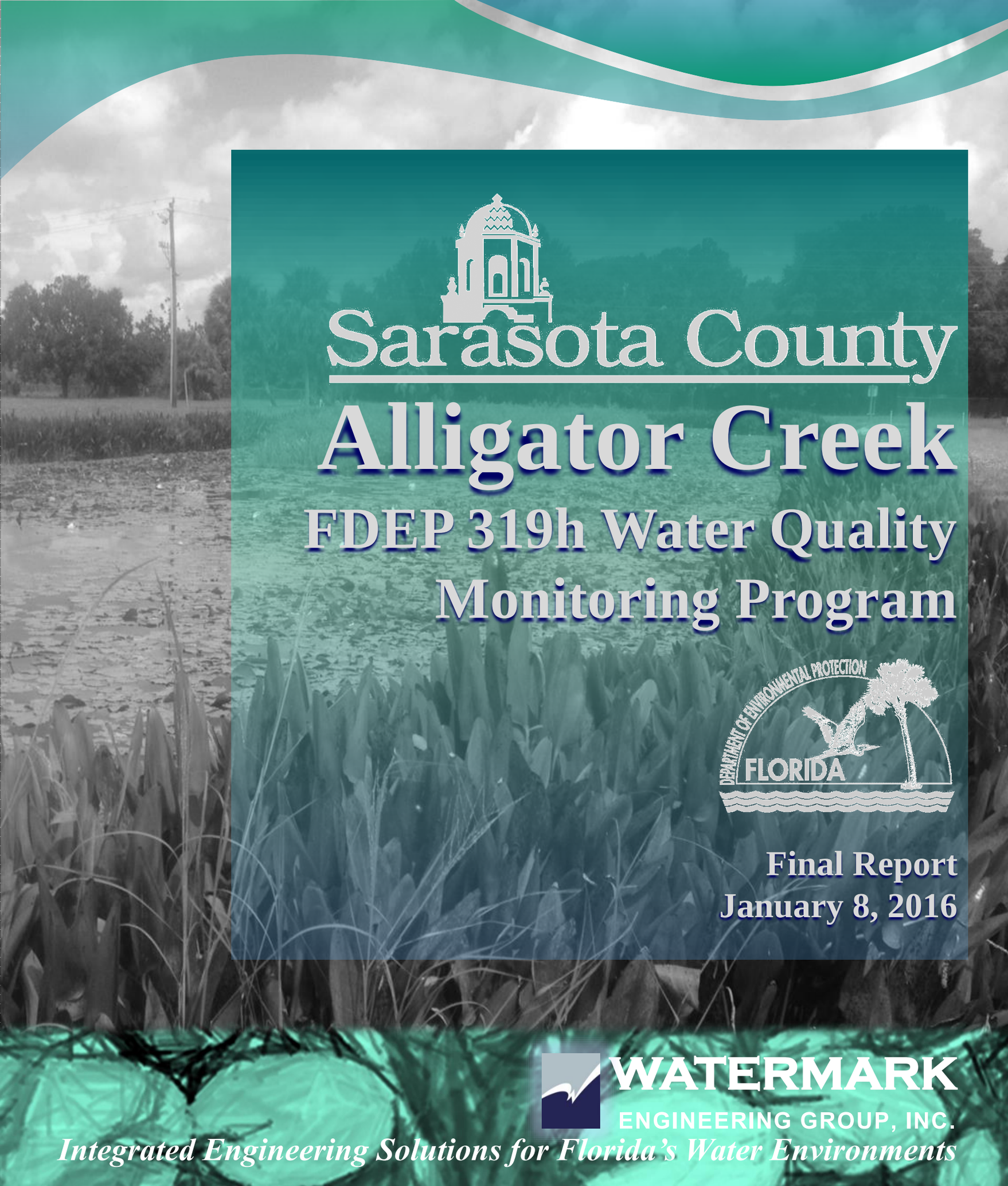

Sarasota County

Alligator Creek

FDEP 319h Water Quality Monitoring Program

Final Report
January 8, 2016

WATERMARK
ENGINEERING GROUP, INC.

Integrated Engineering Solutions for Florida's Water Environments

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Sarasota County

BRIARWOOD STORMWATER TREATMENT FACILITY (BSTF)

Key Project Features

The BSTF is an innovative stormwater retrofit project that uses upflow media filtration.

The project land area makes use of abandoned county land and facilities that were otherwise unused.

On average, the BSTF treats approximately 1.33 times the volume of stormwater that is generated annually to remove large quantities of pollutant mass.

First Year Success (9/2013 - 9/2014)

Reporting Parameter	Mass Removed (lbs.)
TSS Mass Removal Goal (Adjusted for Reporting Period)	48,670
TSS Mass Removed over Report Period	**53,834**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,004
TN Mass Removed over Report Period	**2,053**
TP Mass Removal Goal (Adjusted for Reporting Period)	554
TP Mass Removed over Report Period	**91**

Stormwater Project Fact Sheet

History

- Sarasota County constructed the Briarwood Stormwater Treatment Facility (BSTF) under an FDEP 319(h) grant, completing the project construction in 2012 for about $1.8 million.
- Monitoring of the BSTF began in September of 2013 and continued through March of 2015. The results of monitoring will be used to continue to improve the effectiveness of the BSTF.

Goal of Treatment

- The BSTF provides treatment of polluted stormwater to reduce annual nutrient and solids pollutant mass discharge to Alligator Creek and Lemon Bay. The goal of treatment has been set based on mass of pollutants reduced-more than 40,000 lb of total suspended solids and 1,600 lb of total nitrogen.

Treatment Methods

- The BSTF utilizes an "inter-event" treatment strategy that does not depend on rainfall. The BSTF provides continuous treatment of stored stormwater to remove the mass of pollutants that would otherwise be discharged as untreated runoff during the storm.
- Treatment within the BSTF involves a "treatment train" that consists of stormwater harvesting, engineered wetland systems, and biologically active upflow media filters.

Advantages/Benefits of Treatment

- The BSTF is capable of an annual mass removal of 40,744 lb of Total Suspended Solids and 1,678 lb of Total Nitrogen.
- Total phosphorus has been shown to be reduced to a lesser degree from the BSTF.
- The BSTF has demonstrated potential for improving background water quality conditions in a portion of the Briarwood Lakes Stormwater System.

Limitations of the BSTF

- The existing nutrients and suspended solids present in the Briarwood Lakes Stormwater System pose tough treatment challenges.
- The BSTF has a limited success for large mass removal of total phosphorus.
- Maintenance of the BSTF requires regular harvesting of aquatic vegetation and annual solids removal to successfully operate.

EXECUTIVE SUMMARY

Background: In early 2009, Sarasota County developed a conceptual plan for an innovative, "inter-event" (non-rainfall dependent) stormwater treatment system that was proposed to reduce overall long-term nutrient mass pollution to Alligator Creek and Lemon Bay. The Briarwood Stormwater Treatment Facility (BSTF) is one of several facilities identified in the overall Alligator Creek stormwater improvement projects. These stormwater facilities are the result of a formal agreement between Sarasota County and the Florida Department of Environmental Protection (FDEP) that was established December 9, 2008, under the United States Environmental Protection Agency (USEPA) Clean Water Act (CWA) 319(h) grant program. The grant covered both construction and monitoring of the Alligator Creek Stormwater Improvements program that includes implementation of several best management practices (BMPs) for stormwater treatment within the Alligator Creek drainage basin. The BSTF was evaluated and later implemented, operated, and monitored within the provisions and requirements of FDEP Agreement #G0260.

Figure ES.1 Briarwood Stormwater Treatment Facility (BSTF) in Operation in 2014 (Google Maps, 2014).

Strategic Goals for BSTF Treatment: The Lemon Bay Watershed spans a total of 74.5 square miles, 71% of which lies within Sarasota County. Alligator Creek is one of several urbanized watersheds and coastal streams that discharge to Lemon Bay and was the target of study of the 319(h) grant. The BSTF is a key component of the overall Alligator creek nutrient reduction program. The BSTF has a flexible operational capability to divert as much as 665 million gallons per year (MGY) of attenuated stormwater runoff from approximately 65 acres of the Briarwood Lakes stormwater system (BLSS). This flow capacity represents 233% of the predicted annual runoff volume within the basin and BLSS (See Table ES.1 for various operational comparisons).

BSTF Treatment Implementation: The BSTF was constructed on a limited 5-acre utility site (former site of Venice Gardens Wastewater Treatment Facility) and is shown operational in Figure ES.1. The BSTF utilizes an engineered upflow media filter technology coupled with physical and biological treatment to achieve pollutant mass removal through a "steady-state" treatment train. Construction of the BSTF began in December of 2011 with substantial completion in early 2012. Formal operation of the BSTF began in 2013 and today the BSTF represents one of the most innovative high-rate stormwater treatment systems in Florida that treats up to 2.0 million gallons per day (MGD) of continuous stormwater flow. The BSTF uses no chemicals, requires no on-site staff, and operates with Programmable Logic Control (PLC) and Supervisory Control and Data Acquisition (SCADA) systems. These controls provide for automatic daily flow diversion and daily backwash functions for four (4) upflow filter units. Even though the BSTF has continuous automated operation features, the treatment system requires routine scheduled checking, cleaning, annual biomass harvesting, and programmed solids removal. Throughout the operations of the BSTF, Sarasota County has implemented an effective operations management program to monitor and maintain the operations and vegetative systems of the BSTF.

Table ES.1 Briarwood Stormwater Treatment Facility (BSTF) Treatment Capacity in Relation to Stormwater Runoff Volume

BSTF Influent Pumping Rate (GPM)	Adjusted BSTF Daily Treatment Capacity (MGD)	Estimated BSTF Annual Treated Flow Capacity (MGY)	Percentage of Treatment Available for Annual Stormwater Runoff
750	0.878	285	100%
1000	1.170	380	133%
1250	1.463	475	166%
1500	1.755	570	199%
1750	2.048	665	233%

BSTF Water Quality Monitoring Program: The 319(h) grant required water quality monitoring to evaluate the performance of the BSTF treatment system. This is a final comprehensive report that provides a detailed accounting of three (3) monitoring objectives that include the following areas of evaluation that are referenced throughout the report:

Schedule A- Background Stormwater Characterization and Treatability Analysis
Schedule B- Performance Optimization
Schedule C- Long-term Bimonthly Water Quality Sampling

Schedule A- Background Stormwater Characterization and Treatability Analysis: The initial stormwater characterization (Schedule A) of the 65-acre BLSS lakes and canals provided important background water quality data for design of the system and included limited treatability studies. The water quality throughout the BLSS was representative of an urbanized eutrophic stormwater system with high organic solids and a significant deposition of organic bottom flocculent material. The initial characterization of the stormwater source challenged the process design and operations for development of an effective treatment train. The

Schedule A monitoring included informal treatability studies (at no cost to the grant) that evaluated mechanical filtration systems, the addition of settling agents, and media-based filtration systems.

Schedule B- Performance Optimization: Following construction of the BSTF, an operations and performance monitoring program was implemented to evaluate the capabilities and operational flexibility of the BSTF unit treatment processes. During the Schedule B monitoring, the facility was subjected to varying operational protocols, including high-flow (HF) treatment (with variable filter backwash times), low-flow (LF) treatment, and batch-flow (BF) treatment. Recommendations for facility operations and maintenance were developed from the findings of the Schedule B monitoring program to optimize the flow of stormwater through the BSTF and achieve the optimum removal of pollutant mass (Table ES.1 describes range of operational flow capability).

Schedule C- Long-term Bimonthly Water Quality Sampling: The FDEP 319(h) grant required monitoring over a minimum of eight (8) sample events, beginning in September 2013 with completion in March 2015. The results of Schedule C monitoring were used to assess the performance and benefits of the BSTF relative to the initial established project treatment goals.

Schedule C BSTF Results – Reported Treatment Efficiency: The concept of effective treatment within the BSTF treatment train revolves around maintaining a high ratio of diverted stormwater flow to annual runoff and acceptance of reasonably consistent reductions in pollutant concentrations through the BSFT treatment train.

The realized benefit of pollutant mass removal requires a minimum flow diversion equivalent to 2-2.5 times the annual stormwater runoff volume to the BLSS annual runoff volume to be effective. Treatment efficiencies shown in Tables ES.2 and ES.3 represent basic calculations of pollutant removal efficiencies in the first year and overall Schedule C monitoring period, respectively. The BSTF effectively reduced pollutant concentrations of Total Suspended Solids (TSS) and Total Nitrogen (TN) (averaged over the reporting period) during the first year of operations (09/2013 through 07/2014). Table ES.3 shows results of the BSTF over the entire monitoring period. The overall treatment results are reduced over the longer term from the first year.

Table ES.2 BSTF Treatment Efficiency (09/2013-07/2014)

BSTF Water Quality Parameter (Schedule C Key Parameters)	Averaged Reported Percent Reduction in Pollutant Concentration (09/13-07/14)
Turbidity [NTU]	36.17%
Total Nitrogen [mg/L]	18.89%
Total Phosphorus [mg/L]	2.76%
Chlorophyll A, Corrected [mg/m^3]	21.46%
Total Suspended Solids (TSS) [mg/L]	44.40%
BOD5	32.81%
Total Organic Carbon [mg/L]	2.15%

Table ES.3 BSTF Treatment Efficiency (09/2013-03/2015)

BSTF Water Quality Parameter (Schedule C Key Parameters)	Averaged Reported Percent Reduction in Pollutant Concentration (09/13-03/15)
Turbidity [NTU]	31.27%
Total Nitrogen [mg/L]	12.52%
Total Phosphorus [mg/L]	3.47%
Chlorophyll A, Corrected [mg/m^3]	19.72%
Total Suspended Solids (TSS) [mg/L]	23.69%
BOD	32.18%
Total Organic Carbon [mg/L]	2.58%

BSTF Mass Removal Results-A Reduction in Pollutant Mass Loading Meets 319(h) Goals in Year 1: The effectiveness of pollutant mass removal relies on the capability of the BSTF in handling high volume flows over long extended periods. Although the BSTF pumping rated operational capacity is 1,800 GPM, variable frequency drive systems allow for adjusted flows that range between 900 and 1,500 GPM. The average rate of BSTF flow over the monitoring period was determined to be 1,000 GPM. All pollutant mass load reduction calculations were normalized to the 1,000 GPM condition based on recorded influent pump run times (between sample events) and this pumping rate over the monitoring period.

The 319(h) Schedule C monitoring program required a minimum of eight (8) consecutive bi-monthly sample events (the sample events were intended to be completed through wet and dry seasons with a prescribed 60 day period of operation). The monitoring period referenced in Table ES.2 considered five (5) of nine (9) independent sample events. Over the first year of operation, the performance of the BSTF met or exceeded the 319(h) treatment goals for TSS and TN mass removals. TP was shown to be reduced but the BSTF did not meet the performance goal for TP.

When considering the overall 319(h) monitoring from September 2013 to March 2015, the BSTF achieved less favorable results for TSS and TN removals. Although TP mass removal occurred, the BSTF did not meet the goals for mass removal (Table ES.3). The observation of reduced BSTF performance was correlated with a loss of solids from the BSTF over the last three monitoring events (November 2014-January 2015). During these last events, an estimated 12,634 lb. of TSS and 164 lb. of TN were exported. The significant loss of solids drastically reduced system treatment performance.

The BSTF Operations Provided Positve Result in Background BLSS Water Quality: The BSTF inter-event treatment process recycles stormwater within the last canal system of the BLSS prior to discharging to Alligator Creek.

Table ES.4 Calculated Mass Removals (9/2013-7/2014)

BSTF Year 1 Pollutant Removal Estimates (Reporting Period: 9/2013-9/2014)	
Reporting Parameter	**Mass Removed (lbs.)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	48,670
TSS Mass Removed over Report Period	**53,834**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,004
TN Mass Removed over Report Period	**2,053**
TP Mass Removal Goal (Adjusted for Reporting Period)	554
TP Mass Removed over Report Period	**91**

Table ES.5 Calculated Mass Removals (9/2014-3/2015)

BSTF Overall Pollutant Removal Estimates (Reporting Period: 9/2013-3/2015)	
Reporting Parameter	**Mass Removed (lbs.)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	68,316
TSS Mass Removed over Report Period	**48,313**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,814
TN Mass Removed over Report Period	**2,662**
TP Mass Removal Goal (Adjusted for Reporting Period)	778
TP Mass Removed over Report Period	**129**

Under normal BSTF dry-weather operations, it is estimated that water may recirculate 3 to 10 times through the BSTF prior to discharge to Alligator Creek. The 319(h) water quality monitoring program did not require monitoring for receiving water trends. However, the long-term results of receiving water quality were demonstrated through the observed trends in the BLSS water source (the BLSS discharge canal).

From September 2013 through March 2015, water quality of the BLSS source exhibited background changes that reflect subtle improvements in the BLSS background water quality. Note that Figure ES.2 illustrates a slight general downward trend in TSS concentrations that occurred as a result of the operations of the BSTF. Figures ES.3 and ES.4 provide additional evidence of a reduction in BOD5 and Total Nitrogen within the BLSS. These figures show downward beneficial long-term trends that may be attributable to the BSTF operations.

Conclusions and Recommendations: The BSTF is effective in the long-term reduction of TSS, BOD, and TN mass pollutants in a continuous inter-event high-flow (HF) mode of treatment at a normalized pumping rate of 1000 GPM. Long-term Total Phosphorus (TP) Mass Removal has been documented from the Schedule C monitoring program, yet the effectiveness of TP removal is less predictable. Inter-event treatment has proven to be reasonably consistent, yet the BSTF has a limited capacity to accumulate and store colloidal organic solids. Following long-term operations (estimated 12 continuous months) internal processes within the BSTF release more dissolved and colloidal pollutants (dissolved nitrogen and orthophosphate) than available treatment capacity of the BSTF.

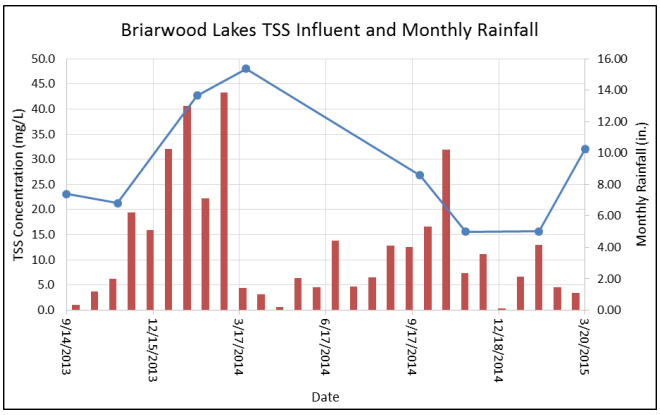


Figure ES.2 Briarwood BLSS TSS Background Trends from 9/2013 through 3/2015 Monitoring Period

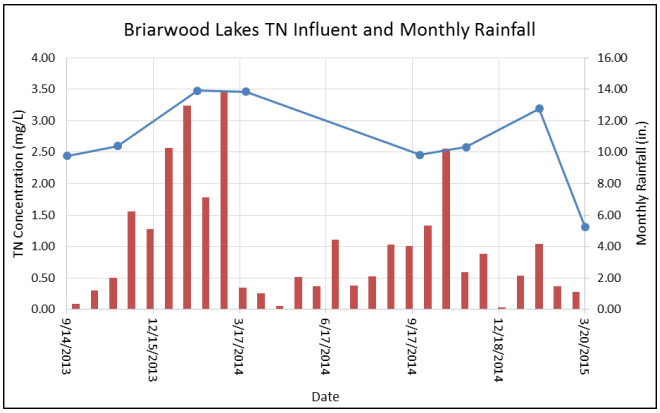


Figure ES.3 Briarwood BLSS BOD Background Trends from 9/2013 through 3/2015 Monitoring Period

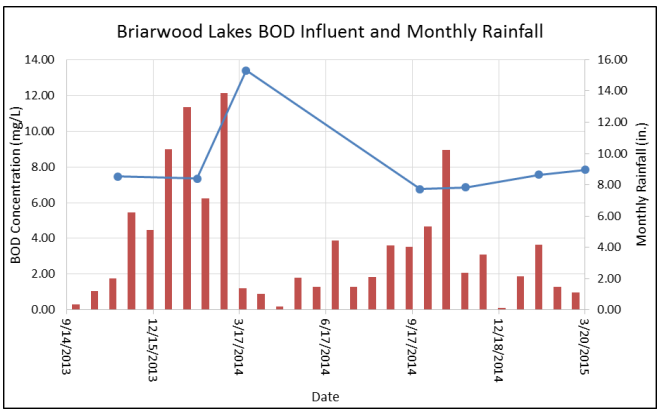


Figure ES.4 Briarwood BLSS Background TN Trends from 9/2013 through 3/2015 Monitoring Period

Recommendations: Sarasota County has invested a significant amount of research, time and funding for the construction and evaluation of the BSTF inter-event treatment system. Although there are challenges for continued cost effective treatment of nutrients within the Alligator Creek/Lemon Bay watershed, there is potential for improved treatment effectiveness through continued research and process refinements of the inter-event concept for stormwater treatment.

The following are final recommendations to consider for future operations of the BSTF:

Improve Performance with Higher Average Pumping Rate: The BSTF has the capacity to treat up to 2.33 times the annual runoff generated from the basin at a pumping rate of 1750 GPM. Since long-term beneficial trends were observed with the inter-event HF mode of treatment with an intermediate average pumping rate of 1000 GPM, it is likely that increasing the average pumping rate would improve the performance of the BSTF.

Improve Performance with Scheduled Solids Maintenance: A BSTF maintenance program should consider monitoring of changes in TSS and dissolved organic nitrogen. When increases in TSS and dissolved organic nitrogen occur, the BSTF should be considered for maintenance. Maintenance should include dewatering of the system, desiccation (drying of organic solids) and removal of at least 20-50% of the accumulated mass.

Improve Vegetative Coverage: It is possible to improve system BSTF performance by expanded surface vegetation coverage in Zone 2 (decomposition zone) and possibly in Zone 3 (aerobic zone). Alternative floating plants may include white water lily and/or water lettuce. Floating vegetation can be more readily controlled and harvested.

Improve Performance with Scheduled Vegetation Harvesting: A BSTF maintenance program should consider routine harvesting of littoral and floating vegetation. It is important to avoid herbicide in harvesting. Harvesting should physically remove vegetation from the process and be considered seasonally. Harvested vegetation may provide planting benefits for other Sarasota County stormwater facilities.

Add Controlled Intermediate Polymer Addition: Consider the broadcast application of polymer (Polyacrylamide) or Chitosan prior to scheduled solids removal. Initial treatability studies of Schedule A monitoring (background studies) produced favorable results of polymer addition to promote flocculent settling in BLSS water samples.

Improve Performance with Fine Bubble Aeration: This option considers an improved method to aerate the BSTF with fine bubbles at Pump Station A. Fine or microbubble aeration has the potential for colloidal solids growth (without chemicals) and may complement the aeration function for ammonification and nitrification.

Create a Stormwater Research Center at the BSTF site: The pioneering successes and challenges of the BSTF are important factors in the progress of environmental nutrient management in Sarasota County and in Florida. The BSTF may bring opportunities for more research funding that benefits the stormwater profession. As a designated stormwater research

center, the BSTF may open doors to professionals, regulators and the public to better understand the benefits of inter-event and media based treatment, and low-impact development practices.

1.0 PROJECT OVERVIEW

1.1 HISTORY

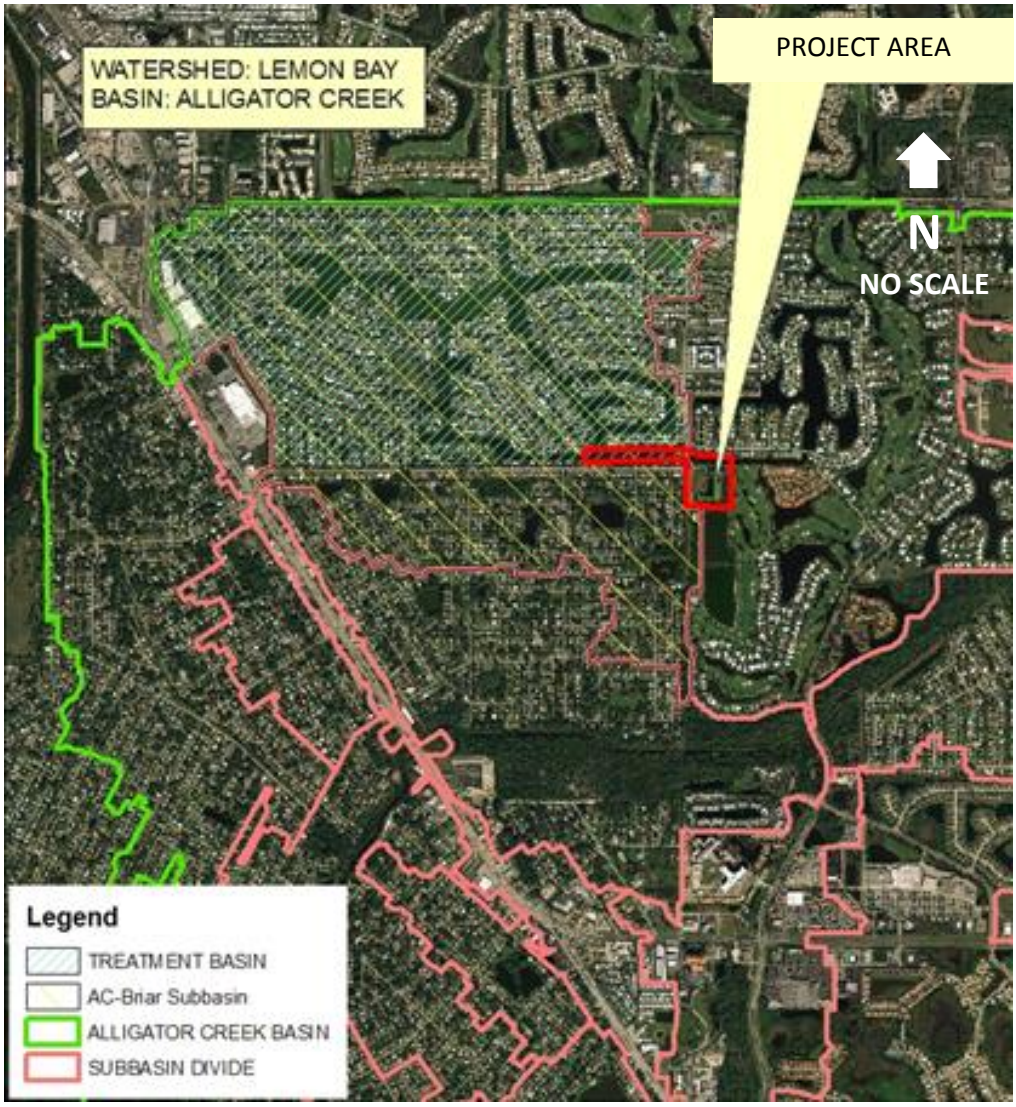


Figure 1.1 Lemon Bay Watershed with Alligator Creek-Briar Subbasin

Alligator Creek is one of many urban drainage basins within Sarasota County's 74.5-square-mile Lemon Bay watershed. Alligator Creek and other urbanized drainage systems within the Lemon Bay watershed convey nutrient-laden runoff to the Lemon Bay Estuary. Sarasota County has established pollutant reduction goals for Lemon Bay that are described within the Lemon Bay Watershed Plan. Venice Gardens is an established residential subdivision of Sarasota County (circa 1950s) within the Alligator Creek basin that is known for its 65 +/- acres of linear canals and inter-connected lakes located throughout the subdivision [This system is referenced in this document as the Briarwood Lakes Stormwater System (BLSS)]. Although the practical function of the BLSS is for stormwater management, the canal features are considered recreational benefits to the community. The primary source of water to the BLSS system (Venice Gardens Lakes) is from residential runoff that originates from the 605-acre urban watershed designated by Sarasota County as "AC-Briar Subbasin" (Figure 1.1).

Hydrologic modeling data suggests that the hydraulic residence time within the Venice Gardens lakes system ranges from 270 days to over a year. The BLSS lakes and canals have a documented history of

legacy pollution that has accumulated from more than 50 years of stormwater runoff and reports of illicit wastewater discharges. Today, water quality within the BLSS lakes and canals is characterized by high levels of organic nitrogen and phosphorus and unusually high background chlorophyll levels above 40 mg/m^3. At times, chlorophyll levels may routinely exceed 100 mg/m^3, which creates severe water quality conditions that limits recreational values of the lakes. The green water color visible in aerial photos of the lakes and canals is evidence of the severity of the water quality degradation (Figure 1.2).

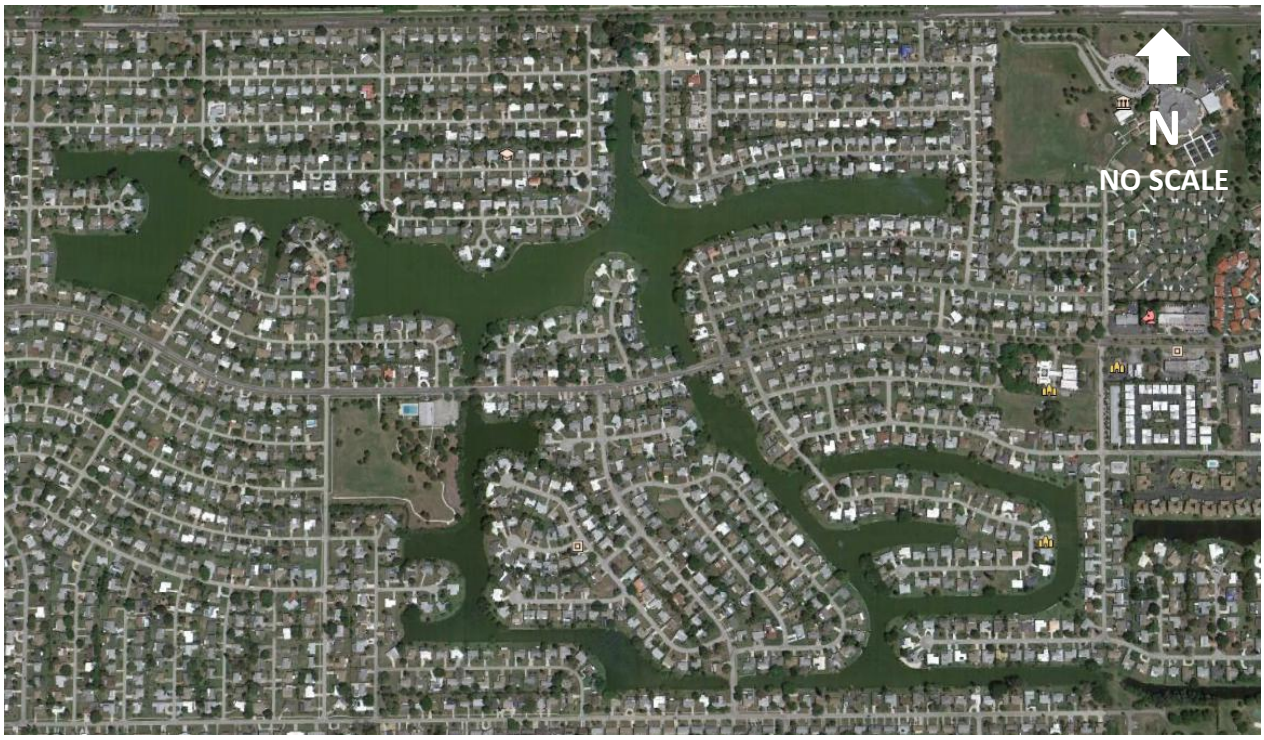


Figure 1.2 Briarwood Lakes and Canal System Serve as 65-acre Stormwater Management to Venice Gardens Refernced as the BLSS in this Report

Sarasota County and the Florida Department of Environmental Protection (FDEP) have entered into an agreement under the United States Environmental Protection Agency (USEPA) 319(h) Grant Program for Alligator Creek Stormwater Improvements within the Lemon Bay Watershed (FDEP Agreement #G0260). The primary goal of treatment within the context of the Alligator Creek 319(h) program is to provide for a reduction in nitrogen loads to Lemon Bay through reduction in mass pollution within the BLSS will effectively reduce the pollutant discharge to achieve this goal.

Sarasota County has estimated annual mass pollutant loading from the AC-Briar Subbasin that served as the basis of need for the FDEP 319(h) grant. The estimated annual pollutant loads are 45,271 lb/yr. for total suspended solids (TSS); 2,468 lb/yr. of total nitrogen (TN); and 644 lb/yr. of total phosphorus (TP).

1.2 Treatment Opportunities and Challenges

Alligator Creek stormwater treatment improvements included the design and implementation of nutrient separating baffle boxes, expanded stormwater ponds, and the construction of an innovative treatment system that can reduce mass nutrient discharges from BLSS lakes and canals. The strategy for the nutrient

reduction program addressed in this report relies on a total mass reduction of nitrogen within the lakes through diversion and treatment of large volume flows at the Briarwood Stormwater Treatment Facility (BSTF).

Goals for the Alligator Creek treatment goals were recommended early in project development and were based on limited information from nutrient loading models and prescribed treatment performance capabilities of traditional stormwater best management practices. Following further evaluation of water quality parameters, the 319(h) goals were refined based on a targeted mass removal versus treatment efficiency.

The BSTF treatment system was established following a thorough evaluation of available treatment system alternative best management practices (BMPs) and published literature. The various BMP treatment alternatives included mechanical disc filtration and solids concentration, engineered wetland treatment systems, media treatment, and chemical addition. The alternatives were assessed based on the following objectives: an overall life-cycle cost evaluation, consideration of maintenance requirements, and capability of meeting the goals of the FDEP 319(h) grant. The BSTF was selected as a more cost effective, semi-passive solution to reduce pollutant mass loadings.

The performance goals for treatment are challenging because of limited land area within urbanized Sarasota County and stringent Sarasota County-imposed operational criteria that specifies no chemical addition for treatment. The BSTF was conceived by Sarasota County as a semi-passive alternative treatment train best management practice (BMP) that was later constructed for $1.8M over 180 days within a 5 +/- acre utility site that is owned by Sarasota County. The BSTF is now a secured and routinely maintained facility that is situated on the former site of the Venice Gardens Wastewater Treatment Plant (WWTP). The use of land for BSTF treatment is limited to approximately 3 acres because of existing active pipelines and wastewater utilities but advantageous in that existing infiltration ponds and on-site power reduced construction costs. The project represents true innovation in sustainable land use of Sarasota County land and the shared operations of multiple public works and treatment operations (both stormwater and wastewater utilities are integrated on the site). The design of the BSTF also features the functional application of recycled materials [recycled tires, reclaimed concrete products, recycled plastic materials (pipes), and reuse of site physical features] throughout the treatment train processes that further complement Sarasota County's commitment to environmental sustainability and reuse.

