Performance Efficiency Evaluation of the Cameron Ditch Stormwater Facility

Final Report

August 2011

Prepared for:

Seminole County, Florida

Prepared by:

Environmental Research & Design, Inc.
Harvey H. Harper, Ph.D., P.E.
3419 Trentwood Blvd., Suite 102
Orlando, FL 32812
407 855-9465

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES -- CONTINUED

LIST OF FIGURES -- CONTINUED

Figure Number / Description **Page**

LIST OF TABLES

LIST OF TABLES -- CONTINUED

SECTION 1

INTRODUCTION

1.1 Project Background

This document provides a summary of work efforts conducted by Environmental Research & Design, Inc. (ERD) for Seminole County (County) to conduct a performance efficiency evaluation of the Cameron Ditch Stormwater Facility. This facility was constructed by the County to reduce loadings discharging from the Cameron Ditch watershed into Lake Jesup. The Cameron Ditch stormwater system consists of an on-line wet detention pond, consisting of both deep and shallow vegetated areas, which was constructed along the historical flow path of Cameron Ditch to provide retrofit water quality treatment. Cameron Ditch is a man-made vegetated conveyance channel which collects runoff from adjacent watershed areas and ultimately discharges into the northern side of Lake Jesup.

Section 303(d) of the Clean Water Act requires states to submit lists of surface waterbodies that do not meet applicable water quality standards. These waterbodies are defined as "impaired waters" and total maximum daily loads (TMDLs) must be established for these waters on a prioritized schedule. Lake Jesup (WBID #2981) has been designated as an "impaired water" due to elevated nutrient and TSI values. A nutrient TMDL was developed by FDEP during 2005 which was adopted into rule on August 3, 2006. The Cameron Ditch stormwater facility was constructed to assist in reducing nutrient loadings to Lake Jesup in an effort to improve in-lake nutrient concentrations.

General location maps for the Cameron Ditch stormwater facility are given on Figure 1-1. The project is located in Seminole County southeast of the intersection of Cameron Avenue and East Lake Mary Blvd. The project lies within the Cameron Ditch sub-basin of the Lake Jesup basin.

1.2 Project Description

The Cameron Ditch stormwater facility consists of a series of meandering wet detention ponds constructed on a 28-acre parcel located along the north shoreline of Lake Jesup. The originally permitted stormwater facility consisted of two cascading wet detention ponds which discharge to a plunge pool, herbaceous wetland, and ultimately into Lake Jesup. The parcel used for the facility is owned by the St. Johns River Water Management District (SJRWMD). The construction activities also included replacement and modifications to structures along the primary conveyance channels to divert runoff into the treatment area. Construction of a passive stormwater park is planned as a future phase to provide recreational opportunities in the rapidly urbanizing adjacent areas. The park infrastructure will include a grass parking lot, a pavilion, restrooms, gazebos, boardwalks, and informational kiosks. Design criteria for the stormwater facility are summarized in Table 1-1. Selected construction drawings for the Cameron Ditch stormwater facility (dated October 2005) are included in Appendix A.

Figure 1-1. Location Map for the Cameron Ditch Stormwater Facility.

TABLE 1-1

DESIGN CRITERIA FOR THE CAMERON DITCH STORMWATER FACILITY (Source: CDM)

PARAMETER	INFORMATION
Treatment System Type	Wet detention ponds/wetland
Pond Area	5.0 acres at NWL, divided into two interconnected treatment areas
Drainage Basin Area	344 acres (includes 315 acres of existing areas to be retrofitted plus 29 acres to be developed with BMPs)
Drainage Basin Land Use	Agricultural (64%), low-density residential (8%), shrub and brushland (11%), wetlands (8%), and other miscellaneous uses
Basin Soil Hydrologic Groups	B/D, D
Basin Impervious Area	189 acres (60%) ; assumed future development
Treatment Volume (both ponds combined)	0.3" over basin area (315 acres); 0.5" over impervious area
Permanent Pool Volume	45.6 ac-ft below NWL (both ponds)
Pond Depth a. Maximum b. Mean	a. 12 ft b. 9.1 ft (45.6 ac-ft/5.0 ac)
Treatment Volume Recovery	50% of treatment volume released in 24-30 hours
Pond Residence Time	14 days (wet season conditions)
Littoral Zone	Approximately 30% of pond area

A schematic overview of the Cameron Ditch stormwater facility and significant drainage inputs and patterns is given in Figure 1-2. An aerial overview of the Cameron Ditch stormwater facility is given on Figure 1-3. The treatment system consists of a series of three cascading wet ponds, which are referred to as Ponds A, B, and C in this document. The constructed configuration is different from the construction plans included in Appendix A which shows Ponds A and B combined into a single pond. Pond A consists of a shallow vegetated cell which receives the dominant runoff inflow into the system. Pond A is connected to Pond B by a 12-inch diameter bleed-down pipe designed to increase the duration of wet conditions in Pond A to support the planted wetland vegetation. Under high flow conditions, excess water from Pond A can also discharge across an earthen berm into Pond B. Water levels in Pond B are regulated by an underground weir structure which contains two orifices, to provide a slow bleed-down of the water from Pond B to Pond C, as well as a horizontal weir for higher discharges. Pond C consists of a combination of deep and shallow vegetated areas and receives inflow from Pond B as well as from western portions of the drainage basin. Water in Pond C migrates through a narrow, shallow vegetated channel before reaching the discharge structure for the overall system.

As indicated on Figure 1-2, discharges from the treatment facility enter a shallow 1.3-acre plunge pool which discharges into a herbaceous wetland which is hydrologically connected to Lake Jesup. The plunge pool is designed to reduce the incoming runoff velocities and spread the flow evenly over the herbaceous wetland area. Although the plunge pool is considered part of the overall treatment system, discharges from the plunge pool were not monitored as part of this project. In addition to discharges from the Cameron Ditch facility, the plunge pool also receives two additional inflows of untreated runoff from Cameron Avenue and Kentucky Street, and it would have been impossible to separate the impacts of these inflows from the treated flows discharging from the Cameron Ditch treatment system.

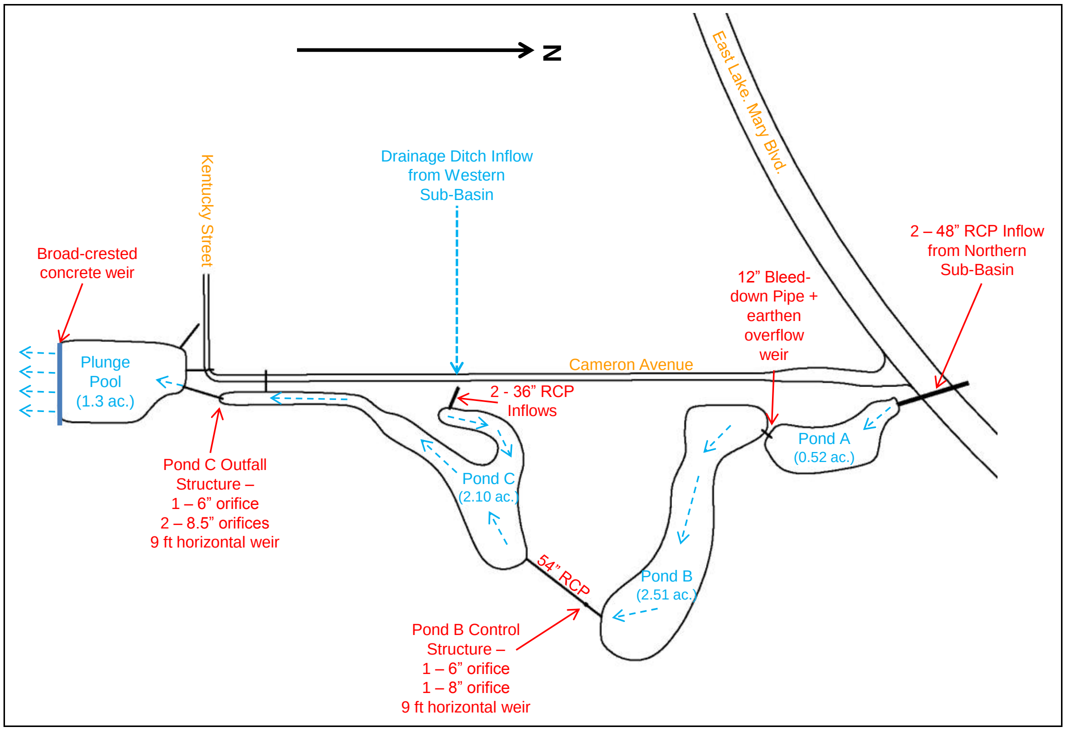


Figure 1-2. Schematic Overview of the Cameron Ditch Stormwater Facility.

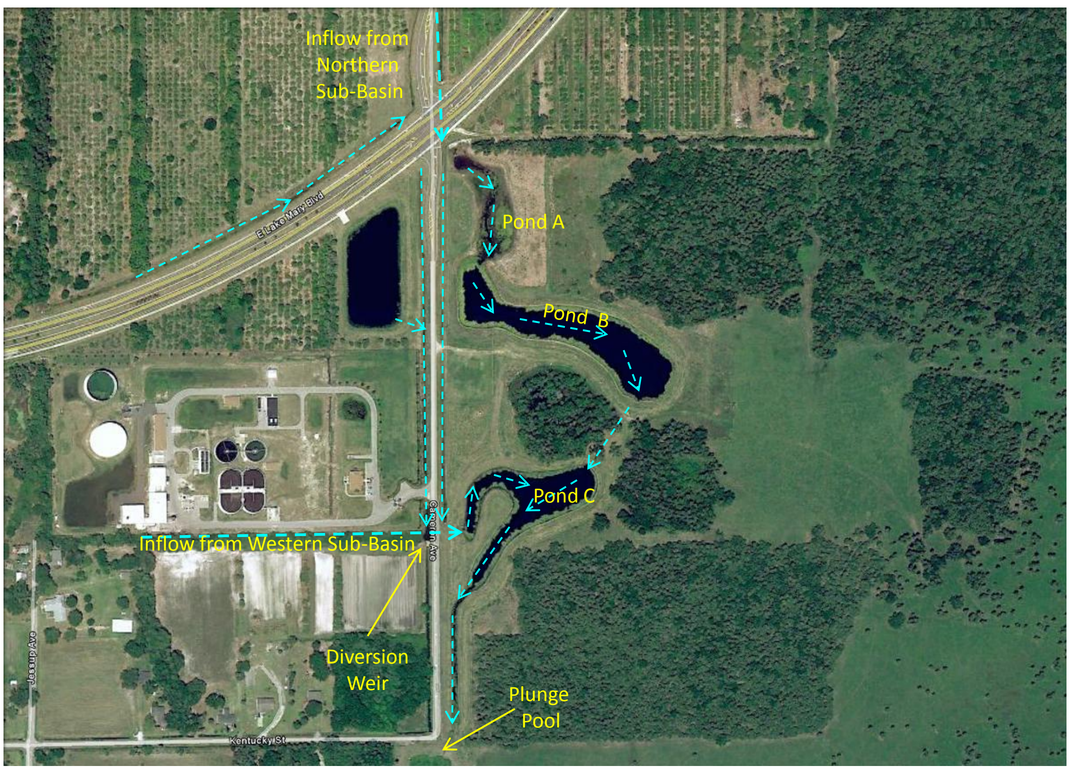


Figure 1-3. Aerial Overview of the Cameron Ditch Stormwater Facility and Significant Drainage Patterns.

An independent delineation of sub-basin areas discharging to the Cameron Ditch stormwater facility was conducted by ERD based upon a review of construction drawings, recent aerial photography, and available 1-ft contour data. Delineations of the contributing sub-basin areas developed by ERD are indicated on Figure 1-4. The Cameron Ditch stormwater facility has two primary points of inflow for runoff from the adjacent sub-basin areas. The dominant source of inflow occurs from a 342.6-acre sub-basin, referred to as the Northern Sub-basin for purposes of this report, which discharges into the northern end of Pond A. Land use in this area consists of a combination of existing agricultural land uses, along with transportation land uses associated with the recently constructed Sanford-Orlando International Airport. The western sub-basin consists of approximately 112.6 acres of existing agricultural and residential areas, along with a City of Sanford water reclamation facility. Runoff generated within this sub-basin discharges into the western lobe of Pond C.

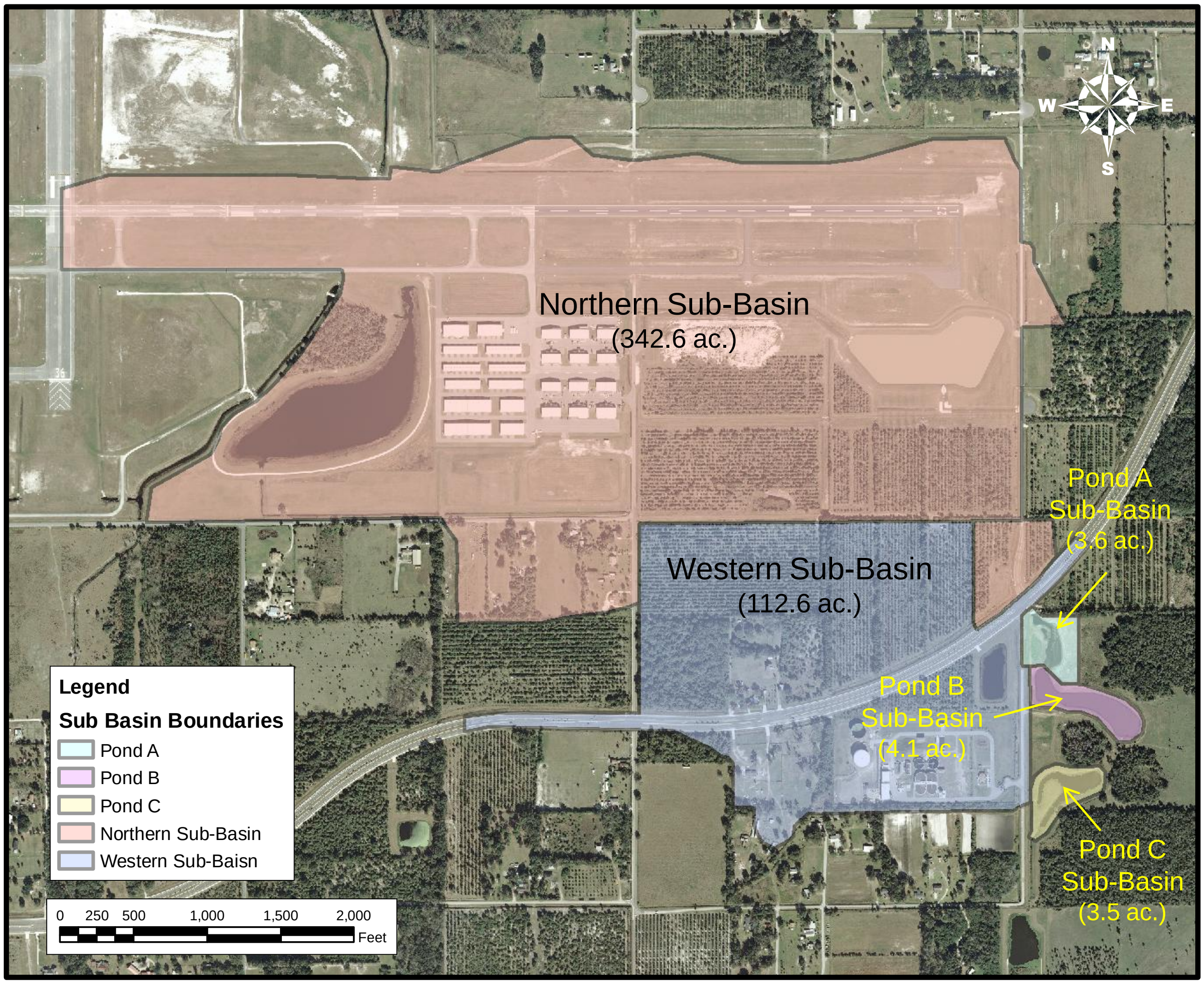
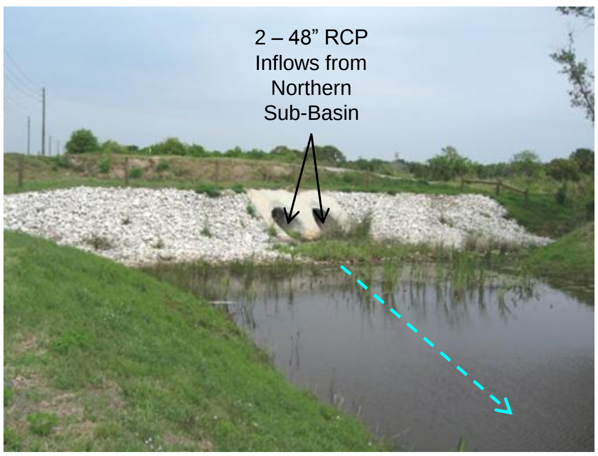


Figure 1-4. Delineated Sub-basin Areas Discharging to the Cameron Ditch Stormwater Facility.

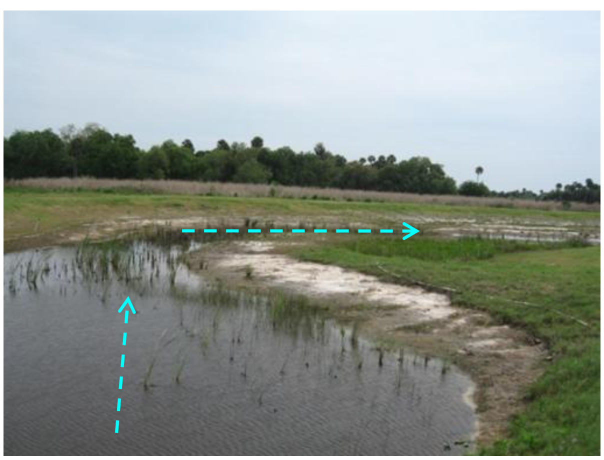
The combined watershed area identified by ERD contains approximately 455 acres which is somewhat larger than the 344-acre drainage basin area indicated in the CDM design report. It appears that construction activities for the Sanford-Orlando International Airport resulted in an increase in the size of the northern sub-basin area which discharges through Cameron Ditch. In addition to the northern and western sub-basins, areas were also identified which discharge directly into each of the three ponds. These small sub-basin areas are also indicated on Figure 1-4.

Photographs of Cameron Ditch Pond A are given on Figure 1-5. The point of inflow for the two 48-inch RCP pipes from the northern sub-basin are indicated on Figure 1-5a. Central portions of Pond A are relatively shallow in depth and are designed to support a diverse community of aquatic vegetation. Photographs of central portions of Pond A are given on Figures 1-5b and c. An earthen overflow berm is located at the downstream end of Pond A, with an embedded 12-inch bleed-down pipe which is used to regulate water levels within Pond A.

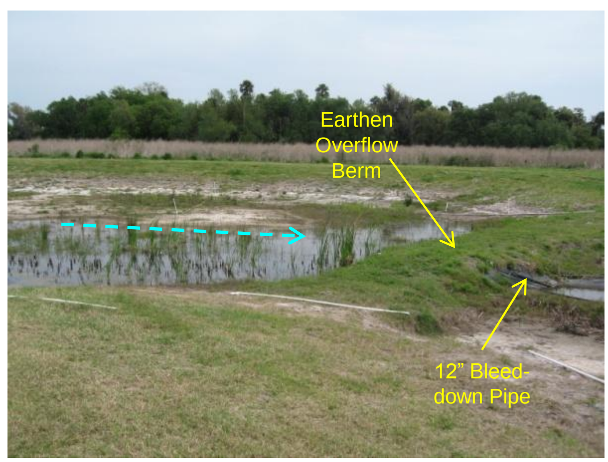


a. Upstream portion of Pond A at point of inflow for the Northern Sub-basin

b. Pond A downstream from inflows



c. Middle portions of Pond A indicating planted vegetation



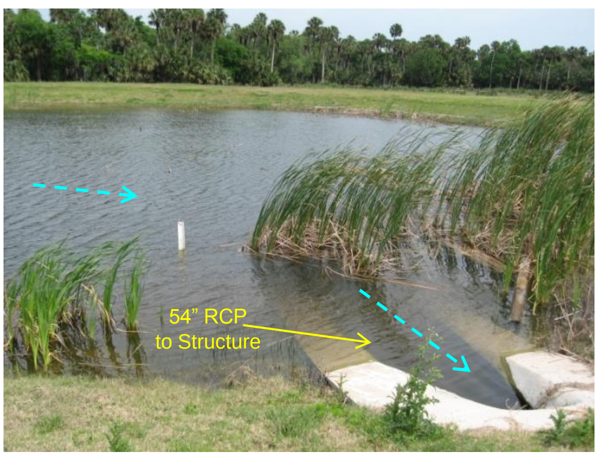
d. Downstream end of Pond A at bleed-down pipe and earthen weir

Figure 1-5. Photographs of Cameron Ditch Pond A.

Photographs of Cameron Ditch Pond B are given on Figure 1-6. Pond B is a relatively deep open water cell which receives the discharges from Pond A. Middle portions of Pond B consist of open water, with littoral zone vegetation around the shoreline. A 54-inch RCP is located at the downstream end of Pond B which is connected to the underground control structure for the pond. This control structure regulates the rate of discharge of water from Pond B to Pond C.

a. Upstream portion of Pond B at point of inflow for Pond A

b. Middle portions of Pond B

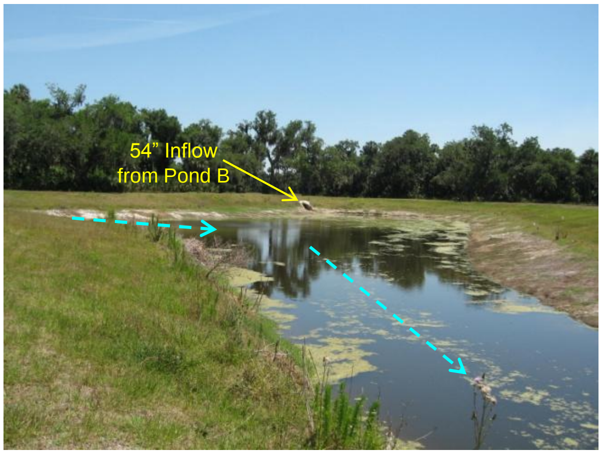


c. Downstream end of Pond B at discharge pipe

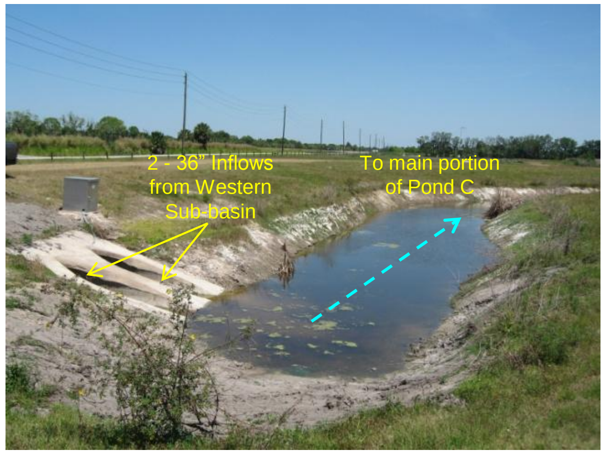
d. Pond B water level control structure

Figure 1-6. Photographs of Cameron Ditch Pond B.

