09 15:28	1116695	475	6/4/09 16:11	842781	183	FSU
6/8/09 12:00	1119500	728	6/8/09 12:00	844820	533	Park staff, no time
6/15/09 12:00	1125600	871	6/15/09 12:00	849130	616	Park staff, no time
6/22/09 12:00	1133100	1071	6/22/09 12:00	854000	696	Park staff, no time
June 2009		852			562	
Total cumulative		**654**			**501**	

Appendix C Water meter data during performance assessment.

Performance Assessment

	Hickory			Magnolia		
Date and time	**meter**	**gal/hr**	**Date / time**	**meter**	**gal/hr**	
5/31/09 16:30	1114825		5/31/09 18:30	841188		FDOH
5/31/09 19:30	1114900	25	5/31/09 19:06	841213	42	FDOH
5/31/09 22:30	1115085	62	5/31/09 23:30	842078	197	FDOH
6/1/09 5:10	1115188	15	6/1/09 5:43	842085	1	FSU
6/1/09 10:46	1115195	1	6/1/09 11:47	842160	12	FSU
6/1/09 11:00	1115202	30	6/1/09 12:07	842160	0	FSU
6/1/09 12:30	1115242	27	6/1/09 15:02	842176	5	FSU
6/1/09 17:01	1115293	11	6/1/09 15:18	842199	86	FSU
6/1/09 17:11	1115296	18	6/1/09 18:00	842206	3	FSU
6/1/09 23:04	1115517	38	6/1/09 18:10	842206	0	FSU
6/1/09 23:16	1115530	65	6/1/09 23:46	842288	15	FSU
6/2/09 5:05	1115616	15	6/1/09 23:59	842288	0	FSU
6/2/09 7:45	1115690	28	6/2/09 8:18	842305	2	FSU
6/2/09 7:55	1115692	12	6/2/09 8:21	842305	0	FSU
6/2/09 11:02	1115747	18	6/2/09 8:33	842320	75	FSU
6/2/09 11:15	1115754	32	6/2/09 15:11	842372	8	FSU
6/2/09 17:02	1115828	13	6/2/09 15:20	842379	47	FSU
6/2/09 17:11	1115830	13	6/2/09 16:10	842382	4	FSU
6/2/09 23:01	1116012	31	6/2/09 17:58	842398	9	FSU
6/2/09 23:12	1116020	44	6/2/09 18:13	842398	0	FSU
6/3/09 5:03	1116053	6	6/3/09 5:32	842521	11	FSU
6/3/09 5:13	1116053	0	6/3/09 15:38	842566	4	FSU
6/3/09 11:03	1116257	35	6/3/09 15:49	842566	0	FSU
6/3/09 11:16	1116258	5	6/3/08 18:10	842608	0	FSU
6/3/09 16:26	1116328	14	6/3/09 18:20	842624	0	FSU
6/3/09 16:42	1116329	4	6/3/09 18:29	842632	53	FSU
6/3/09 17:01	1116335	19	6/4/09 5:38	842711	7	FSU
6/3/09 17:09	1116335	0	6/4/09 5:50	842711	0	FSU
6/3/09 23:02	1116453	20	6/4/09 11:52	842766	9	FSU
6/3/09 23:10	1116453	0	6/4/09 12:02	842766	0	FSU
6/4/09 5:05	1116459	1	6/4/09 15:56	842781	4	FSU
6/4/09 5:13	1116459	0	6/4/09 16:11	842781	0	FSU
6/4/09 11:22	1116649	31				FSU
6/4/09 11:29	1116658	77				FSU
6/4/09 15:28	1116695	9				FSU
Performance	**gal/hr**	**20**			**17**	
Performance	**gal/day**	**473**			**408**	