Since September of 2013, the BSTF has been operational as an innovative treatment system to meet the primary strategic goal of long-term nitrogen mass reduction. Today, the operations of the BSTF utilize a series of sequential treatment zones to encourage settling and an accumulation (and physical removal) of solids. The effectiveness of the system also depends on achieving effective catabolic reactions (algal senescence and the release of ammonia), followed by treatment zones that enhance nitrification, denitrification, and physical sorption.

1.3 Overview of Operations

As the system vegetation matured (Figure 1.3), a treatment optimization and performance evaluation was conducted to "fine-tune" operational parameters and establish high-flow, low-flow, and batch-flow conditional operation protocols. It should be noted that Sarasota County installed a floating wetland system and two small aerators during operations and performance monitoring.

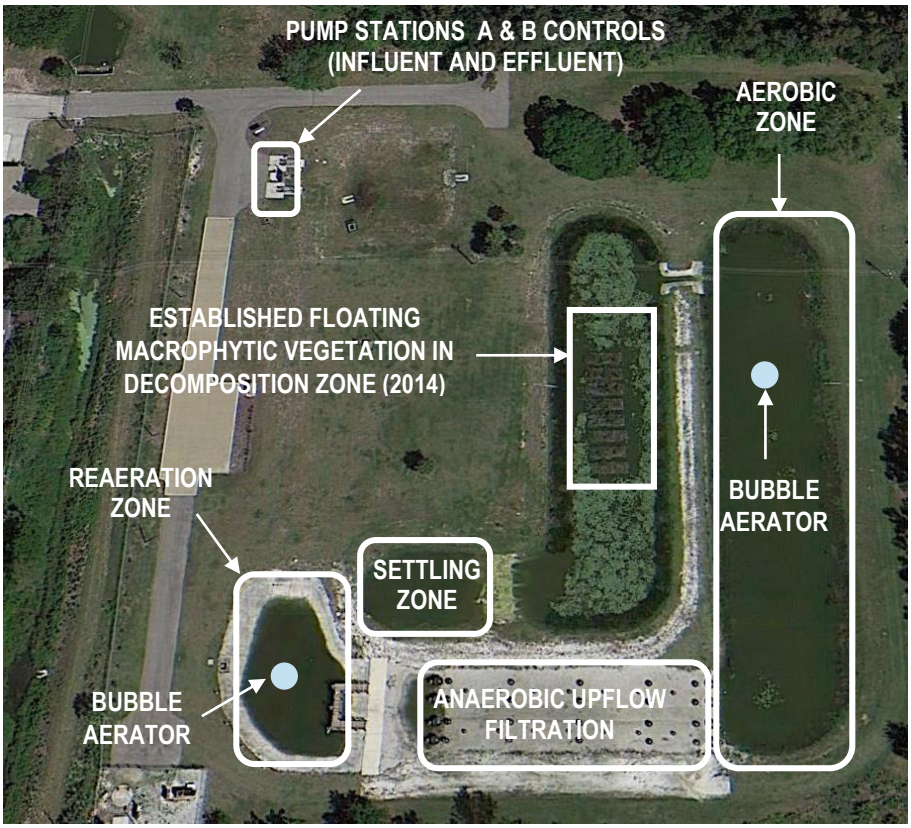


Figure 1.3 Aerial Photograph of the BSTF Treatment Site (Google Earth, 2014)

The design of the system allows for several flexible operation modes with programmed automated system backwash capability. The system still requires occasional operations monitoring, annual control of vegetative growth (removal of biomass), facilities cleaning, and routine filter maintenance. An operations & maintenance manual and nine (9)-session training program was developed for orientation of the Sarasota County staff. The general concept of the BSTF "treatment train" operations relies on a semi-passive (no on-site operator required) continual, uninterrupted diversion of stored stormwater from the BLSS (or programmed batch flow of stormwater from the BLSS) to the treatment system. Because flow is continuous and not dependent on rainfall, the effective mass pollutant removal does not rely on high-efficiency treatment to achieve effective treatment results.

The BSTF system has the capability to treat approximately 665 million gallons (MG) annually (with scheduled maintenance and routine shutdowns). Prior to treatment in the BSTF treatment system, a portion of stormwater flow is harvested and reused within the property limits of the BSTF site.

1.4 Treatment Train Process Description

Sarasota County has established a hydrologic model that predicted an estimated 286 MG/year of runoff generated within the Briarwood Lakes (AC-Briar) subbasin. The BSTF encompasses several sequential treatment processes (Figure 1.4) that work together as a treatment train to treat more than two (2) times the predicted annual runoff volume within the basin. Pollutant reduction within the BSTF occurs largely as a

result of stormwater harvesting and irrigation reuse within the limits of the BSTF property. The remaining continuous diversion of stormwater through the BSTF system allows for the physical capture of algal and colloidal solids (gross solids settling and sorption of algal biomass), biological decay and catabolism processes in the decomposition zone (these processes convert organic solids to produce dissolved organic nutrients), and nitrification and denitrification in the aerobic and anoxic zones. Treatment processes within the BSTF treatment train are low energy and of reduced efficiency. Effective pollutant removal relies on maintaining high-flow, steady-state conditions. Biological nitrogen removal processes are also an important part of the treatment that are concentrated within the anoxic zone and upflow filters.

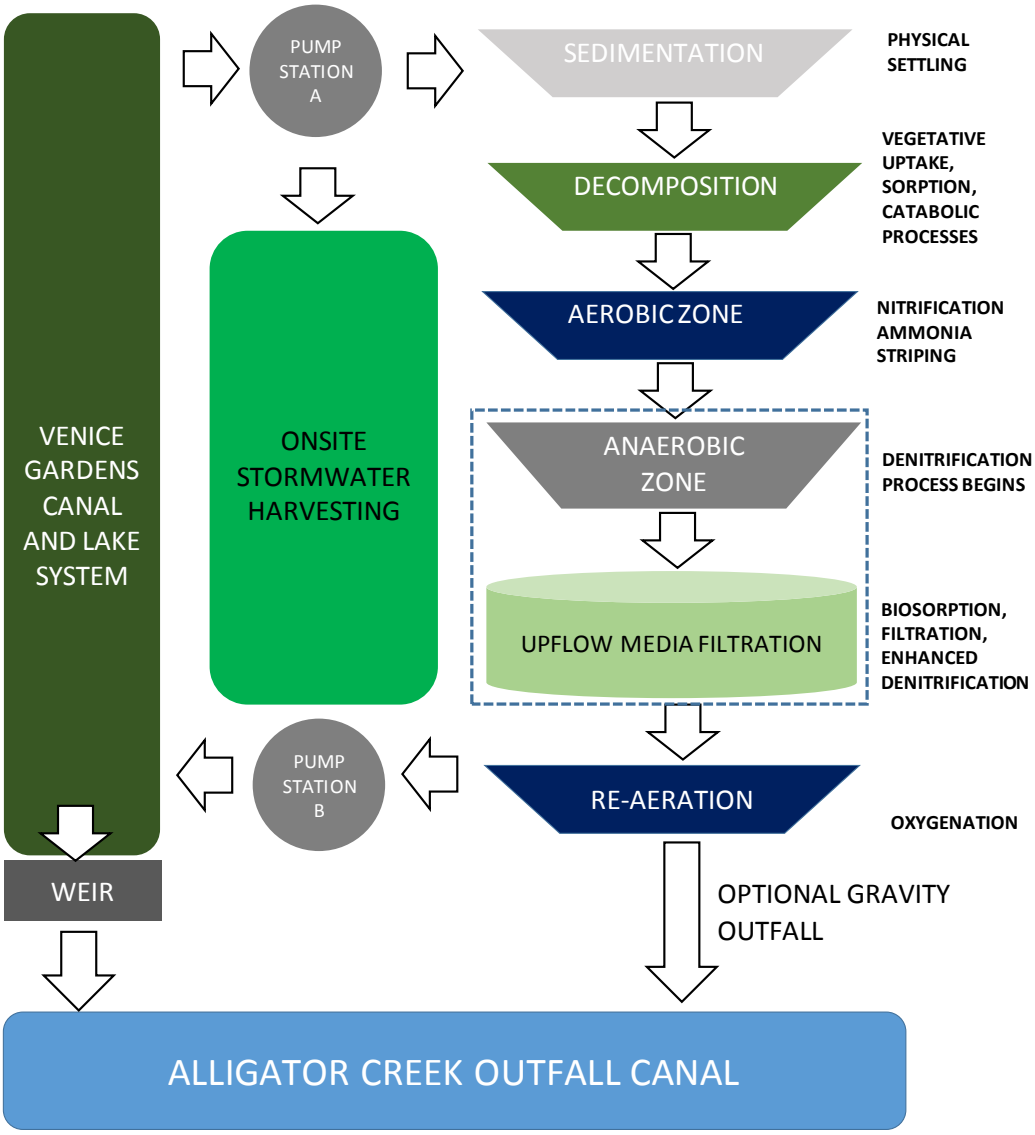


Figure 1.4 BSTF Unit Treatment Process Schematic Flow Diagram

The anaerobic zone consist of a 180 ft. (long) by 50 ft. (wide) by 8 ft. (deep) anoxic zone (recycled concrete) and four parallel 180 ft. by 5 ft. diameter upflow filters. The upflow filters are constructed with a lower broken rock plenum area overlain by a 2 ft. media bed [Bold and Gold (B&G) media]. Figures 1.5 and 1.6 provide plan and cross section details of the filter construction.

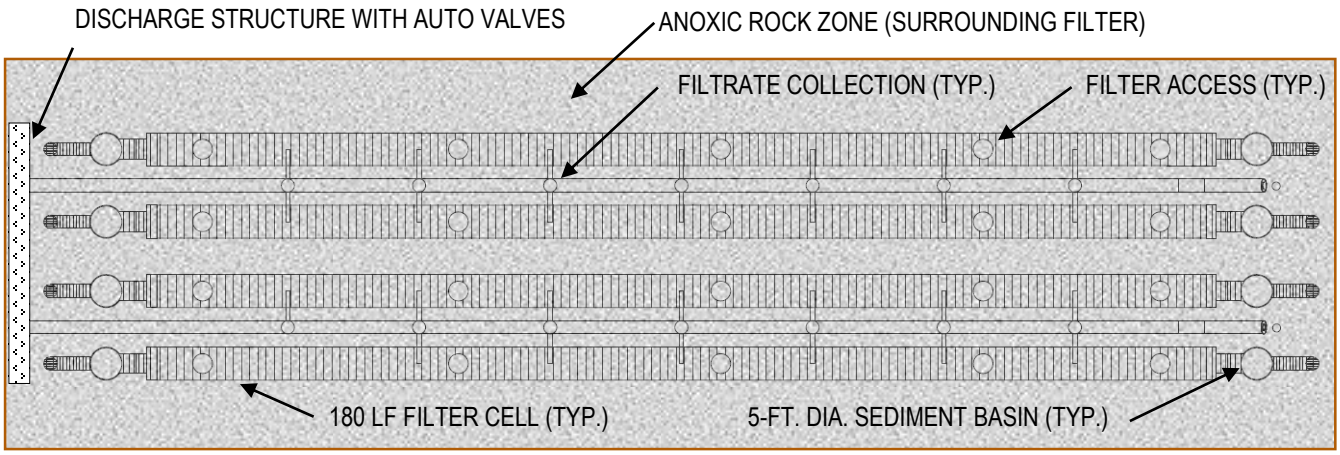


Figure 1.5 Upflow Filter Plan View

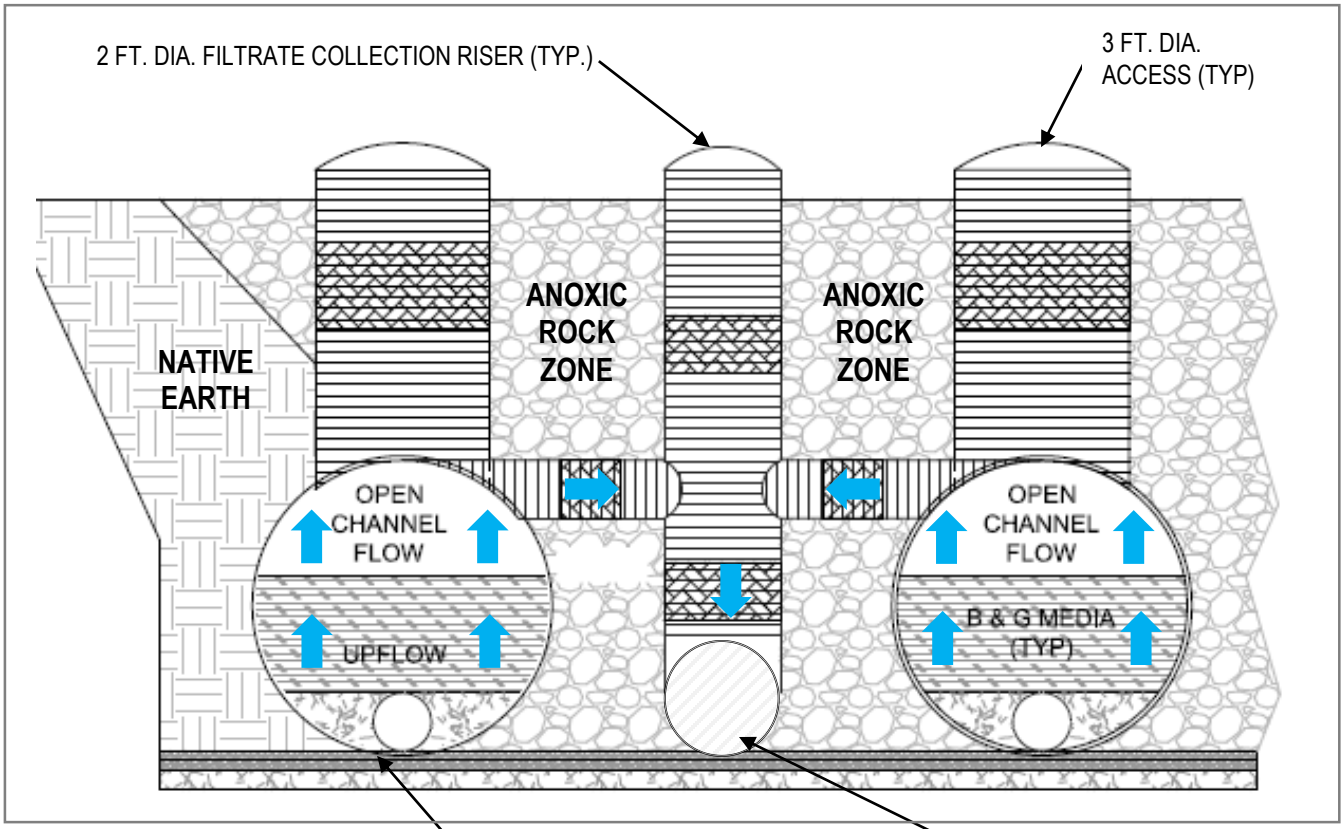


Figure 1.6 Upflow Filter Cross Section View

1.5 Description of Flow through the BSTF

As mentioned earlier in this report, the inter-event treatment strategy of the BSTF relies on a controlled continuous (steady-state) flow of the BLSS stormwater source (stored stormwater runoff) through the integrated BSTF BMP treatment train processes. The BSTF influent structure provides initial screening and is situated near the BLSS outfall weir (Figure 1.7). This structure is hydraulically equalized with the Pump Station A (PS-A) wet-well water level.

Figure 1.7 BSTF Influent Structure (in BLSS)

Stormwater rate of flow is managed by two independent continuous pumping systems (PS-A and PS-B). The pumping logic relies on feedback level controls in the BSTF or an optional timed on/off application of flow at PS-A and PS-B (refer to Figure 1.3 and Figure 1.8). Both PS-A and PS-B are equal high-capacity/low-head (1,750 GPM) submersible duplex Variable Frequency Drive (VFD) pumping systems. The PS-A wet-well is also equipped with an auxiliary submersible 65 GPM vertical turbine high-head pump that provides irrigation (stormwater harvesting) for the project site (This pump is independently controlled by a conventional irrigation timer).

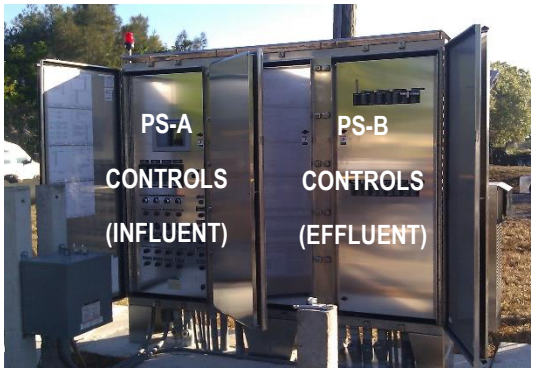


Figure 1.8 PS-A & PS-B

BSTF influent is conveyed under low pressure from PS-A and enters the BSTF at the sedimentation basin (refer to Figure 1.3). The structure in this basin is designed for energy dissipation and the basin configuration encourages gross solids settling. From the sedimentation zone, flow overtops a concrete fabric weir and enters the BSTF decomposition zone (See Figure 1.9). The decomposition zone is designed to maintain 80% or greater surface coverage by macrophytic vegetation (water lily), a floating island, and a maintained littoral shelf area. Water is conveyed from the decomposition zone to the open water aerobic zone. The aerobic zone has been retrofitted with bubble aerators and in-situ DO monitors.

Figure 1.9 BSTF Decomposition Zone

From the aerobic zone, BSTF process water is conveyed through a deep rock filter where a quiescent sub-surface flow regime is maintained (anaerobic zone, Figure 1.10). Flow from the anaerobic zone resurfaces in a depressional area on the west end of the anaerobic zone and enters four parallel screened pre-filter sedimentation structures. Water is then conveyed by differential head conditions through individual filter cell underdrains and upwards through the upflow filter media. The upflow filter clarified filtrate is collected in the two filtrate risers and directed to the final filtrate discharges at the re-aeration zone (Refer to Figures 1.5 and 1.6). Finally, BSTF effluent is re-aerated (by a bubble aerator) and is either discharged to

Alligator Creek by gravity or recirculated back to the BLSS canal fountain outfall approximately 1,250 LF from the influent structure. The fountain is located near the western boundary of the BLSS treatment area shown in Figure 1.1.

The BSTF operational strategy also has a filter backwash feature that is programmed into the pumping controls. The filter backwash automatically drains and reverses flow from PS-B through the upflow filters on a daily basis. The spent backwash re-enters the filter pre-sedimentation chambers for settling.

Fig. 1.10 Anaerobic Zone (Rock) and Upflow Filter (Pipe)

1.6 MONITORING BACKGROUND

Perhaps the most important factor in the development of any stormwater monitoring plan is establishing methods for the accurate measurement of treated water volume and the control of variables that affect the accuracy of calculations for the total mass removed.

Stormwater is diverted to the BSTF and discharged from the facility through a controlled pumping system that features two (2) state-of-the-art variable frequency drive (variable flow) pump stations. The BSTF basins are isolated from groundwater influence using an impermeable basin lining and the positive head difference (by pumping) that is maintained in the basin. The treatment basins provide approximately 18 hours of hydraulic residence time (at peak flow) that allows for a true accounting of pollutant mass removals and the accumulation of mass.

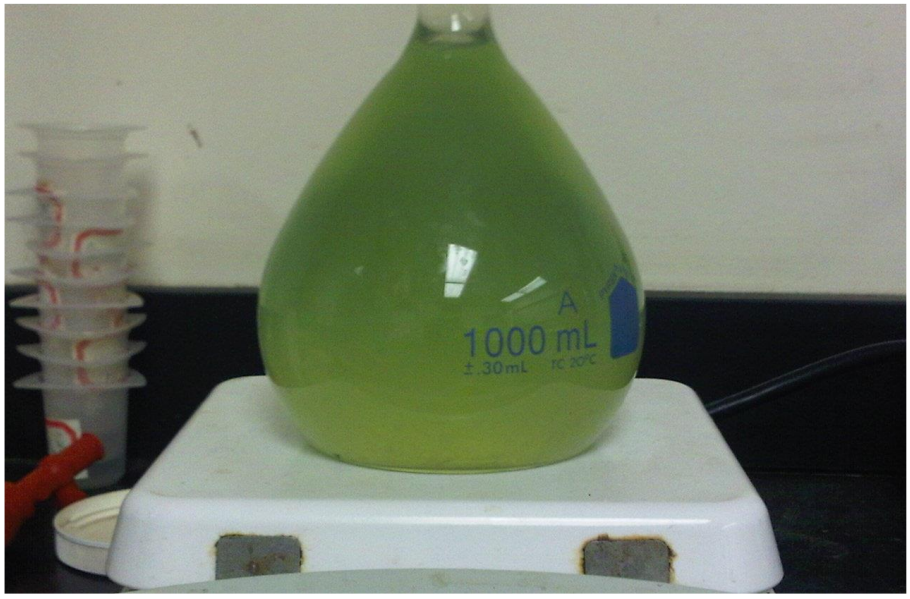


Figure 1.11 Untreated Venice Gardens Briarwood Lake Stormwater sample in Laboratory (UCF, 2009)

The BSTF flow rates (both instantaneous and totalized flows) are monitored by ultrasonic flow measuring devices and verified by records of pump run times (inflow and outflow). During the entire course of monitoring, all water quality monitoring-treated stormwater was directed back to the lake system to maintain water levels in the BLSS. As a supplement to the treatment monitoring program, a flow recorder was installed at the discharge weir. The discharge weir is a broad crested (15-ft wide) structure. The monitoring of discharge from the weir has been recorded by Sarasota County over the course of the long-term

monitoring program. Monitoring results from this study have provided evidence that discharges from the BLSS canal (at the discharge weir) primarily occur during significant summer rain events.

1.7 Monitoring Program Design

The BSTF monitoring program was designed to cover various stages of the development and operation of the BSTF treatment train. The program is multi-faceted and includes the collection and analysis of background stormwater quality (the BLSS lakes and canals), performance monitoring and operational adjustments, and long-term monitoring. There are three schedules of monitoring covered in this final report that are covered in Sections 2.0 - 4.0.

2.0 Schedule A - Background Stormwater Characterization

2.1 Methods of Background Stormwater Characterization

A single-event background stormwater quality characterization of the Briarwood Lakes Stormwater System was completed in the early stages of project planning (July 11, 2009) to better understand background water quality parameters and to establish a basis for design of the treatment system.

The background water quality sampling characterization included three surface water sample locations (Figure 2.1). In addition to background water quality, additional sediment core samples were collected and analyzed for volatile organic solids to determine legacy pollution characteristics.

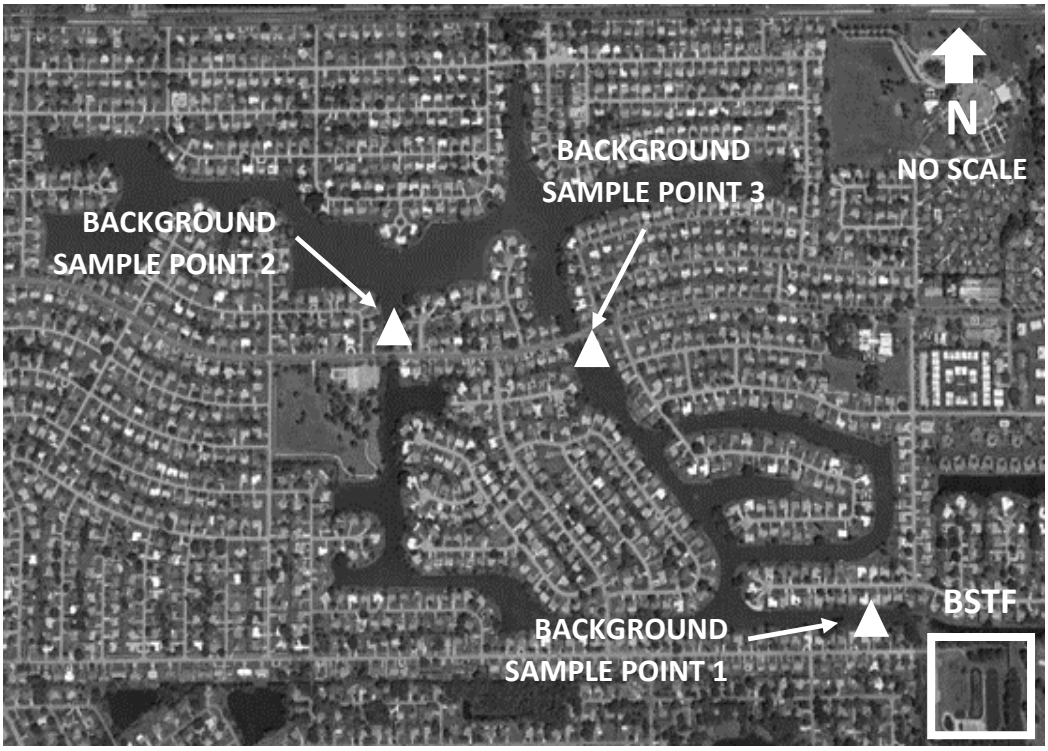


Figure 2.1 Briarwood Lakes Stormwater System (BLSS) Background Sample Locations

Following results of the initial water quality characterization, an equipment sponsored field testing program was completed in late July of 2009 that tested the effectiveness of mechanical disc filters (Figure 2.2) in the reduction of algal solids. Mechanical disc filtration works on a pressurized force of water through a series of tightly compressed, stacked concentric discs to effectively remove small solid particles at relatively high flow rates. This type of filtration system is commonly used in reclaimed water systems and is capable of partially removing algal solids. However, results from the disc filtration field study indicated TSS removal efficiencies of 20 percent or less. For this reason, disc filtration was not considered as a viable option in developing the treatment process.

Figure 2.2 Briarwood Lakes Stormwater System Field Testing of Mechanical Disc Filtration System

An informal stormwater treatability analysis was completed at the University of Central Florida (UCF) Stormwater Academy (Figure 2.3) at no cost to the project. The treatability study examined the potential applicability of several proprietary polymers to enhance settling and alternative media treatment options as a treatment strategy for the project. Because of the need to limit chemical addition, the UCF treatability study only evaluated alternative media mixes as feasible treatment strategies. A series of column studies was completed to create a custom Bold and Gold media for this application.

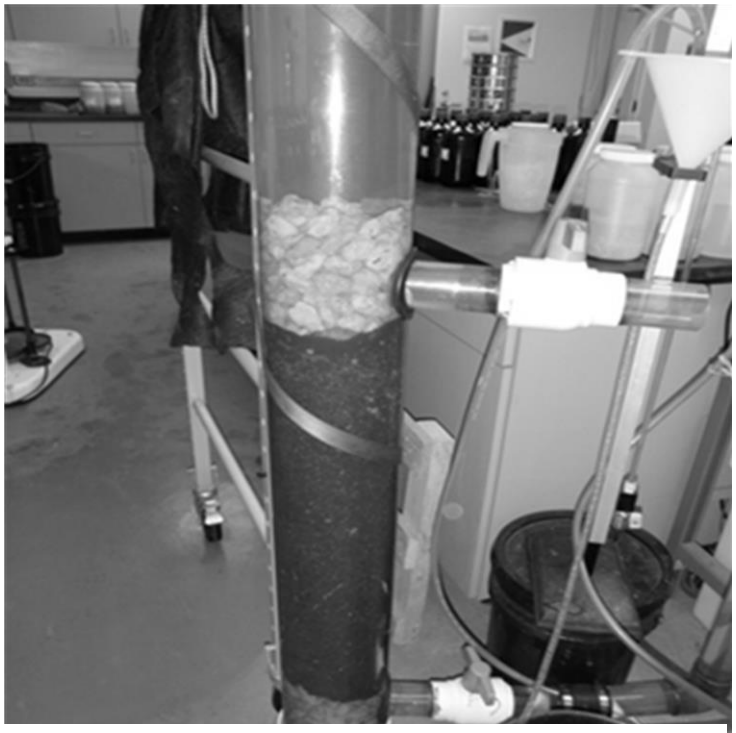


Figure 2.3 Media Bench Scale Column Testing of BLSS Water Source (UCF, 2009)

2.2 Results of Background Stormwater Characterization

The design of the BSTF treatment system relied on an understanding of the stormwater quality and trends within the BLSS lakes and canals that was obtained from the initial 2009 water quality results. These results are summarized in Table 2.1.

Water quality within the Briarwood Stormwater Lake System varies little across the areal extent of the lakes and canals. Nutrients within the lake system water column are nearly entirely organic and are present as reacted particulate (algal biomass) or complex dissolved forms of nitrogen and phosphorus. It was observed that the shallow nature of the system and long exposure to sunlight exacerbates algal growth and allows for long-term algal senescence, storage, and internal load recycling of nutrients. Within the lake water column, DO concentrations vary spatially and diurnally and are characteristic of the effects of photorespiration within a highly productive system. Sediments collected within the lake system indicate a deep layer (average of 19 inches) of flocculent material suggesting long-term legacy deposits of organics (the flocculent Volatile Organics averaged 26.3% of the total solids).

Table 2.1 Summary of Background Stormwater and Sediments in BLSS (AET, 2009)

Sample Point	1	2	3	Average (n = 3)
Time of Sampling	9:09 AM - 10: 25 AM	11:20 AM - 12:25 PM	1:40 PM - 2:40 PM	-
Water Column				
Secchi Depth, in.	7	8	12	9
Water Column Depth, ft.	5.42	5.50	4.67	5.20
Temperature, ºC	31.1	31.6	31.2	31.3
Conductivity, µS/cm	399	416	374	396
pH	8.3	9.0	8.5	8.6
Alkalinity, mg/L as $CaCO_3$	138	122	116	125
Total Suspended Solids, mg/L	48	48	24	40
Total Nitrogen, mg/L	3.63	3.13	2.23	3.00
Total Kjeldahl Nitrogen, mg/L	3.6	3.1	2.2	3.0
Organic Nitrogen, mg/L	3.58	3.08	2.18	2.95
Total Kjeldahl Nitrogen, Filtered, mg/L	1.15	1.95	1.15	1.42
Organic Nitrogen, Filtered, mg/L	1.13	1.93	1.13	1.40
Non-filtrable Organic Nitrogen, mg/L	2.45	1.15	1.05	1.55
Ammonia Nitrogen, mg/L	0.02	0.02	0.02	0.02
Total Oxidized Nitrogen, mg/L	0.025	0.025	0.025	0.025
Total Phosphorus, mg/L	0.27	0.22	0.18	0.22
Total Organic Phosphorus, mg/L	0.258	0.208	0.168	0.211
Filtered Total Phosphorus, mg/L	0.00	0.04	0.02	0.02
Organic Phosphorus, Filtered, mg/L	0.00	0.03	0.01	0.01
Non-filtrable Organic Phosphorus, mg/L	0.26	0.18	0.16	0.20
Orthophosphorus P, mg/L	0.012	0.012	0.012	0.012
Dissolved Organic Carbon, mg/L	23	23	28	25
Sediment				
Flocculent Sediment Layer Depth, in.	3	15	24	19.5*
Dissolved Oxygen, mg/L	< 0.25	0.02	0.04	< 0.1
Oxidation Reduction Potential, mV	-239	-178	-274	-230
pH	-	6.61	6.59	6.6*
Total Solids Content, %	10	11.1	5.3	8.8
% Volatile (Organic)	20	20	39	26.3

*Average value does not include Sample Point 1.

Source: AET Sampling Event (2009).

3.0 SCHEDULE B - PERFORMANCE OPTIMIZATION MONITORING

3.1 PERFORMANCE OPTIMIZATION MONITORING METHODS

Table 3.1 Briarwood Stormwater Treatment Facility (BSTF) Treatment Capacity

BSTF Influent Pumping Rate (GPM)	Adjusted BSTF Daily Treatment Capacity (MGD)	Estimated BSTF Annual Treated Flow Capacity (MGY)	Percentage of Treatment Available for Annual Stormwater Runoff
750	0.878	285	100%
1000	1.170	380	133%
1250	1.463	475	166%
1500	1.755	570	199%
1750	2.048	665	233%

The BSTF has flexibility in operational protocols to vary the rate of flow, hydraulic residence time, and the daily schedule and rate of backwash times (filter backwash is necessary to reverse flow and dislodge solids that may otherwise block the upflow filter treatment system). The performance evaluation examined the treatment train effectiveness of the sedimentation basin, decomposition zone, aerobic zone, and anaerobic upflow filter units. A total of six sample locations were identified for process evaluation throughout the BSTF treatment train. Three independent events were evaluated during low-, high-, and batch-flow scenarios. Water quality trends throughout the treatment train were determined by an analysis of instantaneous grab samples and field measured parameters through the treatment train (Figure 3.1).

BSTF PERFORMANCE MONITORING PLAN
(Schedule B Monitoring)

- Site 1-BSTF Influent wet well (PS-A);
- Site 2-BSTF Sedimentation pond overflow;
- Site 3-BSTF Decomposition zone outflow;
- Site 4-BSTF Aerobic zone outflow (to submerged rock filter);
- Site 5-BSTF Filter effluent;
- Site 6-BSTF Final treated effluent at wet well (PS-B).

Three basic modes of operation were established in the treatment optimization study to determine which operational scheme may produce an optimum removal of pollutants. These optional treatment schemes (high flow, low flow, and batch flow) are discussed below.