Photographs of Cameron Ditch Pond C are given on Figure 1-7. Inflow from Pond B enters into Pond C in an open water cell which is shown on Figure 1-7a. Inflows from the western sub-basin discharge into a side channel located west of the main open water portion of Pond C and co-mingle with discharges from Pond B. Excess water from Pond C travels down a 450-ft long channel, approximately 18-20 ft in width at normal water elevation, which contains a variety of submerged and emergent aquatic vegetation. Photographs of the discharge channel are given on Figures 1-7c and d. This area is designed to provide final nutrient polishing by the wetland vegetation. Discharges through the Pond C outfall structure are directed into the plunge pool and ultimately migrate in the direction of Lake Jesup.

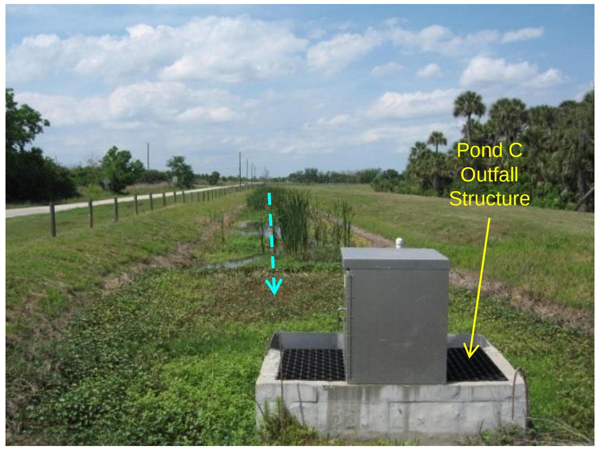


a. Middle portions of Pond C



b. Inflows from western sub-basin into Pond C


c. Downstream narrow vegetated portions of Pond C



d. Pond C outfall structure

Figure 1-7. Photographs of Cameron Ditch Pond C.

As indicated on Table 1-1, the Cameron Ditch stormwater facility is designed to provide treatment equivalent to approximately 0.3 inches over the 315-acre area designed to be retrofitted by the system. According to the construction drawings (CDM, 2005), the total pond area is approximately 5.0 acres at normal water level (NWL), with a permanent pool volume of approximately 45.6 ac-ft. Maximum pond depth within the system is approximately 12 ft, with a mean water depth of 9.1 ft. The system is designed to provide approximately 14 days residence time during wet season conditions, with 50% of the treatment volume released within the first 24-30 hours.

Estimates of stage-area-volume relationships for the Cameron Ditch stormwater facility were generated by ERD based primarily upon the construction drawings provided in Appendix A. However, since the construction drawings indicate a 2-pond system rather than the constructed 3-pond system, separate estimates were generated for Pond A and Pond B (see Figure 1-2) by adding the earthen berm and extending the proposed construction contours to match the constructed configurations for the two ponds. A summary of stage-area-volume relationships for the Cameron Ditch stormwater facility is given in Table 1-2. Based upon this analysis, Pond A has an approximate surface area of 0.52 acres at the assumed control water level (CWL) of 7.7 ft, with an area of 2.51 acres for Pond B (at CWL of 7.7 ft), and 2.10 acres for Pond C (at CWL of 6.2 ft).

TABLE 1-2

STAGE-AREA-VOLUME RELATIONSHIPS FOR THE CAMERON DITCH STORMWATER FACILITY

POND	ELEVATION (ft)	AREA (acres)	VOLUME (ac-ft)
A	9.0	0.94	1.325
	8.0	0.71	0.500
	7.7 (CWL)	0.52	0.384
	7.0	0.068	0.113
	6.0	0.056	0.050
	5.0	0.044	0.00
B	9.0	2.75	24.44
	8.0	2.56	21.78
	7.7 (CWL)	2.51	21.04
	7.0	2.38	19.32
	6.0	2.34	16.96
	5.0	2.24	14.67
	4.0	2.10	12.50
	3.0	2.01	10.44
	2.0	1.92	8.48
	1.0	1.83	6.60
	0.0	1.74	4.82
	-1.0	1.65	3.12
	-2.0	1.56	1.52
	-3.0	1.47	0.00
C	11.0	3.80	27.90
	10.0	3.31	24.35
	9.0	2.94	21.22
	8.0	2.58	18.46
	7.0	2.32	16.01
	6.2 (CWL)	2.10	14.27
	6.0	2.05	13.83
	5.0	1.79	11.91
	4.0	1.62	10.20
	3.0	1.53	8.63
	2.0	1.45	7.14
	1.0	1.36	5.73
	0.0	1.27	4.42
	-1.0	1.19	3.19
	-2.0	1.10	2.04
	-3.0	1.02	0.98
	-4.0	0.94	0.00

A summary of bathymetric characteristics of the Cameron Ditch stormwater facility treatment ponds is given on Table 1-3. The calculated mean water depth in Pond A is approximately 0.74 ft at CWL, with a mean depth of 8.4 ft in Pond B and 6.8 ft in Pond C. Overall, the combined total area of the three ponds at CWL is approximately 5.13 acres, with a total volume at CWL of 35.69 ac-ft, corresponding to an overall mean water depth for the system of approximately 7.0 ft.

TABLE 1-3

BATHYMETRIC CHARACTERISTICS OF THE CAMERON DITCH STORMWATER FACILITY

POND	AREA @ CWL (acres)	VOLUME @ CWL (ac-ft)	MEAN DEPTH @ CWL (ft)
A	0.52	0.384	0.74
B	2.51	21.04	8.4
C	2.10	14.27	6.8
Totals:	**5.13**	**35.69**	**7.0**[1]

1. Overall mean depth for pond system

Construction of the Cameron Ditch stormwater facility was completed during May 2006. Funding for design and construction of the Cameron Ditch stormwater facility was provided by Seminole County and SJRWMD in the amount of $3,420,423. Funding for post-construction monitoring of the Cameron Ditch facility was provided by the Florida Department of Environmental Protection (FDEP) under Agreement No. S0341 in the amount of $92,756.38.

1.3 Work Efforts Performed by ERD

A Quality Assurance Project Plan (QAPP) was developed by ERD during December 2007 which provides details concerning the proposed field monitoring and laboratory analyses. Monitoring equipment was installed at the Cameron Ditch stormwater facility site during March-April 2008. Routine monitoring was initiated at the Cameron Ditch site on May 1, 2008 and was continued for a period of six months until October 2008 when monitoring was halted due to additional construction activities in Pond A to replace and enhance the wetland vegetation. Very few inflow samples were collected during this initial monitoring period due to low rainfall conditions, and the three cells exhibited low water levels with little or no discharge from the system. Since this initial monitoring was impacted by low rainfall and less than desirable wetland vegetation, it was decided to discard data collected during this initial period and resume monitoring after the modifications to Pond A were completed and the wetland vegetation became established. The results of this initial monitoring period are not addressed in this document. Field monitoring was resumed on May 1, 2010 and was continued for a period of ten months until February 28, 2011. The results of this second monitoring period are discussed in this document.

This report has been divided into four separate sections. Section 1 contains an introduction to the report, a description of the Cameron Ditch stormwater facility, and a summary of work efforts performed by ERD. Section 2 provides a detailed discussion of the methodologies used for field and laboratory evaluations. Section 3 provides a discussion of the hydrologic and water quality results, and a summary is provided in Section 4.

SECTION 2

FIELD AND LABORATORY ACTIVITIES

Field and laboratory investigations were conducted by ERD over a 10-month period from May 2010-February 2011 to evaluate the effectiveness of the Cameron Ditch stormwater management facility. Field monitoring was conducted at the inflows and outflow for the pond system and included a continuous record of significant inflows into the system and outflows through the discharge structure. Laboratory analyses were conducted on collected samples for general parameters and nutrients to assist in quantifying concentration-based and mass removal efficiencies. Specific details of monitoring efforts conducted at the Cameron Ditch stormwater facility site are given in the following sections.

2.1 Field Instrumentation and Monitoring

Monitoring locations used to evaluate the performance efficiency of the Cameron Ditch stormwater facility are illustrated on Figure 2-1. Inflow into the stormwater facility was monitored at two significant inflow points which included the double 48-inch RCP inflow into the north side of Pond A and the double 36-inch RCP inflow into the west side of Pond C. These locations are referred to on Figure 2-1 as Site 1 and Site 3, respectively. An additional water quality monitoring site was located at the discharge structure from Pond B which was used to characterize final water quality in Pond B as well as quantify the hydrologic and mass loading inputs to Pond C. This site is referred to as Site 2 on Figure 2-1. A final monitoring site was located at the outfall for Pond C which reflects the overall outfall for the Cameron Ditch stormwater facility. This site is referred to in Figure 2-1 as Site 4. In addition, water level recorders were installed in Pond B upstream from the water control structure, and in Pond C upstream from the final outfall structure. A rain gauge and pan evaporimeter were also installed adjacent to monitoring Site 2 to provide information on rainfall inputs and evaporation losses. A bulk precipitation collector was also located at this site to provide continuous collection of dry and wet precipitation at the site.

Stormwater samplers with integral flow meters were installed at each of the four monitoring sites indicated on Figure 2-1. Monitoring conducted at Site 1 was designed to characterize the inflows from Cameron Ditch into Pond A of the stormwater facility. A general overview of drainage patterns in the vicinity of Site 1 is given on Figure 2-2. Several significant flows converge on the north side of East Lake Mary Blvd. which includes Cameron Ditch from the north and an extensive roadside swale drainage system for East Lake Mary Blvd. on the west side. This area is circled on Figure 2-2. An expanded view of the culvert structures on the north side of East Lake Mary Blvd. is given on Figure 2-3. This photograph illustrates where the flow through Cameron Ditch combines with the roadway inflow from East Lake Mary Blvd., entering the double 48-inch RCPs which transport the runoff beneath East Lake Mary Blvd. into the north side of Pond A.

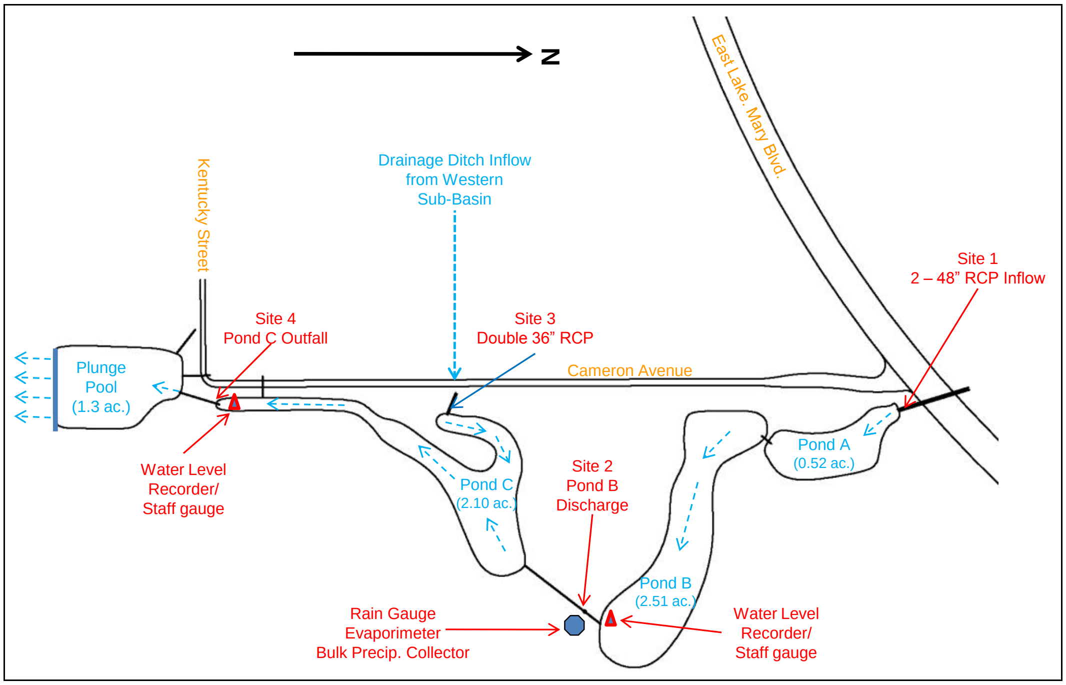


Figure 2-1. Hydrologic and Water Quality Monitoring Sites for the Cameron Ditch Stormwater Facility.

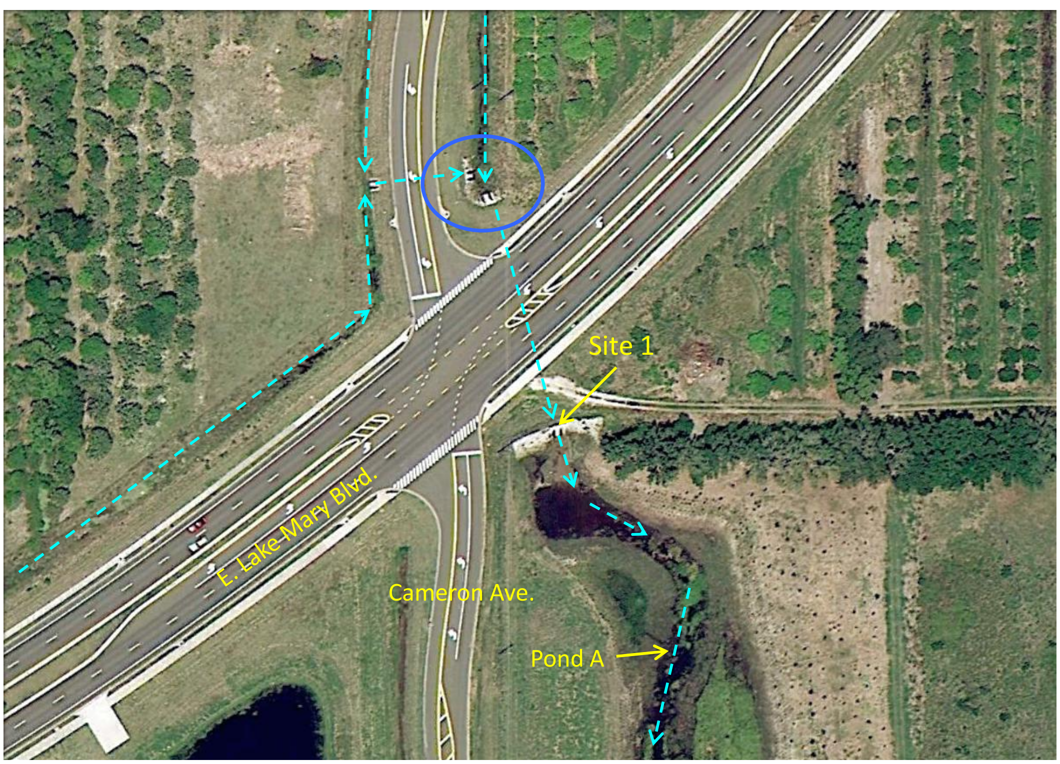


Figure 2-2. Aerial Overview of Monitoring Site 1 and Significant Drainage Patterns.

Figure 2-3. Photograph of the Culvert Structures on the North Side of East Lake Mary Blvd.

Monitoring at Site 1 was conducted on the downstream side of the twin 48-inch RCPs at the point of inflow into Pond A. Photographs of Cameron Ditch Site 1 are given on Figure 2-4. An automatic sequential stormwater sampler with integral flow meter (manufactured by Sigma, Model 900MAX) was installed adjacent to the culvert inflows. The autosampler was housed inside an insulated aluminum equipment shelter, and flow sensor cables and sample tubing were extended approximately 15 ft inside the eastern RCP. This autosampler was used to provide a continuous measurement of inflows into Pond A from Cameron Ditch under both storm event and baseflow conditions, as well as collect flow-weighted samples of the inflow over a wide range of flow conditions. Flow monitoring was conducted in the eastern RCP, and the total inflow was calculated by doubling the recorded inflow to account for the twin RCPs. Field flow measurements were conducted under a wide range of discharge conditions to verify that discharges through the twin RCPs were approximately equal.

The flow meter was programmed to provide a continuous record of inflow into the pond, with measurements stored into internal memory at 10-minute intervals. The automatic sampler contained a single 20-liter polyethylene bottle and was programmed to collect samples in a flow-weighted mode, with 500 ml aliquots piped into the collection bottle with every programmed increment of flow. Since 120 VAC power was not available at the site, the automatic sampler was operated on 12 VDC batteries which were charged using solar panels on the roof of the equipment shelter.

a. Equipment shelter used at Site 1

b. Autosampler inside insulated shelter

c. Twin 48-inch RCPs discharging into Pond from northern sub-basin

d. Sample tubing and flow probe extended approximately 10 ft into culverts

Figure 2-4. Photographs of Cameron Ditch Monitoring Site 1.

An aerial overview of monitoring Sites 2 and 3, and significant drainage patterns, is given on Figure 2-5. Monitoring Site 2 was located at the downstream end of Pond B inside the underground water control structure for the pond. Photographs of this monitoring site are given on Figure 2-6. The field monitoring equipment was installed on the concrete top cover for the box structure containing the bleed-down orifices and overflow weir. Equipment installed at this site provided a continuous record of the rate of flow and water quality characteristics for discharges from Pond B which also became inputs to Pond C.

An automatic sequential sampler with integral flow meter (manufactured by Sigma, Model 900MAX) was installed on top of the structure top for the water control structure. The autosampler was housed inside an insulated aluminum shelter, and sensor cables and sample tubing were extended through pre-existing slots in the manhole cover to the flow monitoring site. The flow probe and sample intake strainer were attached to the upstream wall of the weir structure within the box. In addition to the automatic sampler, the Class A evaporimeter pan, recording rain gauge, and bulk precipitation collector were also installed at this site.

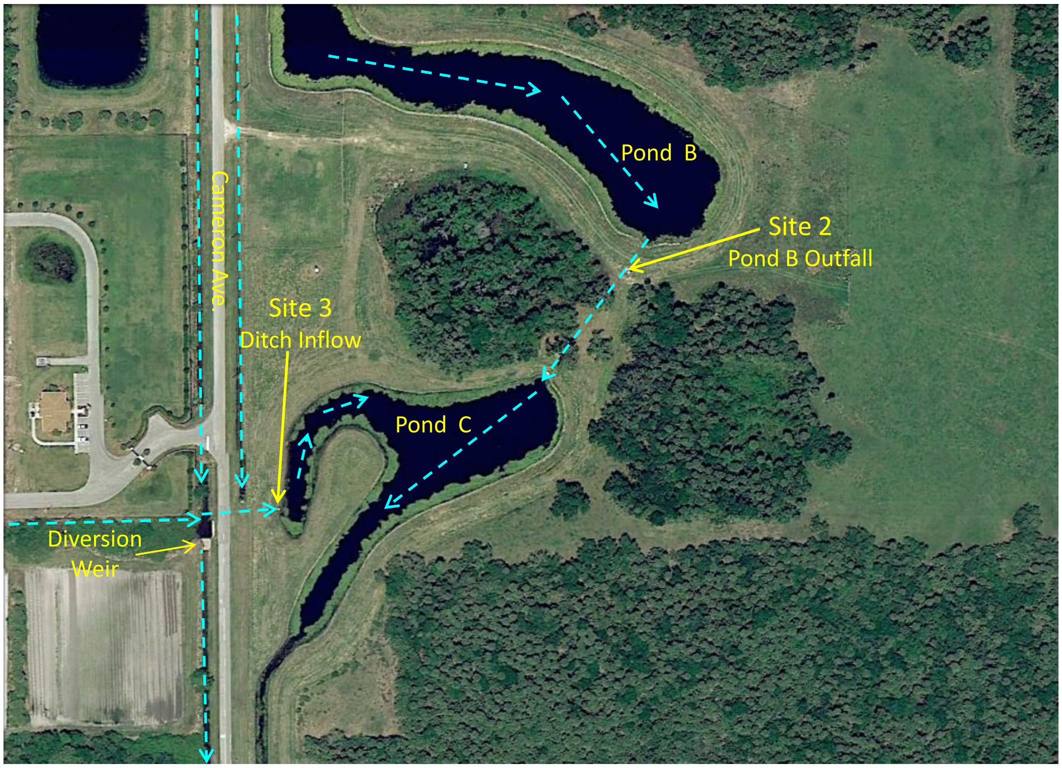
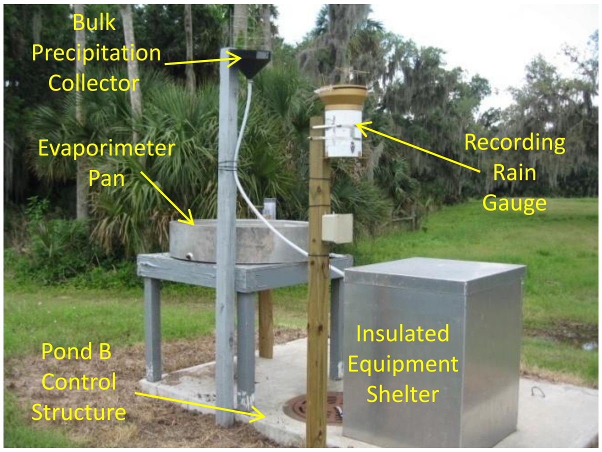


Figure 2-5. Aerial Overview of Monitoring Sites 2 and 3 and Significant Drainage Patterns.



a. Equipment shelter and meteorological equipment placed on top of Pond B water control structure

b. Autosampler inside insulated equipment shelter

Figure 2-6. Photographs of Cameron Ditch Monitoring Site 2.