Appendix D Sampling Event on 01/14/09
Nutrient Data

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				SM	EPA	EPA	calc	EPA	EPA	calc	EPA
				9222D	354.1	353.3		350.3	351.4		365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Background Wells											
CAS	1/14/09	12:14	1	0	0.041	0.310	0.269	0.120	0.448	0.758	0.005
SRWMD#4	1/14/09	12:56	1	0	0.010	0.226	0.216	0.123	0.088	0.314	0.013
Hickory											
S1	1/14/09	9:44	1	7	0.001	6.670	6.669	0.134	0.096	6.766	1.316
S2	1/14/09	10:05	1	0	0.000	1.713	1.713	0.132	0.081	1.795	0.050
C3A	1/14/09	10:55	1	8	0.000	0.963	0.963	0.108	0.072	1.036	0.011
C4	1/14/09	11:12	1	0	0.000	1.180	1.180	0.109	0.084	1.264	0.016
C5	1/14/09	10:35	1	120*	0.026	5.984	5.958	0.118	0.220	6.203	0.032
Magnolia											
M1	1/14/09	13:44	1	10	0.011	17.155	17.144	0.483	0.232	17.386	0.186
M2	1/14/09	13:12	1	67*	0.005	8.157	8.152	0.127	0.136	8.293	0.374
M2	1/14/09	13:12	F2	67*	0.005	7.674	7.669	0.128	0.155	7.829	0.329
M3	1/14/09	12:16	1	0	0.023	3.899	3.876	0.125	0.237	4.136	0.377
M5	1/14/09	13:00	1	0	0.006	11.474	11.468	0.124	0.127	11.601	0.417
M6	1/14/09	12:32	1	0	0.081	5.005	4.924	0.125	0.333	5.338	0.090
M7	1/14/09	12:46	1	0	0.022	9.593	9.571	0.124	0.161	9.754	0.478
M8	1/14/09	13:28	1	0	0.020	0.786	0.766	0.126	0.077	0.862	0.311
M9	1/14/09	11:50	1	13*	0.009	1.370	1.361	0.110	0.127	1.497	0.085
Mag STE	1/14/09	14:10	1	3780	0.371	63.484	63.113	2.025	3.003	66.487	20.802

*colony development was late

Appendix D Sampling Event on 01/14/09
Field Data

Station	Date	Time	Depth	Water T	COND *YSI*	COND *YSI*	Salinity *YSI*	%SAT *YSI*	DO *YSI*	PH *YSI*	ORP *YSI*
			Meters	Celsius	µS/cm	mS/cm	ppt	%	mg/L	mg/L	mg/L
Background Wells											
CAS	1/14/09	3.40	12:14	21.65	41.83			27.4	2.21	8.06	
SRWMD #4	1/14/09	5.46	12:56	22.21	157.9			14.9	0.60	7.71	
Hickory											
S1	1/14/09	4.36	9:44	21.86	634	0.596	0.31	21.7	1.89	7.57	219.1
S2	1/14/09	4.26	10:05	21.58	553	0.518	0.27	39.3	3.47	7.47	218.2
C3A	1/14/09	4.30	10:55	21.46	588	0.548	0.29	57.0	5.03	7.34	243.7
C4	1/14/09	4.37	11:12	21.33	573	0.533	0.27	69.7	6.16	7.31	250.1
C5	1/14/09	4.30	10:35	21.91	696	0.655	0.34	40.6	3.55	7.39	240.8
Magnolia											
M1	1/14/09	2.52	13:44	21.88	959	0.897	0.47	7.2	0.63	7.11	158.9
M2	1/14/09	2.04	13:12	19.64	719	0.645	0.35	18.0	1.64	7.09	165.7
M3	1/14/09	1.70	12:16	20.45	763	0.697	0.37	7.4	0.66	7.20	178.6
M5	1/14/09	2.00	13:00	21.36	886	0.824	0.44	8.0	0.71	7.10	163.8
M6	1/14/09	1.44	12:32	20.93	869	0.801	0.43	5.6	0.51	7.15	172.3
M7	1/14/09	1.63	12:46	21.36	894	0.832	0.44	7.1	0.63	7.12	165.8
M8	1/14/09	1.98	13:28	21.02	715	0.660	0.35	5.9	0.53	7.17	159.6
M9	1/14/09	1.84	11:50	20.67	689	0.633	0.34	11.3	1.02	7.39	180.7
Mag STE	1/14/09		14:10	18.50	1136	0.996	0.570	40.7	3.80	6.79	163.30