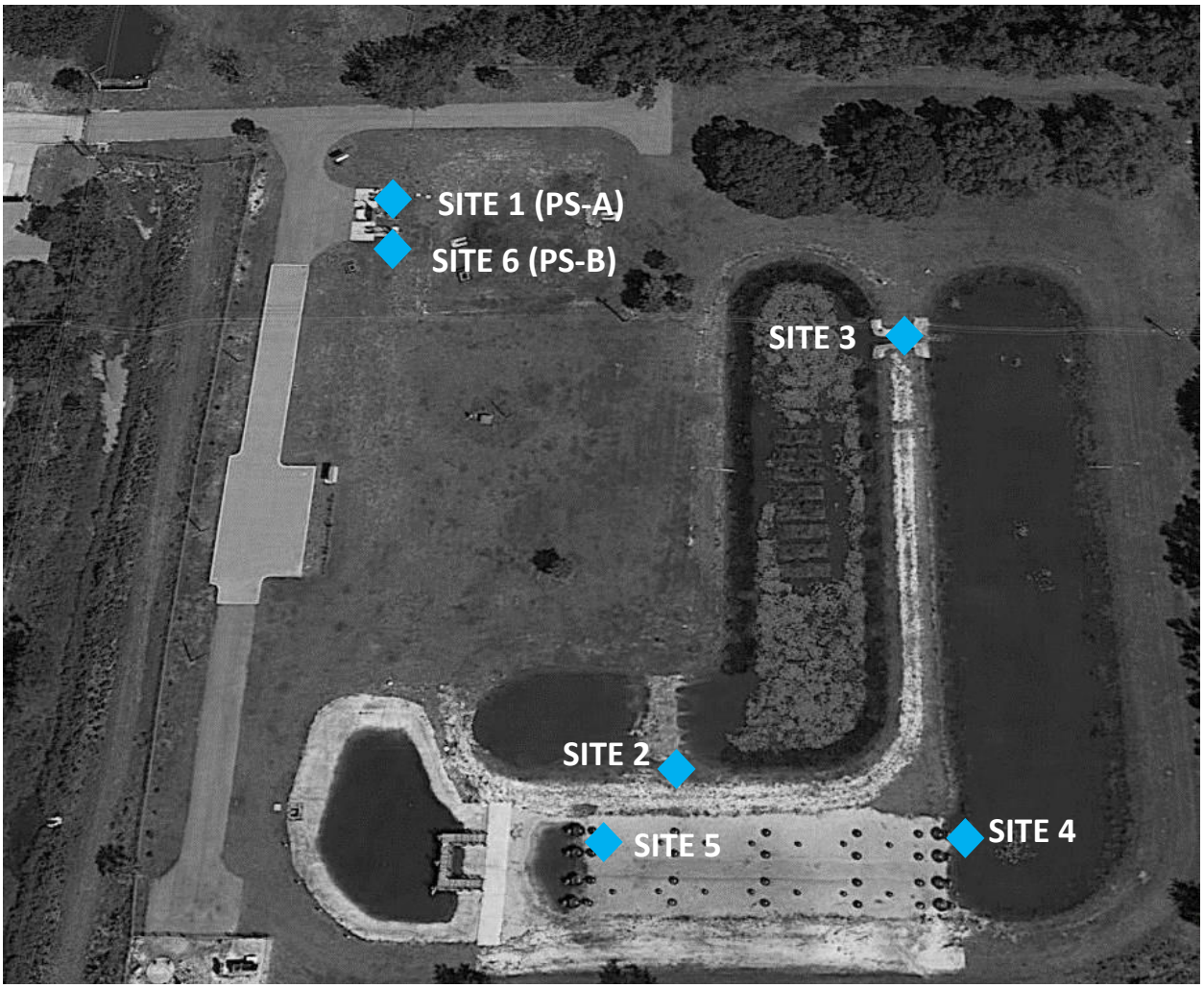


Figure 3.1 Location of BSFT Performance Monitoring Sites (Schedule B)

High-flow Operations: The high-flow (HF) treatment operational mode conveys a high volume of stormwater through the BSTF with the goal of achieving high mass removals of solids. The HF treatment scheme provides treatment for up to 2.0 MGD of stormwater (approximately 1,750 GPM of pumping). Higher flows through the BSTF may allow for capture of more pollutant mass through the physical removal processes (sedimentation, sorption, and filtration). However, the high-flow operations result in a lower hydraulic residence time (compared to low flow and batch flow) in the BSTF and lake system, and thus may be less favorable for biological nitrogen removal. The HF operations require filter backwash on a daily basis to insure that upflow filters do not clog. During the backwash cycle, the influent pumps are stopped and automatic valves open to drain the upflow filter system. Once water levels have been adjusted in the filter (a timed dewatering event), effluent pumps (PS-B) reverse the flow direction in the filters (water enters the top of the filters and solids are forced downward and into the end sediment chambers of each filter cell). The entire backwash cycle is programmed at 4.5 hours. Flow controls for the HF operation are set by water level points in the BSTF to balance water levels and prevent overflows.

Low-flow Operations: The BSTF can operate as a low-flow (LF) treatment system that maintains an inter-event stormwater flow at 0.8 MGD (VFD adjusted flow of 750 GPM). As with the HF operation, this mode provides for the upflow filters to be automatically drained with the filter flow reversed on a daily basis. The timed backwash cycle is 4.5 hours. However, the rate of backwash is limited by the flow set point of PS-B (750 GPM). The LF treatment scheme increases residence time in the decomposition zone, anoxic zone, and upflow filters to provide for more sorption, algal senescence and degradation, and settling. The overall residence time (including the lake system) for low flow may range 4-5 days. Like HF operations, flow controls for the LF operation are entirely based on water level set points in the BSTF that balance water levels and prevent overflows.

Batch-flow Operations: The batch-flow (BF) treatment scheme involves a timed scheduled application of water to the BSTF, a timed basin resting period (extended treatment), and a subsequent return of treated flow to the Briarwood Lake stormwater system. Typically, the resting period is recommended to range between 1 and 7 days. With the BF operational protocol, upflow filters are drained, and flow is reversed through the filters on a timed interval basis (this may be extended beyond a daily backwash frequency period). The residence time of batch flow in the BSTF is variable and can be set to exceed one week in the BSTF to further enhance biological removal systems within the BSTF.

3.2 Results of BSTF Performance Optimization Monitoring

The performance optimization monitoring program water quality samples were collected for each sample event with a minimum one-week resting period between changes in operational protocols.

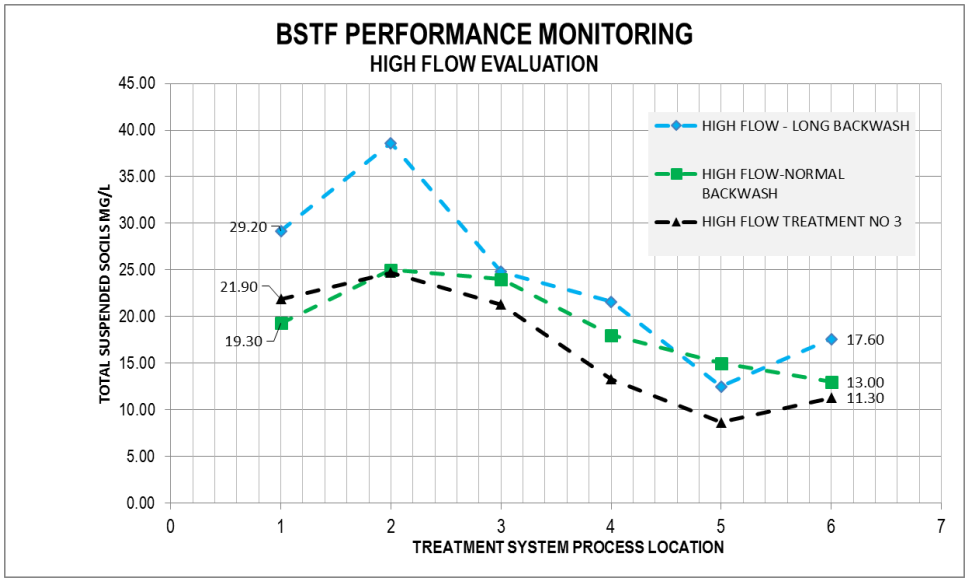


Figure 3.2 Trends in TSS Reduction through BSTF Treatment Train at High Flow

3.2.1 High-flow (HF) Performance Monitoring Results

HF monitoring was completed as the initial system performance evaluation for the BSTF. Performance results for TSS, TN, and TP are discussed in this section.

TSS (HF) Results: The HF operational protocol option demonstrated effective physical sorption and particulate filtration capacity that produced reproducible TSS results for removal. With three different trials,

the results during constant wet conditions are shown in Figure 3.2. Note that extended backwash cycles impacted filter effectiveness.

TN (HF) Results: The HF operational protocol demonstrated effective settling and filtration capability for capture of organic solids to consistently reduce TN with high influent background concentrations (above 2 mg/l).

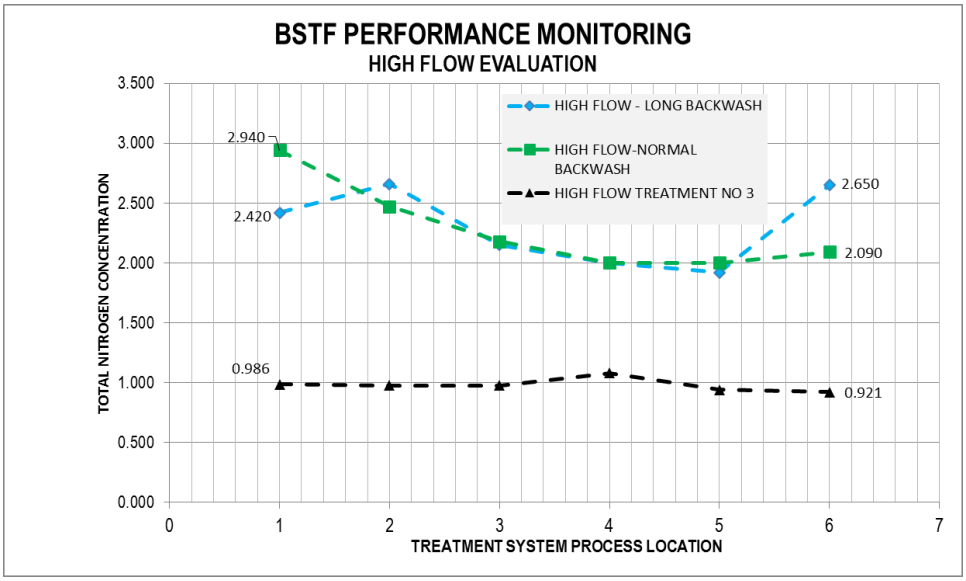


Figure 3.3 Trends in TN Reduction through BSTF Treatment Train at High Flow

TP (HF) Results: Figure 3.4 illustrates the TP reduction potential from the HF operational protocol. The HF did not demonstrate effective pollutant reductions through the aerobic zone, but some removal was still noted through upflow filter processes. Note that the long backwash cycle appeared to negatively impact performance of the aerobic zone.

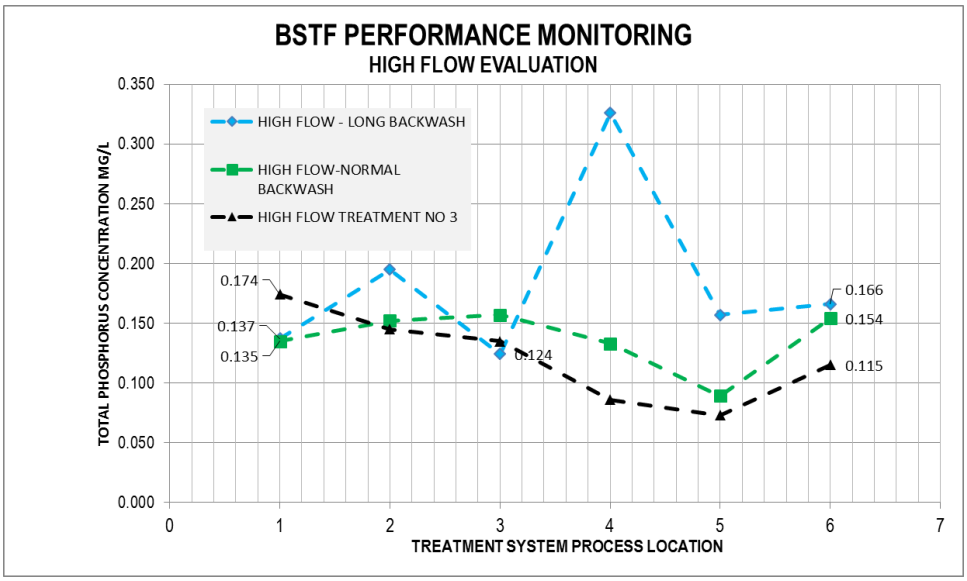


Figure 3.4 Trends in TP Reduction through BSTF Treatment Train at High Flow

3.2.2 Low-flow (LF) Performance Monitoring Results

The LF monitoring event was completed as an independent operational strategy period following the HF performance evaluation. Performance results for TSS, TN, and TP are discussed in this section.

TSS (LF) Results: The TSS reduction potential from the LF operational protocol demonstrated similar trends from HF settings when evaluated for the overall settling and filtration capacity. The system provided up to 50% reduction in TSS concentration (Figure 3.5). With three different trials and constant backwash protocols, the results demonstrated very reproducible results during wet weather conditions.

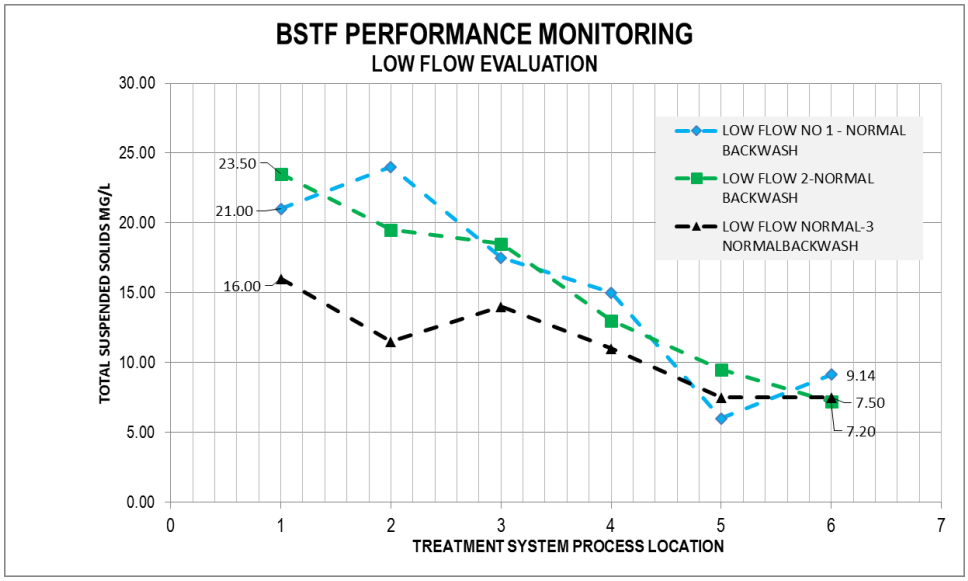


Figure 3.5 Trends in TSS Reduction through BSTF Treatment Train at Low Flow

TN (LF) Results: TN reduction from the LF operational protocol demonstrated reproducible consistent results considered better than the HF evaluation (higher removal efficiencies). With three different trials, the results demonstrated good results for high mass removals during wet weather conditions (Figure 3.6).

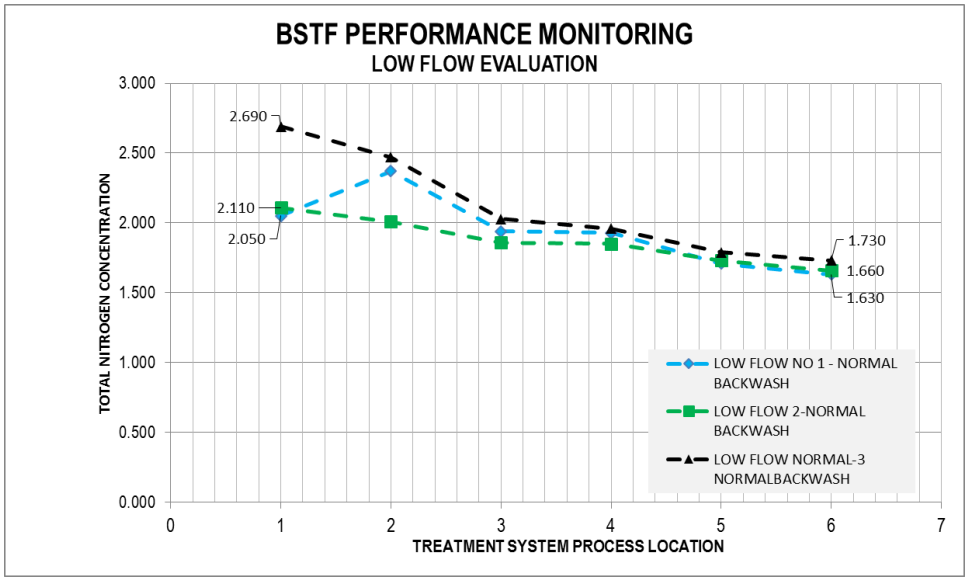


Figure 3.6 Trends in TN Reduction through BSTF Treatment Train at Low Flow

TP (LF) Results: TP reduction from the LF operational scheme showed no improvement over the HF operational scheme and in fact showed increase in TP through the upflow filter in one instance. With three duplicate trials, the results do not show good correlation (Figure 3.7).

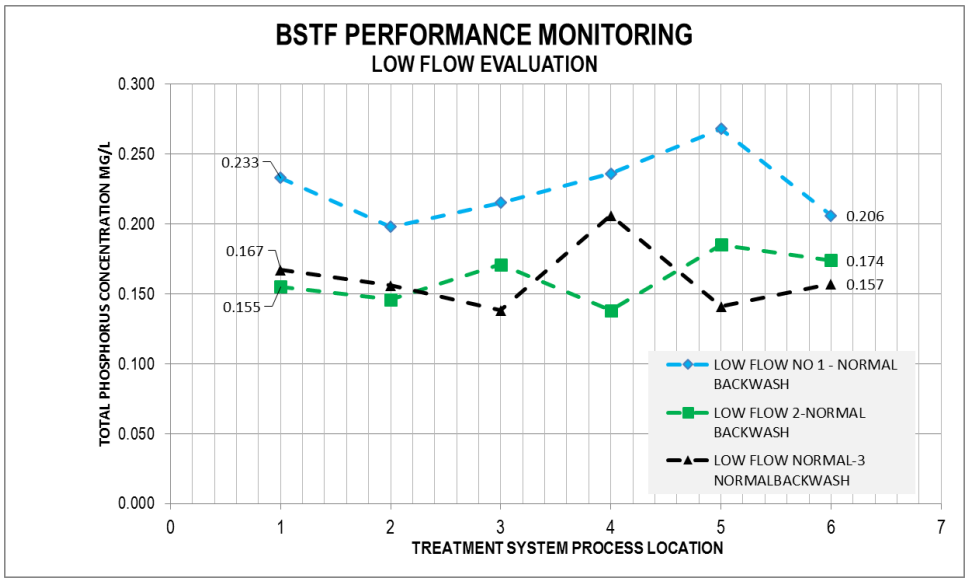


Figure 3.7 Trends in TP Reduction through BSTF Treatment Train at Low Flow

3.2.3 Batch-flow (BF) Performance Monitoring Results

The BF monitoring event was completed for the BSTF at 12, 36, and 40 hours of resting. Performance results for TSS, TN, and TP are discussed in this section.

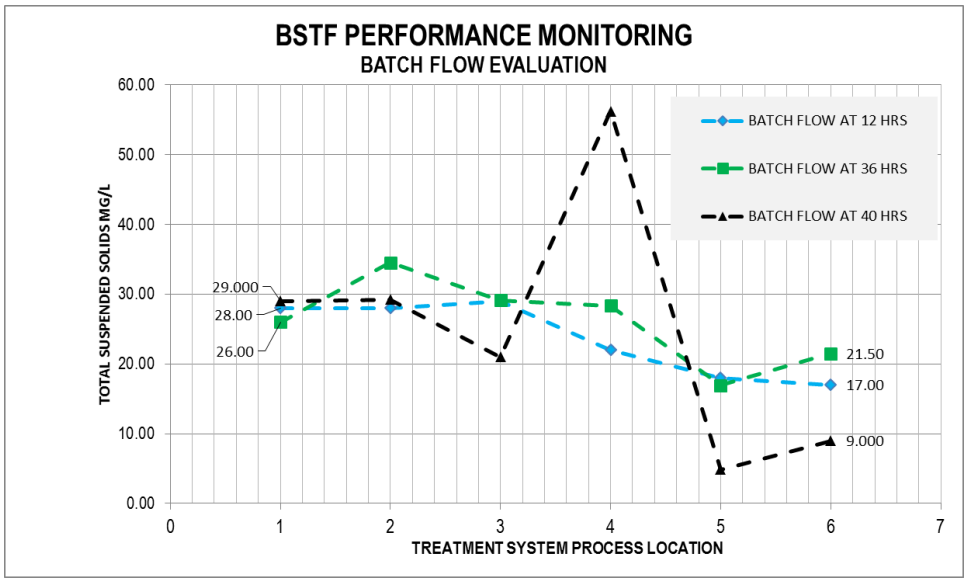


Figure 3.8 Trends in TSS Reduction through BSTF Treatment Train at Batch Flow

TSS (BF) Results: The BF operational protocol demonstrated some interesting results for settling and filtration capacity (Figure 3.8). In this mode of operation, forced aeration (at two aerobic zone locations in the aerobic zone and reaeration zones was installed at locations 4 and 6 (Figure 3.1). The aerators caused mixing of bottom colloidal solids and increased solids loading to the filters. Despite this observation, there were still documented reductions in TSS through the upflow filter (Process Site 5) prior to reaeration.

TN (BF) Results: Figure 3.9 illustrates observed TN reduction from the BF operational protocol. This operational strategy offered little or no improvements for sorption and settling in the decomposition area but

removal was effective in the upflow filters. Interestingly, flow through the upflow filter at 40 hours of resting did show a strong downward trend suggesting that nitrification and denitrification may be occurring at extended hydraulic residence times.

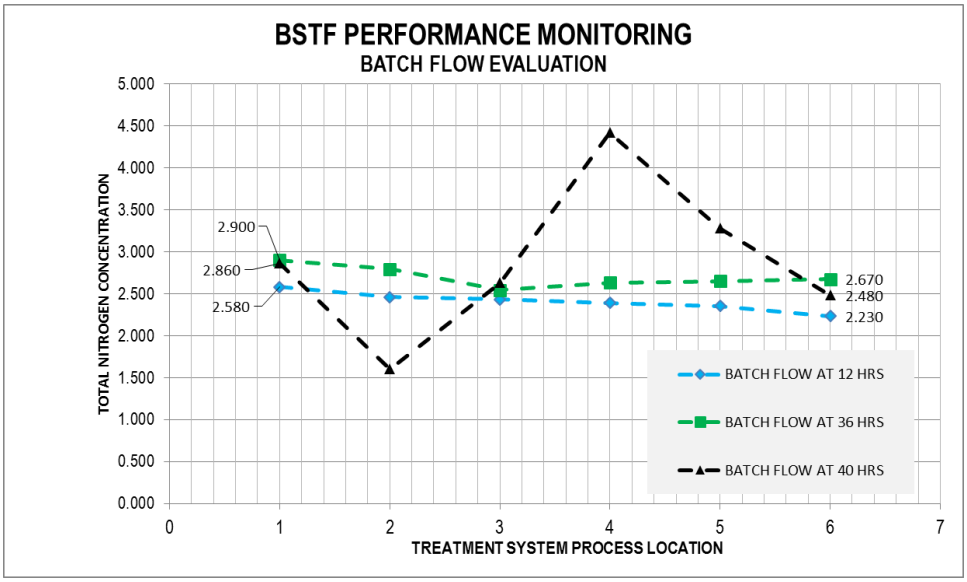


Figure 3.9 Trends in TN Reduction through BSTF Treatment Train at Batch Flow

TP (BF) Results: The BF operational protocols demonstrated little improvements over HF or LF operations scheme. With three different trials at varied hydraulic retention times, the results continued to demonstrate very little differences, except in the last trial where organics were re-suspended. The upflow filter effectively reduced TP in two of the trials.

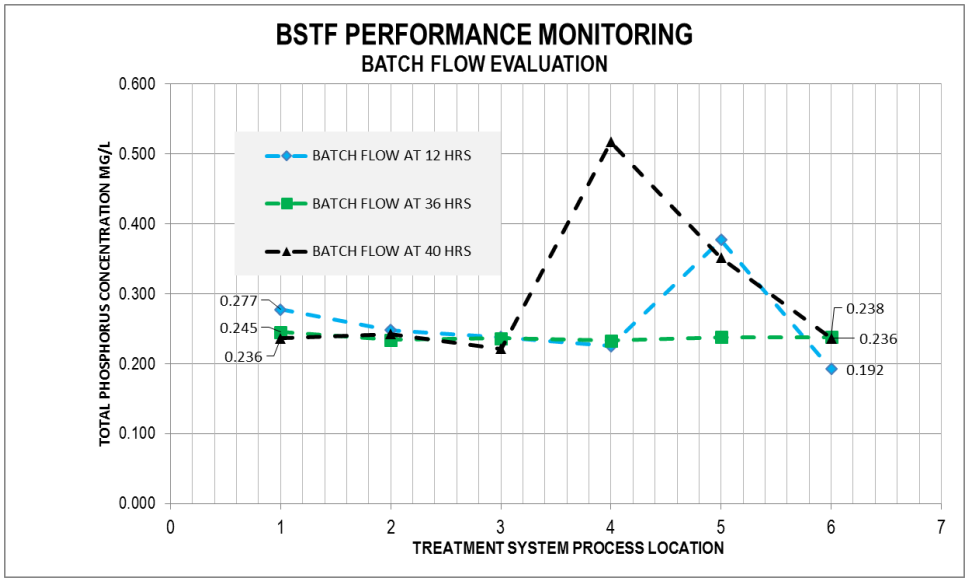


Figure 3.10 Trends in TP Reduction through BSTF Treatment Train at Batch Flow

Summary of Schedule B Monitoring Program Findings: Generally, the operations and performance monitoring program found little variation in system performance between extended batch-flow (BF), low-flow (LF), and high-flow (HF) operations. Although the LF operations scheme provided more consistent results, the HF operations provided higher mass removals. Based on the findings of Schedule B, it was recommended to operate the BSTF under the HF regime to obtain the benefit of higher annual pollutant mass removals.

4.0 SCHEDULE C -BIMONTHLY WATER QUALITY MONITORING

4.1 LONG-TERM BIMONTHLY MONITORING METHODS

The long-term bimonthly BSTF monitoring plan addresses trends in water quality (before and after treatment), flow measurements through the BSTF, and potential factors that may influence treatment effectiveness. The fundamental objective of the bimonthly monitoring is to provide meaningful data for comparison of BSTF performance to the goals of the FDEP 319(h) program. This section outlines methods and results for the Schedule C monitoring program.

Figure 4.1 In Situ Field Sampling at BSTF Site (Summer 2014)

Water Stage Measurements: Water stages were measured in the field during sampling events. These water level readings were taken from staff gages established within the treatment zones.

Flow Measurements: Flow measurements of the BLSS were recorded at the BSTF utilizing a permanent ultrasonic stage recorder/flow meter that was installed at the Briarwood discharge weir. Permanent electromagnetic flow meters were also located in the pump station pipe discharges of Pump Stations A and B (flow was measured considering full-flow pipe conditions and treated flow by calculation of pump run times and the rated pump capacity). The BSTF flow meters have the capability to digitally store continuous time-based data from multiple sources.

Water Quality Analytical Samples: Bimonthly water quality sampling was completed from September 2013 through March 2015 using time- and flow-based automatic composite samplers (ISCO Model 6712). Because the continual flow of water in and out of the treatment system allows for accurate composited samples of equivalent aliquot volumes, composite sampling was taken at the pump station wet wells. The sample schedule was set for a consistent collection of nine liters of sample over the 24-hour programmed sampling period for each of the sample events. Although there are only eight (8) sample events required by the 319(h) grant, nine (9) events were completed (one added sample event included TSS, BOD, and nutrient speciation). Samples were relinquished to the laboratory where analytical methods followed the QAPP (See analytical methods for laboratory testing referenced in Table 4.1).

In Situ Water Quality Measurements: In situ water quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) were collected concurrently with automatic sampler collection using a multi-probe YSI sonde in accordance with the QAPP. The sonde measurement was conducted

approximately midstream of the undisturbed surface water column. In situ water quality measurements were consistently completed following the collection of each wet sample collection.

Weather Conditions and Rainfall measurements: Meteorological conditions were recorded during each sample event, including measurement of the local rain gauge that is located at the BSTF PS-A site. Accurate rainfall measurements are continuously recorded at the Sarasota County ROMP TR 4-2 South Venice site. Because of the close proximity to the project area, an alternate rainfall gauge (Sarasota County AL-1 Jacaranda Bridge Rainfall Gauge) provided more useful data for this study. This rainfall station was used in tracking rainfall versus the ROMP TR-4-2 gauge that was originally recommended.

Table 4.1 Analytical Water Quality Testing Methods

Sample Parameter	Reference Analysis USEPA Method
pH	USEPA Method 150.1
Temperature	USEPA Method 170.1
Specific Conductance	USEPA Method 120.1
Dissolved Oxygen	USEPA Method 360.1
Chlorophyll a	SM 10200H (Modified)
Total Organic Carbon	SM 5310B
BOD	SM 5210B
Dissolved Organic N	USEPA Method 351.2 (Filtered)
Nitrate + Nitrite	USEPA Method 353.2
Ammonia	SM 4500NH3C
Total Kjeldahl Nitrogen	USEPA Method 351.2
Total Nitrogen	USEPA Methods 351.1 & 353.2
Total Phosphorus	USEPA Methods 365.1 & 365.4
Ortho Phosphorus	USEPA Method 365.3
Alkalinity	SM 2320B
Copper	USEPA Method 200.7
Zinc	USEPA Method 200.7
Turbidity (Lab)	USEPA Method 180.1
Total Suspended Solids	SM 2540D

Treatment System Parameters: Pump run times, system conditions, treatment basin stage levels, and conditions of the site vegetation were logged by Sarasota County during weekly site visits. Other operational parameters were recorded at the time of water quality sampling.

4.2 Results of FDEP Schedule C Bimonthly Water Quality Sampling Program

The Schedule C monitoring program was completed over the period beginning September 2013 through March 2015 with the BSTF operating under the HF regime. The objectives of the sampling program were to: 1) Complete a representative number of sampling events during wet and dry seasons; 2) Consider a potential diversion of BSTF treated water through a gravity outfall to Alligator Creek (when storm events would allow); and 3) Document the long-term performance of the BSTF for the pollutant mass removal of organic pollution, particularly TSS, nitrogen, and phosphorus.

Rainfall and Seasonal Influences: Figure 4.2 summarizes monthly rainfall for the entire Schedule C study period. From this figure, it is apparent that the number of sample events during wet weather months reasonably balanced with sample events during dry months.

The monthly rainfall trends are reported with each of the 319(h) sample events and reported with each water quality parameter measured in the Schedule C monitoring program. These results are presented in Appendix A.

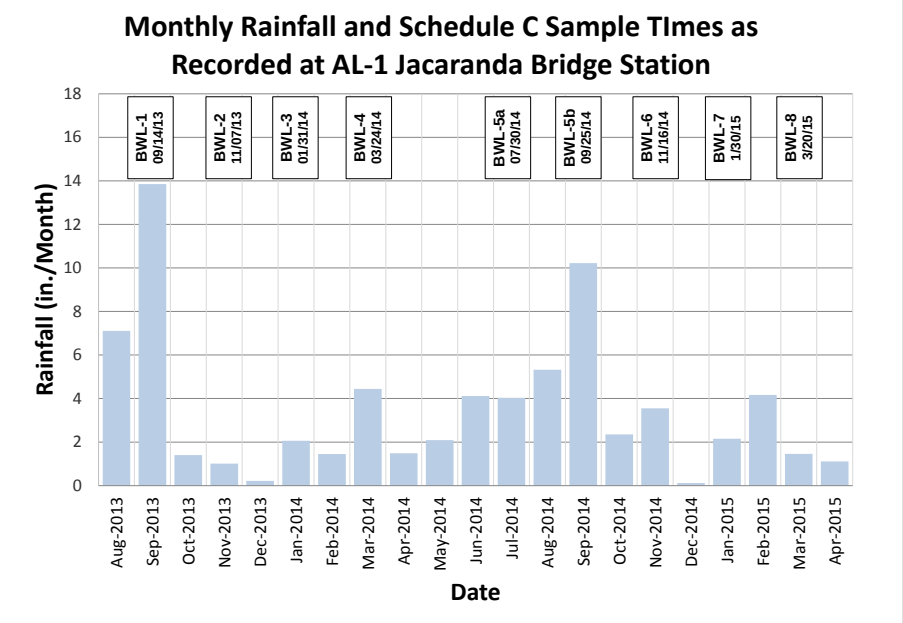


Figure 4.2 Rainfall Records over Course of Schedule C Sampling

In the early stages of monitoring, it was postulated that rainfall influenced water quality in the BLSS through dilution (this observation is supported by data during the August-September 2013 period). However, at least four (4) other sample events coincided with high rainfall months where BLSS nutrients and TSS were shown to increase. Because of the linear configuration of BLSS canals and long residence times, significant rainfall events are believed to cause a migration of stagnate stormwater flow from the upper reaches of the BLSS to the BSTF intake structure that outweighs the influence of rainfall dilution. However, it is possible that high-intensity storms may temporarily influence water quality during and shortly following intense rainfall events. It should be noted that most rainfalls observed over the monitoring period did not produce a significant measurable discharge at the BLSS weir. And because of the need to maintain stage levels within the BLSS it was not possible to divert BSTF discharges to the Alligator Creek ditch outfall for long extended periods.

HF Treatment Mode Influences: The Schedule B monitoring results indicated that the HF operational mode had the highest potential for mass reduction of pollutants and was thus recommended for operations for the long-term monitoring program. The HF settings were adjusted to balance flow through the BSTF during Schedule C monitoring. The BSTF Monitoring events are designated as “BWL” followed by a numeric site indicator. The sample results are defined by the designation of influent (PS-A) and effluent (PS-B) sites (See Figure 3.1 for PS-A and PS-B locations). A concise overall summary of BSTF influent and effluent water quality results is presented in Tables 4.2 and 4.3 and provide an accounting of all water quality parameters required by the FDEP 319(h) grant. Results of the overall bimonthly sampling program can be examined in-depth based on the level of reduction of nutrient concentrations (i.e. raw treatment performance), consideration of improved treatment effectiveness with stormwater harvesting, and most importantly, the potential gross mass removal of nutrients within the system.