The flow meter was programmed to provide a continuous record of inflow into the pond, with measurements stored into internal memory at 10-minute intervals. The automatic sampler contained a single 20-liter polyethylene bottle and was programmed to collect samples in a flow-weighted mode, with 500 ml aliquots piped into the collection bottle with every programmed increment of flow. Since 120 VAC power was not available at the site, the automatic sampler was operated on 12 VDC batteries which were charged using solar panels on the roof of the equipment shelter.

Monitoring Site 3 was located on the western finger of Pond C at the location indicated on Figure 2-5. An expanded view of drainage patterns and structures in the vicinity of Site 3 is given on Figure 2-7. The most significant inflow originates through the heavily vegetated channel which discharges excess runoff from the western sub-basin area. This flow co-mingles with runoff collected in roadside drainage ditches along the east and west sides of Cameron Avenue. The flows converge in an underground structure upstream from Pond C and discharge through two twin 36-inch RCPs into the pond. A ditch diversion weir was constructed to divert water from the western sub-basin into Pond C as opposed to the original drainage pattern which discharged the water in a southerly direction to Lake Jesup.

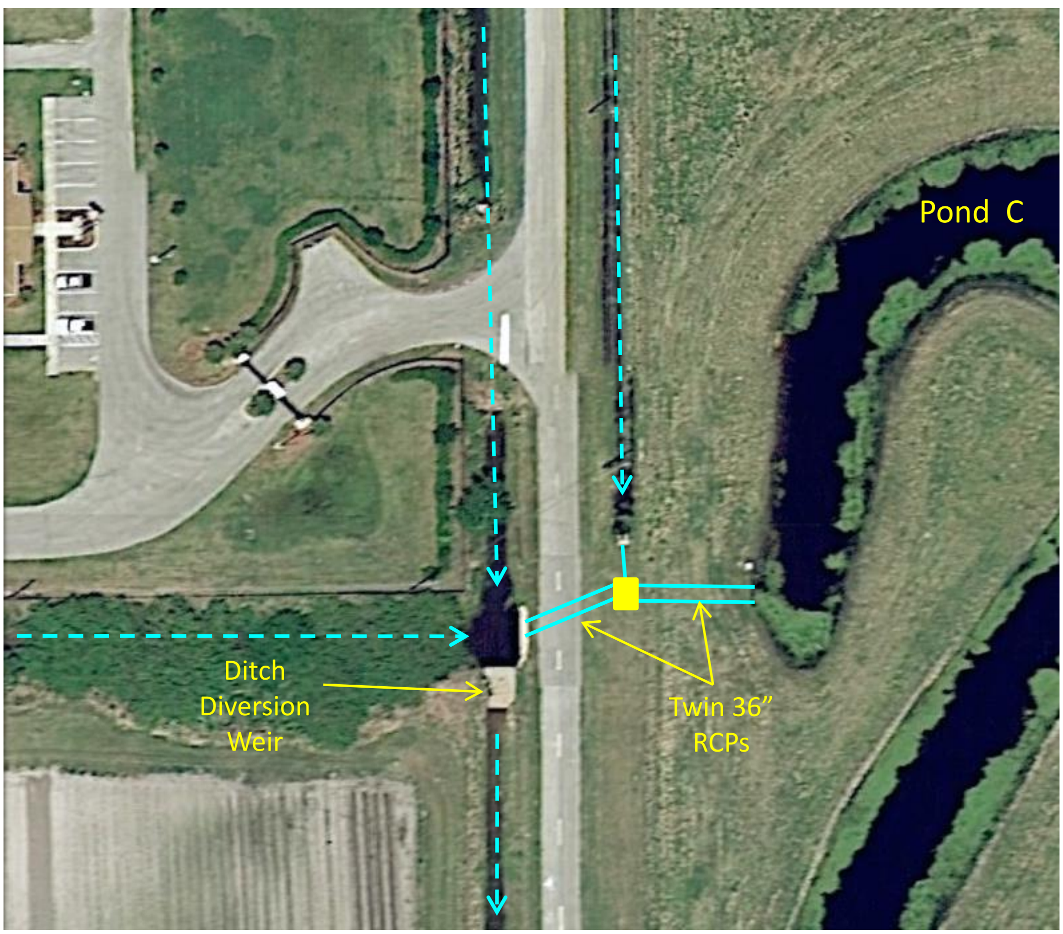
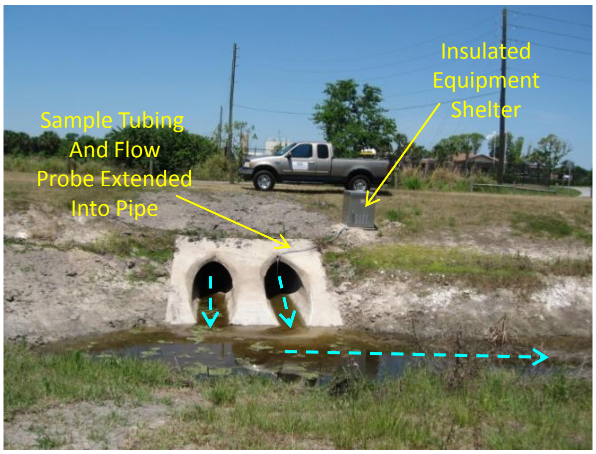


Figure 2-7. Drainage Patterns and Structures in the Vicinity of Site 3.

Inflow monitoring at Site 3 was conducted at the end of the twin 36-inch RCPs upstream of the point of inflow into Pond C. Photographs of Cameron Ditch monitoring Site 3 are given on Figure 2-8. An automatic sequential stormwater sampler with integral flow meter (manufactured by Sigma, Model 900MAX) was installed adjacent to the inflow for the northern 36-inch RCP. The autosampler was housed inside an insulated aluminum shelter, and flow sensor cables and sample tubing were extended from the sampler approximately 10-15 ft upstream in the northern 36-inch RCP to avoid tailwater impacts from the pond during routine storm events. Flow discharges measured at this site were multiplied by two during the evaluation phase to reflect the inflows from the combined RCP pipes.



a. Twin 36-inch RCP inflows from western sub-basin

b. Autosampler used at Site 3

Figure 2-8. Photographs of Cameron Ditch Monitoring Site 3.

The flow meter was programmed to provide a continuous record of inflow into the pond, with measurements stored into internal memory at 10-minute intervals. The automatic sampler contained a single 20-liter polyethylene bottle and was programmed to collect samples in a flow-weighted mode, with 500 ml aliquots piped into the collection bottle with every programmed increment of flow. Since 120 VAC power was not available at the site, the automatic sampler was operated on 12 VDC batteries which were charged using solar panels on the roof of the equipment shelter.

The outflow monitoring site (Site 4) was located at the outfall structure for Pond C which reflects the overall outflow for the treatment system. An aerial overview of monitoring Site 4 and significant drainage patterns is given on Figure 2-9. As discussed previously, Site 4 is located at the end of a 450-ft long densely vegetated channel, approximately 18-20 ft in width at normal water elevation.

Photographs of Cameron Ditch monitoring Site 4 are given on Figure 2-10. An automatic sequential stormwater sampler with integral flow meter (manufactured by Sigma, model 900MAX) was installed on top of the grate for the outfall structure. The autosampler was housed inside an insulated aluminum shelter, and flow sensor cables and sample tubing were extended from the sampler to the front side of the outfall structure adjacent to the bottom bleed-down orifice.

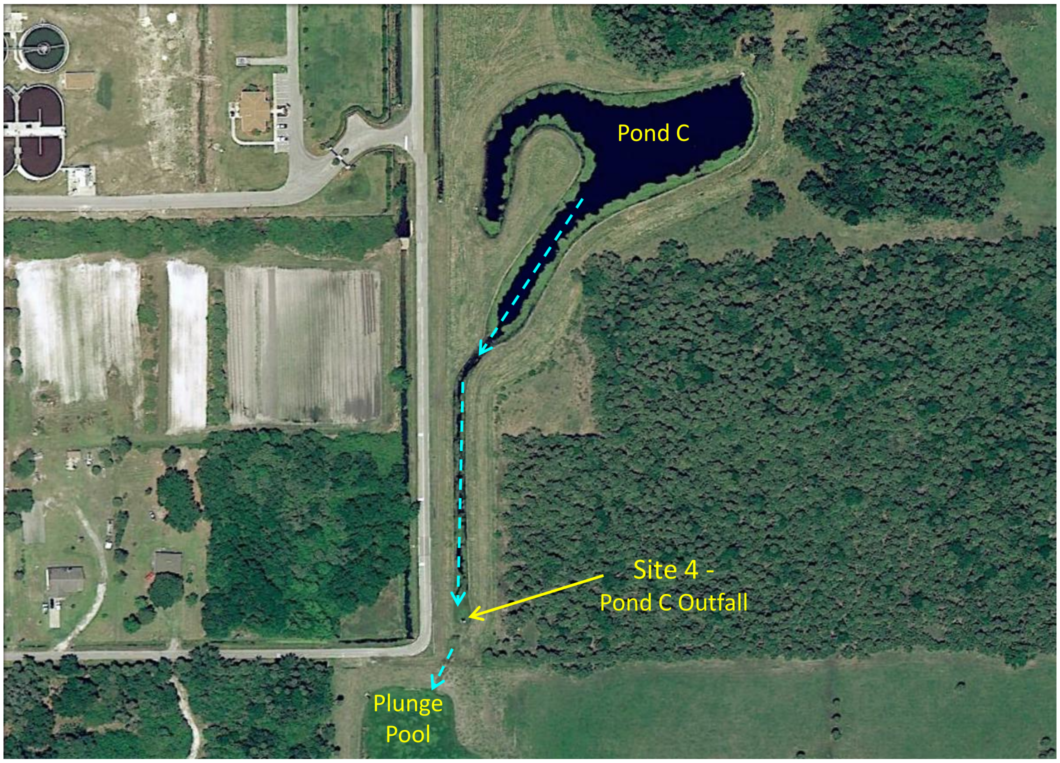
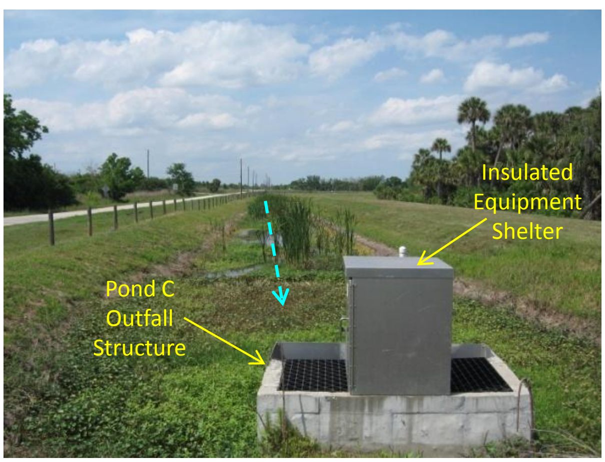


Figure 2-9. Aerial Overview of Monitoring Site 4 and Significant Drainage Patterns.



a. Insulated equipment shelter placed on top of outfall structure

b. Autosampler used at Site 4

Figure 2-10. Photographs of Cameron Ditch Monitoring Site 4.

The flow meter was programmed to provide a continuous record of inflow into the pond, with measurements stored into internal memory at 10-minute intervals. The automatic sampler contained a single 20-liter polyethylene bottle and was programmed to collect samples in a flow-weighted mode, with 500 ml aliquots piped into the collection bottle with every programmed increment of flow. Since 120 VAC power was not available at the site, the automatic sampler was operated on 12 VDC batteries which were charged using solar panels on the roof of the equipment shelter.

Flow measurements at monitoring Site 1 were performed using a pressure transducer sensor which transforms sensitive measurements of water depth into a flow rate using the Manning Equation and pipe geometry. The pressure transducer depth probe was inserted approximately 15 ft upstream in the 48-inch stormsewer. This probe provided continuous measurements of water depth and converted measured water depths into an approximate flow rate.

Flow measurements at the 36-inch RCP inflow at monitoring Site 3 were performed using the area/velocity method. The flow probe utilized at this monitoring site provides simultaneous measurements of water depth and flow velocity. The depth measurements were converted into a cross-sectional area based upon the geometry of the pipe, and the velocity of flow is measured directly by the probe. Discharge is then calculated by the flow meter using the Continuity Equation (Q = A x V) in cubic feet per second (cfs).

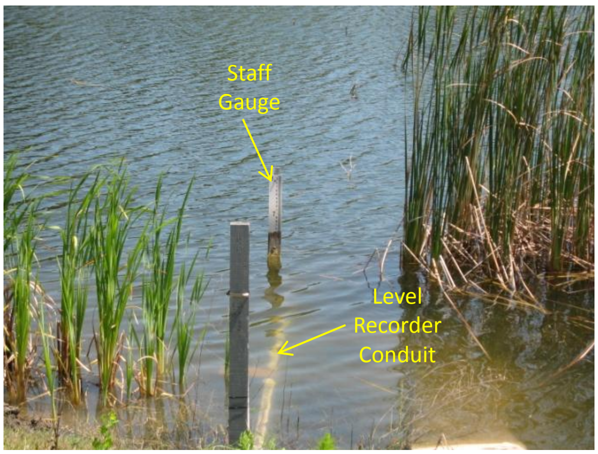
Flow measurements at Site 2 (Pond B outfall) and Site 4 (outfall structure) were performed using a water elevation vs. discharge rating curve based on the geometry of the compound rectangular weir bleed-down structures at each site which contained both orifices and a horizontal overflow weir. Modeling was conducted for each configuration of circular orifice and horizontal weir using standard orifice and rectangular weir equations, and the data were used to develop a rating curve of discharge vs. depth of flow at each site.

Rainfall at the Cameron Ditch site was monitored using a continuous rainfall recorder attached to a 4-inch x 4-inch wooden post adjacent to the Pond B outfall structure (Site 2). The location of the rainfall recorder is indicated on Figure 2-1. The rainfall recorder (Texas Electronics Model 1014-C) produced a continuous record of all rainfall which occurred at the site, with a resolution of 0.01 inch. Rainfall data were stored inside a digital storage device (HOBO Event Rainfall Logger) which was attached to the wooden post inside a waterproof enclosure. The rainfall record is used to provide information on general rainfall characteristics in the vicinity of the monitoring site and to assist in evaluation of hydrologic inputs from the watershed areas.

In addition to the rainfall recorder, a Class A pan evaporimeter was also installed adjacent to the Pond B outfall site. Measurements of water level within the evaporation pan were recorded on a weekly basis and corrected for measured rainfall to provide estimates of evaporation from the pond surface. Information stored in the rainfall data logger, as well as evaporimeter water level measurements, were retrieved on a weekly basis. A photograph of the pan evaporation equipment is given on Figure 2-6.

ERD field personnel visited the Cameron Ditch site at least once each week to retrieve collected inflow and outflow samples and to download stored hydrologic data from each of the automatic samplers as well as the rain gauge and evaporimeter. This information was evaluated for quality control purposes and compiled into a continuous data set for use in evaluating the hydrologic performance efficiency of the system.

In addition to the equipment summarized previously, staff gauges and digital water level recorders were also installed at the weir structures for Ponds B and C. The digital water level recorder (Global Water Model WL16) collected continuous water level measurements at 15-minute intervals. This information was used to assist in completing the hydrologic budget for each pond and to corroborate water level readings from the flow recorders. Manual readings of staff gauge elevations were conducted on a weekly basis to corroborate the readings from the digital water level recorder. Photographs of the staff gauge and water level recorder used in Pond B are given on Figure 2-11.



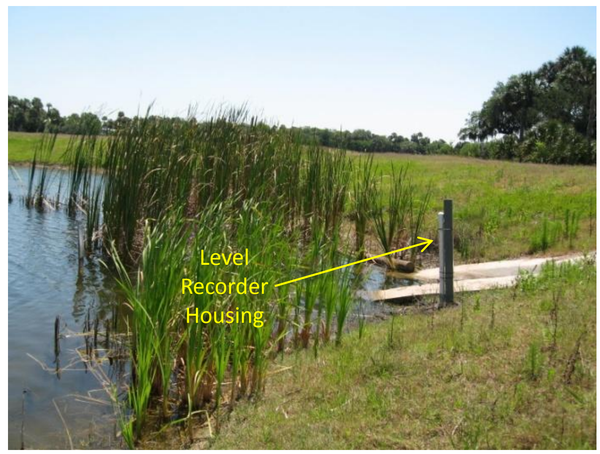


Figure 2-11. Photographs of Staff Gauge and Water Level Recorder Used in Pond B.

2.2 Laboratory Analyses

A summary of laboratory methods and MDLs for analyses conducted on water samples collected during this project is given in Table 2-1. All laboratory analyses were conducted in the ERD Laboratory which is NELAC-certified (No. 1031026). Details on field operations, laboratory procedures, and quality assurance methodologies are provided in the FDEP-approved Comprehensive Quality Assurance Plan for Environmental Research & Design, Inc. In addition, a Quality Assurance Project Plan (QAPP), outlining the specific field and laboratory procedures to be conducted for this project, was submitted to and approved by FDEP prior to initiation of any field and laboratory activities.

TABLE 2-1

ANALYTICAL METHODS AND DETECTION LIMITS FOR LABORATORY ANALYSES

PARAMETER	METHOD OF ANALYSIS	METHOD DETECTION LIMITS (MDLs)[1]
pH	EPA-83, Sec. 150.1[2]	N/A
Conductivity	EPA-83, Sec. 120.1[2]	0.3 μmho/cm
Alkalinity	EPA-83, Sec. 310.1[2]	0.5 mg/l
Ammonia	EPA-83, Sec. 350.1[2]	0.005 mg/l
NO_x	EPA-83, Sec. 353.2[2]	0.005 mg/l
Total Nitrogen	SM-21, Sec. 4500-N C[3]	0.01 mg/l
Ortho-P	EPA-83, Sec. 365.1[2]	0.001 mg/l
Total Phosphorus	SM-21, Sec. 4500-P B.5/F[3]	0.001 mg/l
Turbidity	EPA-83, Sec. 180.1[2]	0.1 NTU
Color	SM-21, Sec. 2120 C[3]	1 Pt-Co Unit
TSS	EPA-83, Sec. 160.2[2]	0.7 mg/l

1. MDLs are calculated based on the EPA method of determining detection limits
2. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.
3. Standard Methods for the Examination of Water and Wastewater, 21st ed., 2005.

2.3 Field Measurements

During each weekly monitoring visit, field measurements of pH, temperature, specific conductivity, dissolved oxygen, and oxidation-reduction potential (ORP) were conducted at each monitoring site where discharge was observed using a Hydrolab Datasonde 4a water quality monitor. Field measurements were conducted at approximately mid-depth in the water column at each site.

2.4 Routine Data Analysis and Compilation

All data generated during this project, including hydrologic, hydraulic, and water quality information, were entered into a computerized database and double-checked for accuracy. Hydrologic and hydraulic information was tabulated and summarized on monthly intervals. This information is used to develop a hydrologic budget for the pond for use in evaluating system performance.

Data collected during this project were analyzed using a variety of statistical methods and software. Simple descriptive statistics were generated for runoff inflow, pond outflow, rainfall, and pond water levels to examine changes in water quality characteristics and system performance throughout the research period. The majority of these analyses were conducted using statistical procedures available in Excel.

Statistical procedures such as multiple regression were also conducted to examine predicted relationships between water quality characteristics and hydrologic or hydraulic factors, such as pond water elevation, antecedent dry period, cumulative event rainfall, and other variables. The majority of these analyses were conducted using the SAS (Statistical Analysis System) package.

Distribution patterns for the inflow, outflow, and bulk precipitation data sets were evaluated using both normal probability and log probability plots. These analyses indicated that the data most closely observe a log-normal distribution which is commonly observed with environmental data. As a result, statistical analyses were conducted using log transformations of each of the data sets. The data were then converted back to untransformed data at the completion of the statistical analyses.

SECTION 3

RESULTS

Field monitoring, sample collection, and laboratory analyses were conducted by ERD from May 1, 2010-February 28, 2011 to evaluate the hydraulic and pollutant removal efficiencies of the Cameron Ditch stormwater facility. A discussion of the results of these efforts is given in the following sections.

3.1 Site Hydrology

3.1.1 Rainfall

A continuous record of rainfall characteristics was collected at the Cameron Ditch monitoring site from May 1, 2010-February 28, 2011 using a tipping bucket rainfall collector with a resolution of 0.01 inch and a digital data logging recorder. The characteristics of individual rain events measured at the Cameron Ditch site are given in Table 3-1. Information is provided for event rainfall, event start time, event end time, event duration, average rainfall intensity, and antecedent dry period for each individual rain event measured at the monitoring site. For purposes of this analysis, average rainfall intensity is calculated as the total rainfall divided by the total event duration. Rainfall for the period from August 12-27, 2010 was estimated from the SJRWMD radar precipitation estimates due to a rain gauge malfunction.

A total of 29.81 inches of rainfall fell in the vicinity of the Cameron Ditch site over the 304-day monitoring period from a total of 94 separate storm events. A summary of rainfall event characteristics measured at the Cameron Ditch rain gauge site from May 1, 2010-February 28, 2011 is given in Table 3-2. Individual rainfall amounts measured at the pond site range from 0.01-1.47 inches, with an average of 0.28 inches/event. Durations for events measured at the site range from 0.02-12.8 hours, with antecedent dry periods ranging from 0.1-29.5 days.

A comparison of measured and typical "average" rainfall in the vicinity of the Cameron Ditch site is given in Figure 3-1. Measured rainfall presented in this figure is based upon the field-measured rain events at the pond site presented in Table 3-1, summarized on a monthly basis. "Average" rainfall conditions are based upon historical average monthly rainfall recorded at the Sanford Airport over the 30-year period from 1971-2000. Historical average annual rainfall in the Sanford area is approximately 51.31 inches/year.

As seen in Figure 3-1, measured rainfall in the vicinity of the Cameron Ditch site was greater than "normal" during June 2010 and January 2011, with substantially lower than "normal" rainfall during the remaining months. A tabular comparison of measured and average rainfall for the Cameron Ditch site is given in Table 3-3. The total rainfall of 29.81 inches measured at the Cameron Ditch site is approximately 34% lower than the "normal" rainfall of 44.96 inches which typically occurs in the Sanford area over the period from May-February.