Appendix E Sampling Event on 03/26/09 and 03/27/09
Nutrient Data

				F Coli	Nitrite	Nitrate+Nitrite	Nitrate	Ammonia	TKN	TN	Total P
				EPA	EPA	EPA	calc	EPA	EPA		EPA
				FC	354.1	353.3		350.3	351.4	calc	365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Background											
CAS	03/26/09	13:31	1	0	0.131	0.139	0.008	0.012	0.172	0.312	0.007
SRWMD #4	03/26/09	13:12	1	4	0.019	0.863	0.845	0.014	0.130	0.993	0.008
Hickory											
S1	03/27/09	14:20	1	1	0.006	1.504	1.498	0.006	0.048	1.551	0.391
S1	03/27/09	14:20	L2	1	0.006	1.562	1.556	0.006	0.053	1.615	0.391
S2	03/27/09	12:15	1	18	0.009	0.104	0.095	0.008	0.169	0.273	0.067
C3A	03/27/09	13:30	1	0	0.008	0.649	0.641	0.007	0.079	0.728	0.052
C4	03/27/09	12:45	1	7	0.004	1.156	1.152	0.007	0.120	1.275	0.052
C5	03/27/09	13:50	1	10	0.035	1.019	0.984	0.008	0.133	1.152	0.032
Hick TT	03/27/09	14:45	1	26000	0.054	0.116	0.063	61.696	173.313	173.429	13.496
Hick STE	03/27/09	14:35	1	8060	0.125	4.600	4.475	44.640	116.386	120.986	12.789
Hick STE	03/27/09	14:35	F2	6760	0.129	0.248	0.119	40.043	97.017	97.265	13.193

Appendix E Sampling Event on 03/26/09 and 03/27/09
Nutrient Data (continued)

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**
				EPA	EPA	EPA	calc	EPA	EPA		EPA
				FC	354.1	353.3		350.3	351.4	calc	365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Magnolia II											
M1	03/26/09	13:40	1	7 *	0.006	13.243	13.236	0.116	0.361	13.604	0.130
M1	03/26/09	13:42	F2	8 *	0.008	11.372	11.364	0.117	0.348	11.720	0.138
M2	03/26/09	12:45	1	32	0.013	4.846	4.834	0.016	0.161	5.008	0.339
M3	03/26/09	11:30	1	20	0.027	1.148	1.122	0.052	0.251	1.399	0.039
M5	03/26/09	12:30	1	7	0.055	1.424	1.369	0.069	0.310	1.734	0.266
M6	03/26/09	11:50	1	10	0.093	2.062	1.969	0.037	0.229	2.292	0.027
M7	03/26/09	12:15	1	29	0.063	5.151	5.088	0.037	0.229	5.380	0.091
M8	03/26/09	13:20	1	2 *	0.026	10.284	10.259	0.015	0.157	10.441	0.091
M9	03/26/09	10:55	1	96	0.048	5.332	5.284	0.014	0.216	5.549	0.123
M9	03/26/09	10:55	L2	90	0.049	5.325	5.276	0.014	0.209	5.534	0.120
Mag TT	03/26/09	14:20	1	10500	0.127	7.761	7.634	83.644	202.893	210.654	0.128
Mag STE	03/26/09	13:58	1	2100	1.184	12.242	11.058	1.675	14.161	26.403	0.113

*colony development was late

Appendix E Sampling Event on 03/26/09 and 03/27/09
Field Data

Station	Date	Time	Depth	Water T *YSI*	COND *YSI*	COND *YSI*	Salinity *YSI*	%SAT *YSI*	DO *YSI*	PH *YSI*	ORP *YSI*
			Meters	Celsius	µS/cm	mS/cm	ppt	%	mg/L	mg/L	mg/L
Background											
CAS	03/26/09	13:31	6.40	21.00	41.83			27.4	2.2	8.06	
SRWMD #4	03/26/09	13:12	6.77	22.21	157.9			14.9	0.6	7.71	
Hickory											
S1	03/27/09	14:20	4.20	21.96	589.00	0.555	0.29	28.2	2.46	6.75	101.9
S1	03/27/09	14:20									
S2	03/27/09	12:15	4.08	21.32	536	0.499	0.26	46.9	4.15	5.79	108.5
C3A	03/27/09	13:30	4.12	21.07	566	0.523	0.27	62.1	5.51	6.60	105.0
C4	03/27/09	12:45	4.18	20.98	563	0.520	0.27	70.1	6.25	6.43	107.5
C5	03/27/09	13:50	4.13	21.86	639	0.600	0.31	28.1	2.46	6.67	96.6
Hick TT	03/27/09	14:45		23.29	1087	1.051	1	2.2			
Hick STE	03/27/09	14:35									

Appendix E Sampling Event on 03/26/09 and 03/27/09
Field Data (continued)