Table 4.2 Summary of BSTF Influent Water Quality Data Monitoring

Summary of BTSF Influent Monitoring Results (Schedule C)									
Sample Number	BWL-Bimonthly-1	BWL-Bimonthly-2	BWL-Bimonthly-3	BWL-Bimonthly-4	BWL-Bimonthly-5A	BWL-Bimonthly-5B	BWL-Bimonthly-6	BWL-Bimonthly-7	BWL-Bimonthly-8
Sample Date	9/14/2013	11/7/2013	1/31/2014	3/24/2014	7/30/2014	9/25/2014	11/13/2014	1/30/2015	3/20/2015
pH	8.38	8.78	8.21	8.66	9.30	8.61	8.93	8.98	6.80
Turbidity (NTU)	10.60	8.60	21.50	29.30	12.50	12.40	12.50	11.90	11.20
DO (mg/L)	8.72	16.53	9.53	7.18	11.10	9.42	14.90	13.25	4.04
Specific Conductivity (µS/cm)	0.372	0.375	0.327	0.325	0.399	0.340	0.400	0.423	0.424
Temp (°C)	30.89	23.51	15.78	24.76	34.21	27.80	23.66	20.53	24.82
ORP	72.0	309.5	155.1	128.8	148.4	120.1	176.9	188.4	80.0
Time	0.53	0.52	0.50	0.54	0.75	0.56	0.71	0.68	0.60
Turbidity [NTU]	10.0	15.0	27.0	30.0	NA	18.0	17.0	22.0	26.0
Copper [µG/L]	4.40	5.30	7.40	4.00	NA	1.20	4.00	4.00	4.00
Zinc [µG/L]	13.40	9.10	15.70	10.00	NA	5.70	6.00	10.30	8.41
Ammonia Nitrogen [mg/L]	0.012	0.008	0.031	0.008	0.035	0.034	0.054	0.036	0.021
Ammonia Nitrogen Dissolved [mg/L]	0.008	0.013	0.008	0.008	NA	0.027	0.048	0.015	0.008
Organic Nitrogen Dissolved [mg/L]	1.04	1.01	1.09	1.28	NA	0.97	1.06	1.32	1.29
TKN [mg/L]	2.43	2.59	3.48	3.46	3.00	2.46	2.57	3.18	3.13
TKN Dissolved [mg/L]	1.040	1.020	1.090	1.280	NA	1.000	1.110	1.330	1.290
Total Nitrogen [mg/L]	2.44	2.60	3.48	3.46	3.00	2.46	2.58	3.19	1.31
Nitrate + Nitrite as N [mg/L]	0.007	0.009	0.004	0.004	0.005	0.004	0.011	0.011	0.016
Orthophosphate [mg/L]	0.016	0.011	0.005	0.002	0.017	0.005	0.002	0.002	0.003
Total Phosphorus [mg/L]	0.083	0.241	0.272	0.311	0.109	0.254	0.229	0.244	0.221
Chlorophyll A, Corrected [mg/m3]	93.10	112.10	129.00	64.10	NA	117.00	37.60	99.40	117.00
Total Alkalinity [mg/L as CaCO3]	164	128	100	90	NA	90	123	125	106
Total Suspended Solids (TSS) [mg/L]	23.1	21.3	42.7	48.0	36.0	26.8	15.6	15.7	32.0
BOD5	NA	7.47	7.34	13.40	4.12	6.76	6.85	7.57	7.84
Total Organic Carbon [mg/L]	12.8	13.8	14.2	17.3	NA	13.1	15.6	16.3	17.2

Table 4.3 Summary of BSTF Effluent Water Quality Data Monitoring

Summary of BTSF Effluent Monitoring Results (Schedule C)									
Sample Number	BWL-Bimonthly-1	BWL-Bimonthly-2	BWL-Bimonthly-3	BWL-Bimonthly-4	BWL-Bimonthly-5A	BWL-Bimonthly-5B	BWL-Bimonthly-6	BWL-Bimonthly-7	BWL-Bimonthly-8
Sample Date	9/14/2013	11/7/2013	1/31/2014	3/24/2014	7/30/2014	9/25/2014	11/13/2014	1/30/2015	3/20/2015
pH	7.98	7.65	7.69	7.89	8.00	7.54	8.16	8.29	8.41
Turbidity (NTU)	6.90	5.60	9.60	11.90	7.50	6.20	11.80	8.10	19.50
DO (mg/L)	4.15	12.52	3.79	1.75	4.79	4.50	7.47	7.34	13.90
Specific Conductivity (µS/cm)	0.381	0.393	0.345	0.341	0.429	0.186	0.408	0.436	0.393
Temp (°C)	31.10	22.98	15.75	24.70	33.03	28.39	22.37	18.89	26.03
ORP	32.6	343.0	155.9	68.1	195.8	124.6	184.5	176.0	73.8
Time	0.53	0.52	0.50	0.54	0.76	0.56	0.71	0.67	0.60
Turbidity [NTU]	7.1	12.0	16.0	18.0	NA	8.8	13.0	17.0	20.0
Copper [µG/L]	4.00	5.30	5.90	4.00	NA	1.83	4.00	4.40	4.00
Zinc [µG/L]	9.30	9.90	30.70	7.00	NA	13.20	8.10	10.20	8.80
Ammonia Nitrogen [mg/L]	0.124	0.039	0.145	0.010	0.116	0.023	0.027	0.037	0.140
Ammonia Nitrogen Dissolved [mg/L]	0.008	0.011	0.096	0.008	NA	0.011	0.016	0.010	0.102
Organic Nitrogen Dissolved [mg/L]	1.02	0.97	1.04	1.21	NA	0.95	1.04	1.31	1.49
TKN [mg/L]	2.03	1.93	2.44	3.07	2.15	1.66	2.00	2.67	2.68
TKN Dissolved [mg/L]	1.020	0.976	1.140	1.210	NA	0.961	1.060	1.320	1.590
Total Nitrogen [mg/L]	2.06	2.09	2.69	3.18	2.18	1.76	2.09	2.81	1.64
Nitrate + Nitrite as N [mg/L]	0.033	0.160	0.254	0.107	0.030	0.100	0.090	0.136	0.115
Orthophosphate [mg/L]	0.019	0.028	0.008	0.006	0.067	0.024	0.002	0.002	0.032
Total Phosphorus [mg/L]	0.114	0.168	0.210	0.269	0.167	0.151	0.209	0.214	0.235
Chlorophyll A Corrected [mg/m3]	58.50	88.40	82.00	98.50	NA	39.50	50.40	66.80	56.50
Total Alkalinity [mg/L as CaCO3]	104	131	103	90	NA	91	121	126	106
Total Suspended Solids (TSS) [mg/L]	8.2	25.0	24.2	24.0	10.0	12.4	19.2	27.3	18.0
BOD5	NA	4.40	5.44	6.00	4.53	3.26	3.71	5.41	6.35
Total Organic Carbon [mg/L]	11.9	12.8	14.4	17.8	NA	13.0	15.1	15.4	17.0

BLSS Water Quality Variations: BLSS lakes and canals provide stormwater attenuation and treatment function for Venice Gardens. The BLSS is considered a Class III (limited) surface water under Florida Administrative Code (F.A.C.) 62-302.400. This surface water classification limits recreational use and fish consumption and provides for propagation and maintenance of limited fish and wildlife. Despite the classification of the surface water, the BLSS lakes and canals are utilized as recreational benefits of the public.

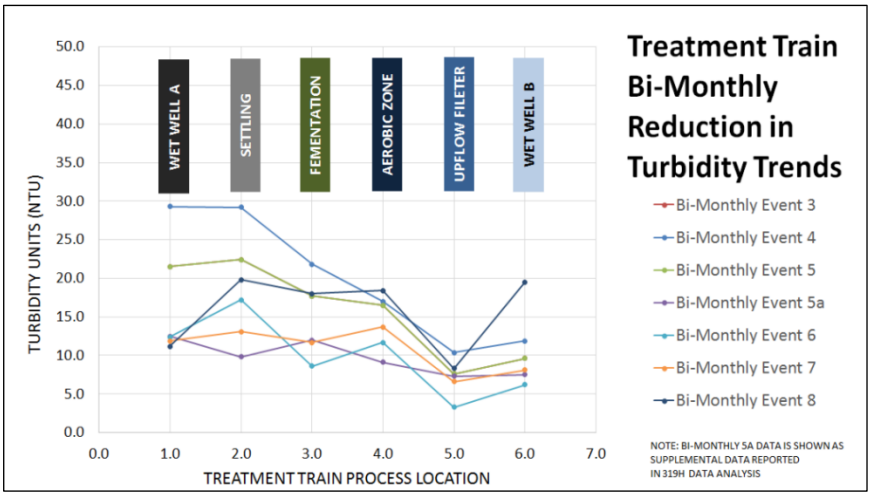


Figure 4.3 Observed Turbidity Reductions through Processes

The BSTF influent water quality reported during each sample event were representative of background water quality conditions within the BLSS lakes and canals at the time of sampling. The BLSS water quality was consistently typical of a highly eutrophic aquatic system that exhibited little temporal or seasonal variation. The BLSS total suspended solids (TSS) routinely exceeded 20 mg/l and Chlorophyll a consistently exceeded 90 mg/m^3. The major fraction of nutrients occurs as organic, colloidal solids (mostly algal biomass). Background Copper concentrations within the BLSS often were often above Class III standards (Class III standard is 3.7 µg/l).

Pollutant Removal Efficiency: The unit process treatment efficiency is defined by the direct observed change in pollutant concentration (IN-OUT) divided by the inflow concentration. Uncorrected efficiency does not account for mass removal efficiency. The BSTF was generally effective in the low efficiency reduction of turbidity, TSS, BOD5, and TN through the monitoring period (Figure 4.3). It is interesting to note that the BSTF performance over the first year of monitoring (Table 4.4) provided better removal efficiencies. The overall performance of the BSTF was reduced from a loss of solids that occurred in the winter of 2014 through 2015 (Figure 4.5).

Table 4.4 BSTF Treatment Performance (09/2013 through 07/2014)

BSTF Water Quality Parameter (Schedule C Key Parameters)	Averaged Reported Percent Reduction in Pollutant Concentration (09/13-07/14)
Turbidity [NTU]	36.17%
Total Nitrogen [mg/L]	18.89%
Total Phosphorus [mg/L]	2.76%
Chlorophyll A, Corrected [mg/m^3]	21.46%
Total Suspended Solids (TSS) [mg/L]	44.40%
BOD5	32.81%
Total Organic Carbon [mg/L]	2.15%

Table 4.5 BSTF Treatment performance (09/2014 through 03/2015)

BSTF Water Quality Parameter (Schedule C Key Parameters)	Averaged Reported Percent Reduction in Pollutant Concentration (09/13-03/15)
Turbidity [NTU]	31.27%
Total Nitrogen [mg/L]	12.52%
Total Phosphorus [mg/L]	3.47%
Chlorophyll A, Corrected [mg/m^3]	19.72%
Total Suspended Solids (TSS) [mg/L]	23.69%
BOD	32.18%
Total Organic Carbon [mg/L]	2.58%

4.3 Evaluation of Effectiveness of BSTF Pollutant Mass Reduction

True treatment system efficiency is determined from a ratio of the mass of pollutants removed versus mass of pollutants present before treatment. The treatment strategy of the BSTF considers a ratio of annual treatment volume to annual runoff of 133% in order to achieve an efficient removal of mass. Over the course of the Schedule C bimonthly reporting period, the BSTF system was evaluated for effective performance of pollutant mass reduction. Total pollutant mass removals were calculated and compared to goals of the 319(h) grant projections to measure the degree of success of the treatment system.

The effective mass pollutant reductions for the BSTF were determined for each monitoring period as follows:

Equation 4.1 Calculation of BSTF Pollutant Removal

$$(\text{Pollutant X})_{\text{lb Mass}} = (X_{\text{IN (mg/l)}} - X_{\text{OUT (mg/l)}}) \times Q_{\text{IN}}\ (\text{GPM}) \times T_{\text{Hours}} \times 60\ (\text{min.}) \times 10^{-6} \times 8.345$$

Where:

Pollutant X = Pollutant of Concern (lb removed)
Q = Rate of Flow (GPM)
T = Time lapsed (Hours)
8.345 = conversion from (mg/l) - (MG) to lb

The pollutant mass loading and stormwater runoff that enters the BLSS is equalized by long-term storage as stormwater travels through the canals and lakes to the outfall (and BSTF influent). The estimates of monthly pollutant loading goals were normalized by an equal standard of measure for each bimonthly sample event.

TSS Mass Reduction: The BSTF has demonstrated a consistent reduction in TSS over the long-term monitoring period (with the exception of a loss of solids in the winter of 2014-2015). Figure 4.4 provides calculated mass reductions in TSS concentrations from the BSTF as they compare to anticipated removal goals for TSS. From these results, 5 out of 9 events were found to exceed treatment goals. The removal of TSS from the system was estimated based on only 1,000 GPM of flow.

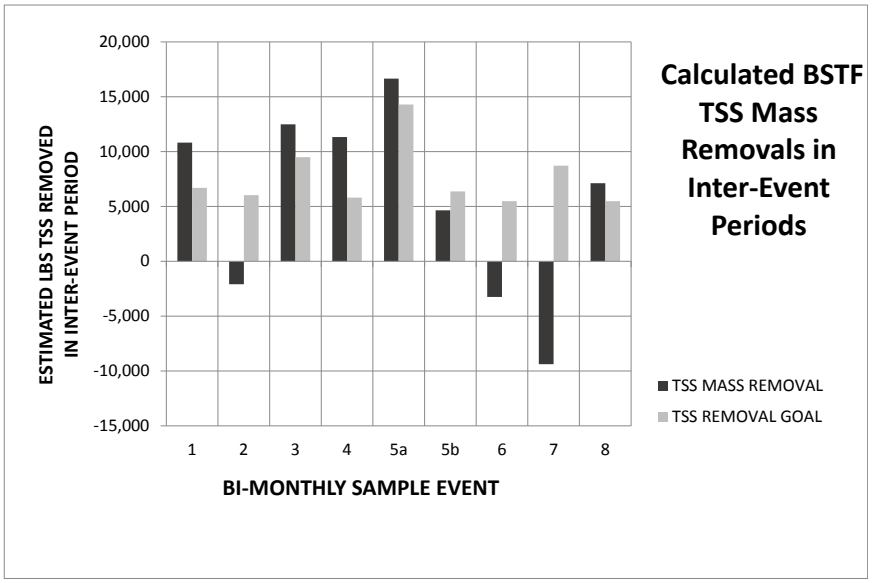


Figure 4.4 Calculated TSS Mass Reduction as compared to BSTF Treatment Goals

TN Mass Reduction: TN reductions in the BSTF treatment process occur as a result of the entrapment of colloidal solids and transformation of organic nitrogen species through the treatment train. The calculated mass reductions in TN compared to the BSTF goals for removal are presented in Figure 4.5. It should be noted that analytical results for TN reported both dissolved and non-filtered forms. It is important to note that biological processes occur as attached microbial growth on plants and media and not as suspended growth.

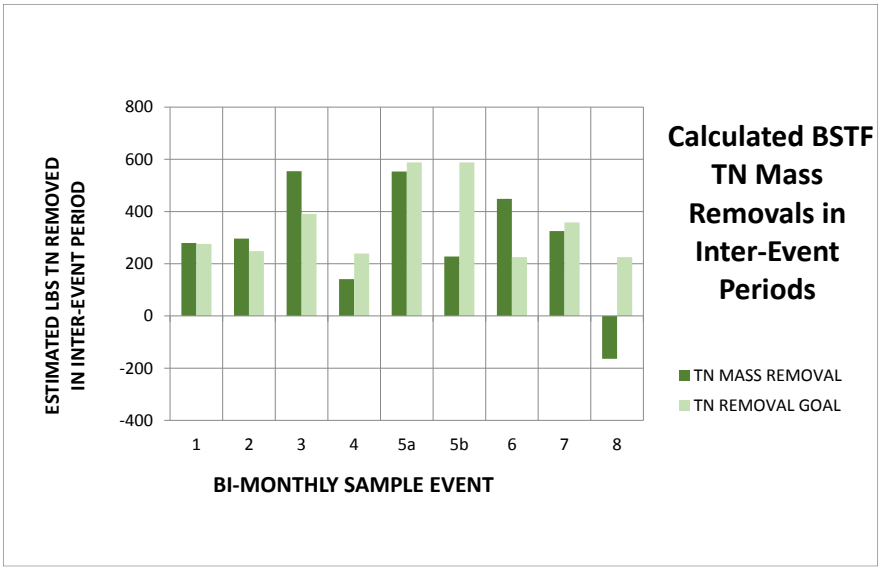


Figure 4.5 Calculated TN Mass Reduction as Compared to BSTF Treatment Goals

TP Mass Reduction: Results for TP mass reductions over the course of the Schedule C monitoring period never met the BSTF treatment goals. At times, the BSTF indicated a transport of TP out of the BSTF. However the overall monitoring results show a net annual removal of TP. Figure 4.6 illustrates the calculated TP removal versus the initial treatment goals.

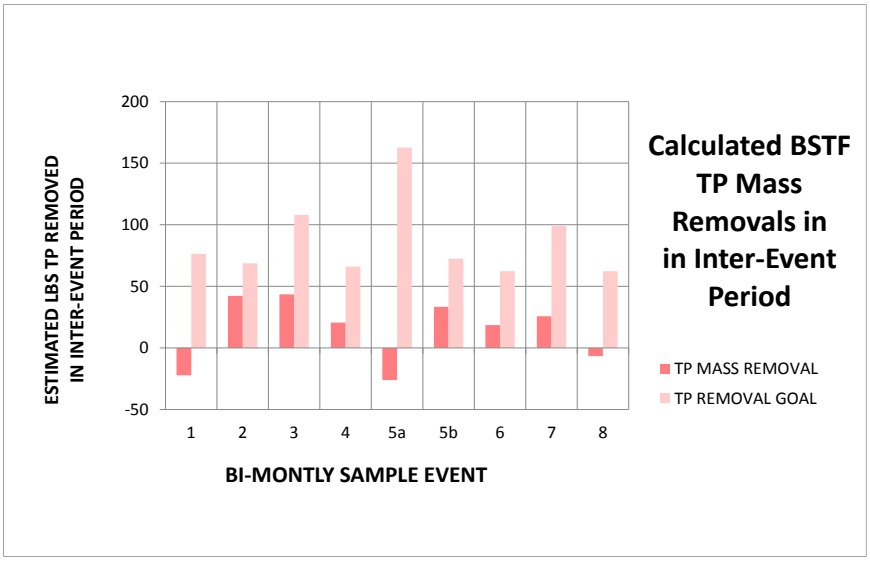


Figure 4.6 Calculated TN Mass Reduction as Compared to BSTF Treatment Goals

4.4 Evaluation of Stormwater Harvesting in BSTF Treatment Scheme

Stormwater harvesting is a critical element in the BSTF treatment train that is required to meet the goal of nutrient mass reduction. Stormwater harvesting and high rate turf irrigation (1 inch per week or 13,500 gallons per week) are especially effective at this site, because the site grades at the BSTF are elevated 2-3 ft. above natural ground. Groundwater elevations are generally 3-5 ft. below grade and this allows for a large effective storage volume in unsaturated soils that can provide high levels of treatment. Stormwater is irrigated at the BSTF through a programmed automatic dosing of 9 irrigation zones (Figure 4.7).

Stormwater irrigation combined with turf grass management is presumed to remove between 80 and 95 percent of organic and nutrient pollutants. The strategy of harvested stormwater irrigation is to saturate turf on a regular daily basis (with no surface accumulation) to optimize evapotranspiration. Infiltration through unsaturated soils allows for natural assimilation and pollutant removal through immobilization of the pollutant (this occurs by chemical means or through adsorption). At the BSTF site, the base flow of groundwater eventually results in a lateral groundwater discharge to the Alligator Creek ditch outfall. It is not practical in the context of this project to quantify the migration of nutrients through soils and discharge volume that may eventually enter Alligator Creek through groundwater base flow.

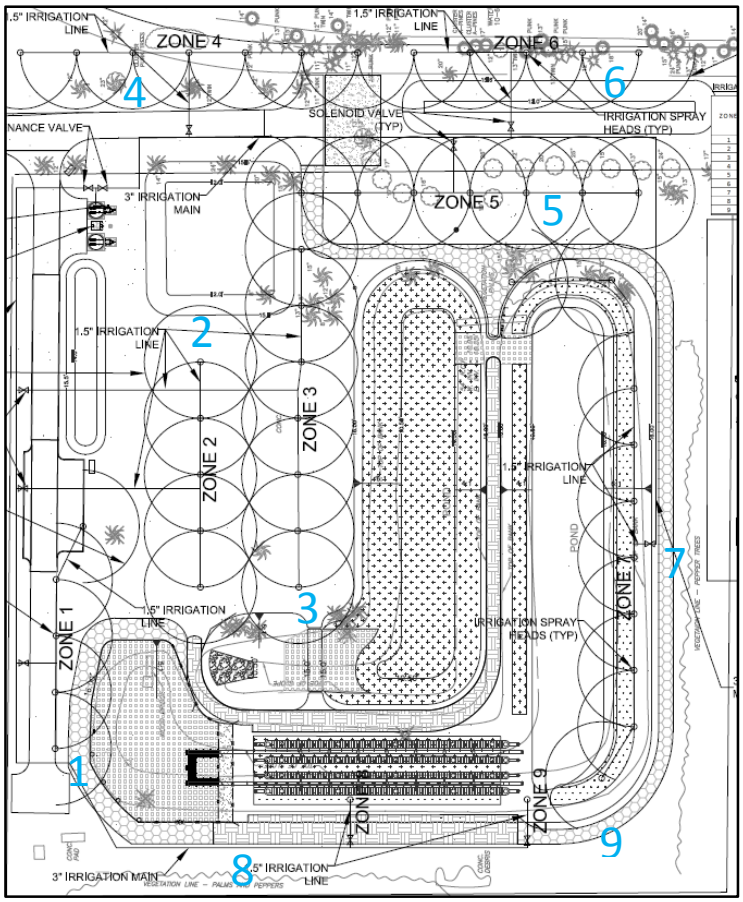


Figure 4.7 BSTF Areas (9) of Stormwater Harvesting by Spray Irrigation

Harvested Stormwater TSS Removal: TSS is removed from irrigated flow by the physical blockage and entrapment of solid particles at the soil surface. It is estimated that 95% (by a reduction in concentration) of colloidal solids may be trapped in the first few inches of the soil. Organic solids can undergo desiccation and decay in the upper soil horizon.

Harvested Stormwater TN Removal: Nitrogen may be removed through a number of physical and biological pathways. When irrigated stormwater is applied, ammonia nitrogen is lost to the atmosphere. The remaining infiltrated stormwater will result in physical sorption and blockage of organic solids (including organic nitrogen) that may be bound in the organic solids. Nitrification and denitrification occurs in unsaturated groundwater flow. It is estimated that 85% of nitrogen (by a reduction in concentration) can be removed by stormwater harvesting. It is recommended that plant and turf grass clippings resulting from maintenance not be allowed to re-enter the system.

Harvested Stormwater TP Removal: Phosphorous removal from irrigated stormwater is less effective and relies largely on plant uptake and immobilization in the soil stratum. For the purpose of this study, an effective reduction of 80% was used to estimate TP reduction in the stormwater treatment system.

5.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

5.1 BSTF TREATMENT SYSTEM OBSERVATIONS

In order to better assess the physical and biological systems within the BSTF, related water quality data were examined for statistical correlations and data trends. These observations are presented in this section.

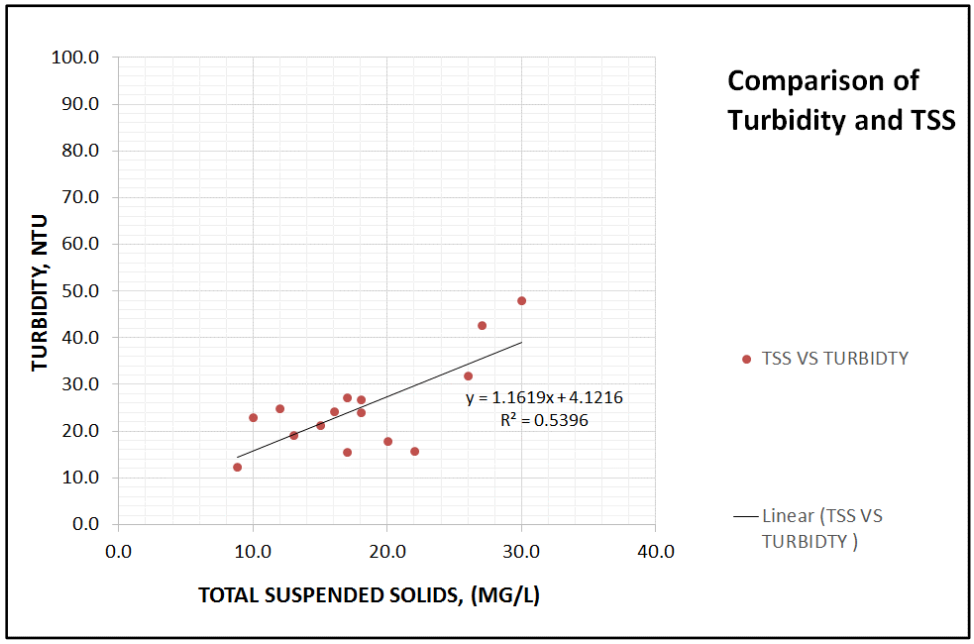


Figure 5.1 Relationship between Turbidity and TSS

Turbidity vs. TSS: In surface water systems, turbidity is usually linearly related to suspended solids. A non-linear relationship can occur where higher concentrations of algae may interfere with light absorption. A definite observed linear relationship is apparent between turbidity and TSS as shown in Figure 5.1.

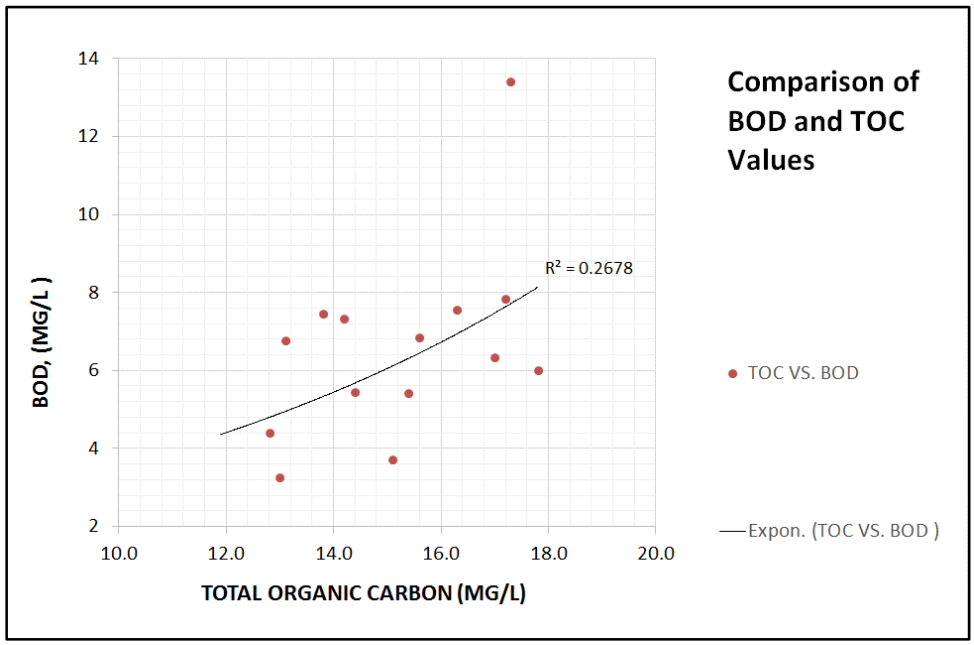


Figure 5.2 Relationship between BOD and TOC

BOD vs. TOC: The organic matter in surface waters creates a biochemical oxygen demand impact aquatic viability. The interpretive relationship of BOD and TOC can prove useful in determining the possibility of natural degradation of

organic matter. A lower TOC:BOD ratio is indicative of an equivalent fraction of inert dissolved and particulate organic matter that may be oxidized (through respiration processes) while higher ratios suggest that a higher fraction of the organics are not available for oxidation. In the evaluation of the BSTF process, a lower TOC:BOD suggests there is potential for bioavailable organic material (for respiration). The observed relationship of TOC to BOD for the Schedule C monitoring period is illustrated in Figure 5.2.

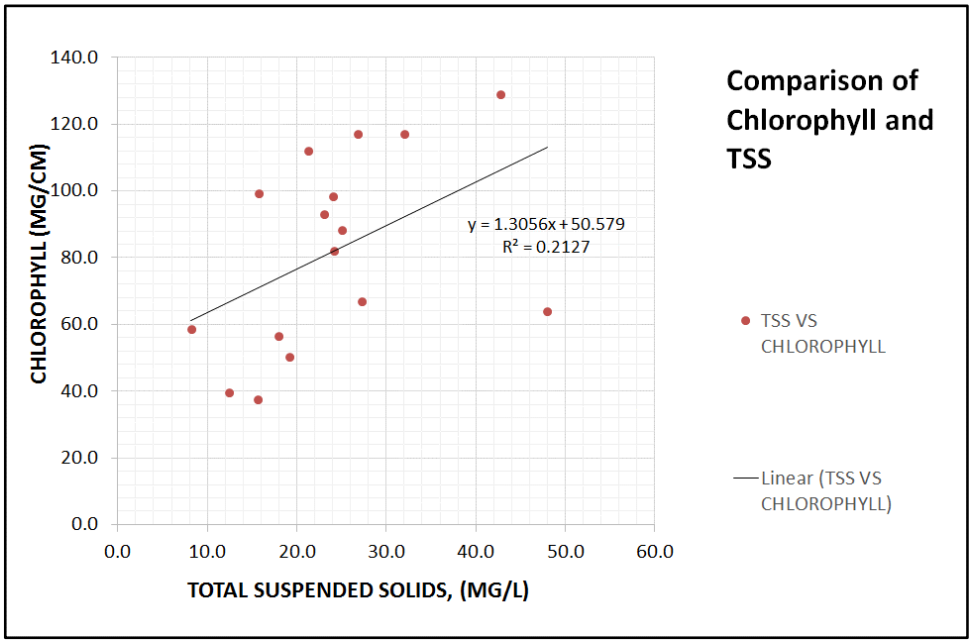


Figure 5.3 Relationship between Chlorophyll and TSS

Chlorophyll vs. TSS: The high levels of chlorophyll observed within the BLSS do not show a strong statistical relationship with total suspended solids. The data presented in Figure 5.3 includes all data collected at both influent and effluent sample points.

Biological Nitrogen Removal: The BSTF removes nitrogen by physical means (ammonia losses to the atmosphere, filtration and sorption) and biological nitrification and denitrification. Internal biological processes of the BSTF occur from catabolism and decay of organic solids (decomposition zone), which produce ammonia and dissolved organic nitrogen. Ammonia can be lost to the atmosphere, or it may be available for nitrification under favorable environmental conditions. One interesting observation was made from a comparison of Schedule C results of total nitrogen, ammonia,

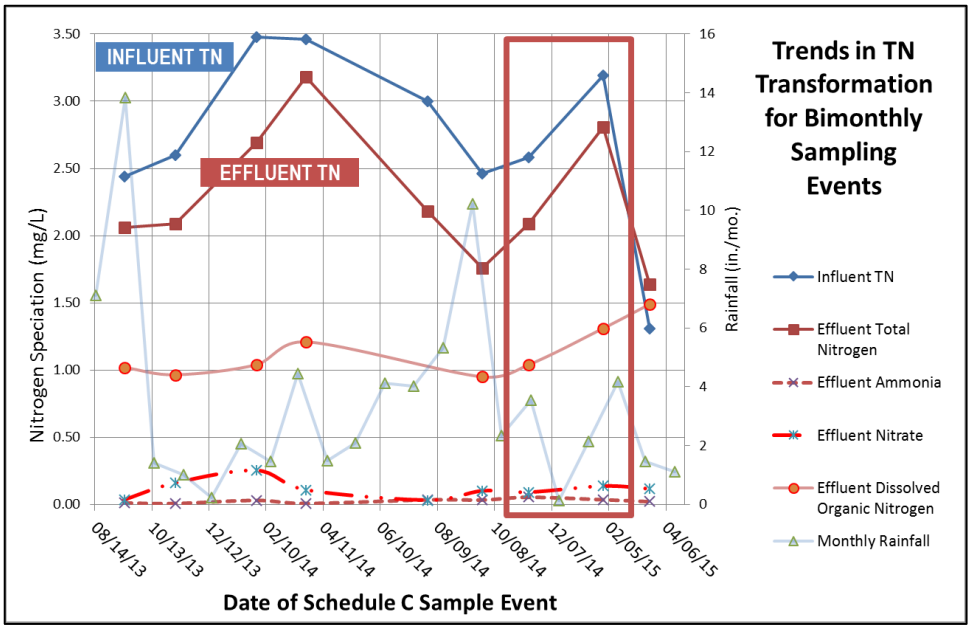


Figure 5.4 Biological Nitrogen Trends in BSTF

and nitrate-nitrogen data (from the fourth sample event and last three events) where dissolved organic nitrogen showed increased trends in concentration after long periods of operation. This observation suggests that the rate of decay may have increased for organically bound nitrogen as excessive levels of solids accumulate within the BSTF treatment zones (especially the decomposition zone). It is believed that the accumulation of colloidal organic solids (and the decay rates) reaches a point that exceeds the BSTF system capacity for nitrification and denitrification.

5.2 Summary of Annualized Estimates of Pollutant Reduction (Based on Schedule C Monitoring)

The Schedule C monitoring program provided useful information on the potential for long-term nutrient mass removals from the BSTF. Over the first year of operation, the performance of the BSTF met or exceeded the 319(h) treatment goals for TSS and TN mass removals. This monitoring period included 5 of the Schedule C sample events. The performance goal for phosphorus was not achieved over this period (See Table 5.1).

When considering the overall 319(h) monitoring period, from September 2013 to March 2015, the BSTF achieved less favorable results for TSS and TN removals and did not meet the goals for phosphorus removal (See Table 5.2). The observation of reduced BSTF performance was exacerbated by a loss of solids over the last three monitoring events (November, 2014-January 2015). During these last events, an estimated 12,634 lb of TSS and 164 lb of TN was exported from the BSTF. The significant loss of solids drastically reduced system treatment performance.

Table 5.1 Calculated Mass Removals (9/2014-7/2014)

BSTF Year 1 Pollutant Removal Estimates (Reporting Period: 9/2013-9/2014)	
Reporting Parameter	**Mass Removed (lbs.)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	48,670
TSS Mass Removed over Report Period	**53,834**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,004
TN Mass Removed over Report Period	**2,053**
TP Mass Removal Goal (Adjusted for Reporting Period)	554
TP Mass Removed over Report Period	**91**

Table 5.2 Calculated Mass Removals (9/2014-7/2014)

BSTF Overall Pollutant Removal Estimates (Reporting Period: 9/2013-3/2015)	
Reporting Parameter	**Mass Removed (lbs.)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	68,316
TSS Mass Removed over Report Period	**48,313**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,814
TN Mass Removed over Report Period	**2,662**
TP Mass Removal Goal (Adjusted for Reporting Period)	778
TP Mass Removed over Report Period	**129**

5.3 BENEFITS OF THE BSTF CONTINUED OPERATIONS

The effectiveness of traditional stormwater treatment BMPs is generally limited to treatment during storm events. Treatment processes occur during rainfall when rainfall runoff is generated (about 10 to 20 percent of storm events produce runoff) to drive the process. In many instances the volume of runoff is too great to treat the total runoff (BMP processes are often designed with high-flow diversions). The innovation of the BSTF has brought about added interest in the area of inter-event treatment, the application of upflow media filtration, and the combination of BMP treatment train unit processes that couple biologically active systems with physical sorption and filtration processes. The inter-event unit processes within the BSTF allow for higher capture of cumulative storm flows (in excess of the total annual volume of runoff) and do not depend on high-efficiency treatment systems (i.e. chemicals).

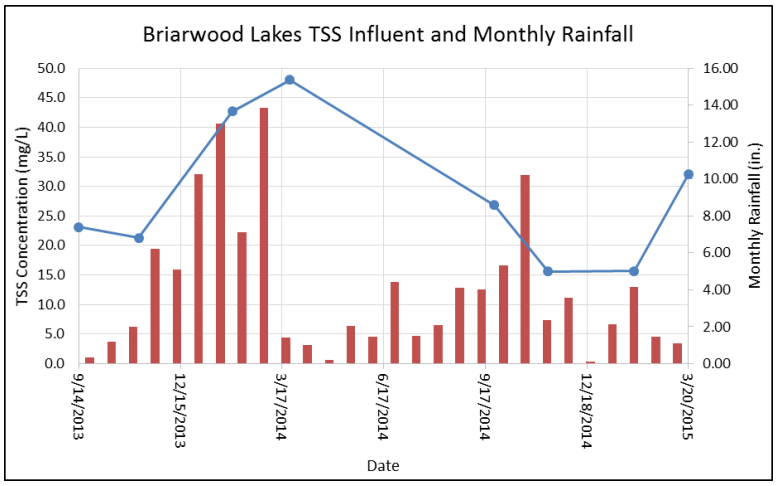


Figure 5.5 Briarwood Lake TSS Trends from 9/2013 through 3/2015 Monitoring Period.