TABLE 3-1

SUMMARY OF RAINFALL MEASURED AT THE CAMERON DITCH MONITORING SITE FROM MAY 2010 – FEBRUARY 2011

EVENT START		EVENT END		EVENT RAINFALL (inches)	DURATION (hours)	ANTECEDENT DRY PERIOD (days)	AVERAGE INTENSITY (inches/hour)
DATE	TIME	DATE	TIME				
5/5/10	14:01	5/5/10	14:19	0.02	0.31	7.1	0.07
5/6/10	11:44	5/6/10	11:51	0.11	0.11	0.9	1.03
5/6/10	16:30	5/6/10	17:13	0.58	0.72	0.2	0.80
5/7/10	8:10	5/7/10	8:10	0.04	0.00	0.6	---
5/17/10	7:12	5/17/10	8:48	0.16	1.60	10.0	0.10
5/17/10	12:31	5/17/10	15:51	0.78	3.32	0.2	0.23
5/18/10	20:05	5/18/10	20:05	0.01	---	1.2	---
5/20/10	11:17	5/20/10	11:17	0.01	---	1.6	---
5/29/10	16:20	5/29/10	16:20	0.01	---	9.2	---
5/31/10	15:22	5/31/10	15:25	0.05	0.05	2.0	1.05
6/1/10	20:46	6/1/10	21:16	0.44	0.50	1.2	0.88
6/2/10	3:51	6/2/10	3:51	0.01	---	0.3	---
6/2/10	20:19	6/2/10	20:32	0.07	0.21	0.7	0.33
6/3/10	17:06	6/3/10	18:13	0.12	1.12	0.9	0.11
6/4/10	9:13	6/4/10	9:13	0.01	---	0.6	---
6/4/10	12:22	6/4/10	12:29	0.02	0.12	0.1	0.17
6/4/10	16:35	6/4/10	18:37	0.26	2.03	0.2	0.13
6/7/10	12:02	6/7/10	12:11	0.50	0.15	2.7	3.31
6/7/10	17:55	6/7/10	19:25	0.44	1.50	0.2	0.29
6/17/10	16:52	6/17/10	19:55	1.47	3.04	9.9	0.48
6/18/10	15:05	6/18/10	17:45	0.36	2.67	0.8	0.14
6/19/10	20:19	6/19/10	22:06	1.11	1.79	1.1	0.62
6/20/10	15:55	6/20/10	18:40	1.42	2.75	0.7	0.52
6/21/10	14:17	6/21/10	15:19	1.34	1.04	0.8	1.29
6/22/10	12:36	6/22/10	12:43	0.02	0.12	0.9	0.17
6/26/10	9:42	6/26/10	9:42	0.01	---	3.9	---
7/2/10	8:42	7/2/10	8:42	0.01	---	6.0	---
7/2/10	16:20	7/2/10	23:04	0.47	6.73	0.3	0.07
7/3/10	15:46	7/3/10	19:40	1.34	3.91	0.7	0.34
7/4/10	18:44	7/4/10	20:27	0.81	1.72	1.0	0.47
7/5/10	21:09	7/5/10	21:32	0.20	0.38	1.0	0.52
7/6/10	13:00	7/6/10	13:00	0.01	---	0.6	---
7/14/10	16:42	7/14/10	17:40	0.17	0.97	8.2	0.17
7/14/10	23:54	7/14/10	23:54	0.01	---	0.3	---
7/15/10	15:48	7/15/10	17:48	0.09	1.99	0.7	0.05
7/28/10	15:14	7/28/10	21:56	1.09	6.71	12.9	0.16
7/29/10	18:07	7/29/10	21:12	0.18	3.08	0.8	0.06
8/1/10	17:14	8/1/10	20:49	0.29	3.58	2.8	0.08
8/7/10	10:51	8/7/10	14:57	0.05	4.10	5.6	0.01
8/8/10	7:33	8/8/10	7:33	0.01	---	0.7	---
8/8/10	13:16	8/8/10	15:37	0.20	2.35	0.2	0.09
8/8/10	22:09	8/9/10	0:43	0.03	2.56	0.3	0.01
8/9/10	10:05	8/9/10	13:00	0.10	2.91	0.4	0.03
8/9/10	16:13	8/9/10	16:29	0.02	0.28	0.1	0.07
8/9/10	20:28	8/9/10	20:28	0.01	---	0.2	---
8/11/10	15:37	8/11/10	19:11	0.41	3.57	1.8	0.12
8/12/10	---[1]	---	---	0.02	---	---	---
8/13/10	---	---	---	0.07	---	---	---
8/15/10	---	---	---	0.03	---	---	---
8/16/10	---	---	---	0.62	---	---	---
8/17/10	---	---	---	0.01	---	---	---
8/18/10	---	---	---	0.21	---	---	---
8/19/10	---	---	---	0.42	---	---	---

TABLE 3-1 -- CONTINUED

SUMMARY OF RAINFALL MEASURED AT THE CAMERON DITCH MONITORING SITE FROM MAY 2010 – FEBRUARY 2011

EVENT START		EVENT END		EVENT RAINFALL (inches)	DURATION (hours)	ANTECEDENT DRY PERIOD (days)	AVERAGE INTENSITY (inches/hour)
DATE	TIME	DATE	TIME				
8/20/10	---	---	---	0.12	---	---	---
8/21/10	---	---	---	1.24	---	---	---
8/22/10	---	---	---	0.71	---	---	---
8/23/10	---	---	---	0.04	---	---	---
8/24/10	---	---	---	0.29	---	---	---
8/25/10	---	---	---	0.23	---	---	---
8/26/10	---	---	---	0.12	---	---	---
8/27/10	---	---	---	0.24	---	---	---
9/5/10	15:52	9/5/10	16:18	0.04	0.43	8.7	0.09
9/5/10	19:50	9/5/10	20:29	0.05	0.66	0.1	0.08
9/6/10	15:39	9/6/10	18:51	0.53	3.20	0.8	0.17
9/8/10	14:48	9/8/10	15:31	0.51	0.71	1.8	0.72
9/9/10	17:27	9/9/10	18:14	0.77	0.80	1.1	0.97
9/12/10	20:22	9/12/10	22:05	0.49	1.70	3.1	0.29
9/13/10	8:02	9/13/10	8:02	0.01	---	0.4	---
9/23/10	20:34	9/23/10	21:19	0.13	0.76	10.5	0.17
9/24/10	11:52	9/24/10	14:07	0.11	2.26	0.6	0.05
9/24/10	17:09	9/24/10	17:26	0.02	0.29	0.1	0.07
9/24/10	21:28	9/25/10	0:29	0.17	3.02	0.2	0.06
9/27/10	19:00	9/27/10	19:17	0.85	0.29	2.8	2.89
9/28/10	7:14	9/28/10	9:43	0.76	2.49	0.5	0.31
9/28/10	16:17	9/28/10	20:13	0.37	3.94	0.3	0.09
10/28/10	8:55	10/28/10	9:01	0.03	0.10	29.5	0.29
11/2/10	13:51	11/2/10	18:10	0.83	4.32	5.2	0.19
11/4/10	7:04	11/4/10	7:04	0.01	---	1.5	---
11/4/10	18:42	11/4/10	23:44	0.10	5.04	0.5	0.02
11/26/10	17:12	11/26/10	17:12	0.01	---	21.7	---
11/27/10	6:10	11/27/10	6:10	0.01	---	0.5	---
11/29/10	3:34	11/29/10	4:45	0.06	1.18	1.9	0.05
11/29/10	14:28	11/29/10	18:14	0.23	3.77	0.4	0.06
12/5/10	1:29	12/5/10	1:29	0.01	---	5.3	---
12/12/10	6:19	12/12/10	6:19	0.01	---	7.2	---
12/18/10	2:55	12/18/10	5:27	0.24	2.54	5.9	0.09
12/18/10	10:09	12/18/10	12:36	0.42	2.46	0.2	0.17
12/25/10	16:34	12/25/10	16:34	0.01	---	7.2	---
1/5/11	12:12	1/5/11	12:15	0.04	0.04	10.8	0.95
1/5/11	18:08	1/6/11	0:17	0.24	6.14	0.2	0.04
1/10/11	6:31	1/10/11	9:18	0.13	2.78	4.3	0.05
1/16/11	19:31	1/16/11	19:49	0.03	0.30	6.4	0.10
1/17/11	1:56	1/17/11	7:38	1.20	5.71	0.3	0.21
1/19/11	2:05	1/19/11	2:07	0.02	0.02	1.8	1.06
1/20/11	18:58	1/21/11	7:47	0.97	12.81	1.7	0.08
1/25/11	11:14	1/25/11	15:48	0.85	4.55	4.1	0.19
2/5/11	9:09	2/5/11	9:14	0.02	0.10	10.7	0.20
2/5/11	14:27	2/5/11	15:55	0.03	1.47	0.2	0.02
2/6/11	2:24	2/6/11	4:03	0.03	1.64	0.4	0.02
2/6/11	20:08	2/6/11	21:05	0.05	0.95	0.7	0.05
2/7/11	10:38	2/7/11	12:53	0.14	2.24	0.6	0.06
2/10/11	2:25	2/10/11	5:04	0.03	2.65	2.6	0.01
2/17/11	5:04	2/17/11	5:04	0.01	---	7.0	---
2/28/11	0:00	2/28/11	0:00	0.01	---	10.8	---
			TOTAL:	**29.81**			

1. Rain gauge malfunction – rainfall estimated from SJRWMD radar precipitation estimates

TABLE 3-2

SUMMARY OF RAINFALL CHARACTERISTICS IN THE VICINITY OF CAMERON DITCH STORMWATER FACILITY FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	MEAN EVENT VALUE
Event Rainfall	Inches	0.01	1.47	0.28
Event Duration	hours	0.02	12.8	2.13
Average Intensity	inches/hour	0.01	36.0	0.84
Antecedent Dry Period	days	0.13	29.5	3.19

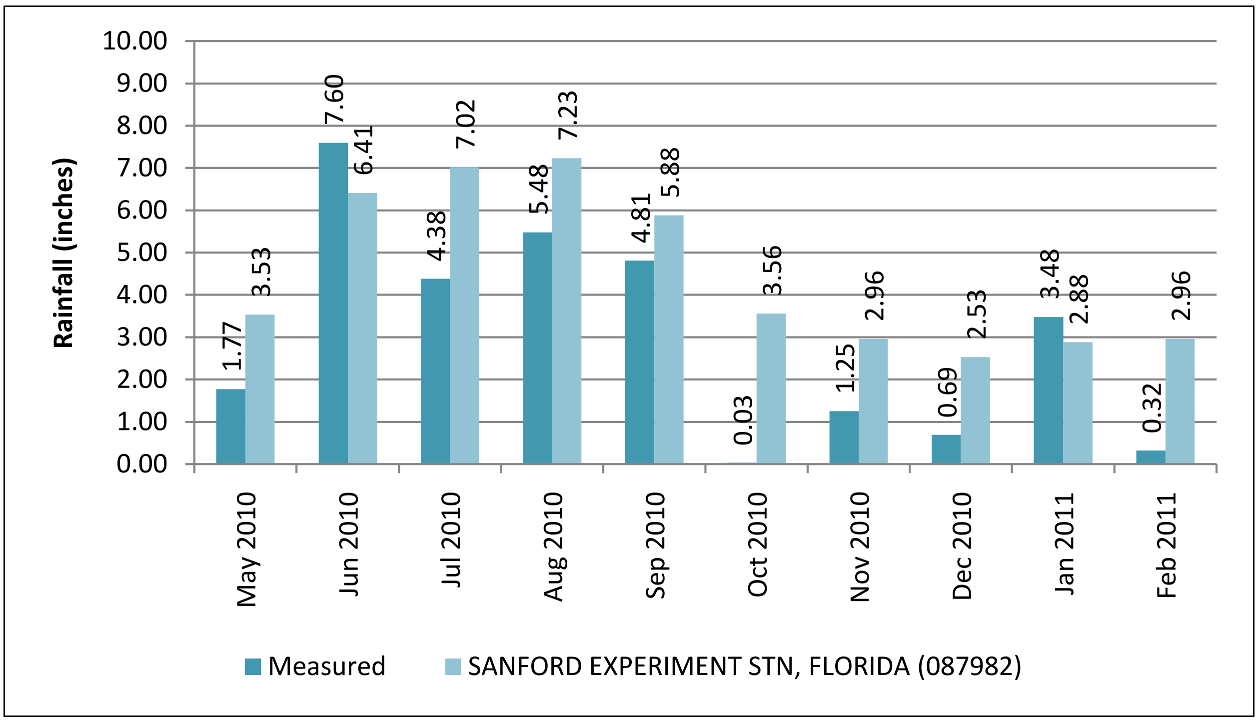


Figure 3-1. Comparison of Average and Measured Rainfall in the Vicinity of the Cameron Ditch Site.

A summary of calculated hydrologic inputs to the Cameron Ditch ponds from direct precipitation during the field monitoring program is given in Table 3-4. These inputs were calculated by multiplying the measured total monthly rainfall at the Cameron Ditch site times the surface areas of each of the three ponds at the mean water elevation recorded during the monitoring program (See Section 3.1.2). The values summarized in Table 3-4 are utilized in a subsequent section to develop hydrologic budgets for each of the ponds.

TABLE 3-3

MEASURED AND AVERAGE RAINFALL FOR THE CAMERON DITCH STORMWATER FACILITY FROM MAY 2010 – FEBRUARY 2011

MONTH	MEAN MONTHLY RAINFALL[1] (inches)	MEASURED SITE RAINFALL[2] (inches)	MONTH	MEAN MONTHLY RAINFALL[1] (inches)	MEASURED SITE RAINFALL[2] (inches)
May 2010	3.53	1.77	October 2010	3.56	0.03
June 2010	6.41	7.60	November 2010	2.96	1.25
July 2010	7.02	4.38	December 2010	2.53	0.69
August 2010	7.23	5.48	January 2011	2.88	3.48
September 2010	5.88	4.81	February 2011	2.96	0.32
			TOTAL:	**44.96**	**29.81**

1. Measured at the Sanford Airport from 1971-2000
2. Measured at the Cameron Ditch site from May 2010-February 2011

TABLE 3-4

SUMMARY OF HYDROLOGIC INPUTS TO THE CAMERON DITCH PONDS FROM DIRECT RAINFALL DURING THE PERIOD FROM MAY 2010 – FEBRUARY 2011

YEAR	MONTH	MONTHLY RAINFALL (inches)	MONTHLY RAINFALL INPUTS (ac-ft)			
			Pond A[1]	Pond B[2]	Pond C[3]	TOTAL
2010	May	1.77	0.14	0.41	0.32	0.87
	June	7.60	0.60	1.74	1.39	3.73
	July	4.38	0.34	1.00	0.80	2.15
	August	5.48	0.43	1.26	1.00	2.69
	September	4.81	0.38	1.10	0.88	2.36
	October	0.03	0.002	0.01	0.01	0.01
	November	1.25	0.10	0.29	0.23	0.61
	December	0.69	0.05	0.16	0.13	0.34
2011	January	3.48	0.27	0.80	0.64	1.71
	February	0.32	0.03	0.07	0.06	0.16
	TOTALS:	**29.81**	**2.33**	**6.83**	**5.46**	**14.64**

1. Based on an assumed surface area of 0.94 acres at the mean water elevation of 9.17 ft (NGVD)
2. Based on an assumed surface area of 2.75 acres at the mean water elevation of 9.17 ft (NGVD)
3. Based on an assumed surface area of 2.20 acres at the mean water elevation of 6.73 ft (NGVD)

3.1.2 Water Level Elevations

Water surface elevations at the Cameron Ditch site were monitored on a continuous basis in Ponds B and C from May 2010-February 2011 using a sensitive water level pressure transducer with a digital data logger. As discussed in Section 2, water level recording devices were located at the outfall structures for each of the two ponds and the data used to evaluate responses of the two ponds to common rain events within the watershed and to indicate when water discharge occurred over the weir structures.

A graphical summary of fluctuations in water levels in the Cameron Ditch Ponds B and C from May 2010-February 2011 is given on Figure 3-2. Total daily rainfall is also summarized on this figure to illustrate changes in water surface elevations resulting from monitored rainfall events.

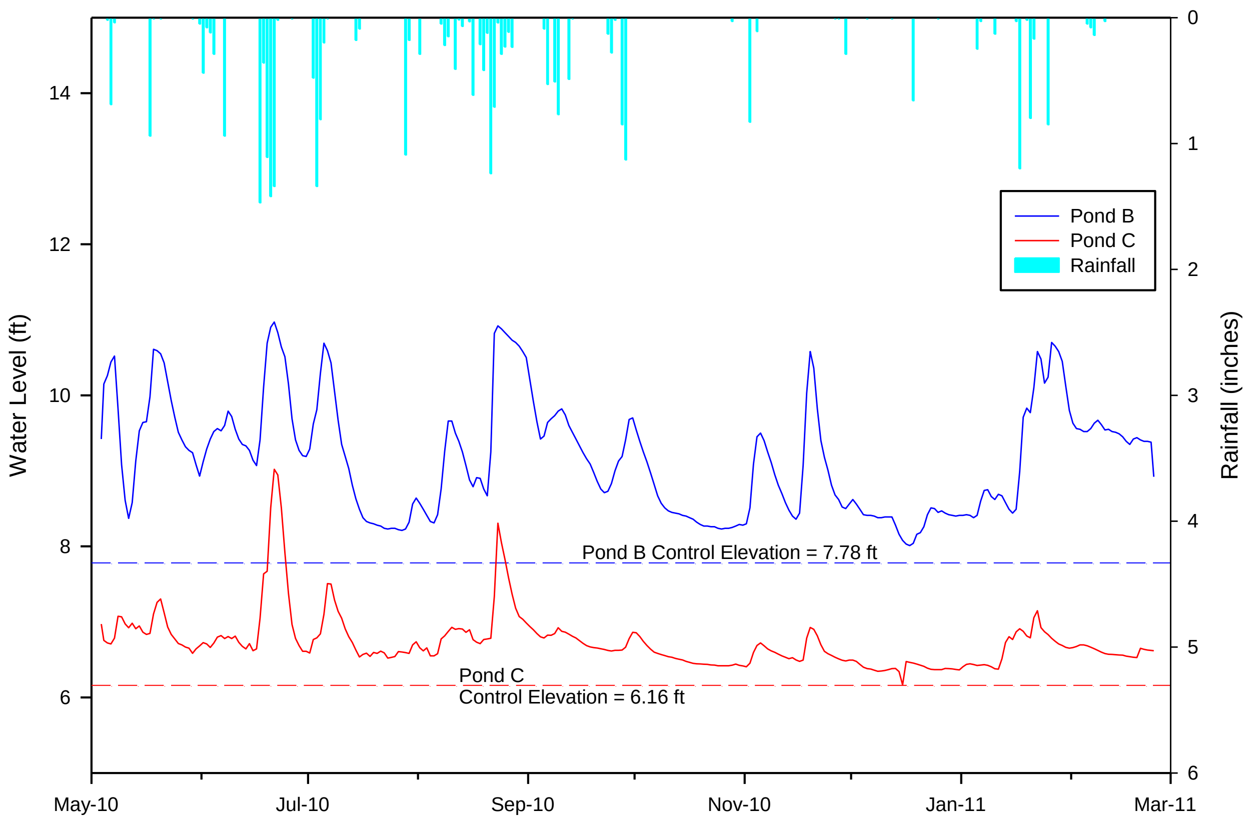


Figure 3-2. Recorded Water Levels in Cameron Ditch Ponds B and C from May 2010-February 2011.

As seen in Figure 3-2, water levels in both Pond B and Pond C were above the control elevations for the two ponds throughout the entire 10-month monitoring program. Water level elevations in Pond B responded rapidly to rain events within the watershed, with a gradual drawdown in water level elevations occurring over a period of several days. Water level elevations in Pond C were less variable than elevations recorded in Pond B, since the primary source of inflow into Pond C was the controlled bleed-down of discharges from Pond B.

In addition to runoff-related inputs, inflows were also observed into Pond A from the northern sub-basin areas which appear to be unrelated to rain events within the basin. The most significant of these events was observed during mid-November 2010 when water level elevations appear to peak in both Ponds B and C when no significant rainfall was recorded at the site. Discharges through the Cameron Ditch system were observed by ERD field personnel on multiple occasions which did not appear to be related to storm events within the sub-basin, with discharge during one of these events estimated by ERD personnel to be in excess of 2 cfs. The source of these additional inflows could not be identified, although on at least one occasion, the inflow appeared to be originating from the East Lake Mary Blvd. drainage system rather than from Cameron Ditch.

Measured minimum, maximum, and average water surface elevations in Ponds B and C during the field monitoring program are summarized on Table 3-5. The measured minimum water surface elevations in each of the two ponds appear to be greater than the control elevations, indicating that discharges occurred on a continuous basis from the Pond B and Pond C outfall structures during the 10-month monitoring program. Measured maximum water elevations are also provided for each of the two ponds. The measured maximum water elevation of 10.97 ft for Pond B is approximately 0.47 ft higher than the overflow elevation for the 9-ft wide horizontal weir. However, based upon the mean water level elevation of 9.17 ft, the lower 8-inch orifice would be completely submerged and the upper 6-inch orifice partially submerged under normal flow conditions. The maximum water level elevation of 9.02 ft observed at the Pond C outfall is approximately 0.08 ft above the top of the 9-ft wide horizontal weir at the outfall structure. However, based upon the mean water level elevation of 6.73 ft measured in Pond C, the two lower 8.5-inch orifices would be typically submerged, with no flow through the upper 6-inch orifice.

TABLE 3-5

SUMMARY OF WATER LEVEL DATA FOR CAMERON DITCH PONDS B AND C

PARAMETER	ELEVATION (ft, NGVD)	
	Pond B	Pond C
Control Elevation	7.78	6.16
Measured Minimum Water Stage	8.01	6.17
Measured Maximum Water Stage	10.97	9.02
Mean Water Level	9.17	6.73
Design Peak Stage (25-yr, 24-hr storm)	12.4	10.8

3.1.3 Pond Inflows and Outflows

Continuous inflow/outflow hydrographs were recorded at each of the four field monitoring sites indicated on Figure 2-1 at 10-minute intervals from May 1, 2010-February 28, 2011. In addition to the continuous inflow/outflow hydrographs, information was also collected on total daily volume and cumulative total volume for the period of record.

A graphical comparison of inflow/outflow hydrographs measured at each of the Cameron Ditch monitoring sites over the period from May 2010-February 2011 is given on Figure 3-3. Hydrographs monitored at Sites 1 and 2 appear to closely mimic each other since Site 2 measures the same basic inflow which occurs at Site 1 after attenuation within Ponds A and B. The maximum recorded inflow into Pond A was approximately 8 cfs which occurred as a result of multiple storm events during June 2010. An inflow peak of approximately 7 cfs was observed during August 2010 as a result of multiple rain events totaling more than 4 inches during the final two weeks of the month. Peak inflow rates during three other rain events approached the range of 3-4 cfs. However, the vast majority of measured inflows to Pond A appear to be approximately 2 cfs or less. The discharge hydrograph at Site 2 is virtually identical to the inflow recorded at Site 1 since Site 2 reflects the discharge of water which enters at Site 1 following attenuation in Ponds A and B.