Station	Date	Time	Rep	Depth Meters	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	%SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L
Magnolia II												
M1	03/26/09	13:40	1	2.50								
M2	03/26/09	12:45	1	2.04		**No YSI Data**						
M3	03/26/09	11:30	1	1.69								
M5	03/26/09	12:30	1	1.98								
M6	03/26/09	11:50	1	1.935								
M7	03/26/09	12:15	1	1.605								
M8	03/26/09	13:20	1	1.96								
M9	03/26/09	10:55	1	1.82								
Mag TT												
Mag STE												

Appendix F Sampling Event on 05/11/09
Nutrient Data

				F Coli	**Nitrite**	**Nitrate+Nitrite**	**Nitrate**	**Ammonia**	**TKN**	**TN**	**Total P**	**pH**
				SM	EPA	EPA	calc	EPA	EPA		EPA	EPA
				9222D	354.1	353.3		350.3	351.4	calc	365.2	150.1
				1	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*	0.011
				4	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*	0.04
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**units**
Background												
CAS	05/11/09	2.52	1	0	0.042	0.155	0.113	0.053	0.073	0.228	0.322	7.15
SRWMD #4	05/11/09	4.61	1	0	0.009	0.020	0.011	0.045	0.095	0.115	0.269	7.40
Hickory												
S1	05/11/09	16:10	1	0	0.005	0.575	0.570	0.041	0.072	0.648	0.567	7.66
S1	05/11/09	16:10	F2	0	0.006	0.453	0.447	0.040	0.069	0.522	0.547	7.79
S2	05/11/09	14:20	1	25	0.000	0.085	0.085	0.047	0.061	0.145	0.060	7.80
C3A	05/11/09	15:25	1	0	0.004	0.109	0.105	0.041	0.110	0.219	0.034	7.68
C4	05/11/09	15:05	1	0	0.001	0.281	0.281	0.044	0.113	0.394	0.047	7.72
C5	05/11/09	15:50	1	0	0.003	2.064	2.062	0.040	0.081	2.145	0.052	7.94
Hick TT	05/11/09	17:00	1	60000	0.062	0.092	0.031	59.414	235.162	235.254	2.919	7.67
Hick STE	05/11/09	16:40	1	3350	1.327	6.307	4.979	33.595	52.537	58.844	2.731	7.80

Appendix F Sampling Event on 05/11/09
Nutrient Data (continued)

				F Coli	Nitrite	Nitrate+Nitrite	Nitrate	Ammonia	TKN	TN	Total P	pH
				SM	EPA	EPA	calc	EPA	EPA		EPA	EPA
				9222D	354.1	353.3		350.3	351.4	calc	365.2	150.1
				1	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*	0.011
				4	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*	0.04
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**units**
Magnolia												
M1	05/11/09	12:38	1	0	0.008	2.698	2.690	0.050	0.120	2.818	0.386	7.69
M2	05/11/09	12:05	1	8	0.005	0.514	0.509	0.051	0.149	0.663	0.384	7.57
M3	05/11/09	11:00	1	5	0.002	0.266	0.264	0.042	0.109	0.375	0.251	7.62
M5	05/11/09	11:55	1	0	0.003	3.787	3.784	0.051	0.138	3.925	0.175	7.73
M6	05/11/09	12:50	1	5	0.064	2.864	2.800	0.051	0.112	2.976	0.577	7.69
M7	05/11/09	11:40	1	3	0.011	4.284	4.273	0.052	0.140	4.424	0.353	7.74
M8	05/11/09	12:15	1	0	0.003	4.351	4.348	0.053	0.142	4.493	0.244	7.63
M9	05/11/09	10:50	1	0	0.002	0.111	0.109	0.035	0.151	0.261	0.047	7.62
MAG TT	05/11/09	13:10	1	13520	0.071	0.055	0.000	38.718	168.989	169.045	1.842	7.29
MAG TT	05/11/09	13:10	F2	12410	0.070	0.070	0.000	40.402	186.769	186.839	1.150	7.32
Mag STE	05/11/09	12:50	1	8000	1.512	6.943	5.431	10.199	13.160	20.102	1.743	7.52
Mag STE	05/11/09	12:50	F2	7610	1.819	6.943	5.124	11.211	12.675	19.618	1.763	7.52