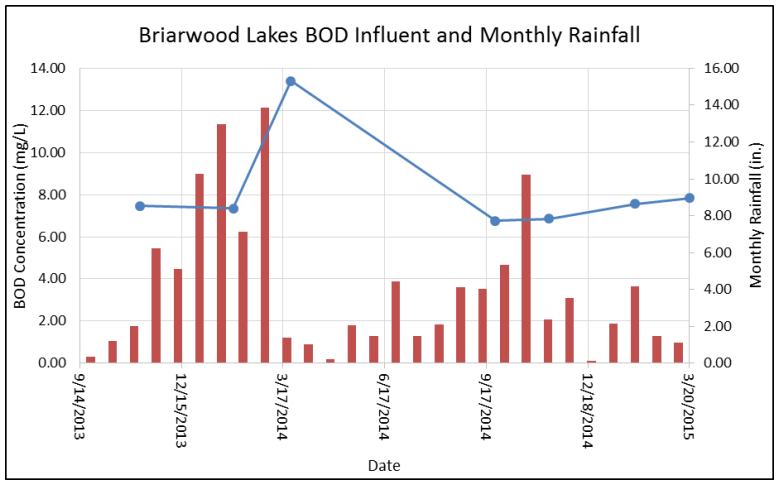


Figure 5.6 Briarwood Lake BOD Trends from 9/2013 through 3/2015 Monitoring Period.

Observed Trends in BLSS Lake Water Quality: The BSTF inter-event treatment process recycles stormwater within the last segment of canal system of the BLSS prior to discharging to Alligator Creek. Under normal BSTF dry-weather operations, it is estimated that stored water within the last segment of the BLSS canal may undergo two and a half (2.5) treatment recycles prior to discharge to Alligator Creek. Although the 319(h) water quality monitoring program did not require monitoring for receiving water trends, the long-term results of receiving water quality was demonstrated through the observed subtle changes in the BLSS source (the BLSS discharge canal).

From September 2015 through March 2015, water quality of the BLSS source exhibited background changes that reflect subtle improvements in the water quality. Figure 5.5 illustrates a slight general downward trend in TSS concentrations that occurred as a result of the operations of the BSTF.

Similarly from Figures 5.6 and 5.7, there is evidence of a reduction in BOD5 and Total Nitrogen within the BLSS. Again, these downward trends document the potential long-term benefits of the BSTF operations in reducing the historic accumulation of organically bound colloidal pollutants in the BLSS System.

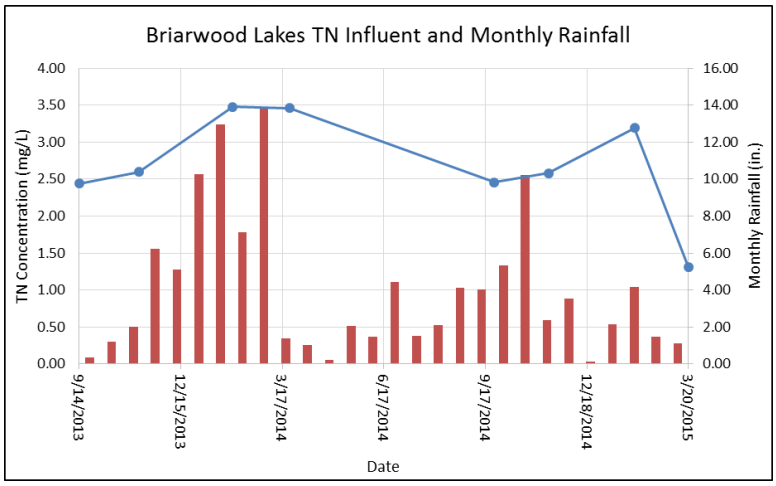


Figure 5.7 Briarwood Lake TN Trends from 9/2013 through 3/2015 Monitoring Period.

Long-term TP Mass Removal has been documented from the Schedule C monitoring program, yet the effectiveness of TP removal is less predictable. Inter-event treatment has proven to be reasonably consistent, yet the BSTF has a limited capacity to accumulate and store colloidal organic solids. Following long-term operations (estimated 12 continuous months) internal processes within the BSTF release more dissolved and colloidal pollutants (dissolved nitrogen and orthophosphate) than available treatment capacity of the BSTF.

5.4 Conclusions and Recommendations

Sarasota County has invested a significant amount of research, time and funding for the construction and evaluation of the BSTF inter-event treatment system. Although there are challenges for continued cost effective treatment of nutrients within the Alligator Creek/Lemon Bay watershed, there is potential for improved treatment effectiveness through continued research and process refinements of the inter-event concept for stormwater treatment. By way of the observed benefits of the BSTF, it can be concluded that the inter-event treatment concept is effective in treating high percentages of drainage basin flows to achieve effective pollutant mass reductions.

The following final recommendations to be considered for future operation of the BSTF:

5.4.1 Improve Performance with Higher Average Pumping Rate: The BSTF has the capacity to treat up to 2.33 times the annual runoff generated from the basin at a pumping rate of 1750 GPM. Since long-term beneficial trends were observed with the inter-event HF mode of treatment with an intermediate average pumping rate of 1000 GPM, it is likely that increasing the average pumping rate would improve the performance of the BSTF.

5.4.2 Improve Performance with Scheduled Solids Maintenance: A BSTF maintenance program should consider monitoring of changes in TSS and dissolved organic nitrogen. When increases in TSS and dissolved organic nitrogen occur, the BSTF should be considered for maintenance. Maintenance should include dewatering of the system, desiccation (drying of organic solids) and removal of at least 20-50% of the accumulated mass.

5.4.3 Improve Vegetative Coverage: It is possible to improve system BSTF performance by with expanded surface vegetation coverage in Zone 2 (decomposition zone) and possibly in Zone 3

(aerobic zone). Alternative floating plants may include white water lily and/or water lettuce. Floating vegetation can be more readily controlled and harvested.

5.4.4 Improve Performance with Scheduled Vegetation Harvesting: A BSTF maintenance program should consider routine harvesting of littoral and floating vegetation. It is important to avoid herbicide in harvesting. Harvesting should physically remove vegetation from the process and be considered seasonally. Harvested vegetation may provide planting benefits for other Sarasota County stormwater facilities.

5.4.5 Add Controlled Intermediate Polymer Addition: Consider the broadcast application of polymer (polyacrylamide) or chitosan prior to scheduled solids removal. Initial treatability studies of Schedule A monitoring (background studies) produced favorable results of polymer addition to promote flocculent settling in BLSS water samples.

5.4.6 Improve Performance with Fine Bubble Aeration: This option considers an improved method to aerate the BSTF with fine bubbles at Pump Station A. Fine or microbubble aeration has the potential for colloidal solids growth (without chemicals) and may complement the aeration function for ammonification and nitrification.

5.4.7 Create a Stormwater Research Center at the BSTF site: The pioneering successes and challenges of the BSTF are important factors in the progress of environmental nutrient management in Sarasota County and in Florida. The BSTF may bring opportunities for more research funding that benefits the stormwater profession. As a designated stormwater research center, the BSTF may open doors to professionals, regulators and the public to better understand the benefits of inter-event and media-based treatment and low-impact development practices.

As Sarasota County continues realizing the benefits of inter-event treatment at the BSTF, it is possible to plan or retrofit other stormwater treatment systems to produce more effective results for large mass pollutant removal that will provide improved natural system conditions of receiving waters.

APPENDIX A
Data, Results, and Records of Measured Pollutants

A.1. Schedule A Summary of Background Water and Sediments (AET, 2009)

Sample Point	1	2	3	Average (n = 3)
Time of Sampling	9:09 AM - 10: 25 AM	11:20 AM - 12:25 PM	1:40 PM - 2:40 PM	-
Water Column				
Secchi Depth, in.	7	8	12	9
Water Column Depth, ft.	5.42	5.50	4.67	5.20
Temperature, ºC	31.1	31.6	31.2	31.3
Conductivity, µS/cm	399	416	374	396
pH	8.3	9.0	8.5	8.6
Alkalinity, mg/L as $CaCO_3$	138	122	116	125
Total Suspended Solids, mg/L	48	48	24	40
Total Nitrogen, mg/L	3.63	3.13	2.23	3.00
Total Kjeldahl Nitrogen, mg/L	3.6	3.1	2.2	3.0
Organic Nitrogen, mg/L	3.58	3.08	2.18	2.95
Total Kjeldahl Nitrogen, Filtered, mg/L	1.15	1.95	1.15	1.42
Organic Nitrogen, Filtered, mg/L	1.13	1.93	1.13	1.40
Non-filtrable Organic Nitrogen, mg/L	2.45	1.15	1.05	1.55
Ammonia Nitrogen, mg/L	0.02	0.02	0.02	0.02
Total Oxidized Nitrogen, mg/L	0.025	0.025	0.025	0.025
Total Phosphorus, mg/L	0.27	0.22	0.18	0.22
Total Organic Phosphorus, mg/L	0.258	0.208	0.168	0.211
Filtered Total Phosphorus, mg/L	0.00	0.04	0.02	0.02
Organic Phosphorus, Filtered, mg/L	0.00	0.03	0.01	0.01
Non-filtrable Organic Phosphorus, mg/L	0.26	0.18	0.16	0.20
Orthophosphorus P, mg/L	0.012	0.012	0.012	0.012
Dissolved Organic Carbon, mg/L	23	23	28	25
Sediment				
Flocculent Sediment Layer Depth, in.	> 3	15	24	19.5*
Dissolved Oxygen, mg/L	< 0.25	0.02	0.04	< 0.1
Oxidation Reduction Potential, mV	-239	-178	-274	-230
pH	-	6.61	6.59	6.6*
Total Solids Content, %	10	11.1	5.3	8.8
% Volatile (Organic)	20	20	39	26.3

*Average value does not include Sample Point 1.

Source: AET Sampling Event (2009).

A.2. Schedule C Summary Data Table

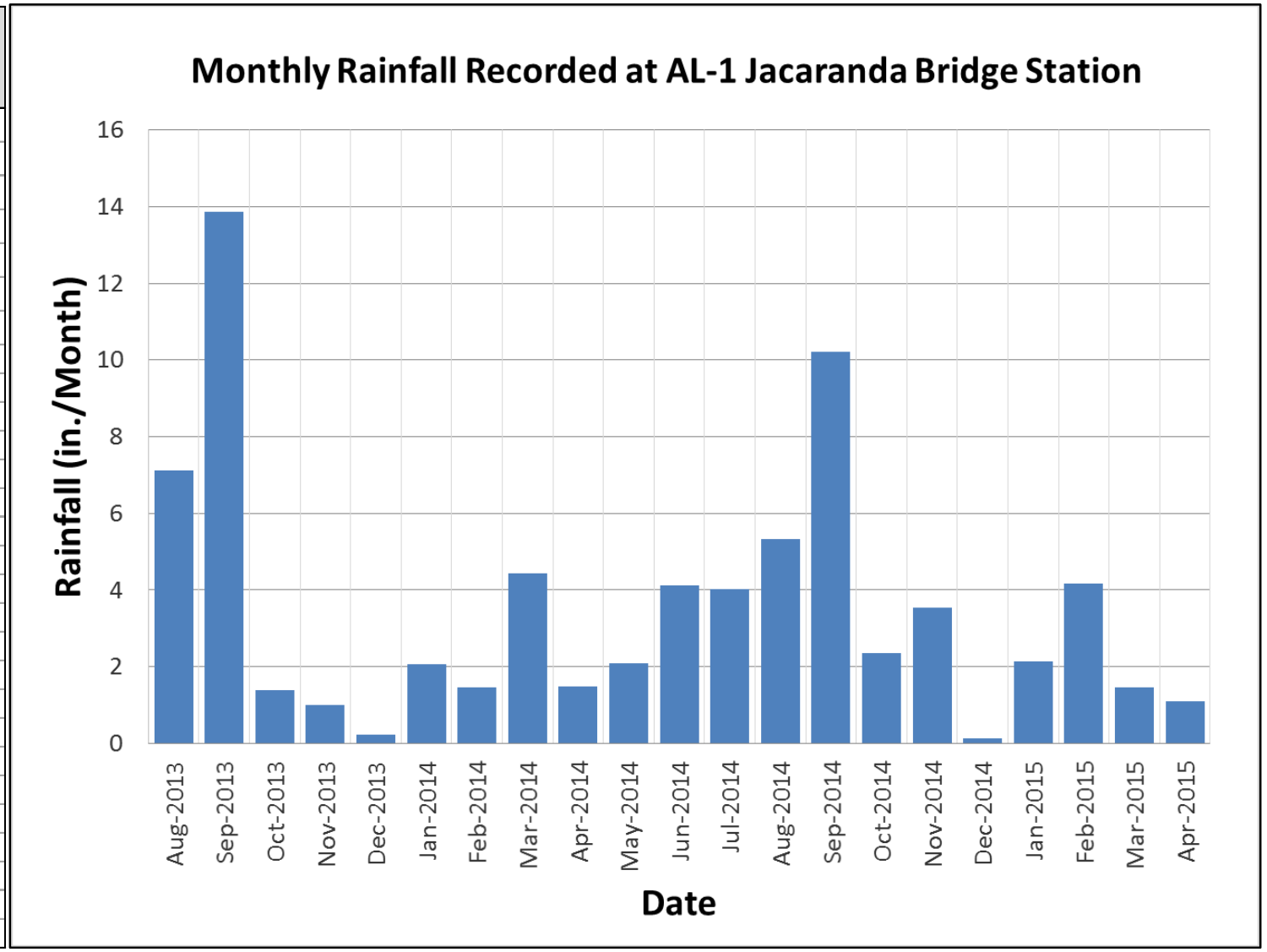
BTSF Influent Parameters (PS-A)	BWL Bimonthly Sampling Event ID (Division III)							
	BWL-1	**BWL-2**	**BWL-3**	**BWL-4**	**BWL-5B***	**BWL-6**	**BWL-7**	**BWL-8**
Sample Date	9/14/2013	11/7/2013	1/31/2014	3/24/2014	9/25/2014	11/13/2014	1/30/2015	3/20/2015
pH	8.38	8.78	8.21	8.66	8.61	8.93	8.98	6.80
Titrant added [mL]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity [mg/L as $CaCO_3$]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turbidity (NTU)	10.60	8.60	21.50	29.30	12.40	12.50	11.90	11.20
DO (mg/L)	8.72	16.53	9.53	7.18	9.42	14.90	13.25	4.04
DO (% Sat)	117.40	194.60	96.20	86.60	69.90	111.40	160.00	48.80
Specific Conductivity (µS/cm)	0.372	0.375	0.327	0.325	0.340	0.400	0.423	0.424
Temp (°C)	30.89	23.51	15.78	24.76	27.80	23.66	20.53	24.82
ORP	72.0	309.5	155.1	128.8	120.1	176.9	188.4	80.0
Time	0.53	0.52	0.50	0.54	0.56	0.71	0.68	0.60
Turbidity [NTU]	10.0	15.0	27.0	30.0	18.0	17.0	22.0	26.0
Copper [µG/L]	4.40	5.30	7.40	4.00	1.20	4.00	4.00	4.00
Zinc [µG/L]	13.40	9.10	15.70	10.00	5.70	6.00	10.30	8.41
Ammonia Nitrogen [mg/L]	0.012	0.008	0.031	0.008	0.034	0.054	0.036	0.021
Ammonia Nitrogen Dissolved [mg/L]	0.008	0.013	0.008	0.008	0.027	0.048	0.015	0.008
Organic Nitrogen Dissolved [mg/L]	1.04	1.01	1.09	1.28	0.97	1.06	1.32	1.29
TKN [mg/L]	2.43	2.59	3.48	3.46	2.46	2.57	3.18	3.13
TKN Dissolved [mg/L]	1.040	1.020	1.090	1.280	1.000	1.110	1.330	1.290
Total Nitrogen [mg/L]	2.44	2.60	3.48	3.46	2.46	2.58	3.19	1.31
Nitrate + Nitrite as N [mg/L]	0.007	0.009	0.004	0.004	0.004	0.011	0.011	0.016
Orthophosphate [mg/L]	0.016	0.011	0.005	0.002	0.005	0.002	0.002	0.003
Total Phosphorus [mg/L]	0.083	0.241	0.272	0.311	0.254	0.229	0.244	0.221
Chlorophyll A, Corrected [mg/m^3]	93.10	112.10	129.00	64.10	117.00	37.60	99.40	117.00
Total Alkalinity [mg/L as $CaCO_3$]	164	128	100	90	90	123	125	106
Total Suspended Solids (TSS) [mg/L]	23.1	21.3	42.7	48.0	26.8	15.6	15.7	32.0
BOD	0.00	7.47	7.34	13.40	6.76	6.85	7.57	7.84
Total Organic Carbon [mg/L]	12.8	13.8	14.2	17.3	13.1	15.6	16.3	17.2

BTSF Influent Parameters (PS-A)	BWL Bimonthly Sampling Event ID (Schedule C)							
	BWL-1	**BWL-2**	**BWL-3**	**BWL-4**	**BWL-5B***	**BWL-6**	**BWL-7**	**BWL-8**
Sample Date	9/14/2013	11/7/2013	1/31/2014	3/24/2014	9/25/2014	11/13/2014	1/30/2015	3/20/2015
pH	7.98	7.65	7.69	7.89	7.54	8.16	8.29	8.41
Titrant added [mL]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity [mg/L as $CaCO_3$]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turbidity (NTU)	6.90	5.60	9.60	11.90	6.20	11.80	8.10	19.50
DO (mg/L)	4.15	12.52	3.79	1.75	4.50	7.47	7.34	13.90
DO (% Sat)	56.10	146.20	155.90	22.70	34.20	57.30	88.40	171.30
Specific Conductivity (µS/cm)	0.381	0.393	0.345	0.341	0.186	0.408	0.436	0.393
Temp (°C)	31.10	22.98	15.75	24.70	28.39	22.37	18.89	26.03
ORP	32.6	343.0	155.9	68.1	124.6	184.5	176.0	73.8
Time	0.53	0.52	0.50	0.54	0.56	0.71	0.67	0.60
Turbidity [NTU]	7.1	12.0	16.0	18.0	8.8	13.0	17.0	20.0
Copper [µG/L]	4.00	5.30	5.90	4.00	1.83	4.00	4.40	4.00
Zinc [µG/L]	9.30	9.90	30.70	7.00	13.20	8.10	10.20	8.80
Ammonia Nitrogen [mg/L]	0.124	0.039	0.145	0.010	0.023	0.027	0.037	0.140
Ammonia Nitrogen Dissolved [mg/L]	0.008	0.011	0.096	0.008	0.011	0.016	0.010	0.102
Organic Nitrogen Dissolved [mg/L]	1.02	0.97	1.04	1.21	0.95	1.04	1.31	1.49
TKN [mg/L]	2.03	1.93	2.44	3.07	1.66	2.00	2.67	2.68
TKN Dissolved [mg/L]	1.020	0.976	1.140	1.210	0.961	1.060	1.320	1.590
Total Nitrogen [mg/L]	2.06	2.09	2.69	3.18	1.76	2.09	2.81	1.64
Nitrate + Nitrite as N [mg/L]	0.033	0.160	0.254	0.107	0.100	0.090	0.136	0.115
Orthophosphate [mg/L]	0.019	0.028	0.008	0.006	0.024	0.002	0.002	0.032
Total Phosphorus [mg/L]	0.114	0.168	0.210	0.269	0.151	0.209	0.214	0.235
Chlorophyll A Corrected [mg/m^3]	58.50	88.40	82.00	98.50	39.50	50.40	66.80	56.50
Total Alkalinity [mg/L as $CaCO_3$]	104	131	103	90	91	121	126	106
Total Suspended Solids (TSS) [mg/L]	8.2	25.0	24.2	24.0	12.4	19.2	27.3	18.0
BOD	0.00	4.40	5.44	6.00	3.26	3.71	5.41	6.35
Total Organic Carbon [mg/L]	11.9	12.8	14.4	17.8	13.0	15.1	15.4	17.0

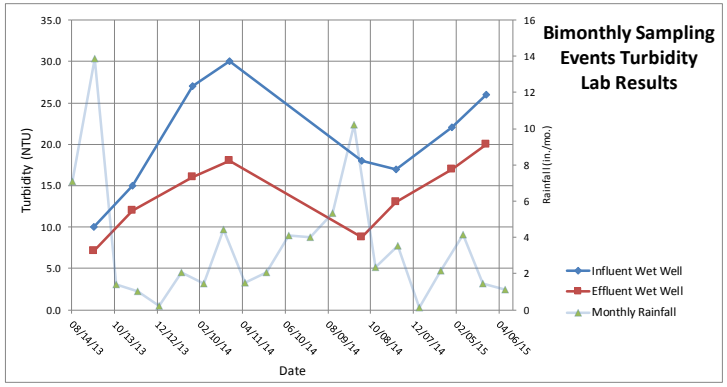
*Note: Sampling Event 5A (performed on 7/30/2014) was not utilized due to incomplete lab samples.

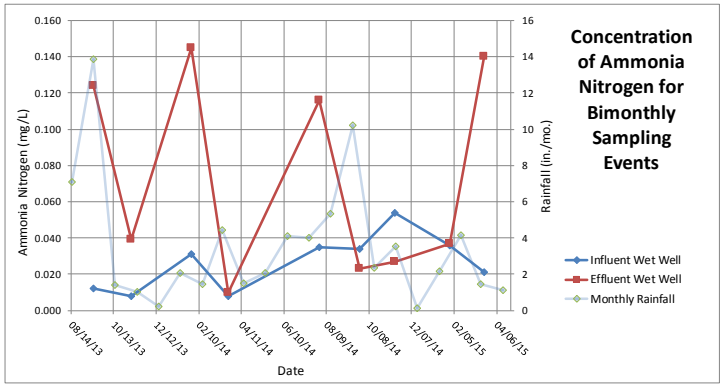
A.3. Rainfall Data

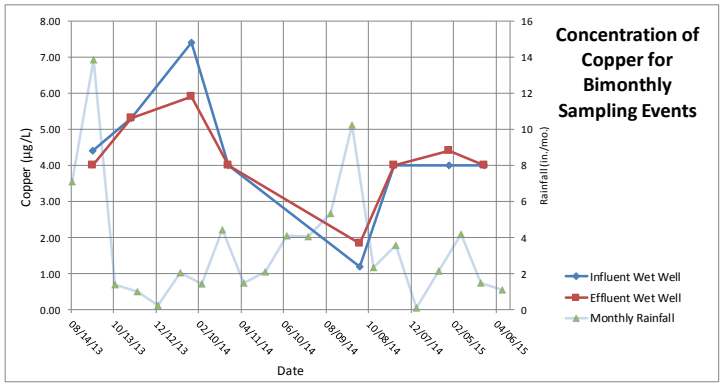
Date	Monthly Rainfall (in.)
Jan-2013	0.34
Feb-2013	1.20
Mar-2013	2.00
Apr-2013	6.21
May-2013	5.10
Jun-2013	10.28
Jul-2013	12.98
Aug-2013	7.11
Sep-2013	13.85
Oct-2013	1.40
Nov-2013	1.01
Dec-2013	0.22
Jan-2014	2.06
Feb-2014	1.45
Mar-2014	4.44
Apr-2014	1.49
May-2014	2.09
Jun-2014	4.12
Jul-2014	4.03
Aug-2014	5.32
Sep-2014	10.22
Oct-2014	2.35
Nov-2014	3.55
Dec-2014	0.12
Jan-2015	2.15
Feb-2015	4.17
Mar-2015	1.46
Apr-2015	1.11

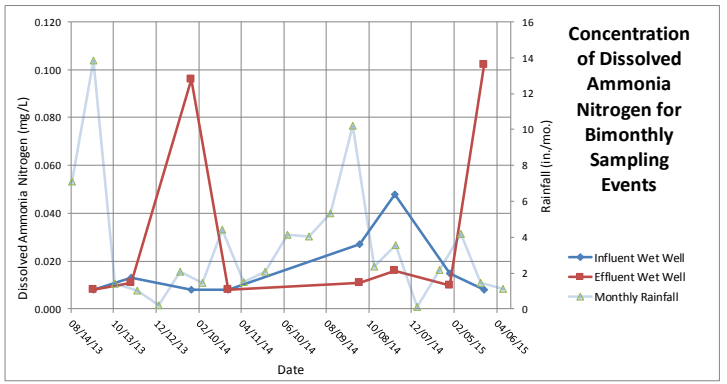


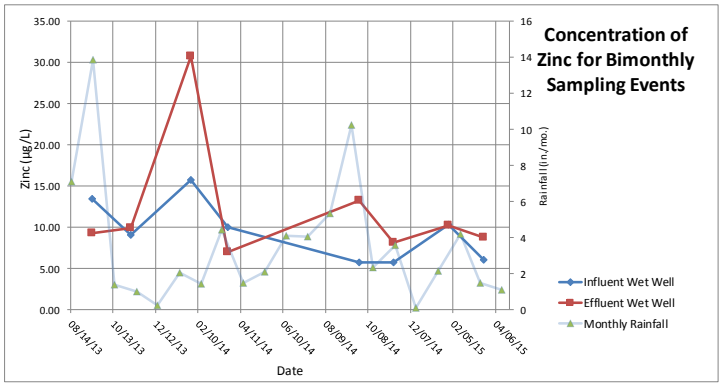
A.4. Schedule C Summary of Bimonthly Results (319h Criteria)

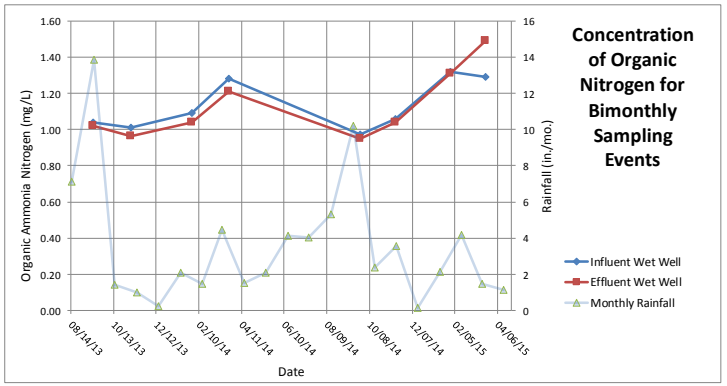


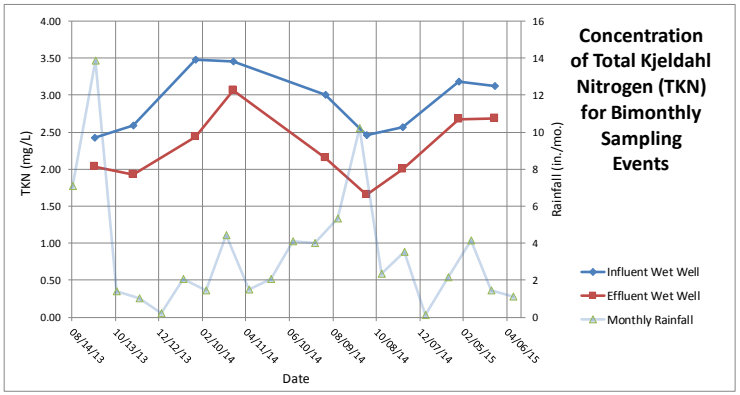


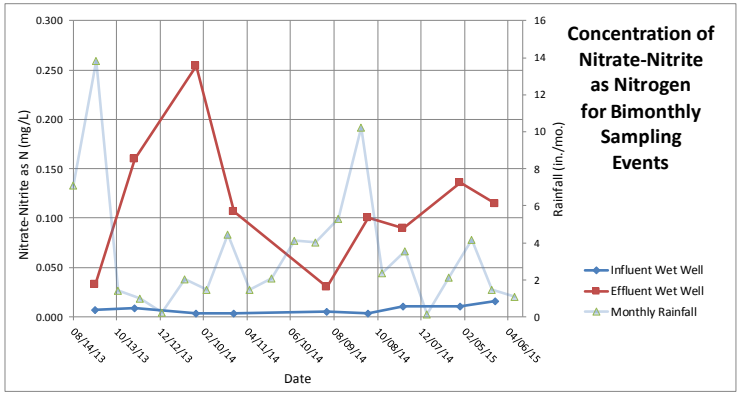


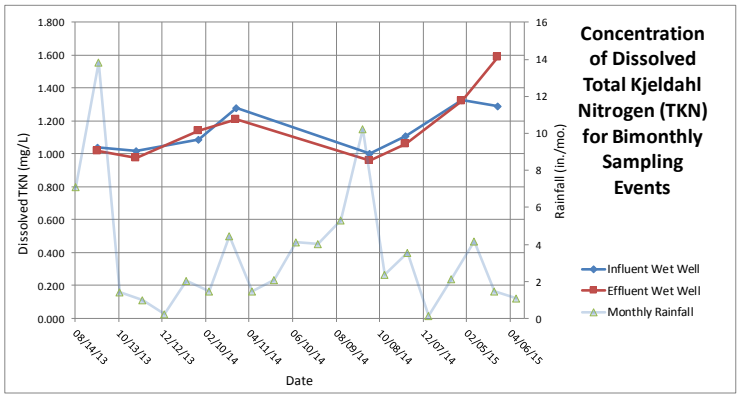


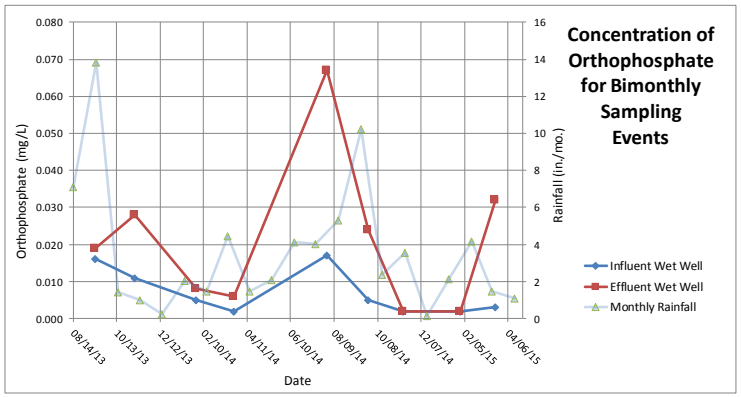


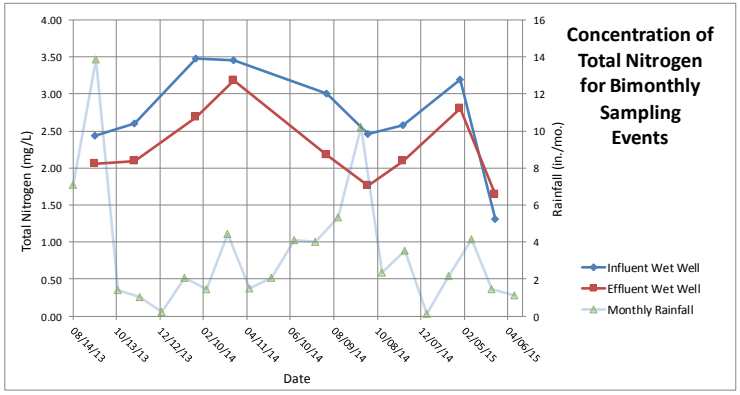


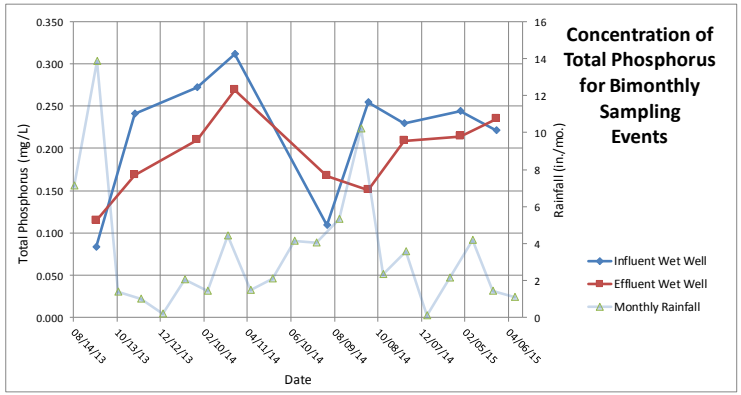

Concentration of Total Kjeldahl Nitrogen (TKN) for Bimonthly Sampling Events
TKN (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

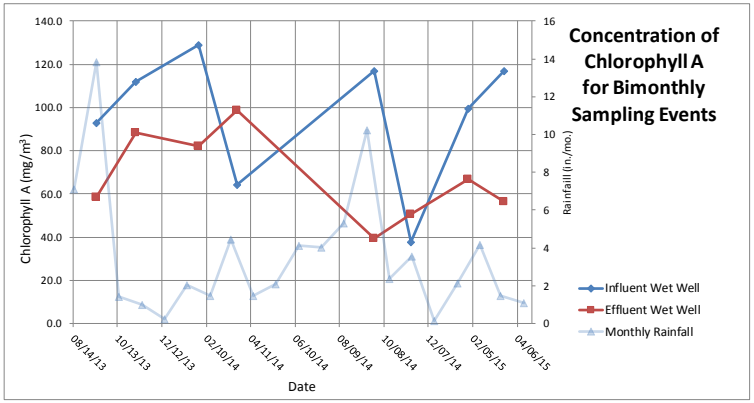

Concentration of Nitrate-Nitrite as Nitrogen for Bimonthly Sampling Events
Nitrate-Nitrite as N (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

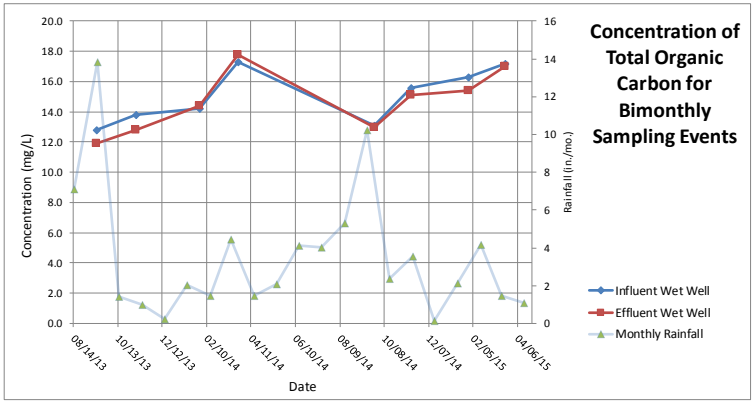

Concentration of Dissolved Total Kjeldahl Nitrogen (TKN) for Bimonthly Sampling Events
Dissolved TKN (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