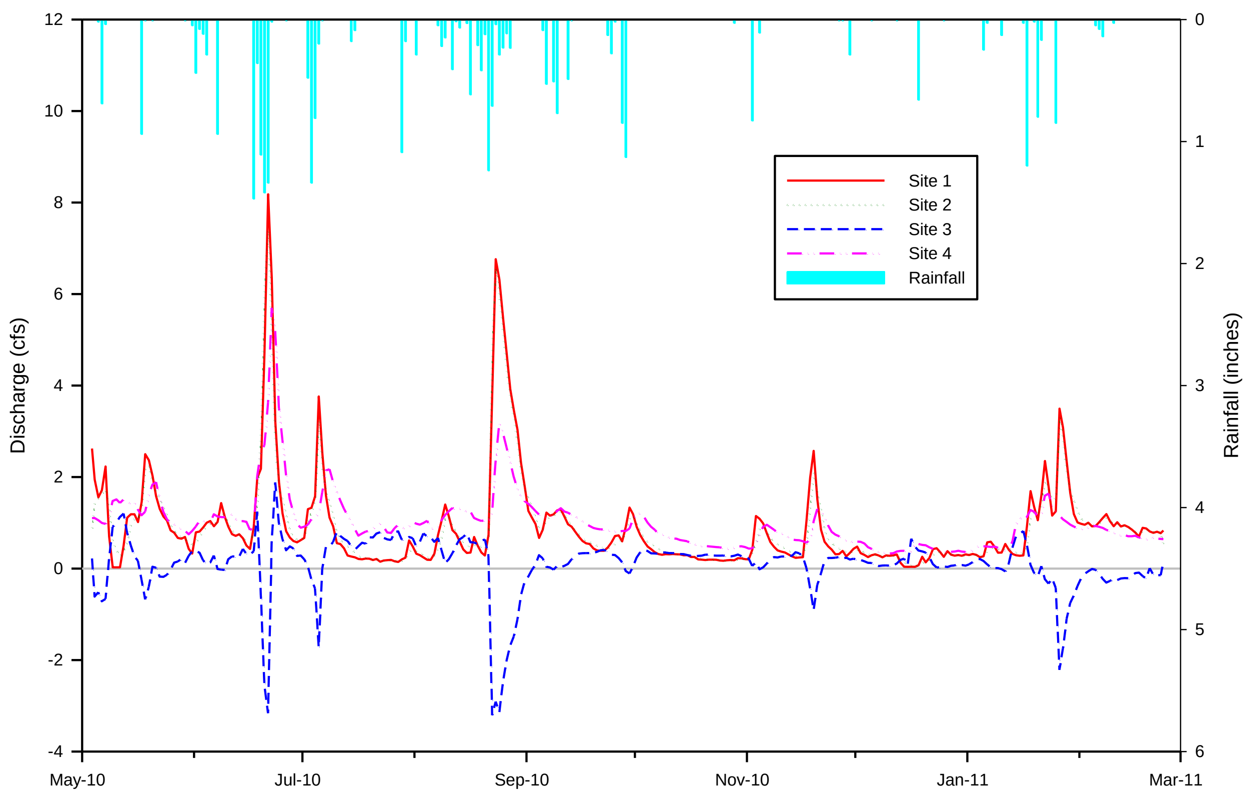


Figure 3-3. Measured Inflow/Outflow Hydrographs at the Cameron Ditch Monitoring Sites from May 2010-February 2011.

In addition to rainfall-driven inflows at Site 1, sustained inflows of approximately 1 cfs or more were observed on multiple occasions which could not be correlated with a rain event. These flows appeared to originate within the roadside drainage system on the north side of East Lake Mary Blvd. rather than from Cameron Ditch itself. The specific source of these inflows was not determined, but flow patterns in the roadside ditch suggest that the source of the flows is relatively near the intersection of East Lake Mary Blvd. and Cameron Avenue. The only developed parcel in this area is the City of Sanford water reclamation facility.

Both inflows and outflows were recorded at monitoring Site 3 which receives inflow from the western sub-basin area and discharges into the western lobe of Pond C. Inflows into Pond C from Site 3 were typically approximately 1 cfs or less during the majority of the field monitoring program. However, flow reversal was observed at Site 3 on multiple occasions which resulted in water discharging from Pond C back into the western sub-basin drainage system. These flow reversals were observed when high water level elevations occurred within the pond system which exceeded the water level within the western drainage system, resulting in a backflow of water from Pond C into the western sub-basin. Similar to the non-runoff related inflows observed at Site 1, inflows at Site 3 were also recorded which could not be correlated with rain events. These inflows were typically in the range of 1 cfs and occurred continuously on multiple occasions for periods of several days.

Discharge hydrographs through the final outfall structure at Site 4 are also summarized on Figure 3-3. As discussed in Section 2, discharges from Site 4 reflect the ultimate discharge from the Cameron Ditch treatment facility. The highest recorded peak discharge was approximately 5 cfs which occurred during June 2010. However, during a majority of the field monitoring program, discharges through the Pond C outfall structure were equal to approximately 1 cfs or less. In general, discharges at Site 4 mimic the inflow hydrographs measured at Sites 1 and 2 since these inflows represent the dominant water source for discharges at Site 4.

A summary of total monthly inflows/outflows at each of the four Cameron Ditch monitoring sites over the period from May 2010-February 2011 is given in Table 3-6. The values summarized in this table were obtained by integrating the inflow/outflow hydrographs (summarized on Figure 3-3) on a monthly basis. Measured inflows at Sites 1 and 2 are approximately equal since each of these sites reflects inputs from the northern sub-basin area. A total inflow of approximately 150.4 ac-ft was recorded at Site 3, with a corresponding outflow of approximately 91.8 ac-ft, resulting in a new inflow of approximately 58.6 ac-ft. Discharges from Site 4 are approximately equivalent to the inflow monitored at Site 2 plus the net inflow from Site 3. The values summarized in Table 3-6 are utilized in a subsequent section for estimation of an overall hydrologic budget for the treatment system.

A summary of calculated runoff coefficients (C-values) for the northern and western sub-basin areas during the field monitoring program is given in Table 3-7. The runoff coefficients are calculated by dividing the measured runoff volume discharged from the northern and western sub-basin areas by the estimated rainfall volume which fell during the field monitoring program within each of the two basins. The resulting calculated C-values are approximately 0.633 for the northern sub-basin and 0.210 for the western sub-basin.

TABLE 3-6

MEASURED MONTHLY INFLOWS / OUTFLOWS FOR THE CAMERON DITCH STORMWATER FACILITY FROM MAY 2010 – FEBRUARY 2011

YEAR	MONTH	MEASURED INFLOW / OUTFLOW VOLUME (ac-ft)					
		Site 1	Site 2	Site 3			Site 4
				Inflow	Outflow	Net	
2010	May	66.7	64.1	15.3	8.7	6.6	70.6
	June	94.5	94.2	21.9	12.6	9.3	104.1
	July	41.4	41.8	31.9	4.8	27.2	68.6
	August	105.8	104.0	22.4	37.5	-15.1	88.5
	September	50.2	51.4	11.1	0.8	10.3	62.3
	October	18.8	20.7	18.7	0.0	18.7	39.6
	November	38.8	38.7	10.4	3.6	6.8	45.1
	December	15.8	15.9	9.6	0.0	9.6	25.6
2011	January	63.0	61.1	8.8	16.6	-7.8	53.2
	February	43.5	43.4	0.3	7.2	-6.9	36.3
	TOTAL:	**538.4**	**535.2**	**150.1**	**92.0**	**58.1**	**593.8**

TABLE 3-7

CALCULATED RUNOFF COEFFICIENTS (C-VALUES) FOR THE CAMERON DITCH STORMWATER FACILITY NORTHERN AND WESTERN SUB-BASINS FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	NORTHERN SUB-BASIN	WESTERN SUB-BASIN
Basin Area	acres	342.6	112.6
Total Rainfall[1]	inches	29.81	29.81
Rainfall Volume	ac-ft	851.1	279.7
Measured Runoff Volume	ac-ft	538.4	58.6
Calculated C-Values	--	0.633	0.210

1. Total rainfall measured at the Cameron Ditch site from May 2010-February 2011

The calculated C-value for the western sub-basin of 0.210 is consistent with the expected C-value for a basin area with similar soil types and degree of development. However, the measured C-value for the northern sub-basin of 0.633 is somewhat higher than would be expected based upon the soil types and degree of development within the sub-basin, as indicated on Figure 1-4. There are several possible explanations for this apparently elevated C-value. First, much of the northern sub-basin has been ditched and drained which provides a relatively rapid removal for runoff generated within the sub-basin and also provides a mechanism for drawdown of groundwater over time through the network of drainage channels and canals. This sub-basin also receives inflow from storage facilities and runway areas associated with the Sanford-Orlando International Airport which also increases the runoff volume compared with undeveloped conditions.

A second factor affecting the apparent C-value at this location is the unidentified inflows from this basin which were observed by ERD field personnel on multiple occasions. The observed inflows were far in excess of the normal inflows which would be expected to result from baseflow generated within the sub-basin area. Although the source of these additional inflows was not determined, the additional water volume generated by these inflows is partially responsible for the relatively elevated C-value.

3.1.4 Pond Evaporation

As discussed in Section 2, a Class A pan evaporimeter was installed on a level wooden platform adjacent to the pond outfall structure for Pond B. Changes in water level within the pan were recorded at approximately 1-week intervals and corrected for rainfall which occurred during the preceding period to obtain estimates of pan evaporation.

A graphical summary of pan evaporation measured at the Cameron Ditch site from May 2010-February 2011 is given on Figure 3-4. Monthly pan evaporation rates measured at the Orlando International Airport (OIA) meteorological station over the period from 1956-1970 are also provided on Figure 3-4 for comparison purposes. In general, a relatively close agreement was observed between the field-measured values at the Cameron Ditch site and the OIA monitoring station, with the exceptions of January and February 2011 when the field measured evaporation was somewhat less than normal. The total pan evaporation measured at the Cameron Ditch site during the 10-month monitoring program was 45.81 inches compared with an average of 59.49 inches which typically occurs in the Central Florida area during the period from May-February.

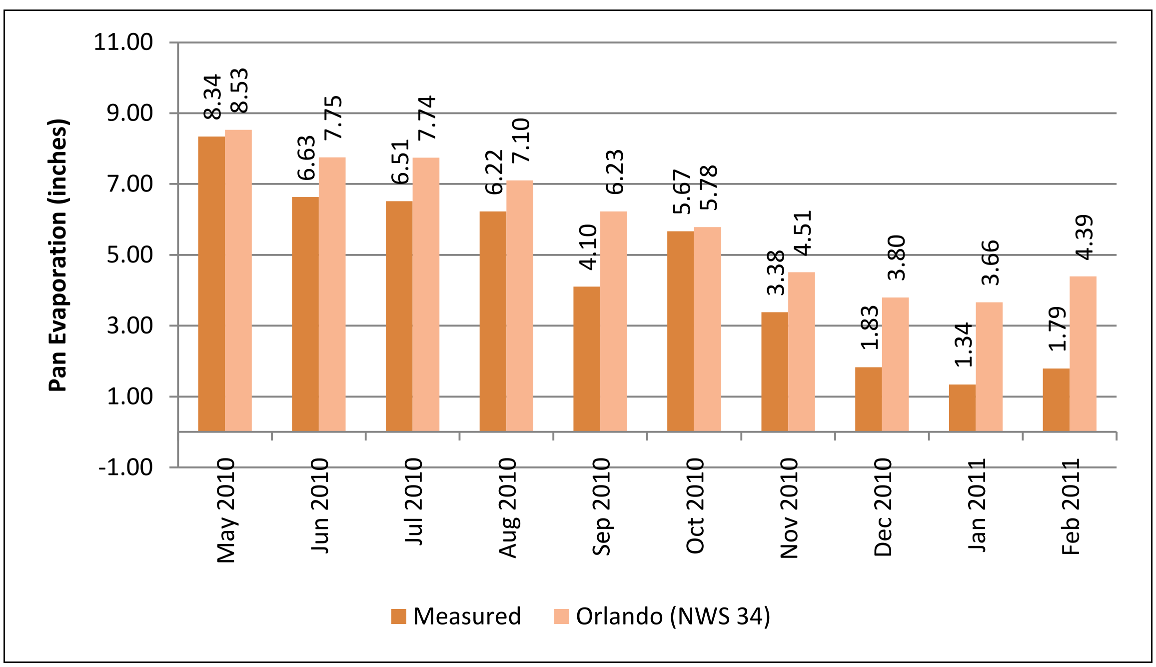


Figure 3-4. Monthly Pan Evaporation Measured at the Cameron Ditch Site from May 2010-February 2011.

A summary of estimated evaporation losses at the Cameron Ditch pond from May 2011-February 2011 is given on Table 3-8. The pan evaporation measurements shown on Figure 3-4 were multiplied by the standard factor of 0.7 to produce estimates of evaporation from the pond surface. Monthly evaporation is provided for each month included in the 10-month study period. Pond evaporation is calculated by multiplying the evaporation depth (in inches) times the area of each of the three ponds at the mean water elevation during the field monitoring program (see Table 3-5). Evaporation losses removed approximately 15.74 ac-ft of water from the Cameron Ditch pond system over the monitoring period. The values listed in Table 3-8 are used in a subsequent section to generate an overall hydrologic budget for the Cameron Ditch treatment system.

TABLE 3-8

SUMMARY OF EVAPORATION LOSSES FROM THE CAMERON DITCH PONDS DURING THE PERIOD FROM MAY 2010 – FEBRUARY 2011

YEAR	MONTH	MONTHLY LAKE EVAPORATION[1] (inches)	MONTHLY EVAPORATION LOSSES (ac-ft)			
			Pond A[2]	Pond B[3]	Pond C[4]	TOTAL
2010	May	5.84	0.46	1.34	1.07	2.87
	June	4.64	0.36	1.06	0.85	2.28
	July	4.56	0.36	1.05	0.84	2.24
	August	4.35	0.34	1.00	0.80	2.14
	September	2.87	0.22	0.66	0.53	1.41
	October	3.97	0.31	0.91	0.73	1.95
	November	2.37	0.19	0.54	0.43	1.16
	December	1.28	0.10	0.29	0.23	0.63
2011	January	0.94	0.07	0.22	0.17	0.46
	February	1.25	0.10	0.29	0.23	0.61
	TOTALS:	**32.07**	**2.51**	**7.35**	**5.88**	**15.74**

1. Obtained by multiplying pan evaporation times 0.7
2. Based on an assumed surface area of 0.94 acres at the mean water elevation of 9.17 ft (NGVD)
3. Based on an assumed surface area of 2.75 acres at the mean water elevation of 9.17 ft (NGVD)
4. Based on an assumed surface area of 2.20 acres at the mean water elevation of 6.73 ft (NGVD)

3.1.5 Hydrologic Budget

A monthly hydrologic budget for Ponds A and B at the Cameron Ditch site is given in Table 3-9. The hydrologic budget for Ponds A and B was combined since these ponds reflect the same basic waterbody which is separated by a bleed-down pipe. Inputs into Ponds A and B are included for inflow from the northern sub-basin (based upon the information summarized in Table 3-6) and inputs from direct precipitation (based upon the summary information provided in Table 3-4). Losses from the ponds are included for discharges through the Pond B outfall structure (summarized in Table 3-6) plus evaporation losses from the pond surface (summarized in Table 3-8). The difference between measured inputs and losses reflects change in storage within the system on a monthly basis.

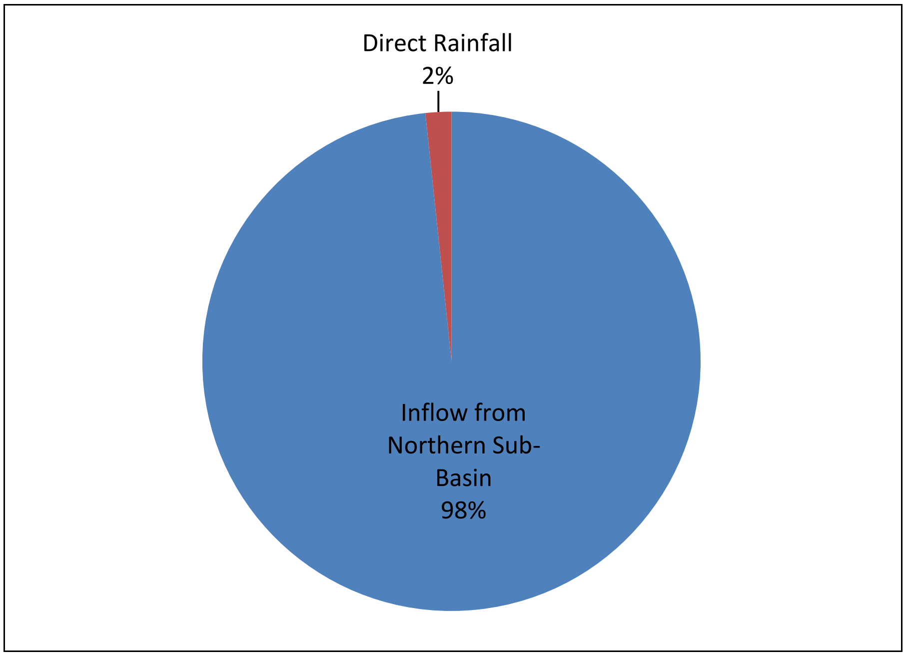
TABLE 3-9

MONTHLY HYDROLOGIC INPUTS AND LOSSES TO PONDS A AND B AT THE CAMERON DITCH FROM MAY 2010 – FEBRUARY 2011

YEAR	MONTH	INPUTS (ac-ft)			LOSSES (ac-ft)			CHANGE IN STORAGE (ac-ft)
		Inflow from Northern Sub-basin	Direct Rainfall on Ponds A and B	Total Inputs	Outflow from Pond B	Evaporation from Ponds A and B	Total Losses	
2010	May	66.7	0.54	67.3	64.1	1.80	65.9	1.38
	June	94.5	2.34	96.8	94.2	1.43	95.6	1.23
	July	41.4	1.35	42.7	41.8	1.40	43.2	-0.44
	August	105.8	1.69	107.5	104.0	1.34	105.4	2.15
	September	50.2	1.48	51.6	51.4	0.88	52.3	-0.69
	October	18.8	0.01	18.8	20.7	1.22	21.9	-3.12
	November	38.8	0.38	39.2	38.7	0.73	39.4	-0.22
	December	15.8	0.21	16.0	15.9	0.39	16.3	-0.36
2011	January	63.0	1.07	64.1	61.1	0.29	61.4	2.71
	February	43.5	0.09	43.6	43.4	0.39	43.8	-0.16
	TOTAL:	**538.4**	**9.16**	**547.6**	**535.2**	**9.86**	**545.1**	**2.49**

A graphical comparison of hydrologic inputs and losses for Ponds A and B is given on Figure 3-5. During the field monitoring program, approximately 98% of the hydrologic inputs to Ponds A and B originated as a result of inflow from the northern sub-basin, with 2% contributed by direct rainfall. Approximately 98% of the losses from Ponds A and B occur as a result of discharges through the Pond B outfall structure, with an additional 2% loss due to evaporation from the water surface.

HYDROLOGIC INPUTS – PONDS A AND B



HYDROLOGIC LOSSES – PONDS A AND B

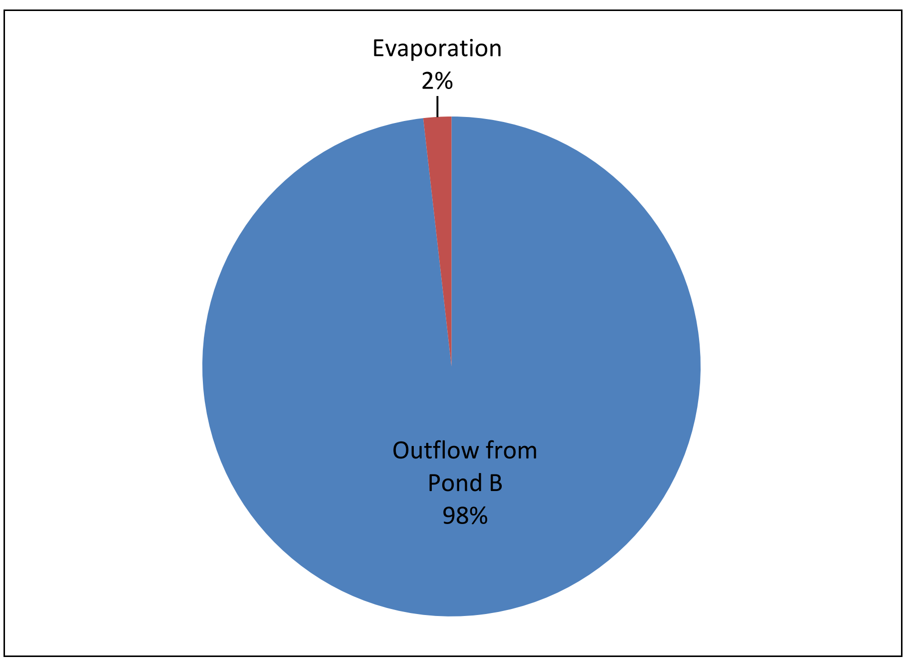


Figure 3-5. Hydrologic Inputs and Losses for Ponds A and B.

A monthly hydrologic budget for Pond C at the Cameron Ditch site is given in Table 3-10. Inputs into Pond C are assumed to occur as a result of inflow from Pond B (summarized on Table 3-6), inflow from the western sub-basin (summarized on Table 3-6), and direct rainfall on the pond surface (summarized on Table 3-4). Losses from Pond C are assumed to occur as a result of discharges through the pond outfall structure (summarized on Table 3-6), reverse flow to the western sub-basin (summarized in Table 3-6), and evaporation losses from the pond surface (summarized on Table 3-8). The difference between the measured inputs and losses reflects change in storage within the pond system.