Appendix F Sampling Event on 05/11/09
Field Data

	Date	Depth	Time	Water T	COND	COND	Salinity	DO %SAT	DO	PH	ORP
		YSI	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*
		Meters		**Celsius**	**µS/cm**	**mS/cm**	**ppt**	**%**	**mg/L**	**mg/L**	**mg/L**
Background											
CAS	05/11/09	2.52	12:35	20.83	53				1.65	3.48	
SRWMD #4	05/11/09	4.61	12:59	21.37	299				1.39	3.36	
Hickory											
S1	05/11/09	3.75	16:19	21.57	645	0.602	0.31	5.6	0.49	4.00	36.3
S1	05/11/09										
S2	05/11/09	3.445	14:18	21.22	548	0.508	0.27	11.6	1.02	4.13	12.9
C3A	05/11/09	3.475	15:24	20.85	555	0.511	0.27	31.3	2.79	4.03	35.6
C4	05/11/09	3.54	14:59	20:57	541	0.495	0.26	36.3	3.26	4.08	33.1
C5	05/11/09	3.475	15:50	21.33	641	0.596	0.31	10.9	0.96	4.00	34.7
Hick TT	05/11/09		16:59	25.91	1611	1.639	0.81	8.9	0.72	4.40	-241.2
Hick STE	05/11/09		16:44	25.96	1403	1.429	0.7	52.6	4.28	4.44	37.2

Appendix F Sampling Event on 05/11/09
Field Data (continued)

	Date	**Depth**	**Time**	**Water T**	**COND**	**COND**	**Salinity**	**DO %SAT**	**DO**	**PH**	**ORP**
			YSI	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*	*YSI*
Station	Date	Meters		Celsius	µS/cm	mS/cm	ppt	%	mg/L	mg/L	mg/L
Magnolia											
M1	05/11/09	1.41	12:34	21.52	827	0.773	0.41	5.6	0.49	3.94	43.5
M2	05/11/09	0.93	12:04	19.95	492	0.445	0.24	5.4	0.49	3.98	23.1
M3	05/11/09	0.62	10:55	19:55	619	0.554	0.3	6.5	0.6	3.97	43.6
M5	05/11/09	0.91	11:54	20.64	748	0.686	0.37	4.2	0.38	3.93	43.0
M6	05/11/09	0.41	11:20	20.49	805	0.73	0.4	2	0.17	3.86	45.7
M7	05/11/09	0.565	11:37	20.32	810	0.738	0.4	2.7	0.24	3.80	43.4
M8	05/11/09	0.87	12:14	19.89	667	0.602	0.33	4.3	0.39	4.00	33.8
M9	05/11/09	0.735	10:44	19.65	562	0.505	0.27	6.9	0.63	4.12	42.6
MAG TT	05/11/09		13:07	26.91	1430	1.482	0.71	1.6	0.11	3.78	-249.4
Mag STE	05/11/09		12:48	26.15	1237	1.264	0.61	9.9	0.8	3.78	55.3

Appendix G Sampling Event on 06/04/09
Nutrient Data

				F Coli	Nitrite	Nitrate+Nitrite	Nitrate	Ammonia	TKN	TN	Total P
				SM	EPA	EPA	calc	EPA	EPA		EPA
				9222D	354.1	353.3		350.3	351.4	calc	365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Background											
CAS	06/04/09	11:00	1	0	0.052	0.476	0.424	0.407	0.832	1.308	0.097
SRWMD #4	06/04/09	11:30	1	0	0.033	1.032	0.999	0.466	0.655	1.687	0.285
Hickory											
S1	06/04/09	11:10	1	0	0.133	4.841	4.709	0.264	0.565	5.407	0.782
S2	06/04/09	10:14	1	0	0.010	0.245	0.235	0.335	0.445	0.690	0.024
C3A	06/04/09	10:46	1	4	0.004	0.208	0.205	0.405	0.367	0.575	0.022
C4	06/04/09	10:34	1	76	0.008	0.467	0.459	0.304	0.450	0.916	0.079
C5	06/04/09	11:00	1	0	0.021	2.982	2.961	0.585	0.485	3.468	0.028
Hick STE	06/04/09	11:20	1	6200	4.607	10.785	6.179	5.759	6.783	17.569	2.668
Hick TT	06/04/09	11:32	1	15400	0.115	0.099	0.000	61.506	58.459	58.558	3.321

Appendix F Sampling Event on 06/04/09
Nutrient Data (continued)