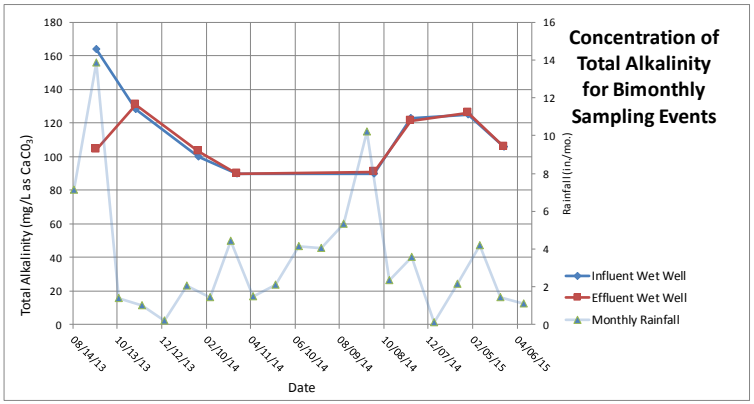

Concentration of Orthophosphate for Bimonthly Sampling Events
Orthophosphate (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

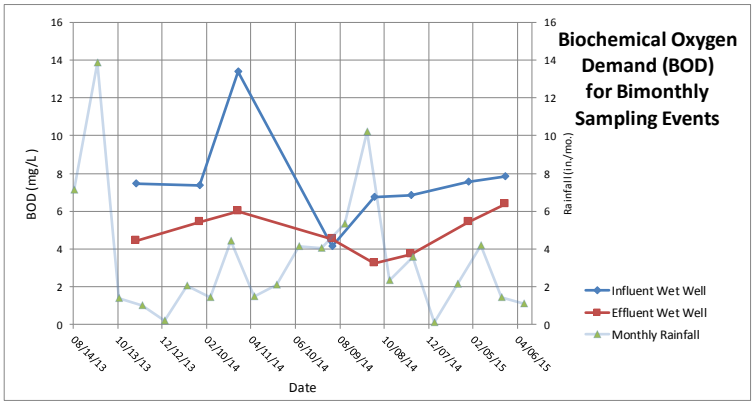

Concentration of Total Nitrogen for Bimonthly Sampling Events
Total Nitrogen (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

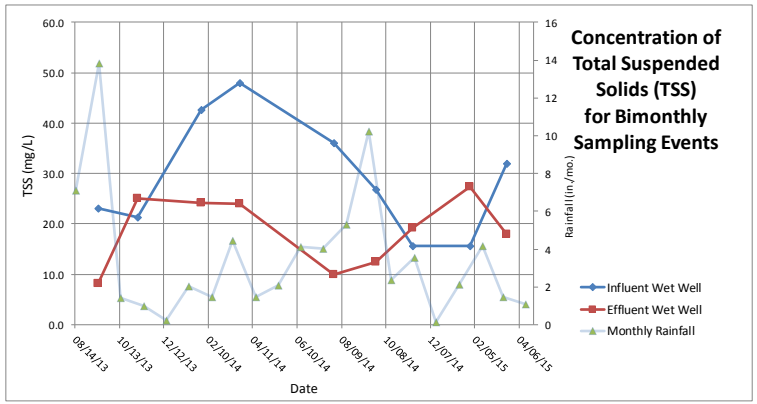

Concentration of Total Phosphorus for Bimonthly Sampling Events
Total Phosphorus (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall


Concentration of Chlorophyll A for Bimonthly Sampling Events
Chlorophyll A (mg/m³)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall


Concentration of Total Organic Carbon for Bimonthly Sampling Events
Concentration (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall


Concentration of Total Alkalinity for Bimonthly Sampling Events
Total Alkalinity (mg/L as CaCO3)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall


Biochemical Oxygen Demand (BOD) for Bimonthly Sampling Events
BOD (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall


Concentration of Total Suspended Solids (TSS) for Bimonthly Sampling Events
TSS (mg/L)
Rainfall (in./mo.)
Date
Influent Wet Well
Effluent Wet Well
Monthly Rainfall

BSTF BIMONTHLY EVENT REPORT NO. 1	
1.0 General Sample Information	
Date/Time	09.14.13 / 12:00 pm
Interevent Period (days)	60
Ambient Conditions	Hot, cloudy, may have rained the night prior
Technician Name(s)	Erik Stuart
Site Rain Gauge (in.)	0.75
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.55
Nitrification Zone	14.35
Reaeration Zone	13.70
Lake Discharge Weir	11.05
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	2,637.0
Pump A2 (hrs)	2,597.0
Pump B1 (hrs)	2,906.0
Pump B2 (hrs)	1,977.0
Total Treated Flow (MG at Influent PSA)	86.4
Irrigation Pump (hrs)	512.0
Harvested Flow (MG)	0.335
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	23.1
TN (mg/L at PSA Influent)	2.44
TP (mg/L at PSA Influent)	0.083
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	8.17
TN (mg/L at PSB Effluent)	2.06
TP (mg/L at PSB Effluent)	0.114
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	6,697.6
TSS Reduction in Concentration (mg/L)	14.9
TSS Mass Removed this Period (lbs)	10,819.5
TN Mass Removal Goal (lbs)	275.8
TN Reduction in Concentration (mg/L)	0.380
TN Mass Removed this Period (lbs)	279.8
TP Mass Removal Goal (lbs)	76.3
TP Reduction in Concentration (mg/L)	-0.031
TP Mass Removed this Period (lbs)	-22.2

BSTF BIMONTHLY EVENT REPORT NO. 2	
1.0 General Sample Information	
Date/Time	11.07.13 / 11:00 am
Interevent Period (days)	54
Ambient Conditions	Hot, overcast
Technician Name(s)	Erik Stuart
Site Rain Gauge (in.)	0
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.45
Nitrification Zone	13.30
Reaeration Zone	12.20
Lake Discharge Weir	11.05
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	3,307.2
Pump A2 (hrs)	3,071.8
Pump B1 (hrs)	3,351.4
Pump B2 (hrs)	2,445.0
Total Treated Flow (MG at Influent PSA)	68.7
Irrigation Pump (hrs)	568.3
Harvested Flow (MG)	0.220
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	21.3
TN (mg/L at PSA Influent)	2.60
TP (mg/L at PSA Influent)	0.241
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	25.0
TN (mg/L at PSB Effluent)	2.09
TP (mg/L at PSB Effluent)	0.168
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	6,027.9
TSS Reduction in Concentration (mg/L)	-3.7
TSS Mass Removed this Period (lbs)	-2,088.0
TN Mass Removal Goal (lbs)	248.3
TN Reduction in Concentration (mg/L)	0.510
TN Mass Removed this Period (lbs)	296.4
TP Mass Removal Goal (lbs)	68.6
TP Reduction in Concentration (mg/L)	0.073
TP Mass Removed this Period (lbs)	42.2

BSTF BIMONTHLY EVENT REPORT NO. 3	
1.0 General Sample Information	
Date/Time	01.31.2014 / 9:30 AM
Interevent Period (days)	85
Ambient Conditions	No rain
Technician Name(s)	Erik Stuart
Site Rain Gauge (in.)	2.75
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.45
Nitrification Zone	13.55
Reaeration Zone	12.30
Lake Discharge Weir	10.75
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	3,976.9
Pump A2 (hrs)	3,689.8
Pump B1 (hrs)	3,678.2
Pump B2 (hrs)	2,982.5
Total Treated Flow (MG at Influent PSA)	77.3
Irrigation Pump (hrs)	1,036.0
Harvested Flow (MG)	1.824
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	42.7
TN (mg/L at PSA Influent)	3.48
TP (mg/L at PSA Influent)	0.272
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	24.2
TN (mg/L at PSB Effluent)	2.69
TP (mg/L at PSB Effluent)	0.210
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	9,488.3
TSS Reduction in Concentration (mg/L)	18.5
TSS Mass Removed this Period (lbs)	12,480.4
TN Mass Removal Goal (lbs)	390.8
TN Reduction in Concentration (mg/L)	0.790
TN Mass Removed this Period (lbs)	554.4
TP Mass Removal Goal (lbs)	108.1
TP Reduction in Concentration (mg/L)	0.062
TP Mass Removed this Period (lbs)	43.5

BSTF BIMONTHLY EVENT REPORT NO. 4	
1.0 General Sample Information	
Date/Time	03.24.2014 / 1:00 PM
Interevent Period (days)	52
Ambient Conditions	Rain
Technician Name(s)	Erik Stuart
Site Rain Gauge (in.)	No data recorded
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.35
Nitrification Zone	13.30
Reaeration Zone	12.00
Lake Discharge Weir	11.07
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	4,163.4
Pump A2 (hrs)	4,433.0
Pump B1 (hrs)	3,841.0
Pump B2 (hrs)	3,512.7
Total Treated Flow (MG at Influent PSA)	55.8
Irrigation Pump (hrs)	1,147.1
Harvested Flow (MG)	0.433
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	48.0
TN (mg/L at PSA Influent)	3.460
TP (mg/L at PSA Influent)	0.311
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	24.0
TN (mg/L at PSB Effluent)	3.180
TP (mg/L at PSB Effluent)	0.269
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	5,804.6
TSS Reduction in Concentration (mg/L)	24.0
TSS Mass Removed this Period (lbs)	11,319.5
TN Mass Removal Goal (lbs)	239.1
TN Reduction in Concentration (mg/L)	0.280
TN Mass Removed this Period (lbs)	141.0
TP Mass Removal Goal (lbs)	66.1
TP Reduction in Concentration (mg/L)	0.042
TP Mass Removed this Period (lbs)	20.5

BSTF BIMONTHLY EVENT REPORT NO. 5A	
1.0 General Sample Information	
Date/Time	07.30.2014 / 4:00 PM
Interevent Period (days)	128
Ambient Conditions	Hot, mostly sunny with intermittent light breezes
Technician Name(s)	Phong Nguyen, Hunter Yates
Site Rain Gauge (in.)	0.25
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.31
Nitrification Zone	-
Reaeration Zone	13.38
Lake Discharge Weir	11.50
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	4,701.7
Pump A2 (hrs)	5,160.8
Pump B1 (hrs)	4,248.1
Pump B2 (hrs)	3,918.8
Total Treated Flow (MG at Influent PSA)	76.0
Irrigation Pump (hrs)	1,318.4
Harvested Flow (MG)	0.668
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	36.0
TN (mg/L at PSA Influent)	3.000
TP (mg/L at PSA Influent)	0.109
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	10.0
TN (mg/L at PSB Effluent)	2.150
TP (mg/L at PSB Effluent)	0.151
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	14,288.3
TSS Reduction in Concentration (mg/L)	26.0
TSS Mass Removed this Period (lbs)	16,652.9
TN Mass Removal Goal (lbs)	588.4
TN Reduction in Concentration (mg/L)	0.850
TN Mass Removed this Period (lbs)	553.1
TP Mass Removal Goal (lbs)	162.7
TP Reduction in Concentration (mg/L)	-0.042
TP Mass Removed this Period (lbs)	-26.1

BSTF BIMONTHLY EVENT REPORT NO. 5B	
1.0 General Sample Information	
Date/Time	09.25.2014 / 1:20 PM
Interevent Period (days)	57
Ambient Conditions	Hot, mostly sunny
Technician Name(s)	Mark Flint, Phong Nguyen
Site Rain Gauge (in.)	4.75
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.40
Nitrification Zone	-
Reaeration Zone	13.30
Lake Discharge Weir	10.70
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	5,152.1
Pump A2 (hrs)	5,349.1
Pump B1 (hrs)	4,692.2
Pump B2 (hrs)	4,129.0
Total Treated Flow (MG at Influent PSA)	38.3
Irrigation Pump (hrs)	1,378.9
Harvested Flow (MG)	0.236
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	26.8
TN (mg/L at PSA Influent)	2.460
TP (mg/L at PSA Influent)	0.254
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	12.4
TN (mg/L at PSB Effluent)	1.760
TP (mg/L at PSB Effluent)	0.151
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	6,362.8
TSS Reduction in Concentration (mg/L)	14.4
TSS Mass Removed this Period (lbs)	4,649.9
TN Mass Removal Goal (lbs)	262.0
TN Reduction in Concentration (mg/L)	0.700
TN Mass Removed this Period (lbs)	228.0
TP Mass Removal Goal (lbs)	72.5
TP Reduction in Concentration (mg/L)	0.103
TP Mass Removed this Period (lbs)	33.4

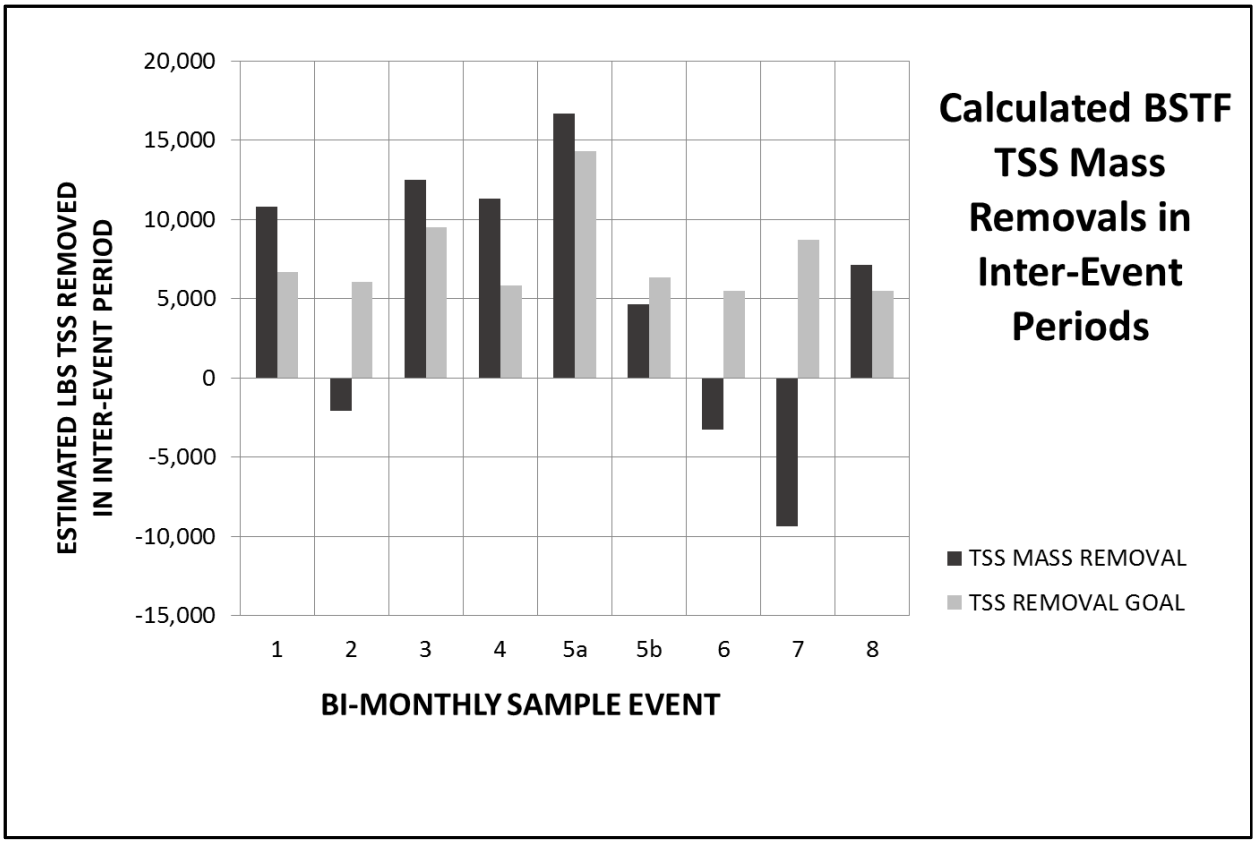
BSTF BIMONTHLY EVENT REPORT NO. 6	
1.0 General Sample Information	
Date/Time	11.13.2014 / 5:00 PM
Interevent Period (days)	49
Ambient Conditions	Cool, mostly sunny
Technician Name(s)	Mark Flint, Phong Nguyen
Site Rain Gauge (in.)	0
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.25
Nitrification Zone	13.65
Reaeration Zone	11.80
Lake Discharge Weir	11.10
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	6,326.9
Pump A2 (hrs)	5,350.3
Pump B1 (hrs)	5,139.8
Pump B2 (hrs)	4,591.7
Total Treated Flow (MG at Influent PSA)	108.9
Irrigation Pump (hrs)	1,428.7
Harvested Flow (MG)	0.194
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	15.6
TN (mg/L at PSA Influent)	2.580
TP (mg/L at PSA Influent)	0.229
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	19.2
TN (mg/L at PSB Effluent)	2.090
TP (mg/L at PSB Effluent)	0.209
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	5,469.7
TSS Reduction in Concentration (mg/L)	-3.6
TSS Mass Removed this Period (lbs)	-3,249.5
TN Mass Removal Goal (lbs)	225.3
TN Reduction in Concentration (mg/L)	0.5
TN Mass Removed this Period (lbs)	448.8
TP Mass Removal Goal (lbs)	62.3
TP Reduction in Concentration (mg/L)	0.0
TP Mass Removed this Period (lbs)	18.5

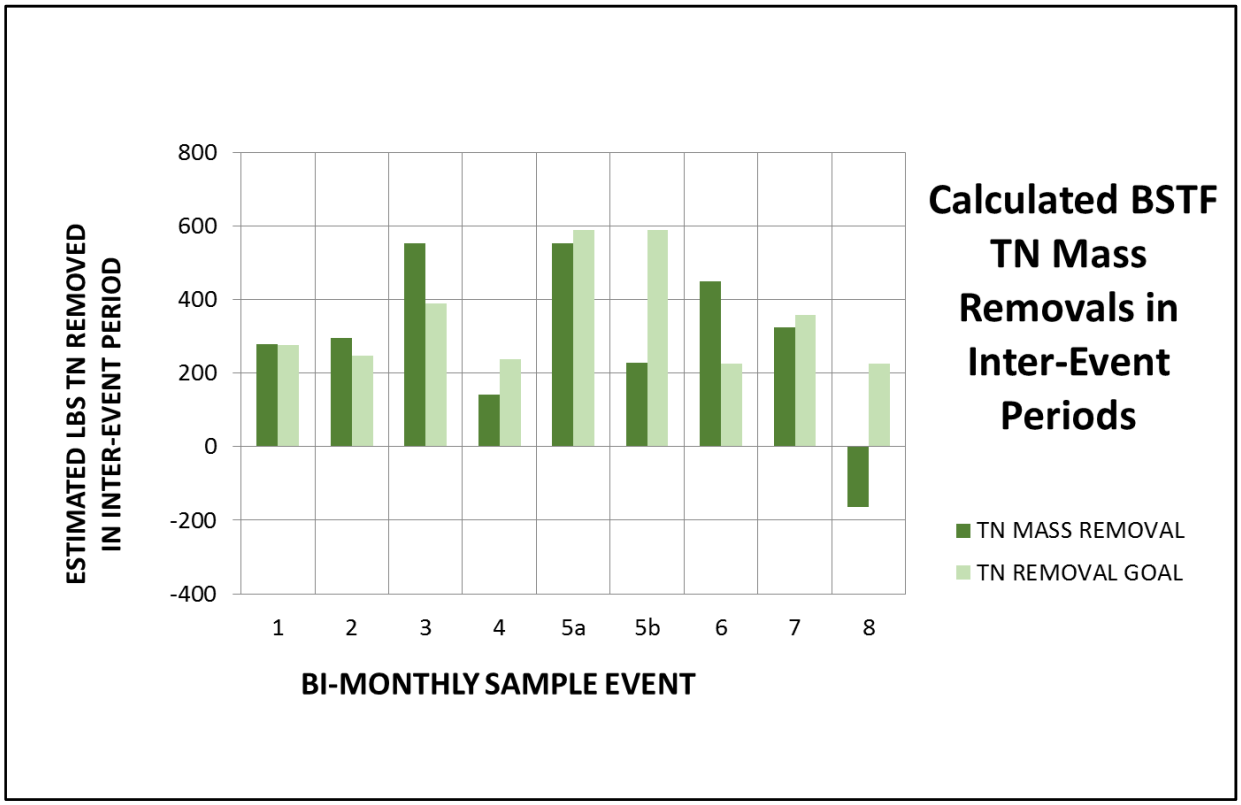
BSTF BIMONTHLY EVENT REPORT NO. 7	
1.0 General Sample Information	
Date/Time	1.30.2015 / 4:00 PM
Interevent Period (days)	78
Ambient Conditions	Cool, clear skies
Technician Name(s)	Phong Nguyen, Avedis Serpekian
Site Rain Gauge (in.)	N/A (rain gauge broken)
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.42
Nitrification Zone	12.96
Reaeration Zone	11.78
Lake Discharge Weir	-
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	7,537.2
Pump A2 (hrs)	5,769.3
Pump B1 (hrs)	5,799.5
Pump B2 (hrs)	5,196.0
Total Treated Flow (MG at Influent PSA)	97.8
Irrigation Pump (hrs)	1,599.1
Harvested Flow (MG)	0.665
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	15.7
TN (mg/L at PSA Influent)	3.190
TP (mg/L at PSA Influent)	0.244
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	27.3
TN (mg/L at PSB Effluent)	2.810
TP (mg/L at PSB Effluent)	0.214
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	8,706.9
TSS Reduction in Concentration (mg/L)	-11.6
TSS Mass Removed this Period (lbs)	-9,389.2
TN Mass Removal Goal (lbs)	358.6
TN Reduction in Concentration (mg/L)	0.380
TN Mass Removed this Period (lbs)	325.0
TP Mass Removal Goal (lbs)	99.2
TP Reduction in Concentration (mg/L)	0.030
TP Mass Removed this Period (lbs)	25.6

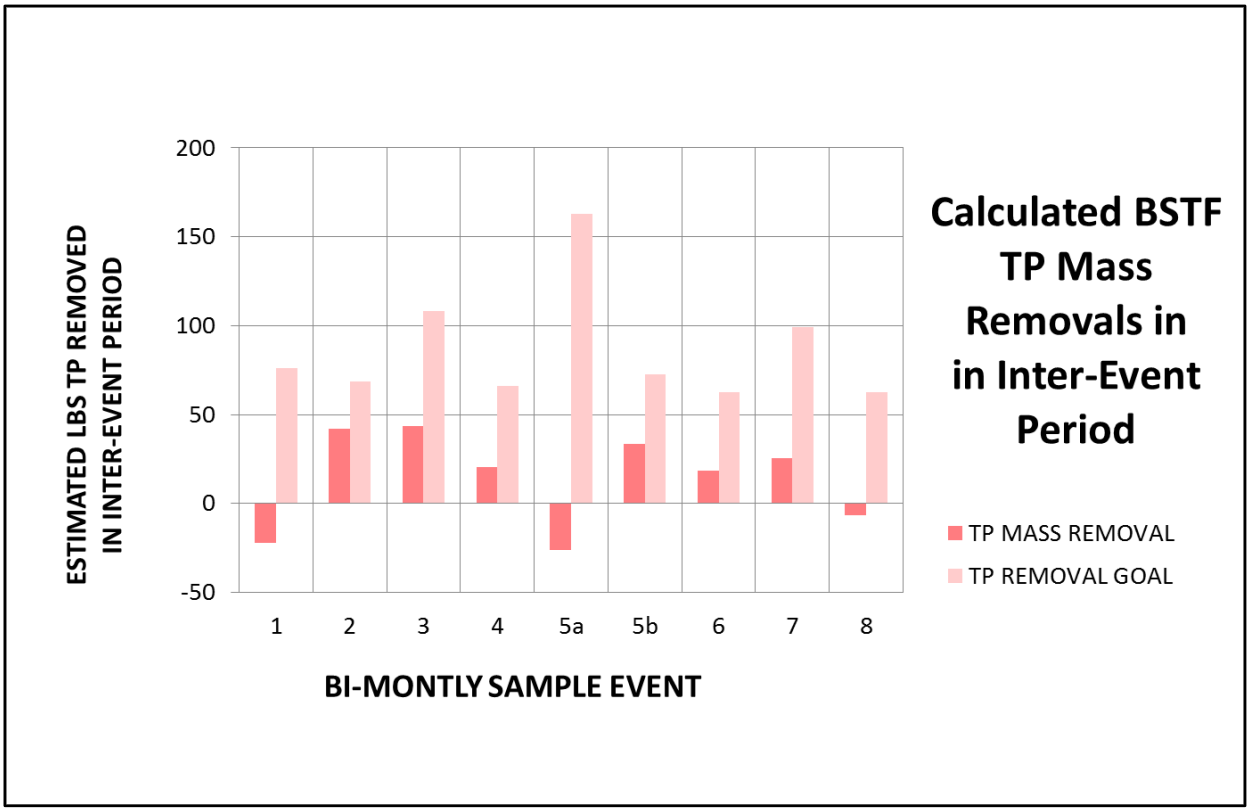
BSTF BIMONTHLY EVENT REPORT NO. 8	
1.0 General Sample Information	
Date/Time	3.20.2015 / 1:30 PM
Interevent Period (days)	49
Ambient Conditions	Warm, clear skies
Technician Name(s)	Phong Nguyen, Mark Flint
Site Rain Gauge (in.)	N/A (rain gauge not replaced)
2.0 Reported Stage Readings (ft.)	
Fermentation Basin	14.45
Nitrification Zone	12.45
Reaeration Zone	11.50
Lake Discharge Weir	11.00
3.0 Pump Run Times (Totalized)	
Pump A1 (hrs)	8,034.2
Pump A2 (hrs)	6,279.5
Pump B1 (hrs)	6,136.9
Pump B2 (hrs)	5,612.2
Total Treated Flow (MG at Influent PSA)	60.4
Irrigation Pump (hrs)	1,663.3
Harvested Flow (MG)	0.250
4.0 Reported Stormwater Inflow Water Quality	
TSS (mg/L at PSA Influent)	32.0
TN (mg/L at PSA Influent)	1.310
TP (mg/L at PSA Influent)	0.221
5.0 Treated Stormwater Effluent fron BSTF	
TSS (mg/L at PSB Effuent)	18.0
TN (mg/L at PSB Effluent)	1.640
TP (mg/L at PSB Effluent)	0.235
6.0 Summary of 319h Grant Key Parameters	
TSS Mass Removal Goal (lbs)	5,469.7
TSS Reduction in Concentration (mg/L)	14.0
TSS Mass Removed this Period (lbs)	7,117.1
TN Mass Removal Goal (lbs)	225.3
TN Reduction in Concentration (mg/L)	-0.330
TN Mass Removed this Period (lbs)	-164.1
TP Mass Removal Goal (lbs)	62.3
TP Reduction in Concentration (mg/L)	-0.014
TP Mass Removed this Period (lbs)	-6.7

BSTF Year 1 Pollutant Removal Estimates (Reporting Period: 9/2013-9/2014)	
Reporting Parameter	**Mass Removed (lb)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	48,670
TSS Mass Removed over Report Period	**53,834**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,004
TN Mass Removed over Report Period	**2,053**
TP Mass Removal Goal (Adjusted for Reporting Period)	554
TP Mass Removed over Report Period	**91**

BSTF Overall Pollutant Removal Estimates (Reporting Period: 9/2013-3/2015)	
Reporting Parameter	**Mass Removed (lb)**
TSS Mass Removal Goal (Adjusted for Reporting Period)	68,316
TSS Mass Removed over Report Period	**48,313**
TN Mass Removal Goal (Adjusted for Reporting Period)	2,814
TN Mass Removed over Report Period	**2,662**
TP Mass Removal Goal (Adjusted for Reporting Period)	778
TP Mass Removed over Report Period	**129**


Calculated BSTF TSS Mass Removals in Inter-Event Periods
ESTIMATED LBS TSS REMOVED IN INTER-EVENT PERIOD
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1
2
3
4
5a
5b
6
7
8
BI-MONTHLY SAMPLE EVENT
TSS MASS REMOVAL
TSS REMOVAL GOAL


Calculated BSTF TN Mass Removals in Inter-Event Periods
ESTIMATED LBS TN REMOVED IN INTER-EVENT PERIOD
800
600
400
200
0
-200
-400
1
2
3
4
5a
5b
6
7
8
BI-MONTHLY SAMPLE EVENT
TN MASS REMOVAL
TN REMOVAL GOAL


Calculated BSTF TP Mass Removals in in Inter-Event Period
ESTIMATED LBS TP REMOVED IN INTER-EVENT PERIOD
200
150
100
50
0
-50
1
2
3
4
5a
5b
6
7
8
BI-MONTLY SAMPLE EVENT
TP MASS REMOVAL
TP REMOVAL GOAL

A.5. Schedule C Benchmark Enviroanalytical Raw Data

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 13090584

Watermark Engineering Group
1422 Apollo Beach Blvd
Apollo Beach, Fl 33572

Project Name : BRIARWOOD BIMONTHLY
Date Received : 09/14/2013
Time Received : 1429

Submission Number 13090584

Sample Number: 001
Sample Date: 09/14/2013
Sample Time: 1250
Sample Description: BWL-Bimonthly-1-1
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	10	NTU	0.05	0.05	180.1	09/15/2013	13:20	BG
COPPER	4.40 I	UG/L	4	16	200.7	09/19/2013	17:01	JSM
ZINC	13.4	UG/L	1.4	5.6	200.7	09/19/2013	17:01	JSM
AMMONIA NITROGEN	0.012 I	MG/L	0.008	0.032	350.1	09/19/2013	15:15	DM
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	09/19/2013	15:13	DM
ORGANIC NITROGEN, DISSOLVED	1.04	MG/L	0.05	0.20	351-350.1	10/02/2013	13:01	JER
TOTAL KJELDAHL NITROGEN	2.43	MG/L	0.05	0.20	351.2	10/02/2013	13:00	JER
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.04	MG/L	0.05	0.20	351.2	10/02/2013	13:01	JER
TOTAL NITROGEN	2.44	MG/L	0.05	0.20	353+351	10/02/2013	13:00	JER/WY
NITRATE+NITRITE AS N	0.007 IJ4	MG/L	0.004	0.016	353.2	09/18/2013	10:00	WY
ORTHO PHOSPHORUS AS P	0.016	MG/L	0.002	0.008	365.3	09/16/2013	09:25	MR
TOTAL PHOSPHORUS AS P	0.083	MG/L	0.008	0.032	365.3	09/17/2013	12:50	MR
CHLOROPHYLL A, CORRECTED	93.1	MG/M3	0.25	1.00	445.0	09/20/2013	12:25	BG
TOTAL ALKALINITY (CACO3)	164	MG/L	0.594	2.376	SM2320B	09/23/2013	12:32	MR
TOTAL SUSPENDED SOLIDS	23.1	MG/L	0.570	2.280	SM2540D	09/16/2013	14:13	JA
TOTAL ORGANIC CARBON	12.8	MG/L	0.271	1.084	SM5310B	09/20/2013	14:47	KD

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Submission Number 13090584

Sample Number: 002
Sample Date: 09/14/2013
Sample Time: 1255
Sample Description: BWL-Bimonthly-1-6
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	7.1	NTU	0.05	0.05	180.1	09/15/2013	13:20	BG
COPPER	4 U	UG/L	4	16	200.7	09/19/2013	17:04	JSM
ZINC	9.30	UG/L	1.4	5.6	200.7	09/19/2013	17:04	JSM
AMMONIA NITROGEN	0.124	MG/L	0.008	0.032	350.1	09/19/2013	15:19	DM
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	09/19/2013	15:17	DM
ORGANIC NITROGEN, DISSOLVED	1.02	MG/L	0.05	0.20	351-350.1	10/02/2013	13:03	JER
TOTAL KJELDAHL NITROGEN	2.03	MG/L	0.05	0.20	351.2	10/02/2013	13:02	JER
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.02	MG/L	0.05	0.20	351.2	10/02/2013	13:03	JER
TOTAL NITROGEN	2.06	MG/L	0.05	0.20	353+351	10/02/2013	13:02	JER/WY
NITRATE+NITRITE AS N	0.033	MG/L	0.004	0.016	353.2	09/18/2013	10:00	WY
ORTHO PHOSPHORUS AS P	0.019	MG/L	0.002	0.008	365.3	09/16/2013	09:28	MR
TOTAL PHOSPHORUS AS P	0.114	MG/L	0.008	0.032	365.3	09/17/2013	12:51	MR
CHLOROPHYLL A, CORRECTED	58.5	MG/M3	0.25	1.00	445.0	09/20/2013	12:25	BG
TOTAL ALKALINITY (CACO3)	104	MG/L	0.594	2.376	SM2320B	09/23/2013	12:32	MR
TOTAL SUSPENDED SOLIDS	81.7	MG/L	0.570	2.280	SM2540D	09/16/2013	14:14	JA
TOTAL ORGANIC CARBON	11.9	MG/L	0.271	1.084	SM5310B	09/20/2013	15:02	KD

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

Dale D. Dixon / Laboratory Director — 10/04/2013 Date

Tülay Tanrisever/ QC Officer

Jennifer Hatfield / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES: Chlorophyll A lab filtered on 09/15/13 at 1230.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

Benchmark EnviroAnalytical,Inc
1711 12th Street East
Palmetto, Fl 34221
941-723-9986
941-723-6061 Fax
www.benchmarkea.com

Client Information: **Watermark Engineering Group, Inc.**
1422 Apollo Beach Blvd.
Apollo Beach, Fl 33572
813-641-1200
Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility ~~Weekly~~ Bimonthly
Profile 560

Laboratory Submission # 1309058Y

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 9/15 1230	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) (Lab Filtered)	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2 ✓	Plain	Plain	1:4 HNO_3 pH<2 ✓	
Bimonthly 1-1			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 1 Quart Plastic	1 x ½ Pint Plastic	
BWL-~~OPT~~__-_____	G	SW	Date & Time: 9-14-13 12:50							1
Bimonthly 1-6 BWL-~~OPT~~__-_____	G	SW	Date & Time: 9-14-13 12:55							2
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____-Dup	G	SW	Date & Time:							
	G	SW	Date & Time:							

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).
2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SDMNT), or sludge (SLDG).
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container.