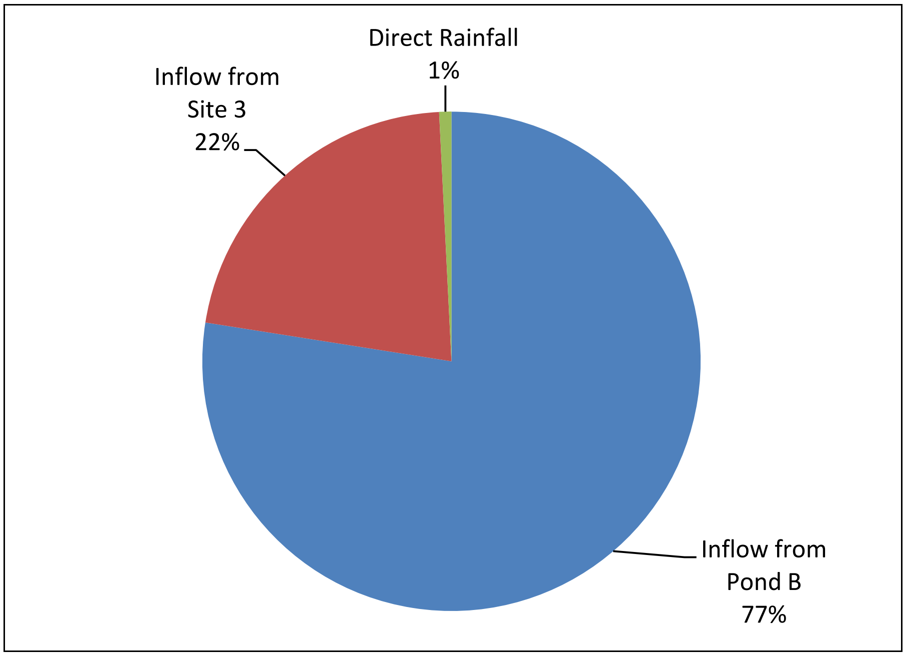
TABLE 3-10

MONTHLY HYDROLOGIC INPUTS AND LOSSES TO POND C AT THE CAMERON DITCH FROM MAY 2010 – FEBRUARY 2011

YEAR	MONTH	INPUTS (ac-ft)				LOSSES (ac-ft)				Change In Storage
		Inflow from Pond B	Inflow from Western Sub-basin	Direct Rainfall on Pond C	Total Inputs	Discharge through Pond C Outfall	Evaporation from Pond C	Loss to Western Sub-basin	Total Losses	
2010	May	64.1	15.26	0.32	79.7	70.6	1.07	8.69	80.3	-0.65
	June	94.2	21.91	1.39	117.5	104.1	0.85	12.7	117.6	-0.16
	July	41.8	31.90	0.80	74.5	68.6	0.84	4.78	74.2	0.28
	August	104.0	22.37	1.00	127.4	88.5	0.80	37.6	126.8	0.56
	September	51.4	11.03	0.88	63.4	62.3	0.53	0.81	63.6	-0.28
	October	20.7	18.67	0.01	39.3	39.6	0.73	0.00	40.3	-0.99
	November	38.7	10.35	0.23	49.3	45.1	0.43	3.60	49.1	0.17
	December	15.9	9.54	0.13	25.6	25.6	0.23	0.00	25.9	-0.28
2011	January	61.1	8.79	0.64	70.5	53.2	0.17	16.6	69.9	0.63
	February	43.4	0.26	0.06	43.7	36.3	0.23	7.21	43.8	-0.08
	TOTAL:	**535.2**	**150.1**	**5.46**	**690.8**	**593.8**	**5.88**	**92.0**	**691.7**	**-0.88**

A graphical comparison of hydrologic inputs and losses for Pond C is given on Figure 3-6. Approximately 77% of the hydrologic inputs into Pond C originated as inflow from Pond B. Approximately 22% of the hydrologic inputs to Pond C originated from the western sub-basin, with 1% contributed by direct rainfall. Approximately 86% of the losses from Pond C occurred as a result of discharges through the pond outfall structure, with 13% of the hydrologic losses occurring as a result of reverse flow from Pond C into the western sub-basin. Approximately 1% of the hydrologic losses occurred as a result of evaporation from the pond surface.

HYDROLOGIC INPUTS – POND C



HYDROLOGIC LOSSES – POND C

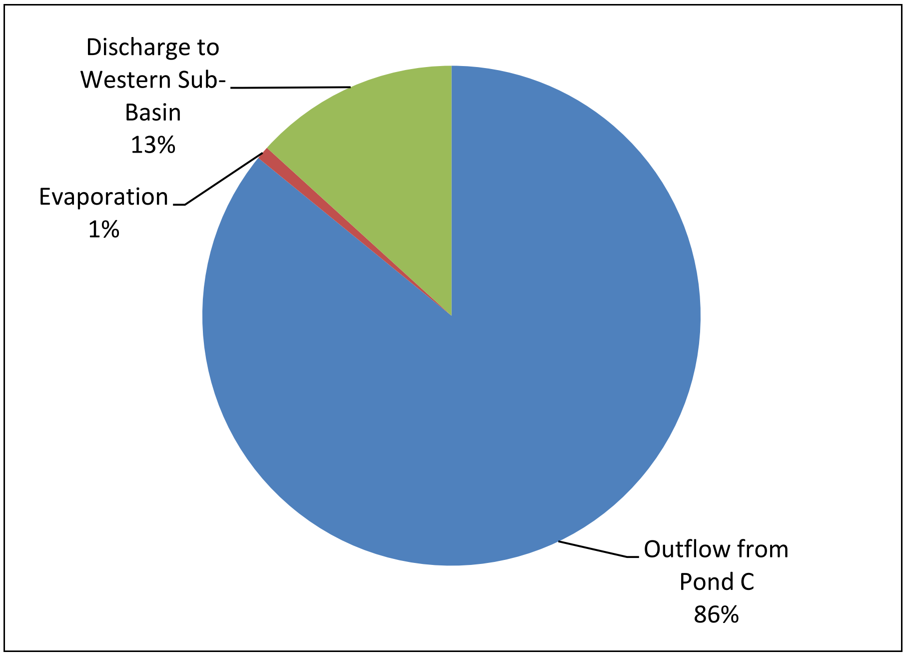


Figure 3-6. Hydrologic Inputs and Losses for Pond C.

3.1.6 Hydraulic Detention Time

An estimate of the average detention time within each of the three treatment ponds was conducted by dividing the estimated volume for each of the three ponds at control water elevation (as summarized in Table 1-2) by the sum of the total hydrologic inputs to each of the three ponds resulting from runoff inflows and direct precipitation. A summary of this analysis is given in Table 3-11.

TABLE 3-11

CALCULATED DETENTION TIMES FOR THE CAMERON DITCH STORMWATER FACILITY DURING THE FIELD MONITORING PROGRAM FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	POND A	POND B	POND C	OVERALL SYSTEM
Volume at CWL	ac-ft	0.38	21.04	14.27	35.69
Total Inputs[1]	ac-ft	540.7	547.5	598.8	611.1
Mean Detention Time	days	0.21 (5 hours)	11.7	7.2	18.2

1. Combined inputs from runoff and precipitation

Based upon this analysis, the mean detention time in Pond A during the field monitoring program was approximately 0.2 days (5 hours), with a detention time of approximately 11.7 days in Pond B and 7.2 days in Pond C. The overall residence time for the system was approximately 18.2 days. According to the design report for the facility prepared by CDM (2002), the system was designed to achieve a 14-day residence time, calculated on wet season conditions. The observed detention time of 18.2 days appears to be similar to the desired wet season detention time of 14 days.

3.2 Chemical Characteristics of Monitored Inputs and Outputs

A summary of sample collection activities conducted at the Cameron Ditch stormwater facility site from May 2010-February 2011 is given in Table 3-12. A total of 34 flow-weighted composite inflow samples was collected at the Cameron Ditch inflow (Site 1), with 35 flow-weighted composite samples collected at the Pond B outflow (Site 2), 20 flow-weighted samples collected from the western sub-basin inflow (Site 3), 35 flow-weighted samples collected at the Pond C outfall (Site 4), and 19 samples of bulk precipitation. In addition to the samples listed previously, field measurements of temperature, pH, conductivity, dissolved oxygen, oxygen saturation percentage, and oxidation-reduction (redox) potential were also collected at each of the monitoring sites when flowing water was observed.

TABLE 3-12

SUMMARY OF SAMPLE COLLECTION PERFORMED AT THE CAMERON DITCH POND SITE

SAMPLE TYPE	NUMBER OF SAMPLES COLLECTED
Cameron Ditch/Northern Sub-basin (Site 1)	34
Pond B Outfall (Site 2)	35
Western Sub-basin (Site 3)	20
Pond C Outfall (Site 4)	35
Bulk Precipitation	19

3.2.1 Physical-Chemical Field Measurements

As discussed in Section 2.3, field measurements of pH, temperature, specific conductivity, dissolved oxygen, dissolved oxygen saturation, and ORP were conducted at each of the four Cameron Ditch monitoring sites during each weekly field visit when measureable flow was present. Field measurements were conducted at approximately mid-depth in the water column at each of the monitoring sites. A complete listing of physical-chemical field measurements collected during the Cameron Ditch monitoring program is given in Appendix B.

A tabular summary of field measurements conducted at the Cameron Ditch site from May 2010-February 2011 is given on Table 3-13. Information is provided for the minimum and maximum measured values for each parameter, along with the log-normal mean value as a measure of central tendency. A relatively wide range of values was observed for each of the measured field parameters during the field monitoring program, particularly for temperature, conductivity, dissolved oxygen, and redox potential. A graphical summary of field measurements of temperature, pH, conductivity, and dissolved oxygen at the Cameron Ditch site from May 2010-February 2011 is given on Figure 3-7. Temperature measurements were relatively uniform at each of the four monitoring sites, ranging from approximately 28-35^{o}C during summer conditions and decreasing to approximately 10-20^{o}C during winter conditions. Measured pH values at the monitoring sites were approximately neutral to alkaline in value. Relatively consistent pH measurements were observed at Sites 1 and 4 which reflect the dominant inflow and outflows for the system. However, highly variable pH measurements were observed at Site 2, presumably due to algal productivity within Pond B. Inflow from the western sub-basin at Site 3 also exhibited highly variable pH readings, particularly during the period from September-February.

Measured conductivity values were relatively similar in the northern sub-basin inflow (Site 1) and at Site 2 which reflects the discharge from Pond B. As indicated on Table 3-13, a slight decrease in mean conductivity appears to occur between these monitoring sites. However, conductivity measurements conducted at the western inflow (Site 3) and at the system outfall (Site 4) were highly variable throughout the field monitoring program. Measured conductivity values at the western sub-basin inflow ranged from 267-3025 μmho/cm, covering more than one order of magnitude between the minimum and maximum value. Measured conductivity values at the system discharge (Site 4) ranged from 186-1556 μmho/cm, covering a range of slightly less than one order of magnitude. The mean conductivity values at these sites are approximately twice the conductivity values measured at Sites 1 and 2.

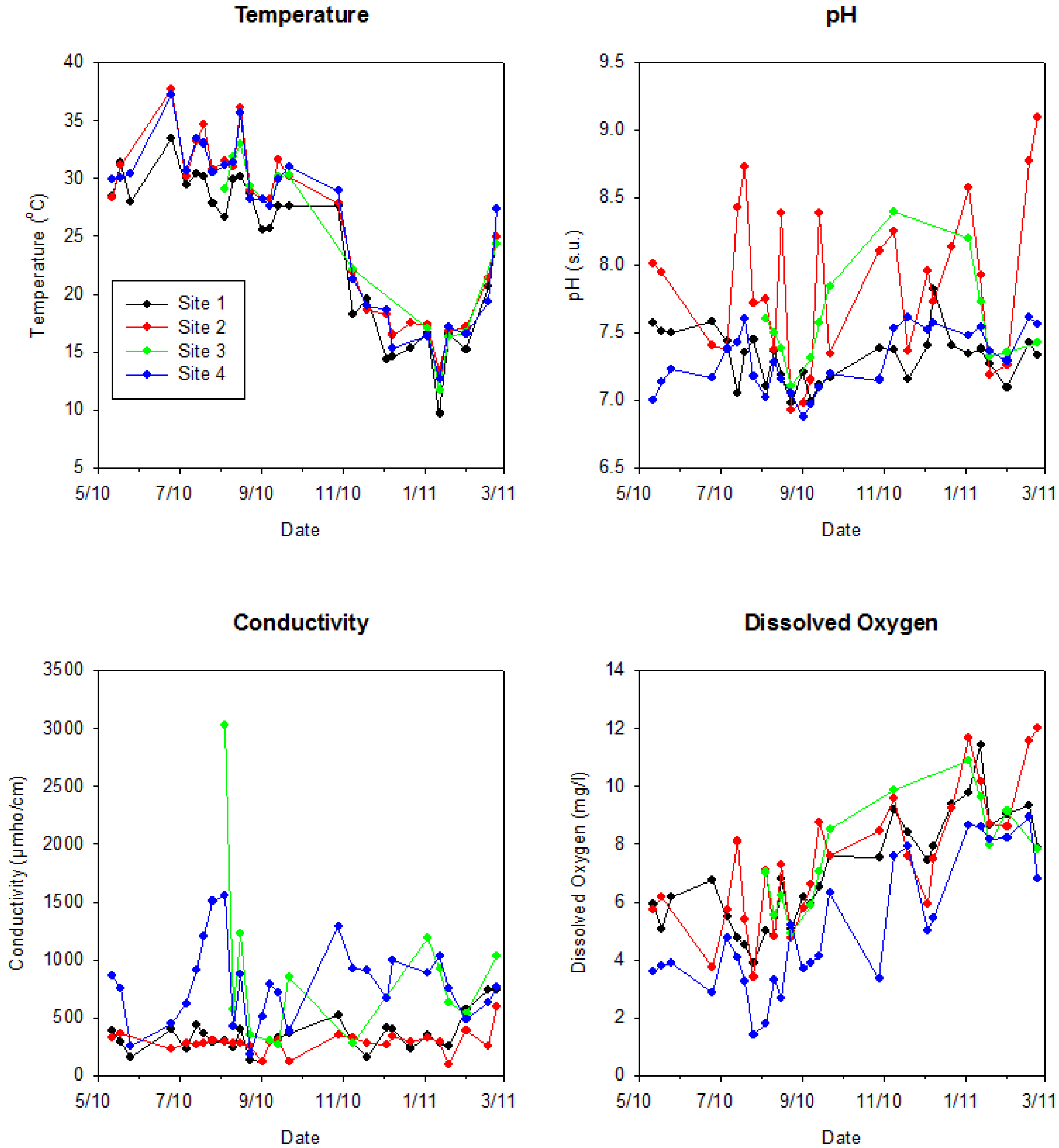


Figure 3-7. Graphical Summary of Field Measurements of Temperature, pH, Conductivity, and Dissolved Oxygen at the Cameron Ditch Site from May 2010-February 2011.

TABLE 3-13

SUMMARY OF FIELD MEASUREMENTS CONDUCTED AT THE CAMERON DITCH SITE FROM MAY 2010 – FEBRUARY 2011

SITE	PARAMETER	TEMPERATURE (°C)	pH (units)	SPECIFIC CONDUCTIVITY (μmho/cm)	DISSOLVED OXYGEN (mg/l)	DISSOLVED OXYGEN (% Sat.)	REDOX (mv)
1	Minimum Value	9.67	6.98	124	3.9	49	55
	Maximum Value	33.39	7.82	742	11.4	104	678
	Log-Normal Mean	23.04	7.32	322	6.8	80	237
2	Minimum Value	13.33	6.93	117	3.4	46	38
	Maximum Value	37.67	9.09	595	12	146	524
	Log-Normal Mean	25.33	7.86	279	7.1	88	223
3	Minimum Value	11.69	7.10	267	4.9	64	72
	Maximum Value	32.93	8.40	3025	10.9	113	489
	Log-Normal Mean	23.39	7.56	635	7.4	89	274
4	Minimum Value	12.66	6.87	186	1.4	19	59
	Maximum Value	37.15	7.61	1556	9.0	97	504
	Log-Normal Mean	25.29	7.28	669	4.6	56	225

Measured dissolved oxygen concentrations at the four monitoring sites were also highly variable during the field monitoring program, ranging from low to elevated at most sites. A general trend of lower dissolved oxygen concentrations was observed during summer conditions, with more elevated dissolved oxygen levels observed during fall and winter conditions. During summer conditions, discharges from the treatment system at Site 4 were typically less than the minimum Class III criterion of 5 mg/l, with more elevated values observed during fall and winter conditions. Of the four monitoring sites, the lowest levels of dissolved oxygen were typically observed at Site 4, with substantially higher dissolved oxygen concentrations observed at the remaining sites. The lower levels of dissolved oxygen observed at Site 4 may be related to the densely vegetated outfall channel which limits oxygen diffusion into the water column.

3.2.2 Pond Inputs/Outflows

Field monitoring at the Cameron Ditch stormwater facility site was conducted at four separate locations which included inflow from the northern sub-basin through Cameron Ditch (Site 1), outfall from Pond B to Pond C (Site 2), inflow from the western sub-basin (Site 3), and the discharge from Pond C (Site 4). A complete listing of the chemical characteristics of samples collected at each of the inflow/outflow monitoring sites during the field monitoring program is given in Appendix C.1. A discussion of the chemical characteristics of inflows/outflows measured at each of the monitoring sites is given in the following sections.

3.2.2.1 Northern Sub-basin – Cameron Ditch Inflow (Site 1)

A summary of the chemical characteristics of inflow collected from the northern sub-basin/Cameron Ditch site (Site 1) from May 2010-February 2011 is given in Table 3-14. Information is provided for the minimum and maximum values measured for each parameter during the field monitoring program, along with the log-normal mean value. A log-normal mean is calculated for each parameter rather than an arithmetic mean since the data exhibit a log-normal distribution, and a log-normal mean provides a better measure of central tendency for the data. Although not listed on Table 3-14, median values were also calculated for each of the evaluated parameters which were very similar, and in many cases, identical to the calculated log-normal mean values.

TABLE 3-14

CHARACTERISTICS OF NORTHERN SUB-BASIN / CAMERON DITCH INFLOW SAMPLES COLLECTED AT SITE 1 FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	LOG-NORMAL MEAN
pH[1]	s.u.	6.98	7.82	7.32
Conductivity[1]	μmho/cm	124	742	322
Alkalinity	mg/l	40.2	64.4	50
NH_3	μg/l	< 5	112	36
NO_x	μg/l	< 5	300	21
Diss. Organic N	μg/l	43	1089	315
Particulate N	μg/l	11	1073	99
Total N	μg/l	280	1271	583
SRP	μg/l	1	128	17
Diss. Organic P	μg/l	1	41	6
Particulate P	μg/l	3	317	19
Total P	μg/l	18	373	52
Turbidity	NTU	0.9	92.5	4.4
TSS	mg/l	0.6	553	9.8
Color	Pt-Co	20	63	39

1. Field measured values

In general, inflows from the northern sub-basin/Cameron Ditch were approximately neutral in pH, with an overall mean pH value of 7.32. Inflows from the northern sub-basin/Cameron Ditch were also moderately buffered, with a mean alkalinity of 50.0 mg/l. Measured alkalinity values were relatively consistent at this site throughout the entire field monitoring program. Field measured conductivity values at this site ranged from low to elevated, with an overall mean of 322 μmho/cm.

Measured concentrations of nitrogen species were highly variable at the northern sub-basin/Cameron Ditch inflow, with several orders of magnitude difference between minimum and maximum values for most nitrogen species. However, in spite of the high degree of variability, measured concentrations for nitrogen species discharging from the northern sub-basin/Cameron Ditch were generally low in value, with extremely low mean concentrations of 36 μg/l for ammonia, 21 μg/l for NO_x, and 99 μg/l for particulate nitrogen. The observed concentrations for particulate nitrogen are substantially lower than commonly observed in urban runoff and likely reflect significant pre-treatment for particulate matter within the densely vegetated conveyance systems present within the sub-basin. The dominant nitrogen species at this site is dissolved organic nitrogen which comprises more than 50% of the total nitrogen measured. The overall total nitrogen concentration of 583 μg/l is approximately one-quarter to one-third of the total nitrogen concentrations commonly observed in urban runoff.

Similar to the trends observed for nitrogen species, measured concentrations for phosphorus species were also highly variable but extremely low in value on an average basis. The mean measured concentrations of 17 μg/l for SRP, 6 μg/l for dissolved organic phosphorus, and 19 μg/l for particulate phosphorus are approximately an order of magnitude lower than concentrations for these parameters commonly observed in urban runoff. The mean total phosphorus concentration of 52 μg/l is approximately one-fourth to one-fifth of the total phosphorus concentrations commonly observed in urban runoff.

Highly variable concentrations were also observed for turbidity and TSS at the northern sub-basin/Cameron Ditch site, although the mean concentrations for each parameter are extremely low in value. The measured concentrations for turbidity and TSS are approximately one order of magnitude lower than concentrations for these parameters commonly observed in urban runoff. Inflow through the sub-basin was moderately colored, with a mean color concentration of 39 Pt-Co units.

3.2.2.2 Pond B Outflow (Site 2)

A summary of the chemical characteristics of Pond B discharges (Site 2) collected from May 2010-February 2011 is given in Table 3-15. Discharges from Pond B reflect the inflow from the northern sub-basin/Cameron Ditch (Site 1) after migrating through Pond A and Pond B. Discharges from Pond B were moderately buffered, with minimum, maximum, and mean concentrations similar to the alkalinity measurements conducted at Site 1. Alkalinity appears to react in a relatively conservative manner within the pond system. Field measured pH values at Site 2 were highly variable, ranging from approximately neutral to alkaline in value, with an overall mean of 7.86. Measured conductivity values were also highly variable, although less variable than the inflow monitored at Site 1.