				F Coli	Nitrite	Nitrate+Nitrite	Nitrate	Ammonia	TKN	TN	Total P
				EPA	EPA	calc	EPA	EPA		EPA	
				9222D	354.1	353.3		350.3	351.4	calc	365.2
			MDL	*1*	*0.003*	*0.006*	*0.006*	*0.022*	*0.056*	*0.056*	*0.004*
Magnolia			PQL	*4*	*0.012*	*0.024*	*0.024*	*0.088*	*0.224*	*0.224*	*0.016*
Station	**Date**	**Time**	**Rep**	**Cts/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
M1	06/04/09	14:56	1	1	0	0.005	6.083	6.078	6.127	0.945	7.072
M2	06/04/09	14:32	1	1	0	0.004	0.184	0.180	0.226	0.623	0.849
M3	06/04/09	12:30	1	4	0.178	13.957	13.779	0.544	0.524	14.481	0.196
M5	06/04/09	14:22	1	1	4	0.016	2.943	2.927	3.011	0.683	3.694
M6	06/04/09	12:36	1	32	2.626	1.415	0.000	0.359	0.686	2.101	0.056
M7	06/04/09	12:45	1	14	0.202	19.425	19.223	0.373	0.562	19.987	0.220
M8	06/04/09	14:44	1	1	0	0.002	0.102	0.099	0.137	0.669	0.807
M9	06/04/09	12:15	1	2	0.017	0.239	0.221	0.419	0.562	0.801	0.159
M9	06/04/09	12:15	F2	2	0.019	0.297	0.277	0.401	0.471	0.767	0.056
Mag STE	06/04/09	12:05	1	6700	3.000	25.002	22.003	11.734	17.042	42.044	3.535
Mag STE	06/04/09	12:05	F2	10700	0.022	25.330	25.308	11.848	14.407	39.737	3.314
Mag TT	06/04/09	11:55	1	102100	0.115	0.075	0.000	100.784	102.330	102.405	3.435

Appendix F Sampling Event on 06/04/09
Field Data

Station	Date	Depth Meters	Time *YSI*	Water T *YSI* Celsius	COND *YSI* µS/cm	COND *YSI* mS/cm	Salinity *YSI* ppt	DO %SAT *YSI* %	DO *YSI* mg/L	PH *YSI* mg/L	ORP *YSI* mg/L	PH *Probe* units
Background												
CAS	06/04/09	2.79	11:04	21.33	277				2.19	4.48		
SRWMD #4	06/04/09	4.9	11:43	21.48	206				1.45	8.46		
Hickory												
S1	06/04/09	3.73	11:09	21.62	660	0.618	0.32	3.2	0.29	7.37	29.7	7.2
S2	06/04/09	3.64	10:12	21.13	532	0.493	0.26	4.8	0.43	7.51	33.4	7.3
C3A	06/04/09	3.66	10:44	20.83	550	0.506	0.27	27.0	2.50	7.41	32.6	7.2
C4	06/04/09	3.73	10:32	20.96	542	0.500	0.26	30.6	2.71	7.49	32.6	7.2
C5	06/04/09	3.66	10:59	21.41	658	0.613	0.32	32.4	2.87	7.38	31.7	7.2
Hick STE	06/04/09		11:24	25.41	874	0.881	0.43	45.0	3.68	7.77	26.3	
Hick TT	06/04/09		11:31	25.85	1309	1.330	0.65	27.4	2.22	6.98	-146.8	6.8
Magnolia												
M1	06/04/09	1.97	14:54	21.16	839	0.778	0.41	2.3	0.21	7.33	13.7	7.1
M2	06/04/09	1.45	14:31	21.04	616	0.569	0.3	3.3	0.29	7.48	10.3	7.1
M3	06/04/09	1.115	12:28	20.03	663	0.600	0.32	4.0	0.36	7.35	10.2	7.2
M5	06/04/09	1.39	14:21	20.59	745	0.682	0.36	4.9	0.44	7.76	14.0	7.2
M6	06/04/09	0.815	12:35	20.39	778	0.710	0.38	3.7	0.33	7.26	11.6	7.2
M7	06/04/09	1.03	12:43	20.57	744	0.681	0.36	4.3	0.37	7.33	11.5	7.2
M8	06/04/09	1.375	14:43	20.24	638	0.580	0.32	2.5	0.23	7.47	13.3	7.2
M9	06/04/09	1.24	12:11	20.22	566	0.515	0.27	4.0	0.36	7.46	9.9	7.1
Mag STE	06/04/09		12:04	26.50	1113	1.145	0.55	55.7	4.47	6.21	-2.5	6.2
Mag TT	06/04/09		11:54	27.07	1463	1.521	0.73	16.5	1.30	6.94	-125.9	6.7