Laboratory Sample Acceptability: pH <2 : ✓
BEA Temperature: 0.9°C

Instructions:
1. Each bottle has a label identifying sample ID, premeasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3. All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4. The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

1	Collected By: Erik Strenert	Date 09/14/13	Time 1429	Received By: Bradley Moran	Date 9/14/13	Time 1429

Erik Strenert

4 of 4

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 13110291

Watermark Engineering Group
1422 Apollo Beach Blvd
Apollo Beach, Fl 33572

Project Name : BRIARWOOD STORMWATER
Date Received : 11/07/2013
Time Received : 1514

Submission Number 13110291

Sample Number: 001
Sample Date: 11/07/2013
Sample Time: 1158
Sample Description: BWL-BiMon-2-1
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	15	NTU	0.05	0.05	180.1	11/08/2013	11:30	JB
COPPER	5.30 I	UG/L	4	16	200.7	11/13/2013	18:56	JSM
ZINC	9.10	UG/L	1.4	5.6	200.7	11/13/2013	18:56	JSM
AMMONIA NITROGEN	0.008 I	MG/L	0.008	0.032	350.1	11/11/2013	13:11	JB
AMMONIA NITROGEN, DISSOLVED	0.013 I	MG/L	0.008	0.032	350.1	11/12/2013	09:42	JB
ORGANIC NITROGEN, DISSOLVED	1.01	MG/L	0.05	0.20	351-350.1	11/14/2013	12:40	JER/JB
TOTAL KJELDAHL NITROGEN	2.59	MG/L	0.05	0.20	351.2	11/14/2013	12:35	JER
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.02	MG/L	0.05	0.20	351.2	11/14/2013	12:36	JER
TOTAL NITROGEN	2.60	MG/L	0.05	0.20	353+351	11/14/2013	12:35	JER/TN/W
NITRATE+NITRITE AS N	0.009 I	MG/L	0.004	0.016	353.2	11/08/2013	10:25	TN/WY
ORTHO PHOSPHORUS AS P	0.011	MG/L	0.002	0.008	365.3	11/07/2013	17:12	MR
TOTAL PHOSPHORUS AS P	0.241	MG/L	0.008	0.032	365.3	11/12/2013	12:17	MR
CHLOROPHYLL A, CORRECTED	112.1	MG/M3	0.25	1.00	445.0	11/14/2013	15:35	JMG/BG
TOTAL ALKALINITY (CACO3)	128	MG/L	0.594	2.376	SM2320B	11/13/2013	09:50	MR
TOTAL SUSPENDED SOLIDS	21.3	MG/L	0.570	2.280	SM2540D	11/11/2013	12:05	JG/JA
BIOCHEMICAL OXYGEN DEMAND	7.47	MG/L	0.5	2.0	SM5210B	11/08/2013	12:43	SJ/SJ
TOTAL ORGANIC CARBON	13.8	MG/L	0.271	1.084	SM5310B	11/19/2013	12:42	KD

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EnviroAnalytical Inc.

NELAC Certification # E84167

Submission Number 13110291

Sample Number: 002 **Sample Description:** BWL-BiMon-2-2
Sample Date: 11/07/2013 **Sample Method:** Grab
Sample Time: 1200

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	12	NTU	0.05	0.05	180.1	11/08/2013	11:30	JB
COPPER	5.30 I	UG/L	4	16	200.7	11/13/2013	19:07	JSM
ZINC	9.90	UG/L	1.4	5.6	200.7	11/13/2013	19:07	JSM
AMMONIA NITROGEN	0.039	MG/L	0.008	0.032	350.1	11/11/2013	13:15	JB
AMMONIA NITROGEN, DISSOLVED	0.011 I	MG/L	0.008	0.032	350.1	11/12/2013	09:47	JB
ORGANIC NITROGEN, DISSOLVED	0.965	MG/L	0.05	0.20	351-350.1	11/14/2013	12:40	JER/JB
TOTAL KJELDAHL NITROGEN	1.93	MG/L	0.05	0.20	351.2	11/14/2013	12:37	JER
TOTAL KJELDAHL NITROGEN, DISSOLVED	0.976	MG/L	0.05	0.20	351.2	11/14/2013	12:38	JER
TOTAL NITROGEN	2.09	MG/L	0.05	0.20	353+351	11/14/2013	12:37	JER/TN/W
NITRATE+NITRITE AS N	0.160	MG/L	0.004	0.016	353.2	11/08/2013	10:25	TN/WY
ORTHO PHOSPHORUS AS P	0.028	MG/L	0.002	0.008	365.3	11/07/2013	17:14	MR
TOTAL PHOSPHORUS AS P	0.168	MG/L	0.008	0.032	365.3	11/12/2013	12:18	MR
CHLOROPHYLL A, CORRECTED	88.4	MG/M3	0.25	1.00	445.0	11/14/2013	15:37	JMG/BG
TOTAL ALKALINITY (CACO3)	131	MG/L	0.594	2.376	SM2320B	11/13/2013	09:50	MR
TOTAL SUSPENDED SOLIDS	25.0	MG/L	0.570	2.280	SM2540D	11/11/2013	12:06	JG/JA
BIOCHEMICAL OXYGEN DEMAND	4.4	MG/L	0.5	2.0	SM5210B	11/08/2013	12:43	SJ/SJ
TOTAL ORGANIC CARBON	12.8	MG/L	0.271	1.084	SM5310B	11/19/2013	12:57	KD

Submission Number 13110291

Sample Number: 003 **Sample Description:** BWL-BiMon-2-2-Dup
Sample Date: 11/07/2013 **Sample Method:** Grab
Sample Time: 1200

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	13	NTU	0.05	0.05	180.1	11/08/2013	11:30	JB
COPPER	5.70 I	UG/L	4	16	200.7	11/13/2013	19:12	JSM
ZINC	14.5	UG/L	1.4	5.6	200.7	11/13/2013	19:12	JSM
AMMONIA NITROGEN	0.027 I	MG/L	0.008	0.032	350.1	11/11/2013	13:21	JB
AMMONIA NITROGEN, DISSOLVED	0.025 I	MG/L	0.008	0.032	350.1	11/11/2013	13:19	JB
ORGANIC NITROGEN, DISSOLVED	1.22	MG/L	0.05	0.20	351-350.1	11/14/2013	12:40	JER/JB
TOTAL KJELDAHL NITROGEN	2.33	MG/L	0.05	0.20	351.2	11/14/2013	12:39	JER

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TOTAL KJELDAHL NITROGEN, DISSOLVED	1.24	MG/L	0.05	0.20	351.2	11/14/2013	12:40	JER
TOTAL NITROGEN	2.49	MG/L	0.05	0.20	353+351	11/14/2013	12:39	JER/TN/W
NITRATE+NITRITE AS N	0.159	MG/L	0.004	0.016	353.2	11/08/2013	10:25	TN/WY
ORTHO PHOSPHORUS AS P	0.034	MG/L	0.002	0.008	365.3	11/07/2013	17:15	MR
TOTAL PHOSPHORUS AS P	0.218	MG/L	0.008	0.032	365.3	11/12/2013	12:19	MR
CHLOROPHYLL A, CORRECTED	91.5	MG/M3	0.25	1.00	445.0	11/14/2013	15:38	JMG/BG
TOTAL ALKALINITY (CACO3)	127	MG/L	0.594	2.376	SM2320B	11/13/2013	09:50	MR
TOTAL SUSPENDED SOLIDS	28.0	MG/L	0.570	2.280	SM2540D	11/11/2013	12:07	JG/JA
BIOCHEMICAL OXYGEN DEMAND	5.37	MG/L	0.5	2.0	SM5210B	11/08/2013	12:43	SJ/SJ
TOTAL ORGANIC CARBON	13.9	MG/L	0.271	1.084	SM5310B	11/19/2013	13:12	KD

Tulay Dixon 11/21/2013

Dale D. Dixon / Laboratory Director — Date

Tülay Tanrisever/ QC Officer

Jennifer Hatfield / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

NOTES: Chlorophyll A lab filtered on 11/07/13 at 1600.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

Benchmark EnviroAnalytical,Inc
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Client Information: **Watermark Engineering Group, Inc.**
1422 Apollo Beach Blvd.
Apollo Beach, Fl 33572
813-641-1200
Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility Weekly
Profile 560

Laboratory Submission # BwL-BiMon2 13110291

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 11/07 1600	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) (Lab Filtered)	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2	Plain	Plain	1:4 HNO_3 pH<2	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-OPT BiMon2-1	G	SW	Date & Time: 11-7-13 @ 1158							1
BWL-OPT BiMon2-2	G	SW	Date & Time: 11-7-13 @ 1200							2
BWL-OPT ~~BiMo~~	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT__-_____	G	SW	Date & Time:							
BWL-OPT BiMon2 Dup	G	SW	Date & Time: 11-7-13 @ 1200							3

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).
2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SD/MNT), or sludge (SLDG).
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container

Instructions:
1. Each bottle has a label identifying sample ID, premeasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3. All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4. The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 ~~;~~
BEA Temperature: 2-4°c

1	Collected By: Erik Stuart	Date 11-7-13	Time	Received By:	Date 11/7/13	Time 1514

Erik Stuart

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 14011166

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Mark Flint

Project Name : BRIARWOOD STORMWATER TREATMENT
Date Received : 01/31/2014
Time Received : 1350

Submission Number 14011166

Sample Number: 001
Sample Date: 01/31/2014
Sample Time: 1114

Sample Description: BWL BIMONTHLY 3-1
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	27	NTU	0.05	0.05	180.1	01/31/2014	16:00	MV
COPPER	7.40 I	UG/L	4	16	200.7	02/03/2014	18:29	TSA
ZINC	15.7	UG/L	1.4	5.6	200.7	02/03/2014	18:29	TSA
AMMONIA NITROGEN	0.031 I	MG/L	0.008	0.032	350.1	02/04/2014	15:05	MV
AMMONIA NITROGEN, DISSOLVED	0.008 UJ4	MG/L	0.008	0.032	350.1	02/04/2014	15:04	MV
ORGANIC NITROGEN, DISSOLVED	1.09	MG/L	0.05	0.20	351-350.1	02/04/2014	15:11	JB/MV
TOTAL KJELDAHL NITROGEN	3.48	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.09	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB
TOTAL NITROGEN	3.48	MG/L	0.05	0.20	353+351	02/04/2014	09:08	JB/TN
NITRATE+NITRITE AS N	0.004 U	MG/L	0.004	0.016	353.2	02/03/2014	09:27	TN
ORTHO PHOSPHORUS AS P	0.005 I	MG/L	0.002	0.008	365.3	01/31/2014	17:26	MR
TOTAL PHOSPHORUS AS P	0.272	MG/L	0.008	0.032	365.3	02/05/2014	13:07	MR
CHLOROPHYLL A, CORRECTED	129	MG/M3	0.25	1.00	445.0	02/03/2014	15:38	TN
TOTAL ALKALINITY (CACO3)	100	MG/L	0.594	2.376	SM2320B	02/03/2014	11:50	MV
TOTAL SUSPENDED SOLIDS	42.7	MG/L	0.570	2.280	SM2540D	02/04/2014	09:03	JG/JA
BIOCHEMICAL OXYGEN DEMAND	7.35	MG/L	0.5	2.0	SM5210B	01/31/2014	14:13	DN/DN
TOTAL ORGANIC CARBON	14.2	MG/L	0.271	1.084	SM5310B	02/06/2014	14:21	KD

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

Submission Number 14011166

Sample Number: 002 **Sample Description:** BWL BIMONTHLY 3-2
Sample Date: 01/31/2014 **Sample Method:** Grab
Sample Time: 1127

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	16	NTU	0.05	0.05	180.1	01/31/2014	16:00	MV
COPPER	5.90 I	UG/L	4	16	200.7	02/03/2014	18:59	TSA
ZINC	30.7	UG/L	1.4	5.6	200.7	02/03/2014	18:59	TSA
AMMONIA NITROGEN	0.145	MG/L	0.008	0.032	350.1	02/04/2014	15:09	MV
AMMONIA NITROGEN, DISSOLVED	0.096	MG/L	0.008	0.032	350.1	02/04/2014	15:07	MV
ORGANIC NITROGEN, DISSOLVED	1.04	MG/L	0.05	0.20	351-350.1	02/04/2014	15:11	JB/MV
TOTAL KJELDAHL NITROGEN	2.44	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.14	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB
TOTAL NITROGEN	2.69	MG/L	0.05	0.20	353+351	02/04/2014	09:08	JB/TN
NITRATE+NITRITE AS N	0.254	MG/L	0.004	0.016	353.2	02/03/2014	09:27	TN
ORTHO PHOSPHORUS AS P	0.008	MG/L	0.002	0.008	365.3	01/31/2014	17:27	MR
TOTAL PHOSPHORUS AS P	0.210	MG/L	0.008	0.032	365.3	02/05/2014	13:08	MR
CHLOROPHYLL A, CORRECTED	82.0	MG/M3	0.25	1.00	445.0	02/03/2014	15:39	TN
TOTAL ALKALINITY (CACO3)	103	MG/L	0.594	2.376	SM2320B	02/03/2014	11:50	MV
TOTAL SUSPENDED SOLIDS	24.2	MG/L	0.570	2.280	SM2540D	02/04/2014	09:04	JG/JA
BIOCHEMICAL OXYGEN DEMAND	5.44	MG/L	0.5	2.0	SM5210B	01/31/2014	14:13	DN/DN
TOTAL ORGANIC CARBON	14.4	MG/L	0.271	1.084	SM5310B	02/06/2014	14:37	KD

Submission Number 14011166

Sample Number: 003 **Sample Description:** BWL BIMONTHLY 3-2 DUP
Sample Date: 01/31/2014 **Sample Method:** Grab
Sample Time: 1129

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	15	NTU	0.05	0.05	180.1	01/31/2014	16:00	MV
COPPER	5.20 I	UG/L	4	16	200.7	02/03/2014	19:04	TSA
ZINC	30.5	UG/L	1.4	5.6	200.7	02/03/2014	19:04	TSA
AMMONIA NITROGEN	0.110	MG/L	0.008	0.032	350.1	02/04/2014	15:13	MV
AMMONIA NITROGEN, DISSOLVED	0.104	MG/L	0.008	0.032	350.1	02/04/2014	15:11	MV
ORGANIC NITROGEN, DISSOLVED	1.07	MG/L	0.05	0.20	351-350.1	02/04/2014	15:11	JB/MV
TOTAL KJELDAHL NITROGEN	2.56	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

TOTAL KJELDAHL NITROGEN, DISSOLVED	1.17	MG/L	0.05	0.20	351.2	02/04/2014	09:08	JB
TOTAL NITROGEN	2.84	MG/L	0.05	0.20	353+351	02/04/2014	09:08	JB/TN
NITRATE+NITRITE AS N	0.278	MG/L	0.004	0.016	353.2	02/03/2014	09:27	TN
ORTHO PHOSPHORUS AS P	0.008	MG/L	0.002	0.008	365.3	01/31/2014	17:29	MR
TOTAL PHOSPHORUS AS P	0.213	MG/L	0.008	0.032	365.3	02/05/2014	13:09	MR
CHLOROPHYLL A, CORRECTED	71.2	MG/M3	0.25	1.00	445.0	02/03/2014	15:40	TN
TOTAL ALKALINITY (CACO3)	105	MG/L	0.594	2.376	SM2320B	02/03/2014	11:50	MV
TOTAL SUSPENDED SOLIDS	17.9	MG/L	0.570	2.280	SM2540D	02/04/2014	09:05	JG/JA
BIOCHEMICAL OXYGEN DEMAND	5.76	MG/L	0.5	2.0	SM5210B	01/31/2014	14:13	DN/DN
TOTAL ORGANIC CARBON	14.9	MG/L	0.271	1.084	SM5310B	02/06/2014	14:52	KD

Dale D. Dixon / Laboratory Director — 02/10/2014
Date

Tülay Tanrisever/ QC Officer

Jessica Sierra Medina / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

NOTES: Chlorophyll A lab filtered on 01/31/14 at 1422.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

1711 12th Street East * Palmetto, FL 34221 * Phone (941) 723-9986 * Fax (941) 723-6061

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1422 Apollo Beach Blvd.
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Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 1401166
14-BWL-Bimonthly-3

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 1131 14:22	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) (Lab Filtered)	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2	Plain	Plain	1:4 HNO_3 pH<2	
Bimonthly 3-1			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-~~OPT~~__-_____	G	SW	Date & Time: 1-31-14 11:14							1
BWL-~~OPT~~3-2	G	SW	Date & Time: 1-31-14 11:27							2
BWL-~~OPT~~3-2dup	G	SW	Date & Time: 1-31-14 11:29							3
BWL-~~OPT~~__-_____	G	SW	Date & Time:							
BWL-~~OPT~~__-_____	G	SW	Date & Time:							
BWL-~~OPT~~__-_____	G	SW	Date & Time:							
BWL-OPT__-_____-Dup	G	SW	Date & Time:							

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).

2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SD/MNT), or sludge (SLDG).

3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).

4 Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container

Instructions:
1 Each bottle has a label identifying sample ID, preincanced preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2 The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3 All bottles not containing preservative may be rinsed with appropriate sample proof to collection.
4 The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 ✓
BEA Temperature: 2.6°C

	Collected By:	Date	Time	Received By:	Date	Time
1	Erik Strunk	1-31-14			1/31/14	1350

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NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 14030919

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Mark Flint

Project Name : BRIARWOOD STORMWATER TREATMENT
Date Received : 03/24/2014
Time Received : 1534

Submission Number 14030919

Sample Number: 001
Sample Date: 03/24/2014
Sample Time: 1310

Sample Description: BWL-BiMonthly-4-1
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	30	NTU	0.05	0.05	180.1	03/25/2014	10:00	MV
COPPER	4 U	UG/L	4	16	200.7	03/27/2014	12:49	TSA
ZINC	10.0	UG/L	1.4	5.6	200.7	03/27/2014	12:49	TSA
AMMONIA NITROGEN	0.008 U	MG/L	0.008	0.032	350.1	03/26/2014	10:35	MR
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	03/26/2014	11:32	MR
ORGANIC NITROGEN, DISSOLVED	1.28	MG/L	0.05	0.20	351-350.1	03/27/2014	09:48	JB/MR
TOTAL KJELDAHL NITROGEN	3.46	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.28	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB
TOTAL NITROGEN	3.46	MG/L	0.05	0.20	353+351	03/27/2014	09:48	JB/KR
NITRATE+NITRITE AS N	0.004 I	MG/L	0.004	0.016	353.2	03/25/2014	08:54	KR
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	03/25/2014	17:03	JP
TOTAL PHOSPHORUS AS P	0.311	MG/L	0.008	0.032	365.3	03/25/2014	14:46	JP
CHLOROPHYLL A, CORRECTED	64.1	MG/M3	0.25	1.00	445.0	03/25/2014	12:57	KR
TOTAL ALKALINITY (CACO3)	90.0	MG/L	0.594	2.376	SM2320B	03/25/2014	09:30	MR
TOTAL SUSPENDED SOLIDS	48.0	MG/L	0.570	2.280	SM2540D	03/31/2014	09:03	MV
BIOCHEMICAL OXYGEN DEMAND	13.4	MG/L	0.5	2.0	SM5210B	03/25/2014	13:45	BG/DN
TOTAL ORGANIC CARBON	17.3	MG/L	0.271	1.084	SM5310B	03/27/2014	19:48	JB

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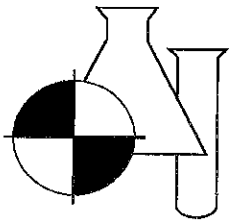

NELAC Certification # E84167

Submission Number 14030919

Sample Number: 002 **Sample Description:** BWL-BiMonthly-4-1-DUP
Sample Date: 03/24/2014 **Sample Method:** Grab
Sample Time: 1310

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	32	NTU	0.05	0.05	180.1	03/25/2014	10:00	MV
COPPER	4 U	UG/L	4	16	200.7	03/27/2014	12:54	TSA
ZINC	8.60	UG/L	1.4	5.6	200.7	03/27/2014	12:54	TSA
AMMONIA NITROGEN	0.025 I	MG/L	0.008	0.032	350.1	03/26/2014	10:38	MR
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	03/26/2014	11:32	MR
ORGANIC NITROGEN, DISSOLVED	1.19	MG/L	0.05	0.20	351-350.1	03/27/2014	09:48	JB/MR
TOTAL KJELDAHL NITROGEN	3.69	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.19	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB
TOTAL NITROGEN	3.69	MG/L	0.05	0.20	353+351	03/27/2014	09:48	JB/KR
NITRATE+NITRITE AS N	0.004 U	MG/L	0.004	0.016	353.2	03/25/2014	08:54	KR
ORTHO PHOSPHORUS AS P	0.017	MG/L	0.002	0.008	365.3	03/25/2014	17:05	JP
TOTAL PHOSPHORUS AS P	0.317	MG/L	0.008	0.032	365.3	03/25/2014	14:47	JP
CHLOROPHYLL A, CORRECTED	174	MG/M3	0.25	1.00	445.0	03/25/2014	12:59	KR
TOTAL ALKALINITY (CACO3)	88.5	MG/L	0.594	2.376	SM2320B	03/25/2014	09:30	MR
TOTAL SUSPENDED SOLIDS	58.0	MG/L	0.570	2.280	SM2540D	03/26/2014	10:00	MV
BIOCHEMICAL OXYGEN DEMAND	14.2	MG/L	0.5	2.0	SM5210B	03/25/2014	13:45	BG/DN
TOTAL ORGANIC CARBON	17.6	MG/L	0.271	1.084	SM5310B	03/27/2014	20:04	JB

Submission Number 14030919

Sample Number: 003 **Sample Description:** BWL-BiMonthly-4-6
Sample Date: 03/24/2014 **Sample Method:** Grab
Sample Time: 1315

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	18	NTU	0.05	0.05	180.1	03/25/2014	10:00	MV
COPPER	4 U	UG/L	4	16	200.7	03/27/2014	13:16	TSA
ZINC	7.00	UG/L	1.4	5.6	200.7	03/27/2014	13:16	TSA
AMMONIA NITROGEN	0.010 I	MG/L	0.008	0.032	350.1	03/26/2014	10:40	MR
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	03/26/2014	11:34	MR
ORGANIC NITROGEN, DISSOLVED	1.21	MG/L	0.05	0.20	351-350.1	03/27/2014	09:48	JB/MR
TOTAL KJELDAHL NITROGEN	3.07	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB

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TOTAL KJELDAHL NITROGEN, DISSOLVED	1.21	MG/L	0.05	0.20	351.2	03/27/2014	09:48	JB
TOTAL NITROGEN	3.18	MG/L	0.05	0.20	353+351	03/27/2014	09:48	JB/KR
NITRATE+NITRITE AS N	0.107	MG/L	0.004	0.016	353.2	03/25/2014	08:54	KR
ORTHO PHOSPHORUS AS P	0.006 I	MG/L	0.002	0.008	365.3	03/25/2014	17:06	JP
TOTAL PHOSPHORUS AS P	0.269	MG/L	0.008	0.032	365.3	03/25/2014	14:48	JP
CHLOROPHYLL A, CORRECTED	98.5	MG/M3	0.25	1.00	445.0	03/25/2014	13:00	KR
TOTAL ALKALINITY (CACO3)	90.0	MG/L	0.594	2.376	SM2320B	03/25/2014	09:30	MR
TOTAL SUSPENDED SOLIDS	24.0	MG/L	0.570	2.280	SM2540D	03/26/2014	10:00	MV
BIOCHEMICAL OXYGEN DEMAND	6.00	MG/L	0.5	2.0	SM5210B	03/25/2014	13:45	DN/BG
TOTAL ORGANIC CARBON	17.8	MG/L	0.271	1.084	SM5310B	03/27/2014	20:20	JB

Tülay Dixon 04/02/2014

Dale D. Dixon / Laboratory Director — Date

Tülay Tanrisever/ QC Officer

Jessica Medina Sierra / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

NOTES: Chlorophyll A lab filtered on 03/24/14 at 1540.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

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Sun City Center, Fl 33573
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Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 14030919

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 364 1340	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) (Lab Filtered)	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2 ✓	Plain	Plain	1:4 HNO_3 pH<2 ✓	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
	G	SW	Date & Time: 3-24-14		BWL - Bimonthly - 4÷1				1:10 pm	1
	G	SW	Date & Time:	↓		↓	4÷1 dup		1:10 pm	2
	G	SW	Date & Time:				4÷6		1:15 pm	3

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).

2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SDMNT), or sludge (SLDG)
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 **Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).**
Under "Preservative," list any preservatives that were added to the sample container.

Laboratory Sample Acceptability: pH <2 ✓
BEA Temperature: 24°c

Instructions:
1. Each bottle has a label identifying sample ID, premeasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3. All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4. The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

1	Collected By: Eric Stumpf	Date 3-24-14	Time 1534	Received By: Ayn	Date 3/24/14	Time 1534

4 of 4

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NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 14071224

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Haylee La Torre

Project Name : SARASOTA COUNTY ALLIGATOR CREEK
Date Received : 07/31/2014
Time Received : 1017

Submission Number 14071224

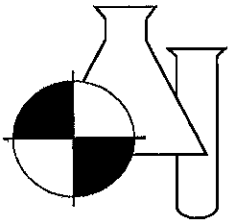
Sample Number: 001
Sample Date: 07/30/2014
Sample Time: 1828
Sample Description: BWL-1
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
AMMONIA NITROGEN	0.035	MG/L	0.008	0.032	350.1	08/01/2014	10:49	SJ
TOTAL KJELDAHL NITROGEN	3.00	MG/L	0.05	0.20	351.2	08/05/2014	10:54	JB
TOTAL NITROGEN	3.00	MG/L	0.05	0.20	353+351	08/05/2014	10:54	JB/HL
NITRATE+NITRITE AS N	0.005 I	MG/L	0.004	0.016	353.2	08/04/2014	09:29	HL
ORTHO PHOSPHORUS AS P	0.017	MG/L	0.002	0.008	365.3	07/31/2014	16:05	KR
TOTAL PHOSPHORUS AS P	0.109	MG/L	0.008	0.032	365.3	08/01/2014	09:49	KR
TOTAL SUSPENDED SOLIDS	36.0	MG/L	0.570	2.280	SM2540D	08/05/2014	16:22	JA/SW
BIOCHEMICAL OXYGEN DEMAND	4.12	MG/L	0.5	2.0	SM5210B	07/31/2014	15:01	KC/KC

Submission Number 14071224

Sample Number: 002
Sample Date: 07/30/2014
Sample Time: 1830
Sample Description: BWL-6
Sample Method: Grab

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
AMMONIA NITROGEN	0.116	MG/L	0.008	0.032	350.1	08/01/2014	10:50	SJ
TOTAL KJELDAHL NITROGEN	2.15	MG/L	0.05	0.20	351.2	08/05/2014	10:54	JB
TOTAL NITROGEN	2.18	MG/L	0.05	0.20	353+351	08/05/2014	10:54	JB/HL
NITRATE+NITRITE AS N	0.030	MG/L	0.004	0.016	353.2	08/04/2014	09:29	HL
ORTHO PHOSPHORUS AS P	0.067	MG/L	0.002	0.008	365.3	07/31/2014	16:07	KR



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TOTAL PHOSPHORUS AS P	0.167	MG/L	0.008	0.032	365.3	08/01/2014	09:51	KR
TOTAL SUSPENDED SOLIDS	10.0	MG/L	0.570	2.280	SM2540D	08/05/2014	16:23	JA/SW
BIOCHEMICAL OXYGEN DEMAND	4.53	MG/L	0.5	2.0	SM5210B	07/31/2014	15:01	KC/KC

Submission Number 14071224

Sample Number: 003 **Sample Description:** BWL-6-DUP
Sample Date: 07/30/2014 **Sample Method:** Grab
Sample Time: 1830

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
AMMONIA NITROGEN	0.119	MG/L	0.008	0.032	350.1	08/08/2014	11:57	SJ
TOTAL KJELDAHL NITROGEN	2.12	MG/L	0.05	0.20	351.2	08/05/2014	10:54	JB
TOTAL NITROGEN	2.15	MG/L	0.05	0.20	353+351	08/05/2014	10:54	JB/HL
NITRATE+NITRITE AS N	0.030	MG/L	0.004	0.016	353.2	08/04/2014	09:29	HL
ORTHO PHOSPHORUS AS P	0.061	MG/L	0.002	0.008	365.3	07/31/2014	16:10	KR
TOTAL PHOSPHORUS AS P	0.151	MG/L	0.008	0.032	365.3	08/01/2014	09:53	KR
TOTAL SUSPENDED SOLIDS	10.0	MG/L	0.570	2.280	SM2540D	08/05/2014	16:24	JA/SW
BIOCHEMICAL OXYGEN DEMAND	13.8	MG/L	0.5	2.0	SM5210B	07/31/2014	15:01	KC/KC

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EnviroAnalytical Inc.

NELAC Certification # E84167

Jessica Sierra Medina 08/14/2014

Dale D. Dixon / Laboratory Director — Date

Tülay Tanrisever/ QC Officer

Jessica Sierra Medina / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

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H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

I = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES:

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

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Client Information: **Watermark Engineering Group, Inc.**
3868 Sun City Center Blvd
Sun City Center, Fl 33573
813-641-1200
Fax: 813-641-1204
Haylee La Torre hlatorre@watermarkengineers.com

Project Name: Sarasota County Alligator Creek

Laboratory Submission # 1407124

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]			Laboratory Sample #
			NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Field Filtered) (365.3)	BOD (SM5210B) TSS (SM2540D)	
			A	B	C	
			1:4 H_2SO_4 pH<2	Plain	Plain	
			1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 1 Quart Plastic	
BWL-1	C	SW	Date & Time: 7/30 ~~17:47~~ 18:28	7/30 • 18:28	7/30 18:28 •	1
BWL-6	C	SW	Date & Time: 7/30 ~~18:00~~ 18:30	7/30 • ~~18:00~~ 18:30	7/30 ~~18:00~~ 18:30 •	2
BWL-6-DUP	C	SW	Date & Time: 7/30 ~~18:00~~ 18:30	7/30 • ~~18:00~~ 18:30	7/30 ~~18:00~~ • 18:30	3
			Date & Time:			
			Date & Time:			

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).
2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SDMNT), or sludge (SLDG).
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 **Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).**
Under "Preservative," list any preservatives that were added to the sample container.

Instructions:
1. Each bottle has a label identifying sample ID, premeasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3. All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4. The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 ✓
BEA Temperature: 0.8°C

1	Collected By: Hunter Yates, Phong Nguyen	Date 7/30/14	Time 18:30	Received By:		Date	Time
2	Relinquished By:	Date 7/31/14	Time 1017	Received By:		Date 7/31/14	Time 1017
3	Relinquished By:	Date	Time	Received By:		Date	Time

4 of 4

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 14091061

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Mark Flint

Project Name : BRIARWOOD STORMWATER TREATMENT
Date Received : 09/25/2014
Time Received : 1532

Submission Number 14091061

Sample Number: 001
Sample Date: 09/25/2014
Sample Time: 1324

Sample Description: BWL-1
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	18	NTU	0.11	0.11	180.1	09/25/2014	15:52	SJ
ZINC	5.70	UG/L	1.4	5.6	200.7	09/29/2014	16:53	JSM
AMMONIA NITROGEN	0.034	MG/L	0.008	0.032	350.1	09/26/2014	10:26	SJ
AMMONIA NITROGEN, DISSOLVED	0.027 I	MG/L	0.008	0.032	350.1	09/29/2014	10:26	SJ
ORGANIC NITROGEN, DISSOLVED	0.973	MG/L	0.05	0.20	351-350.1	10/01/2014	12:06	KS/SJ
TOTAL KJELDAHL NITROGEN	2.46	MG/L	0.05	0.20	351.2	10/01/2014	12:06	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.00	MG/L	0.05	0.20	351.2	10/01/2014	12:06	KS
TOTAL NITROGEN	2.46	MG/L	0.05	0.20	353+351	10/01/2014	10:21	KS/KC/KR
NITRATE+NITRITE AS N	0.004 U	MG/L	0.004	0.016	353.2	10/01/2014	10:21	KC/KR
ORTHO PHOSPHORUS AS P	0.005	MG/L	0.002	0.008	365.3	09/25/2014	17:14	KR
TOTAL PHOSPHORUS AS P	0.254	MG/L	0.008	0.032	365.3	09/26/2014	10:10	KR
CHLOROPHYLL A, CORRECTED	117	MG/M3	0.25	1.00	445.0	10/06/2014	15:42	BG
TOTAL ALKALINITY (CACO3)	89.5	MG/L	0.594	2.376	SM2320B	09/30/2014	08:30	SJ
TOTAL SUSPENDED SOLIDS	26.8	MG/L	0.570	2.280	SM2540D	09/30/2014	09:02	SW
COPPER	1.20 I	UG/L	0.346	1.384	SM3113B	09/30/2014	15:33	JSM
BIOCHEMICAL OXYGEN DEMAND	6.76	MG/L	0.5	2.0	SM5210B	09/26/2014	08:30	PN/PN
TOTAL ORGANIC CARBON	13.1	MG/L	0.271	1.084	SM5310B	09/26/2014	20:53	KD

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NELAC Certification # E84167

Submission Number 14091061

Sample Number: 002 **Sample Description:** BWL-6
Sample Date: 09/25/2014 **Sample Method:** Composite
Sample Time: 1321

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	8.8	NTU	0.11	0.11	180.1	09/25/2014	15:52	SJ
ZINC	13.2	UG/L	1.4	5.6	200.7	09/29/2014	16:57	JSM
AMMONIA NITROGEN	0.023 I	MG/L	0.008	0.032	350.1	09/26/2014	10:28	SJ
AMMONIA NITROGEN, DISSOLVED	0.011 I	MG/L	0.008	0.032	350.1	09/29/2014	10:27	SJ
ORGANIC NITROGEN, DISSOLVED	0.950	MG/L	0.05	0.20	351-350.1	10/01/2014	12:06	KS/SJ
TOTAL KJELDAHL NITROGEN	1.66	MG/L	0.05	0.20	351.2	10/01/2014	12:06	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	0.961	MG/L	0.05	0.20	351.2	10/01/2014	12:06	KS
TOTAL NITROGEN	1.76	MG/L	0.05	0.20	353+351	10/01/2014	10:21	KS/KC/KR
NITRATE+NITRITE AS N	0.100	MG/L	0.004	0.016	353.2	10/01/2014	10:21	KC/KR
ORTHO PHOSPHORUS AS P	0.024	MG/L	0.002	0.008	365.3	09/25/2014	17:15	KR
TOTAL PHOSPHORUS AS P	0.151	MG/L	0.008	0.032	365.3	09/26/2014	10:11	KR
CHLOROPHYLL A, CORRECTED	39.5	MG/M3	0.25	1.00	445.0	10/06/2014	15:43	BG
TOTAL ALKALINITY (CACO3)	91.0	MG/L	0.594	2.376	SM2320B	09/30/2014	08:30	SJ
TOTAL SUSPENDED SOLIDS	12.4	MG/L	0.570	2.280	SM2540D	09/30/2014	09:03	SW
COPPER	1.83 I	UG/L	0.346	1.384	SM3113B	09/30/2014	15:52	JSM
BIOCHEMICAL OXYGEN DEMAND	3.26	MG/L	0.5	2.0	SM5210B	09/26/2014	08:30	PN/PN
TOTAL ORGANIC CARBON	13.0	MG/L	0.271	1.084	SM5310B	09/26/2014	21:08	KD

Submission Number 14091061

Sample Number: 003 **Sample Description:** BWL-6-DUP
Sample Date: 09/25/2014 **Sample Method:** Composite
Sample Time: 1321

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	8.5	NTU	0.11	0.11	180.1	09/25/2014	15:52	SJ
ZINC	8.40	UG/L	1.4	5.6	200.7	09/29/2014	17:00	JSM
AMMONIA NITROGEN	0.023 I	MG/L	0.008	0.032	350.1	09/26/2014	10:29	SJ
AMMONIA NITROGEN, DISSOLVED	0.010	MG/L	0.008	0.032	350.1	09/30/2014	14:14	SJ
ORGANIC NITROGEN, DISSOLVED	0.967	MG/L	0.05	0.20	351-350.1	10/09/2014	10:21	KS/SJ
TOTAL KJELDAHL NITROGEN	1.68	MG/L	0.05	0.20	351.2	10/01/2014	12:06	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	0.977	MG/L	0.05	0.20	351.2	10/09/2014	11:00	KS

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TOTAL NITROGEN	1.78	MG/L	0.05	0.20	353+351	10/01/2014	10:21	KS/KC/KR
NITRATE+NITRITE AS N	0.102	MG/L	0.004	0.016	353.2	10/01/2014	10:21	KC/KR
ORTHO PHOSPHORUS AS P	0.023	MG/L	0.002	0.008	365.3	09/25/2014	17:16	KR
TOTAL PHOSPHORUS AS P	0.153	MG/L	0.008	0.032	365.3	09/26/2014	10:12	KR
CHLOROPHYLL A, CORRECTED	43.7	MG/M3	0.25	1.00	445.0	10/06/2014	15:44	BG
TOTAL ALKALINITY (CACO3)	92.0	MG/L	0.594	2.376	SM2320B	09/30/2014	08:30	SJ
TOTAL SUSPENDED SOLIDS	13.6	MG/L	0.570	2.280	SM2540D	09/30/2014	09:04	SW
COPPER	1.60 I	UG/L	0.346	1.384	SM3113B	09/30/2014	15:59	JSM
BIOCHEMICAL OXYGEN DEMAND	3.21	MG/L	0.5	2.0	SM5210B	09/26/2014	08:30	PN/PN
TOTAL ORGANIC CARBON	13.4	MG/L	0.271	1.084	SM5310B	09/26/2014	21:23	KD

Dale D. Dixon / Laboratory Director — 10/09/2014 Date

Tülay Tanrisever/ QC Officer

Jessica Sierra Medina / QC Officer

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

NOTES: Chlorophyll A lab filtered on 09/25/14 at 1650.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

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Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 14091061

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 9/25 1657	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) **(Lab Filtered)**	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2 ✓	Plain	Plain	1:4 HNO_3 pH<2 ✓	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-1	Comp.	SW	Start Date & Time: 9/25/14, 13:23 End Date & Time: 9/25/14, 13:24							1
BWL-6	Comp.	SW	Start Date & Time: 9/25/14, 13:20 End Date & Time: 9/25/14, 13:21							2
BWL-6-DUP	Comp	SW	Start Date & Time: 9/25/14, 13:20 End Date & Time: 9/25/14, 13:21							3
	Comp.	SW	Start Date & Time: End Date & Time:							

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).