TABLE 3-15

CHARACTERISTICS OF POND B OUTFLOW SAMPLES COLLECTED AT SITE 2 FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	LOG-NORMAL MEAN
pH[1]	s.u.	6.93	9.09	7.86
Conductivity[1]	μmho/cm	117	595	279
Alkalinity	mg/l	43	62.8	51
NH_3	μg/l	7	304	51
NO_x	μg/l	< 5	1229	72
Diss. Organic N	μg/l	50	1165	368
Particulate N	μg/l	17	1023	214
Total N	μg/l	369	2224	906
SRP	μg/l	1	100	8
Diss. Organic P	μg/l	1	44	5
Particulate P	μg/l	5	287	33
Total P	μg/l	11	297	58
Turbidity	NTU	1.2	48.1	6.0
TSS	mg/l	1.3	122	13.7
Color	Pt-Co	22	77	42

1. Field measured values

Similar to the trends exhibited by the northern sub-basin/Cameron Ditch inflow, measured concentrations of nitrogen species in the discharge from Pond B were highly variable throughout the field monitoring program, with 1-2 orders of magnitude difference between minimum and maximum values measured for most nitrogen species. However, mean concentrations for each of the nitrogen species are higher in the discharge from Pond B than measured in the inflow to the pond system at Site 1. The largest increase in concentration for nitrogen species occurs for particulate nitrogen, which presumably reflects nitrogen incorporated into algal biomass within the open water portions of Pond B. The dominant nitrogen species in the discharge from Pond B is dissolved organic nitrogen which was also the dominant nitrogen species observed at Site 1. The mean total nitrogen concentration of 906 μg/l at Site 2 reflects an increase of approximately 55% compared with the mean nitrogen concentration measured at Site 1.

Measured concentrations of phosphorus species in the discharge from Pond B were also highly variable, with 1-3 orders of magnitude difference between minimum and maximum values measured for the phosphorus species. In general, phosphorus concentrations in discharges from Pond B were low in value for each measured phosphorus form. Decreases in concentrations were observed between Site 1 and Site 2 for SRP and dissolved organic phosphorus, although increases in concentrations were observed between the two sites for particulate phosphorus and total phosphorus. It is assumed that the increase in particulate phosphorus is a result of incorporation of phosphorus into algal biomass within Pond B. However, overall, the mean total phosphorus concentration in discharges from Pond B of 58 μg/l reflects an increase of approximately 12% compared with the mean inflow total phosphorus concentration at Site 1.

Measured concentrations of turbidity, TSS, and color were highly variable in discharges from Pond B, with 1-2 orders of magnitude between minimum and maximum values for turbidity and TSS. The overall mean concentrations of 6 NTU for turbidity and 13.7 mg/l for TSS reflect relatively low concentrations. However, although relatively low in value, the mean measured concentrations for turbidity, TSS, and color in the discharge from Pond B are all higher than the mean concentrations measured in the inflow at Site 1. Measured turbidity values increased by approximately 36% during migration through Pond B, with a 40% increase in TSS, and an 8% increase in color.

3.2.2.3 Western Sub-basin Inflow (Site 3)

A summary of the measured chemical characteristics of inflow from the western sub-basin (Site 3) during the field monitoring program from May 2010-February 2011 is given in Table 3-16. Inflow from this site contained highly variable alkalinity values, ranging from moderately to well buffered. The overall mean alkalinity of 81.0 mg/l reflects relatively well buffered characteristics at this site. Field measured pH values for the western sub-basin inflow ranged from approximately neutral to slightly alkaline, with an overall mean pH of 7.56. Measured conductivity values at this site were highly variable, with more than one order of magnitude between minimum and maximum values. The mean conductivity value of 635 μmho/cm at this site is approximately twice the mean conductivity values measured at Sites 1 or 2.

Inflows from the western sub-basin contained highly variable concentrations for nitrogen species, with 1-2 orders of magnitude difference between minimum and maximum values measured for nitrogen species at this site. Relatively low mean values were observed for both ammonia and NO_x at this site, with a mean of 44 μg/l for ammonia and 66 μg/l for NO_x. Dissolved organic nitrogen appears to be the dominant nitrogen species at this site, comprising more than 50% of the measured total nitrogen. The mean particulate nitrogen concentration of 119 μg/l measured at this site reflects a low concentration compared with values commonly observed in runoff and is likely a result of significant pre-treatment afforded by the densely vegetated conveyance channels within the western sub-basin. The distribution of nitrogen species in inflows from the western sub-basin is very similar to the distribution of nitrogen species observed at Site 1, although mean concentrations in the western sub-basin are approximately 20-30% greater for each nitrogen species than observed in the northern sub-basin. The overall mean total nitrogen concentration of 743 μg/l is approximately one-third of the total nitrogen concentration commonly observed in urban runoff.

TABLE 3-16

CHARACTERISTICS OF WESTERN SUB-BASIN INFLOW SAMPLES COLLECTED AT SITE 3 FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	LOG-NORMAL MEAN
pH[1]	s.u.	7.10	8.40	7.56
Conductivity[1]	μmho/cm	267	3025	635
Alkalinity	mg/l	56.4	125	81
NH_3	μg/l	11	130	44
NO_x	μg/l	3	412	66
Diss. Organic N	μg/l	104	1094	395
Particulate N	μg/l	37	499	119
Total N	μg/l	486	1616	743
SRP	μg/l	1	218	47
Diss. Organic P	μg/l	1	77	8
Particulate P	μg/l	2	92	24
Total P	μg/l	34	295	106
Turbidity	NTU	1.3	10.6	3.6
TSS	mg/l	1	33.7	5.8
Color	Pt-Co	21	67	37

1. Field measured values

A high degree of variability was observed in measured phosphorus species discharging from the western sub-basin, with 1-3 orders of magnitude difference between minimum and maximum measured values for phosphorus species. Measured phosphorus concentrations in the western sub-basin appear to be somewhat greater than phosphorus concentrations measured in the northern sub-basin, particularly for SRP and particulate phosphorus. The overall mean total phosphorus concentration of 106 μg/l measured in the western sub-basin is approximately two times greater than the mean concentration measured in the northern sub-basin. The dominant phosphorus species measured in inflows from the western sub-basin is SRP which comprises approximately 45% of the total phosphorus measured at this site.

Measured concentrations for turbidity, TSS, and color were relatively low in value in samples collected from the western sub-basin. Measured mean concentrations for each of these species are greater than mean values measured in the northern sub-basin.

3.2.2.4 Pond C Outfall (Site 4)

A summary of the chemical characteristics of Pond C outfall (Site 4) samples collected at the Cameron Ditch site from May 2010-February 2011 is given on Table 3-17. Discharges from Pond C were found to be moderately to relatively well buffered, with measured alkalinity values ranging from 58.6-92.0 mg/l and an overall mean of 70 mg/l. Field measured pH values at this site were approximately neutral, with an overall mean of 7.28. However, measured conductivity values were highly variable, ranging from 186-1556 μmho/cm, with an overall mean of 669 μmho/cm.

Measured concentrations of nitrogen species were highly variable in the Pond C outfall, with 1-2 orders of magnitude difference between minimum and maximum values. In general, the mean characteristics of nitrogen species measured at the Pond C outfall are very similar to the mean characteristics of nitrogen species measured in inflows from the western sub-basin. Extremely low levels of both ammonia and NO_x were observed at the Pond C outfall. The dominant nitrogen species is dissolved organic nitrogen which comprises approximately 50% of the total nitrogen measured at this site.

TABLE 3-17

CHARACTERISTICS OF POND C OUTFALL SAMPLES COLLECTED AT SITE 4 FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	LOG-NORMAL MEAN
pH[1]	s.u.	6.87	7.61	7.28
Conductivity[1]	μmho/cm	186	1556	669
Alkalinity	mg/l	58.6	92	70
NH_3	μg/l	14	84	48
NO_x	μg/l	3	393	65
Diss. Organic N	μg/l	11	1267	362
Particulate N	μg/l	6	517	134
Total N	μg/l	309	1847	754
SRP	μg/l	1	123	30
Diss. Organic P	μg/l	1	69	5
Particulate P	μg/l	1	100	12
Total P	μg/l	17	209	58
Turbidity	NTU	0.9	12	3.0
TSS	mg/l	0.9	19.9	4.5
Color	Pt-Co	21	78	40

1. Field measured values

Measured concentrations of phosphorus species in the Pond C outfall were highly variable, with 1-3 orders of magnitude difference between minimum and maximum values. However, in general, phosphorus concentrations in discharges from Pond C were relatively low in value. The dominant phosphorus species at the outfall was SRP which comprised more than half of the total phosphorus in the discharge. This finding is somewhat unusual, since SRP concentrations in pond discharges are typically near the detection limit for the test. Relatively low levels of both dissolved organic phosphorus and particulate phosphorus were observed in the discharge from the system. Overall, the mean total phosphorus concentration of 58 μg/l in the Pond C outfall is identical to the mean total phosphorus concentration which discharged into Pond C from Pond B.

Relatively low levels of turbidity, TSS, and color were observed in discharges from Pond C. However, the degree of variability for these parameters appears to be relatively high considering that the samples were collected at the ultimate discharge from the treatment system. The mean measured concentrations for turbidity and TSS at the system outfall are lower in value than observed at any of the other monitoring sites.

3.2.3 **Bulk Precipitation**

A total of 19 bulk precipitation samples was collected at the Cameron Ditch site during the 304-day monitoring program. A complete listing of the characteristics of each of the monitored bulk precipitation samples is given in Appendix C.2. A summary of the characteristics of bulk precipitation samples collected at the Cameron Ditch site from May 2010-February 2011 is given in Table 3-18. Measured pH values in bulk precipitation ranged from 4.81-6.53, with an overall mean of 5.58. This value is typical of pH values commonly observed in urban precipitation. Measured conductivity values ranged from 12-140 μmho/cm, with an overall mean of 51 μmho/cm, which is also typical of values commonly observed in urban runoff. Bulk precipitation measured at the site was poorly buffered, with a mean alkalinity of only 4.0 mg/l.

Measured nitrogen concentrations in bulk precipitation were highly variable, although less variable than concentrations observed in the inflow samples. The dominant nitrogen species in bulk precipitation was particulate nitrogen, followed by dissolved organic nitrogen, ammonia, and NO_x. Measured concentrations of ammonia and NO_x in bulk precipitation were low to moderate in value and typical of concentrations commonly observed in the Central Florida area. The overall total nitrogen concentration of 678 μg/l is typical of nitrogen concentrations commonly observed in bulk precipitation in the Central Florida area.

Highly variable concentrations were observed for measured phosphorus species in bulk precipitation, although the degree of variability appears to be less than observed for the inflow samples. The dominant phosphorus species in bulk precipitation was particulate phosphorus which comprised approximately 40% of the total phosphorus measured. Approximately 25% of the total phosphorus was contributed by SRP, with the remainder by dissolved organic phosphorus. The overall mean total phosphorus concentration of 64 μg/l in bulk precipitation is similar to values commonly observed in the Central Florida area.

TABLE 3-18

CHARACTERISTICS OF BULK PRECIPITATION SAMPLES COLLECTED AT THE CAMERON DITCH SITE FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	MINIMUM VALUE	MAXIMUM VALUE	LOG-NORMAL MEAN
pH	s.u.	4.81	6.53	5.58
Conductivity	μmho/cm	12	140	51
Alkalinity	mg/l	0.6	22.2	4
NH_3	μg/l	15	536	111
NO_x	μg/l	8	547	89
Diss. Organic N	μg/l	24	302	122
Particulate N	μg/l	29	877	183
Total N	μg/l	185	1383	678
SRP	μg/l	1	93	17
Diss. Organic P	μg/l	1	81	8
Particulate P	μg/l	11	106	28
Total P	μg/l	21	214	64
Turbidity	NTU	1	18.2	2.6
TSS	mg/l	0.2	50.5	6.1
Color	Pt-Co	1	30	8

A high degree of variability was observed in measured concentrations for turbidity, TSS, and color in bulk precipitation samples. However, the observed mean values for these parameters were relatively low in value and within the range of concentrations commonly observed in Central Florida bulk precipitation.

3.2.4 Comparison of Chemical Characteristics

A tabular comparison of mean chemical characteristics of inflow and outflow samples collected at the Cameron Ditch site from May 2010-February 2011 is given on Table 3-19. Values summarized in this table reflect the log-normal mean values for each of the monitoring sites provided in previous sections. Mean pH values measured at the four inflow/outflow monitoring sites are similar, ranging from 7.28-7.86. A somewhat lower mean pH value of 5.58 was observed for bulk precipitation. Measured conductivity values appear to be relatively similar at Sites 1 and 2, with substantially higher values observed at Sites 3 and 4. In comparison, mean conductivity measured in bulk precipitation is approximately one-sixth of the values measured at Sites 1 and 2.

TABLE 3-19

COMPARISON OF MEAN CHEMICAL CHARACTERISTICS OF INFLOW / OUTFLOW SAMPLES COLLECTED AT THE CAMERON DITCH SITE FROM MAY 2010 – FEBRUARY 2011

PARAMETER	UNITS	SITE 1	SITE 2	SITE 3	SITE 4	BULK PRECIPITATION
pH	s.u.	7.32	7.86	7.56	7.28	5.58
Conductivity	μmho/cm	322	279	635	669	51
Alkalinity	mg/l	50	51	81	70	4
NH_3	μg/l	36	51	44	48	111
NO_x	μg/l	21	72	66	65	89
Diss. Organic N	μg/l	315	368	395	362	122
Particulate N	μg/l	99	214	119	134	183
Total N	μg/l	583	906	743	754	678
SRP	μg/l	17	8	47	30	17
Diss. Organic P	μg/l	6	5	8	5	8
Particulate P	μg/l	19	33	24	12	28
Total P	μg/l	52	58	106	58	64
Turbidity	NTU	4.4	6.0	3.6	3.0	2.6
TSS	mg/l	9.8	13.7	5.8	4.5	6.1
Color	Pt-Co	39	42	37	40	8

Low levels of ammonia and NO_x were observed at each of the four inflow/outflow monitoring sites. The mean concentrations for ammonia and NO_x in bulk precipitation are higher than the concentrations measured at the inflow and outflow monitoring sites. Measured concentrations of dissolved organic nitrogen appear to be similar in value at each of the four inflow/outflow monitoring sites, with mean concentrations ranging from 315-395 μg/l. The mean concentration of dissolved organic nitrogen in bulk precipitation is approximately one-third of the values measured at the inflow/outflow monitoring sites. Measured concentrations of particulate nitrogen at the inflow/outflow monitoring sites were somewhat more variable, ranging from 99-214 μg/l and a mean of 183 μg/l in bulk precipitation. In general, total nitrogen concentrations measured at the inflow/outflow monitoring sites appear to be low to moderate in value. A substantial increase in total nitrogen appears to occur between Sites 1 and 2, with relatively similar total nitrogen concentrations at Sites 3 and 4.

A moderate degree of variability was observed in mean SRP concentrations between the four inflow/outflow monitoring sites, ranging from 8-47 µg/l. A decrease in SRP concentrations appears to occur between Sites 1 and 2. The mean SRP concentration in bulk precipitation of 17 µg/l is similar to the inflow concentration measured at Site 1. Concentrations of dissolved organic phosphorus were low in value at each of the four inflow/outflow monitoring sites as well as in bulk precipitation. Relatively low levels of particulate phosphorus were also observed in the inflow/outflow monitoring sites, ranging from 12-33 µg/l. The mean particulate phosphorus concentration in bulk precipitation of 28 µg/l is similar to values observed in the inflow/outflow monitoring sites. Mean concentrations for total phosphorus appear to be relatively similar in value at Sites 1, 2, 4, and in bulk precipitation, ranging from 52-64 µg/l. However, the mean total phosphorus concentration of 106 µg/l observed at Site 3 is approximately twice as high as values measured at the remaining sites.

Relatively low levels of turbidity and TSS were observed at each of the inflow/outflow monitoring sites as well as in bulk precipitation. Measured color concentrations at the four inflow/outflow monitoring sites were similar in value, ranging from 37-42 Pt-Co units. Measured color concentrations in bulk precipitation were substantially lower, with a mean of only 8 Pt-Co units.

Graphical comparisons of the chemical characteristics of inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site were developed for general parameters, nitrogen species, and phosphorus species in the form of Tukey box plots, also often called "box and whisker plots". The bottom line of the box portion of each plot represents the lower quartile, with 25% of the data points falling below this value. The upper line of the box represents the 75% upper quartile, with 25% of the data falling above this value. The **blue** horizontal line within the box represents the median value, with 50% of the data falling both above and below this value. The **red** horizontal line within the box represents the mean of the data points. The vertical lines, also known as "whiskers", represent the 5 and 95 percentiles for the data sets. Individual values which fall outside of the 5-95 percentile range, sometimes referred to as “outliers”, are indicated as **red dots**.

A statistical comparison of general parameters measured in inflow/outflow and bulk precipitation samples at the Cameron Ditch site is given on Figure 3-8. In general, measured pH values at each of the four inflow/outflow monitoring sites exhibited a relatively low degree of variability, with the majority of measured values ranging from 7-7.8. A substantially lower pH value, along with a higher degree of variability in measured values, was observed for bulk precipitation. Measured alkalinity values appear to be relatively similar at Sites 1 and 2, with the majority of measured values ranging from 40-60 mg/l. Similar concentrations for alkalinity were also observed at Sites 3 and 4, with measured values ranging from approximately 60-100 mg/l. Alkalinity in the bulk precipitation samples was low in value.

Measured concentrations of conductivity appeared to be relatively similar at Sites 1 and 2, with substantially more elevated values observed at Sites 3 and 4. Bulk precipitation was characterized by extremely low levels of conductivity. Relatively low levels of TSS were observed at each of the inflow/outflow and bulk precipitation monitoring sites, although the highest concentrations appear to occur at Sites 1 and 2.

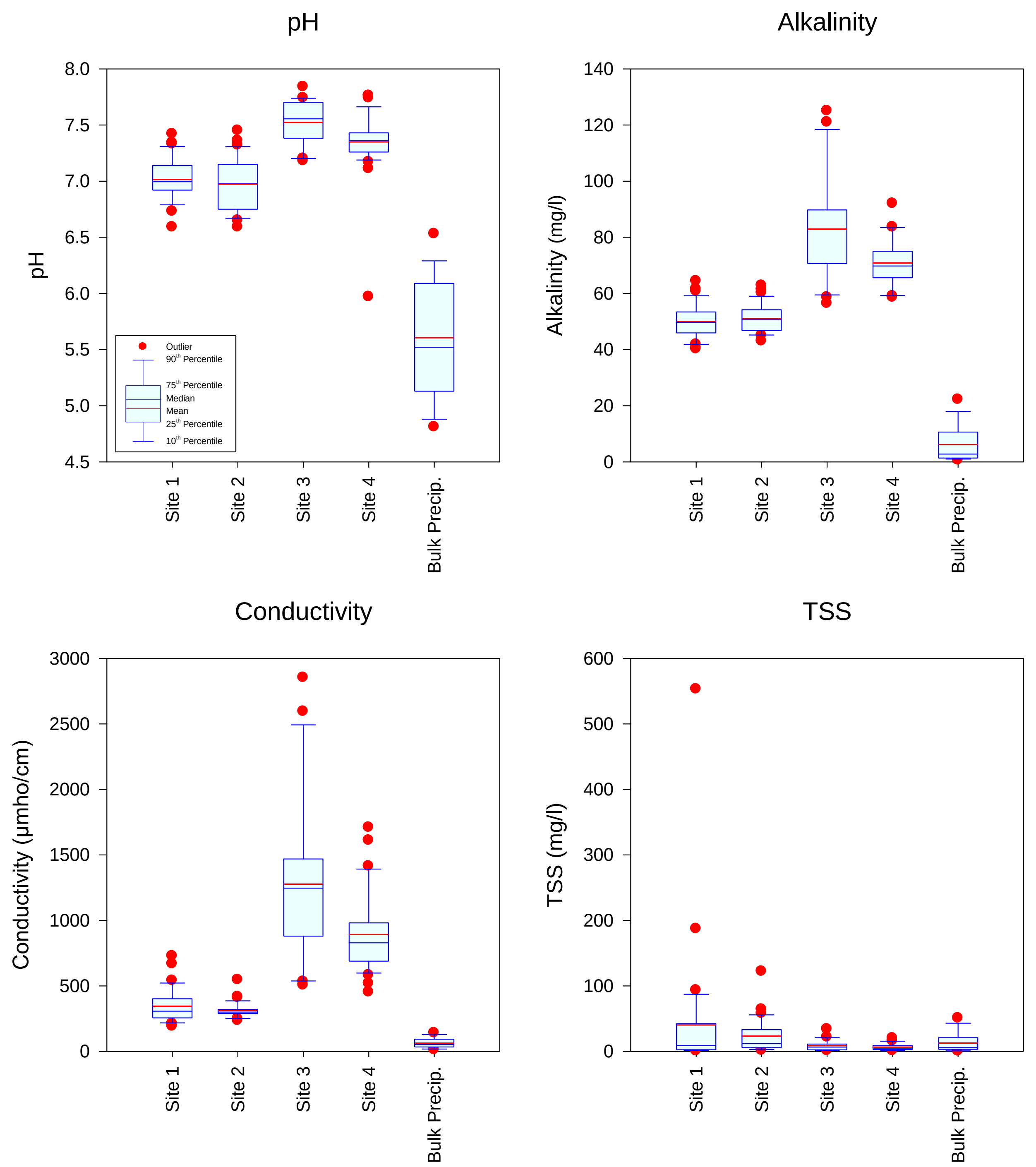


Figure 3-8. Statistical Comparison of General Parameters Measured in Inflow/Outflow and Bulk Precipitation Samples at the Cameron Ditch Site.

A statistical comparison of turbidity, color, and dissolved oxygen measurements in inflow/ outflow and bulk precipitation samples at the Cameron Ditch site is given in Figure 3-9. Turbidity measurements were low in value at each of the four inflow/outflow monitoring sites as well as in bulk precipitation. Turbidity values measured at Sites 1 and 2 appear to be slightly higher, and exhibit a higher degree of variability, than measurements conducted at the remaining sites. Measured color concentrations appear to be very similar at monitoring Sites 1, 2, 3, and 4, with substantially lower values for bulk precipitation. Relatively similar levels of dissolved oxygen were observed at Sites 1, 2, and 3, with slightly lower values observed at the system outfall at Site 4.

A statistical comparison of nitrogen species at the inflow/outflow monitoring sites and in bulk precipitation is given in Figure 3-10. Measured ammonia concentrations appear to be relatively similar at each of the four inflow/outflow monitoring sites, with higher and more variable concentrations observed for ammonia in bulk precipitation. A relatively low level of NO_x was measured at the inflow from the eastern sub-basin (Site 1), with higher and relatively similar values observed at Sites 2, 3, 4, and in bulk precipitation. Measured particulate nitrogen concentrations appear to be relatively similar at Sites 1, 3, 4, and in bulk precipitation. However, a higher mean concentration and a higher degree of variability was observed for particulate nitrogen measured at Site 2. As discussed previously, this increase in particulate nitrogen is thought to be associated with growth of algal biomass within Pond B. A similar pattern is exhibited by total nitrogen, with relatively similar concentrations observed at Sites 1, 3, 4, and in bulk precipitation, and a slightly higher value observed at Site 2.