2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SED/SNT), or sludge (SLUDGE).

3 "Container Type" is used to indicate whether the container is plastic, (P) or glass (G).

4 **Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).**
Under "Preservative," list any preservative that were added to the sample container.

Instructions:
1. Each bottle has a label identifying sample ID, preincasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3. All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4. The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 ✓
BEA Temperature:

1	Collected By: Phong T. Nguyen, Mark J. Flint	Date 9/25/14	Time 13:20	Received By:	Date 9/25/14	Time 1532
2	Relinquished By:	Date	Time	Received By:	Date	Time

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NELAC Certification # E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 14110548

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Mark Flint

Project Name : BRIARWOOD STORMWATER
Date Received : 11/14/2014
Time Received : 0930

Submission Number 14110548

Sample Number: 001
Sample Date: 11/13/2014
Sample Time: 1641

Sample Description: BWL-1
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	17	NTU	0.11	0.11	180.1	11/14/2014	13:10	SJ
COPPER	4 U	UG/L	4	16	200.7	11/17/2014	16:32	JSM
ZINC	6.00	UG/L	1.4	5.6	200.7	11/17/2014	16:32	JSM
AMMONIA NITROGEN	0.054	MG/L	0.008	0.032	350.1	11/19/2014	12:07	SJ
AMMONIA NITROGEN, DISSOLVED	0.048	MG/L	0.008	0.032	350.1	11/19/2014	12:08	SJ
ORGANIC NITROGEN, DISSOLVED	1.06	MG/L	0.05	0.20	351-350.1	11/19/2014	12:12	KS/SJ
TOTAL KJELDAHL NITROGEN	2.57	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.11	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS
TOTAL NITROGEN	2.58	MG/L	0.05	0.20	353+351	11/17/2014	09:28	KS/KC
NITRATE+NITRITE AS N	0.011 I	MG/L	0.004	0.016	353.2	11/17/2014	09:28	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	11/14/2014	16:15	KR
TOTAL PHOSPHORUS AS P	0.229	MG/L	0.008	0.032	365.3	11/17/2014	09:57	KR
CHLOROPHYLL A, CORRECTED	37.6	MG/M3	0.25	1.00	445.0	11/18/2014	11:00	JA
TOTAL ALKALINITY (CACO3)	123	MG/L	0.594	2.376	SM2320B	11/18/2014	08:40	SJ
TOTAL SUSPENDED SOLIDS	15.6	MG/L	0.570	2.280	SM2540D	11/19/2014	12:58	SW
BIOCHEMICAL OXYGEN DEMAND	6.85	MG/L	0.5	2.0	SM5210B	11/14/2014	10:41	PN/PN
TOTAL ORGANIC CARBON	15.6	MG/L	0.271	1.084	SM5310B	11/18/2014	15:26	KD

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Submission Number 14110548

Sample Number: 002 **Sample Description:** BWL-6
Sample Date: 11/13/2014 **Sample Method:** Composite
Sample Time: 1625

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	13	NTU	0.11	0.11	180.1	11/14/2014	13:10	SJ
COPPER	4 U	UG/L	4	16	200.7	11/17/2014	16:37	JSM
ZINC	8.10	UG/L	1.4	5.6	200.7	11/17/2014	16:37	JSM
AMMONIA NITROGEN	0.027	MG/L	0.008	0.032	350.1	11/19/2014	12:09	SJ
AMMONIA NITROGEN, DISSOLVED	0.016	MG/L	0.008	0.032	350.1	11/19/2014	12:10	SJ
ORGANIC NITROGEN, DISSOLVED	1.04	MG/L	0.05	0.20	351-350.1	11/19/2014	12:12	KS/SJ
TOTAL KJELDAHL NITROGEN	2.00	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.06	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS
TOTAL NITROGEN	2.09	MG/L	0.05	0.20	353+351	11/24/2014	14:06	KS/KC
NITRATE+NITRITE AS N	0.090	MG/L	0.004	0.016	353.2	11/24/2014	14:06	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	11/14/2014	16:17	KR
TOTAL PHOSPHORUS AS P	0.209	MG/L	0.008	0.032	365.3	11/17/2014	09:58	KR
CHLOROPHYLL A, CORRECTED	50.4	MG/M3	0.25	1.00	445.0	11/18/2014	11:00	JA
TOTAL ALKALINITY (CACO3)	121	MG/L	0.594	2.376	SM2320B	11/18/2014	08:40	SJ
TOTAL SUSPENDED SOLIDS	19.2	MG/L	0.570	2.280	SM2540D	11/19/2014	12:59	SW
BIOCHEMICAL OXYGEN DEMAND	3.71	MG/L	0.5	2.0	SM5210B	11/14/2014	10:41	PN/PN
TOTAL ORGANIC CARBON	15.1	MG/L	0.271	1.084	SM5310B	11/18/2014	16:16	KD

Submission Number 14110548

Sample Number: 003 **Sample Description:** BWL-6-DUP
Sample Date: 11/13/2014 **Sample Method:** Composite
Sample Time: 1625

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date	Analysis Time	Analyst
TURBIDITY	13	NTU	0.11	0.11	180.1	11/14/2014	13:10	SJ
COPPER	4 U	UG/L	4	16	200.7	11/17/2014	16:41	JSM
ZINC	8.00	UG/L	1.4	5.6	200.7	11/17/2014	16:41	JSM
AMMONIA NITROGEN	0.025	MG/L	0.008	0.032	350.1	11/19/2014	12:11	SJ
AMMONIA NITROGEN, DISSOLVED	0.016	MG/L	0.008	0.032	350.1	11/19/2014	12:12	SJ
ORGANIC NITROGEN, DISSOLVED	1.12	MG/L	0.05	0.20	351-350.1	11/19/2014	12:12	KS/SJ
TOTAL KJELDAHL NITROGEN	2.22	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS

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TOTAL KJELDAHL NITROGEN, DISSOLVED	1.14	MG/L	0.05	0.20	351.2	11/17/2014	10:21	KS
TOTAL NITROGEN	2.31	MG/L	0.05	0.20	353+351	11/24/2014	14:06	KS/KC
NITRATE+NITRITE AS N	0.091	MG/L	0.004	0.016	353.2	11/24/2014	14:06	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	11/14/2014	16:19	KR
TOTAL PHOSPHORUS AS P	0.200	MG/L	0.008	0.032	365.3	11/17/2014	09:59	KR
CHLOROPHYLL A, CORRECTED	54.0	MG/M3	0.25	1.00	445.0	11/18/2014	11:00	JA
TOTAL ALKALINITY (CACO3)	121	MG/L	0.594	2.376	SM2320B	11/18/2014	08:40	SJ
TOTAL SUSPENDED SOLIDS	17.2	MG/L	0.570	2.280	SM2540D	11/19/2014	13:00	SW
BIOCHEMICAL OXYGEN DEMAND	3.96	MG/L	0.5	2.0	SM5210B	11/14/2014	10:41	PN/PN
TOTAL ORGANIC CARBON	15.0	MG/L	0.271	1.084	SM5310B	11/18/2014	16:31	KD

Tulay Onaran 12/01/2014

Dale D. Dixon / Laboratory Director — Date

Tülay Tanriseven / QC Officer

Deborah A. Murphy / Project Manager

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.

B = Results based upon colony counts outside the ideal range.

H = Value based on field kit determination. Results may not be accurate.

I = Reported value is between the laboratory MDL and the PQL.

J = Estimated value.

J1 = Est. value surrogate recovery limits exceeded.

J2 = Est. value. No quality control criteria exists for component.

J3 = Est. value quality control criteria for precision or accuracy not met.

J4 = Est. value. Sample matrix interference suspected.

J5 = Est. value. Data questionable due to improper lab or field protocols

K = Off-scale low. Value is known to be < the value reported.

L = Off-scale high. Value is known to be > the value reported

N = Presumptive evidence of presence of material.

O = Sampled, but analysis lost or not performed.

Q = Sample held beyond accepted hold time.

T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.

U = Analyte analyzed but not detected at the value indicated.

V = Analyte detected in sample and method blank.Results for this analyte in associated samples may be biased high. Standard , Duplicate and Spike values are within control limits. Reported data are usable

Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.

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

! = Data deviate from historically established concentration ranges.

? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the Presence or absence of the analyte cannot be determined from the data.

* = Not reported due to interference.

ND = Not Detected at or above adjusted reporting limit.

NOTES: Chlorophyll A lab filtered on 11/14/14 at 1715.

NOTES:

PQL = 4xMDL.

MBAS calculated as LAS; molecular weight = 340.

X = Value exceed MCL.

For questions and comments regarding these results, please contact Bettina Beilfuss at (941) 723-9986

Results relate only to the samples.

Benchmark EnviroAnalytical,Inc
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Client Information:

Watermark Engineering Group, Inc.
3868 Sun City Center Blvd
Sun City Center, Fl 33573
813-641-1200
Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 14116548

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 11/14 1715	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) **(Lab Filtered)**	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2	Plain	Plain	1:4 HNO_3 pH<2	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-1	Comp.	SW	Start Date & Time: 11/12/14, 1:05 PM End Date & Time: 11/13/14, 1:08 PM			(1641*)				1
BWL-6	Comp.	SW	Start Date & Time: 11/12/14, 1:00 PM End Date & Time: 11/13/14, 1:00 PM			(1625*)				2
BWL-6-DUP	Comp.	SW	Start Date & Time: 11/12/14, 1:00 PM End Date & Time: 11/13/14, 1:00 PM			(1625*)				3
	Comp.	SW	Start Date & Time: End Date & Time:							

1 "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).

2 "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SDMNT), or sludge (SLDG).
3 "Container Type" is used to indicate whether the container is plastic (P) or glass (G).
4 **Sample must be refrigerated or stored in wet ice after collection.** The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container.

*Per Sample bottles. (PTN) 11/14/14

Laboratory Sample Acceptability: pH <2 : ✓
BEA Temperature: 4.0°c

Instructions:
1 Each bottle has a label identifying sample ID, premeasured preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2 The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3 All bottles not containing preservatives may be rinsed with appropriate sample prior to collection.
4 The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

1	Collected By: Phong Nguyen (PTN) Mark Flint (MF)	Date 11/13/14	Time	Received By:	Date	Time
2	Relinquished By:	Date 11/14/2014	Time 930	Received By:	Date 11/14/14	Time 0930

4 of 4

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification #E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 15011177

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Mark Flint

Project Name : BRIARWOOD STORMWATER TREATMENT
Date Received : 01/31/2015
Time Received : 1310

Submission Number: 15011177
Sample Number: 001
Sample Description: BWL-1

Sample Date: 01/30/2015
Sample Time: 1345
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	22	NTU	0.11	0.11	180.1	01/31/2015 14:10	BG
COPPER	4 U	UG/L	4	16	200.7	02/09/2015 17:51	JSM
ZINC	10.3	UG/L	1.4	5.6	200.7	02/09/2015 17:51	JSM
AMMONIA NITROGEN	0.036	MG/L	0.008	0.032	350.1	02/02/2015 10:18	SJ
AMMONIA NITROGEN, DISSOLVED	0.015 I	MG/L	0.008	0.032	350.1	02/02/2015 10:20	SJ
ORGANIC NITROGEN, DISSOLVED	1.32	MG/L	0.05	0.20	351-350.1	02/04/2015 09:51	KS/SJ
TOTAL KJELDAHL NITROGEN	3.18	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.33	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL NITROGEN	3.19	MG/L	0.05	0.20	353+351	02/04/2015 09:28	KS/KC
NITRATE+NITRITE AS N	0.011 I	MG/L	0.004	0.016	353.2	02/04/2015 09:28	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	02/01/2015 09:05	SJ
TOTAL PHOSPHORUS AS P	0.244	MG/L	0.008	0.032	365.3	02/02/2015 12:36	SJ
CHLOROPHYLL A, CORRECTED	99.4	MG/M3	0.25	1.00	445.0	02/05/2015 15:00	BG
TOTAL ALKALINITY (CACO3)	125	MG/L	0.594	2.376	SM2320B	02/03/2015 09:00	DW
TOTAL SUSPENDED SOLIDS	15.7	MG/L	0.570	2.280	SM2540D	02/03/2015 12:05	SN/SW
BIOCHEMICAL OXYGEN DEMAND	7.57	MG/L	0.5	2.0	SM5210B	02/01/2015 08:43	SJ/PN
TOTAL ORGANIC CARBON	16.3	MG/L	0.271	1.084	SM5310B	02/03/2015 18:48	KD

Submission Number: 15011177
Sample Number: 002
Sample Description: BWL-6

Sample Date: 01/30/2015
Sample Time: 1345
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	17	NTU	0.11	0.11	180.1	01/31/2015 14:10	BG
COPPER	4.40 I	UG/L	4	16	200.7	02/09/2015 18:01	JSM

ZINC	10.2	UG/L	1.4	5.6	200.7	02/09/2015 18:01	JSM
AMMONIA NITROGEN	0.037	MG/L	0.008	0.032	350.1	02/02/2015 10:19	SJ
AMMONIA NITROGEN, DISSOLVED	0.010 I	MG/L	0.008	0.032	350.1	02/02/2015 10:21	SJ
ORGANIC NITROGEN, DISSOLVED	1.31	MG/L	0.05	0.20	351-350.1	02/04/2015 09:51	KS/SJ
TOTAL KJELDAHL NITROGEN	2.67	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.32	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL NITROGEN	2.81	MG/L	0.05	0.20	353+351	02/04/2015 09:28	KS/KC
NITRATE+NITRITE AS N	0.136	MG/L	0.004	0.016	353.2	02/04/2015 09:28	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	02/01/2015 09:08	SJ
TOTAL PHOSPHORUS AS P	0.214	MG/L	0.008	0.032	365.3	02/02/2015 12:37	SJ
CHLOROPHYLL A, CORRECTED	66.8	MG/M3	0.25	1.00	445.0	02/05/2015 15:00	BG
TOTAL ALKALINITY (CACO3)	126	MG/L	0.594	2.376	SM2320B	02/03/2015 09:00	DW
TOTAL SUSPENDED SOLIDS	27.3	MG/L	0.570	2.280	SM2540D	02/03/2015 12:05	SN/SW
BIOCHEMICAL OXYGEN DEMAND	5.41	MG/L	0.5	2.0	SM5210B	02/01/2015 08:43	SJ/PN
TOTAL ORGANIC CARBON	15.4	MG/L	0.271	1.084	SM5310B	02/03/2015 19:03	KD

Submission Number: 15011177 **Sample Date:** 01/30/2015

Sample Number: 003 **Sample Time:** 1345

Sample Description: BWL-6-DUP **Sample Method:** Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	18	NTU	0.11	0.11	180.1	01/31/2015 14:10	BG
COPPER	4.60 I	UG/L	4	16	200.7	02/09/2015 18:05	JSM
ZINC	10.4	UG/L	1.4	5.6	200.7	02/09/2015 18:05	JSM
AMMONIA NITROGEN	0.039	MG/L	0.008	0.032	350.1	02/02/2015 10:20	SJ
AMMONIA NITROGEN, DISSOLVED	0.010 I	MG/L	0.008	0.032	350.1	02/02/2015 10:22	SJ
ORGANIC NITROGEN, DISSOLVED	1.32	MG/L	0.05	0.20	351-350.1	02/04/2015 09:51	KS/SJ
TOTAL KJELDAHL NITROGEN	2.68	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.33	MG/L	0.05	0.20	351.2	02/04/2015 09:51	KS
TOTAL NITROGEN	2.82	MG/L	0.05	0.20	353+351	02/04/2015 09:28	KS/KC
NITRATE+NITRITE AS N	0.136	MG/L	0.004	0.016	353.2	02/04/2015 09:28	KC
ORTHO PHOSPHORUS AS P	0.002 U	MG/L	0.002	0.008	365.3	02/01/2015 09:11	SJ
TOTAL PHOSPHORUS AS P	0.210	MG/L	0.008	0.032	365.3	02/02/2015 12:38	SJ
CHLOROPHYLL A, CORRECTED	51.2	MG/M3	0.25	1.00	445.0	02/05/2015 15:00	BG
TOTAL ALKALINITY (CACO3)	127	MG/L	0.594	2.376	SM2320B	02/03/2015 09:00	DW
TOTAL SUSPENDED SOLIDS	24.7	MG/L	0.570	2.280	SM2540D	02/03/2015 12:05	SN/SW
BIOCHEMICAL OXYGEN DEMAND	5.48	MG/L	0.5	2.0	SM5210B	02/01/2015 08:43	SJ/PN
TOTAL ORGANIC CARBON	15.1	MG/L	0.271	1.084	SM5310B	02/03/2015 19:18	KD

02/11/2015

Dale D. Dixon / Laboratory Director — Date

Tülay Tanrisever / QC Officer

Deborah Murphy / Project Manager

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.
B = Results based upon colony counts outside the ideal range.
H = Value based on field kit determination. Results may not be accurate.
I = Reported value is between the laboratory MDL and the PQL.
J1 = Estimated value. Surrogate recovery limits exceeded.
J2 = Estimated value. No quality control criteria exists for component.
J3 = Estimated value. Quality control criteria for precision or accuracy not met.
J4 = Estimated value. Sample matrix interference suspected.
J5 = Estimated value. Data questionable due to improper lab or field protocols.
K = Off-scale low. Value is known to be < the value reported.
L = Off-scale high. Value is known to be > the value reported.
N = Presumptive evidence of presence of material.
O = Sampled, but analysis lost or not performed.
Q = Sample held beyond accepted hold time.
T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.
U = Analyte analyzed but not detected at the value indicated.
V = Analyte detected in sample and method blank. Results for this analyte in associated samples may be biased high. Standard, Duplicate and Spike values are within control limits. Reported data are usable.
Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.
Z = Too many colonies were present (TNTC). The numeric value represents the filtration volume.
! = Data deviate from historically established concentration ranges.
? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the presence or absence of the analyte cannot be determined from the data.
* = Not reported due to interference.

NOTES:

MBAS calculated as LAS; molecular weight = 340.
PQL = 4xMDL.
ND = Not detected at or above the adjusted reporting limit.
X = Value exceeds MCL.

COMMENTS:

Chlorophyll A lab filtered on 01/31/15 at 1400.

For questions or comments regarding these results, please contact us at (941) 723-9986.

Results relate only to the samples.

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813-641-1200
Fax: 813-641-1204
Mark Flint – mflint@watermarkengineers.com

Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 1501177

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 1/31 1400	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) **(Lab Filtered)**	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2 ✓	Plain	Plain	1:4 HNO_3 pH<2 ✓	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-1	Comp.	SW	Start Date & Time: ~~1/30/15~~ 1/29/15, 1:45 PM End Date & Time: 1/30/15, 1:45 PM							1
BWL-6	Comp.	SW	Start Date & Time: ~~1/30/15~~ 1/29/15, 1:45 PM End Date & Time: 1/30/15, 1:45 PM							2
BWL-6-DUP	Comp.	SW	Start Date & Time: ~~1/30/15~~ 1/29/15, 1:45 PM End Date & Time: 1/30/15, 1:45 PM							3
	Comp.	SW	Start Date & Time: End Date & Time:							

[1] "Sample Type" is used to indicate whether the sample was a grab (G) or whether it was a composite (C).

[2] "Sample Matrix" is used to indicate whether the sample is being discharged to drinking water (DW), groundwater (GW), surface water (SW), soil, sediment (SED/SNT), or sludge (SLDG).

[3] "Container Type" is used to indicate whether the container is plastic (P) or glass (G).

[4] Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).
Under "Preservative," list any preservatives that were added to the sample container

Instructions:
1 Each bottle has a label identifying sample ID, preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2 The following information should be added to each bottle label after collection with permanent black ink: date and time of collection, sampler's name or initials, and any field number or ID.
3 All bottles not containing preservative may be rinsed with appropriate sample prior to collection.
4 The client is responsible for documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 ✓

BEA Temperature: 0.9 °C

1	Collected By: Phong Nguyen, Avedis Serpekian	Date 1/30/15	Time ~~4~~:00 PM	Received By: Brad	Date 1/31/15	Time 1310
2	Relinquished By:	Date	Time	Received By:	Date	Time

h30 h

BENCHMARK
EnviroAnalytical Inc.

NELAC Certification #E84167

ANALYTICAL TEST REPORT
THESE RESULTS MEET NELAC STANDARDS

Submission Number : 15030746

Watermark Engineering Group
3868 Sun City Center Blvd
Sun City Center, Fl 33573

Project Name : BRIARWOOD STORMWATER TREATMENT
Date Received : 03/20/2015
Time Received : 1630

Mark Flint

Submission Number: 15030746
Sample Number: 001
Sample Description: BWL-1

Sample Date: 03/20/2015
Sample Time: 1330
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	26	NTU	0.11	0.11	180.1	03/21/2015 13:20	BG
COPPER	4 U	UG/L	4	16	200.7	03/30/2015 12:30	KC/JSM
ZINC	8.41	UG/L	1.4	5.6	200.7	03/30/2015 12:30	KC/JSM
AMMONIA NITROGEN	0.021 I	MG/L	0.008	0.032	350.1	03/23/2015 10:12	SJ
AMMONIA NITROGEN, DISSOLVED	0.008 U	MG/L	0.008	0.032	350.1	03/23/2015 10:21	SJ
ORGANIC NITROGEN, DISSOLVED	1.29	MG/L	0.05	0.20	351-350.1	03/24/2015 09:53	KS/SJ
TOTAL KJELDAHL NITROGEN	3.13	MG/L	0.05	0.20	351.2	03/24/2015 12:03	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.29	MG/L	0.05	0.20	351.2	03/24/2015 12:03	KS
TOTAL NITROGEN	1.31	MG/L	0.05	0.20	353+351	03/25/2015 09:53	KS/SW
NITRATE+NITRITE AS N	0.016	MG/L	0.004	0.016	353.2	03/25/2015 09:53	SW
ORTHO PHOSPHORUS AS P	0.003 I	MG/L	0.002	0.008	365.3	03/21/2015 12:46	SJ
TOTAL PHOSPHORUS AS P	0.221	MG/L	0.008	0.032	365.3	03/23/2015 12:50	SJ
CHLOROPHYLL A, CORRECTED	117	MG/M3	0.25	1.00	445.0	03/27/2015 09:00	BG
TOTAL ALKALINITY (CACO3)	106	MG/L	0.594	2.376	SM2320B	03/26/2015 09:00	DW
TOTAL SUSPENDED SOLIDS	32.0	MG/L	0.570	2.280	SM2540D	03/24/2015 13:01	SN/KP
BIOCHEMICAL OXYGEN DEMAND	7.84	MG/L	0.5	2.0	SM5210B	03/21/2015 12:49	PN/SJ
TOTAL ORGANIC CARBON	17.2	MG/L	0.271	1.084	SM5310B	03/24/2015 13:44	KD

Submission Number: 15030746
Sample Number: 002
Sample Description: BWL-2

Sample Date: 03/20/2015
Sample Time: 1330
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	20	NTU	0.11	0.11	180.1	03/21/2015 13:20	BG
COPPER	4 U	UG/L	4	16	200.7	03/30/2015 12:34	JSM/KC

ZINC	8.80	UG/L	1.4	5.6	200.7	03/30/2015	12:34	JSM/KC
AMMONIA NITROGEN	0.140	MG/L	0.008	0.032	350.1	03/23/2015	10:14	SJ
AMMONIA NITROGEN, DISSOLVED	0.102	MG/L	0.008	0.032	350.1	03/23/2015	10:23	SJ
ORGANIC NITROGEN, DISSOLVED	1.49	MG/L	0.05	0.20	351-350.1	03/24/2015	09:53	KS/SJ
TOTAL KJELDAHL NITROGEN	2.68	MG/L	0.05	0.20	351.2	03/24/2015	12:03	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.59	MG/L	0.05	0.20	351.2	03/24/2015	12:03	KS
TOTAL NITROGEN	1.64	MG/L	0.05	0.20	353+351	03/25/2015	09:53	KS/SW
NITRATE+NITRITE AS N	0.115	MG/L	0.004	0.016	353.2	03/25/2015	09:53	SW
ORTHO PHOSPHORUS AS P	0.032	MG/L	0.002	0.008	365.3	03/21/2015	12:49	SJ
TOTAL PHOSPHORUS AS P	0.235	MG/L	0.008	0.032	365.3	03/23/2015	12:51	SJ
CHLOROPHYLL A, CORRECTED	56.5	MG/M3	0.25	1.00	445.0	03/27/2015	09:00	BG
TOTAL ALKALINITY (CACO3)	106	MG/L	0.594	2.376	SM2320B	03/26/2015	09:00	DW
TOTAL SUSPENDED SOLIDS	18.0	MG/L	0.570	2.280	SM2540D	03/24/2015	13:01	SN/KP
BIOCHEMICAL OXYGEN DEMAND	6.35	MG/L	0.5	2.0	SM5210B	03/21/2015	12:49	PN/SJ
TOTAL ORGANIC CARBON	17.0	MG/L	0.271	1.084	SM5310B	03/24/2015	13:59	KD

Submission Number: 15030746
Sample Number: 003
Sample Description: BWL-2 DUP

Sample Date: 03/20/2015
Sample Time: 1330
Sample Method: Composite

Parameter	Result	Units	MDL	PQL	Procedure	Analysis Date/Time	Analyst
TURBIDITY	18	NTU	0.11	0.11	180.1	03/21/2015 13:20	BG
COPPER	4 I	UG/L	4	16	200.7	03/30/2015 12:38	KC
ZINC	8.49	UG/L	1.4	5.6	200.7	03/30/2015 12:38	KC
AMMONIA NITROGEN	0.138	MG/L	0.008	0.032	350.1	03/23/2015 10:18	SJ
AMMONIA NITROGEN, DISSOLVED	0.108	MG/L	0.008	0.032	350.1	03/23/2015 10:24	SJ
ORGANIC NITROGEN, DISSOLVED	1.40	MG/L	0.05	0.20	351-350.1	03/24/2015 09:53	KS/SJ
TOTAL KJELDAHL NITROGEN	2.81	MG/L	0.05	0.20	351.2	03/24/2015 12:03	KS
TOTAL KJELDAHL NITROGEN, DISSOLVED	1.51	MG/L	0.05	0.20	351.2	03/24/2015 12:03	KS
TOTAL NITROGEN	1.63	MG/L	0.05	0.20	353+351	03/25/2015 09:53	KS/SW
NITRATE+NITRITE AS N	0.119	MG/L	0.004	0.016	353.2	03/25/2015 09:53	SW
ORTHO PHOSPHORUS AS P	0.031	MG/L	0.002	0.008	365.3	03/21/2015 12:51	SJ
TOTAL PHOSPHORUS AS P	0.238	MG/L	0.008	0.032	365.3	03/23/2015 12:52	SJ
CHLOROPHYLL A, CORRECTED	59.0	MG/M3	0.25	1.00	445.0	03/27/2015 09:00	BG
TOTAL ALKALINITY (CACO3)	107	MG/L	0.594	2.376	SM2320B	03/26/2015 09:00	DW
TOTAL SUSPENDED SOLIDS	18.0	MG/L	0.570	2.280	SM2540D	03/24/2015 13:01	SN/KP
BIOCHEMICAL OXYGEN DEMAND	6.32	MG/L	0.5	2.0	SM5210B	03/21/2015 12:49	PN/SJ
TOTAL ORGANIC CARBON	17.0	MG/L	0.271	1.084	SM5310B	03/24/2015 14:15	KD

Dale D. Dixon / Laboratory Director — 04/06/2015 Date

Tülay Tanrisever / QC Officer

Deborah A. Murphy / Project Manager

DATA QUALIFIERS THAT MAY APPLY:

A = Value reported is an average of two or more determinations.
B = Results based upon colony counts outside the ideal range.
H = Value based on field kit determination. Results may not be accurate.
I = Reported value is between the laboratory MDL and the PQL.
J1 = Estimated value. Surrogate recovery limits exceeded.
J2 = Estimated value. No quality control criteria exists for component.
J3 = Estimated value. Quality control criteria for precision or accuracy not met.
J4 = Estimated value. Sample matrix interference suspected.
J5 = Estimated value. Data questionable due to improper lab or field protocols.
K = Off-scale low. Value is known to be < the value reported.
L = Off-scale high. Value is known to be > the value reported.
N = Presumptive evidence of presence of material.
O = Sampled, but analysis lost or not performed.
Q = Sample held beyond accepted hold time.
T = Value reported is < MDL. Reported for informational purposes only and shall not be used in statistical analysis.
U = Analyte analyzed but not detected at the value indicated.
V = Analyte detected in sample and method blank. Results for this analyte in associated samples may be biased high. Standard, Duplicate and Spike values are within control limits. Reported data are usable.
Y = Analysis performed on an improperly preserved sample. Data may be inaccurate.
Z = Too many colonies were present (TNTC). The numeric value represents the filtration volume.
! = Data deviate from historically established concentration ranges.
? = Data rejected and should not be used. Some or all of QC data were outside criteria, and the presence or absence of the analyte cannot be determined from the data.
* = Not reported due to interference.

NOTES:

MBAS calculated as LAS; molecular weight = 340.
PQL = 4xMDL.
ND = Not detected at or above the adjusted reporting limit.
X = Value exceeds MCL.

COMMENTS:

Chlorophyll A lab filtered on 03/20/15 at 1655.

For questions or comments regarding these results, please contact us at (941) 723-9986.

Results relate only to the samples.

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Project Name: Briarwood Stormwater Treatment Facility
Profile 560

Laboratory Submission # 1503O7446

Sample Name	Sample Type[1]	Sample Matrix[2]	Parameters, Preservation[4], Container Type[3]							Laboratory Sample #
			Corrected Chlorophyll a (445.0) 3/20 1655	TOC (SM5310B)	Dissolved Organic Nitrogen (Calc.) NH_3 (350.1) TKN (351.2) **(Lab Filtered)**	NH_3 (350.1) TKN (351.2) NO_3-NO_2 (353.2) TP (365.3) TN (Calc.)	Ortho-Phosphate (Lab Filtered) (365.3)	BOD_5 (SM5210B) TSS (SM2540D) T-Alkalinity (SM2320B) Turbidity (180.1)	Cu Zn. (200.7)	
			A	B	C	D	E	F	G	
			Plain	1:1 HCl	Plain	1:4 H_2SO_4 pH<2 ✓	Plain	Plain	1:4 HNO_3 pH<2 ✓	
			1 x 500mL Opaque Plastic	1 x 40mL Glass Vial	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x ½ Pint Plastic	1 x 2 Quart Plastic	1 x ½ Pint Plastic	
BWL-1	Comp.	SW	Start Date & Time: 3/20/15 1:00-1:30 PM End Date & Time: 3/20/15 1:00-1:30 PM							1
BWL-2	Comp.	SW	Start Date & Time: 3/20/15 1:00-1:30 PM End Date & Time: 3/20/15 1:00-1:30 PM							2
BWL-2-DUP	Comp.	SW	Start Date & Time: 3/20/15 1:00-1:30 PM End Date & Time: 3/20/15 1:00-1:30 PM							3
	Comp.	SW	Start Date & Time: End Date & Time:							

[1] Sample Type: Comp. = composite sample; Grab = grab sample.
[2] Sample Matrix: SW = surface water; GW = groundwater; WW = wastewater; SO = soil; SED = sediment; SL = sludge; OL = oil; O = other.
[3] Container Type: P = plastic; G = glass.
[4] Preservation: Sample must be refrigerated or stored in wet ice after collection. The temperature during storage should be less than or equal to 6°C (42.8°F).

Instructions:
1. Each bottle must be labeled with the sample ID, preservative contained in the bottle, sample type, client ID, and parameters for analysis.
2. The following information should be recorded on each bottle label after collection: date and time of collection, sampler's name or initials, and any field measurements.
3. All bottles containing preservatives must be filled with appropriate sample, prior to collection.
4. The chain of custody is the documentation of the sampling event. Please note special sampling events on the sample custody form.

Laboratory Sample Acceptability: pH <2 : ✓
BEA Temperature: 1.2 °C

1	Collected By: Mark Flint	Date 3/20/15	Time 1:30 PM	Received By:		Date	Time
2	Relinquished By: Mark Flint	Date 3/20/15	Time 1630	Received By:		Date 3/20/15	Time 1630

Note: BWL-2 = effluent wet well, BWL-1 = influent wet well, DUP = duplicate

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