A statistical comparison of phosphorus species measured in the inflow/outflow samples and in bulk precipitation at the Cameron Ditch site is given in Figure 3-11. Measured SRP concentrations appear to be relatively similar at Sites 1 and 2. However, inflow concentrations from the western sub-basin at Site 3 appear to have substantially higher levels of SRP. Relatively consistent low levels of dissolved organic phosphorus were observed at each of the four inflow/ outflow monitoring sites, as well as in bulk precipitation. Relatively low levels of particulate phosphorus were also observed at Sites 1, 3, 4, and in bulk precipitation, with a somewhat higher and more variable concentration observed at Site 2, likely a result of algal biomass within Pond B. In general, measured total phosphorus concentrations at Sites 1, 2, 4, and in bulk precipitation appear to be relatively similar. However, total phosphorus concentrations measured at the inflow from the western sub-basin (Site 3) appear to be both higher in concentration and more variable than observed at the remaining sites.

A graphical summary of temporal variability in pH and alkalinity in inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-12. Field measured pH values at the northern sub-basin inflow (Site 1) and the Pond B outfall structure (Site 2) appear to exhibit relatively close agreement throughout much of the monitoring program. Similarly, measured pH values at the western sub-basin inflow (Site 3) and the Pond C outfall (Site 4) also appear to be relatively similar and higher in value than pH measurements conducted at Sites 1 and 2. No apparent seasonal trends are visible in the pH data. Measured pH values in bulk precipitation are typically lower and more variable than concentrations measured at the inflow/outflow sites.

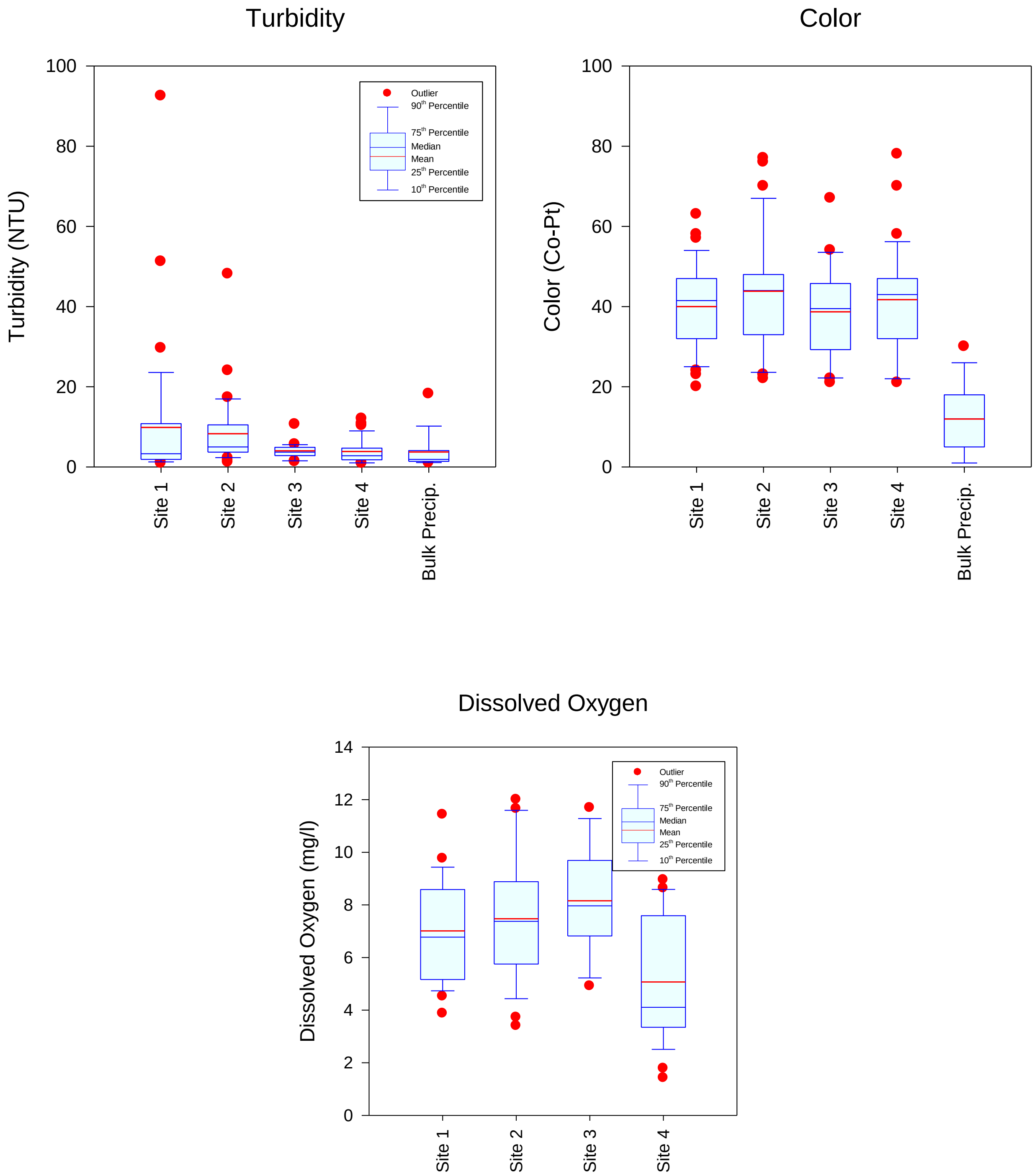


Figure 3-9. Statistical Comparison of Turbidity, Color, and Dissolved Oxygen Measured in Inflow/Outflow and Bulk Precipitation Samples at the Cameron Ditch Site.

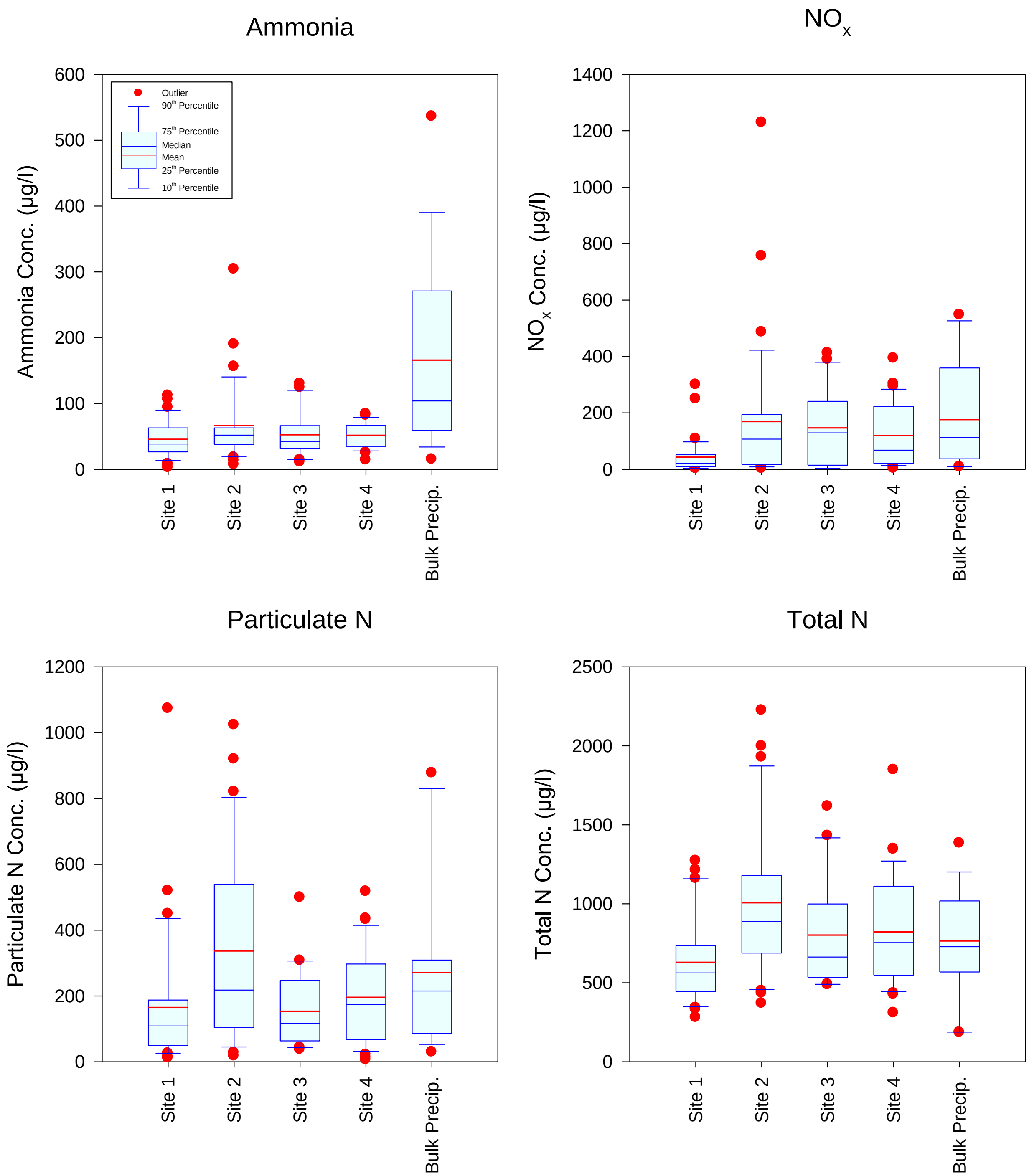


Figure 3-10. Statistical Comparison of Nitrogen Species Measured in Inflow/Outflow and Bulk Precipitation Samples at the Cameron Ditch Site.

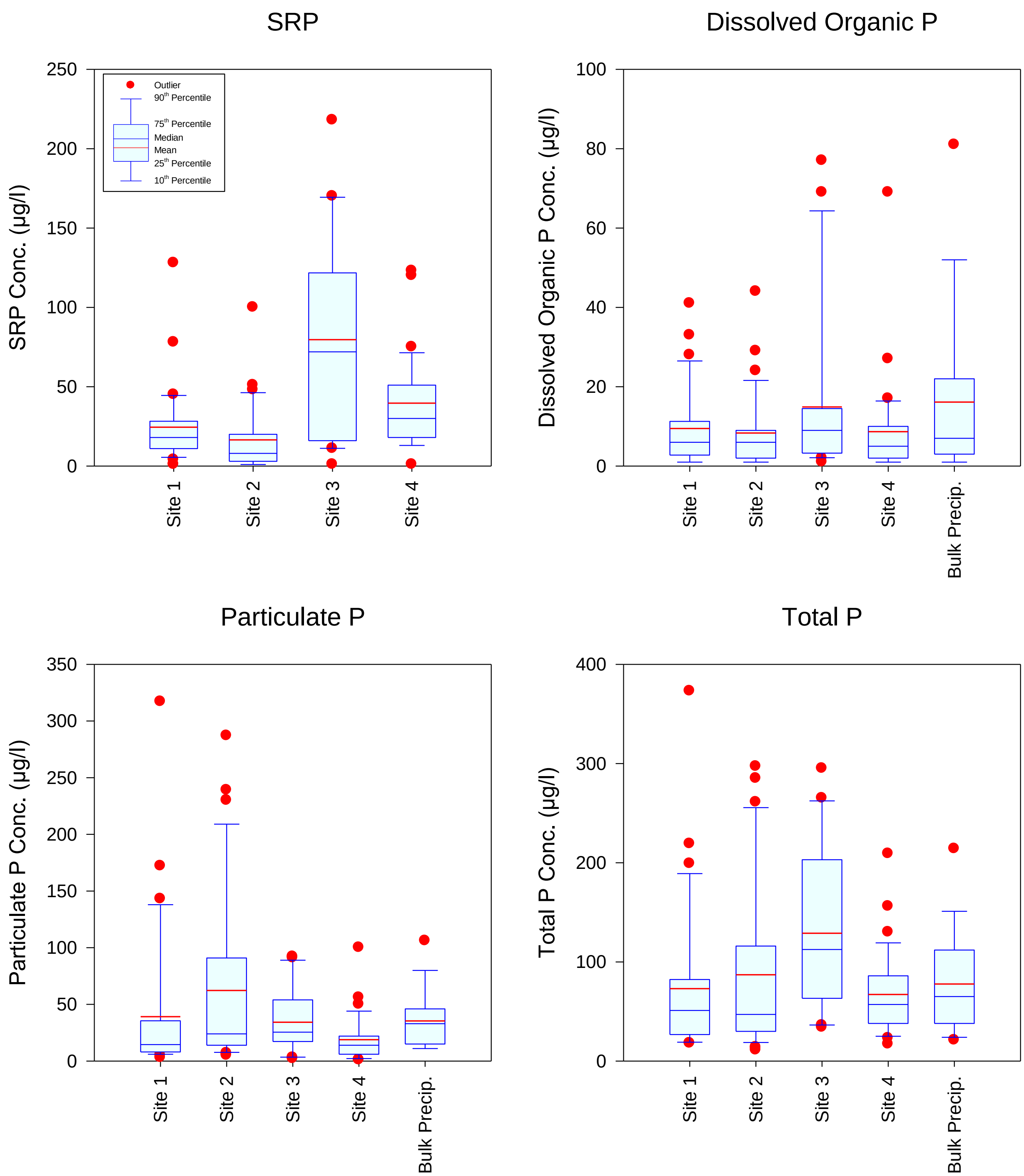
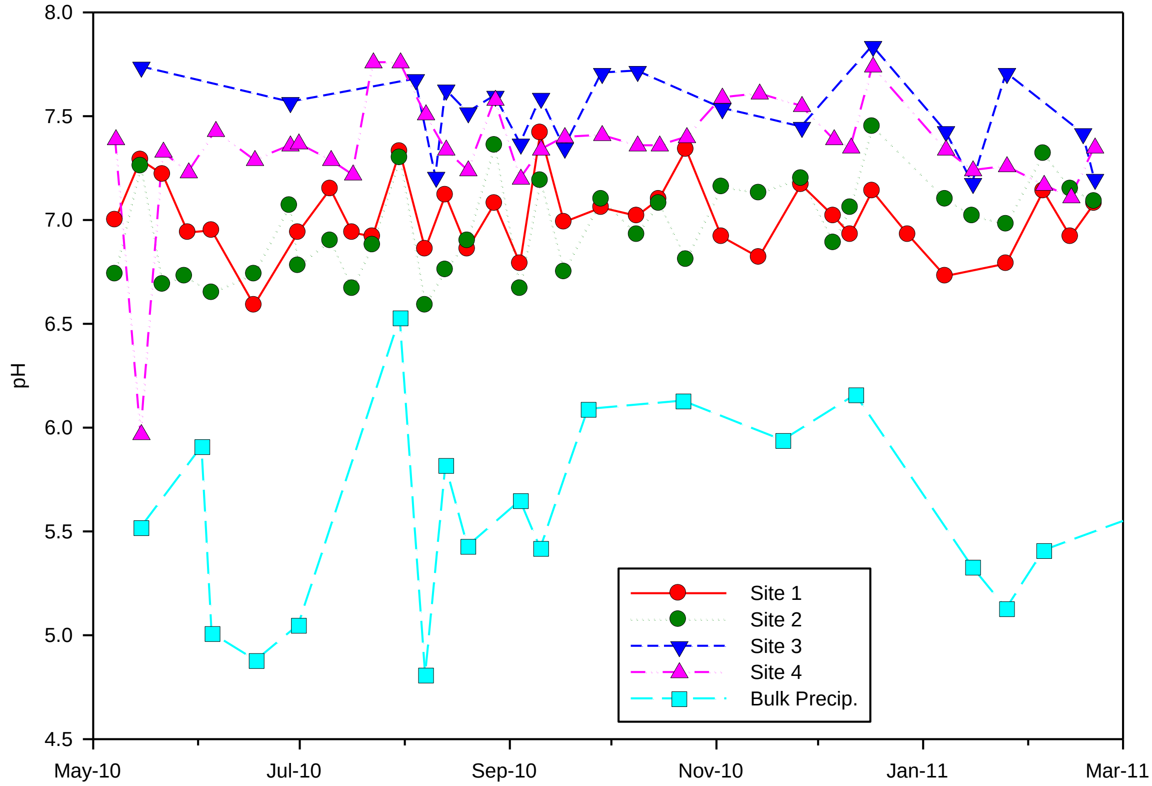


Figure 3-11. Statistical Comparison of Phosphorus Species Measured in Inflow/Outflow and Bulk Precipitation Samples at the Cameron Ditch Site.



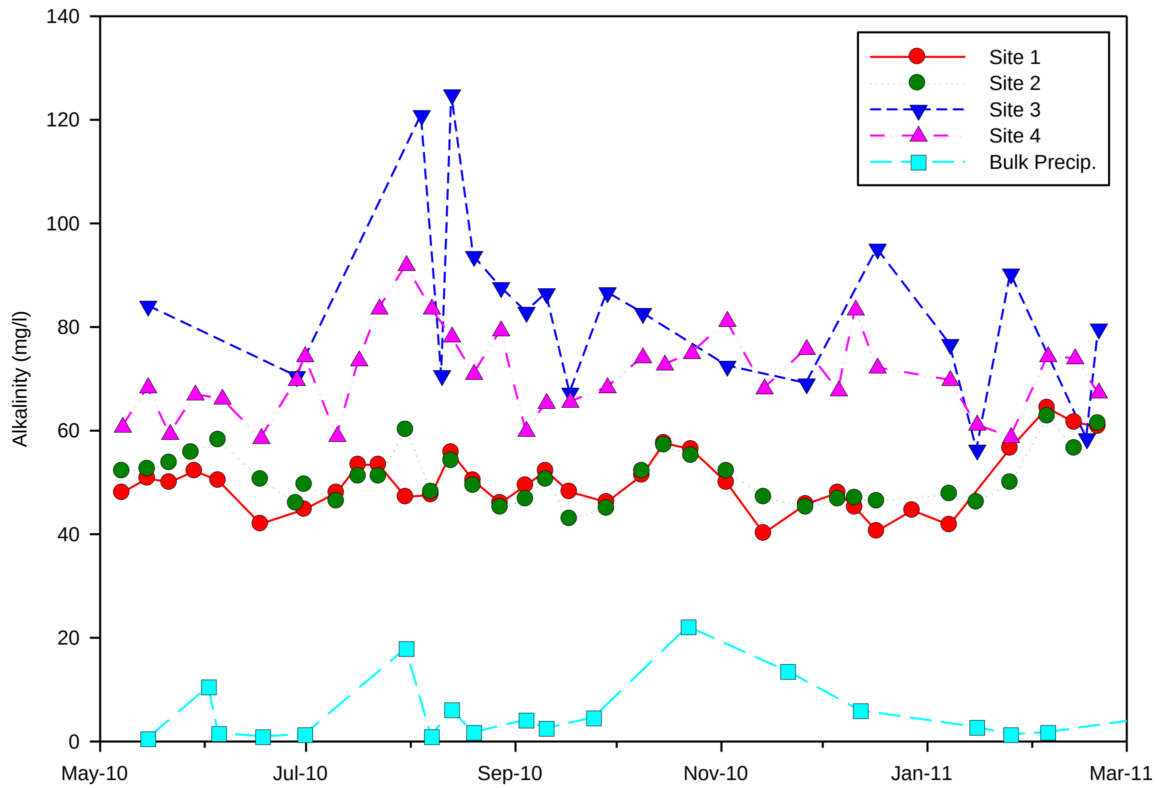


Figure 3-12. Temporal Variability in pH and Alkalinity in Inflow/Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.

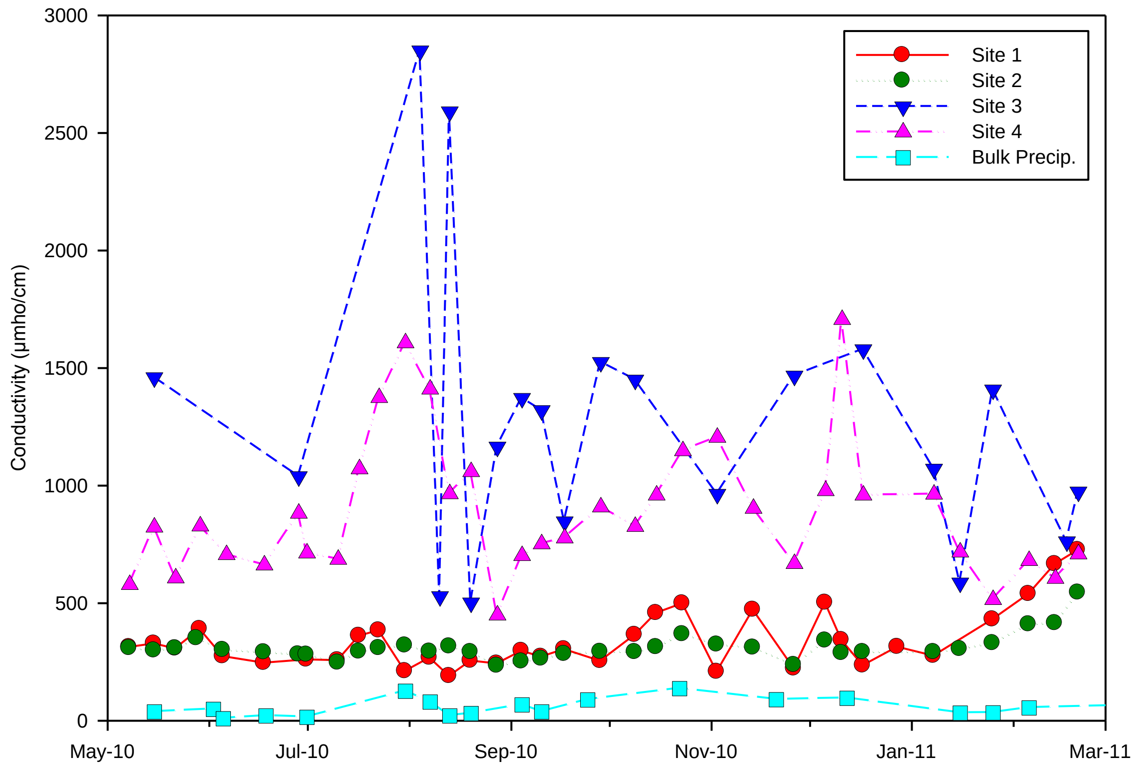
Similar patterns are also exhibited for alkalinity measurements at the inflow/outflow and bulk precipitation sites. Relatively close agreement appears to occur for alkalinity values measured at the northern sub-basin inflow (Site 1) and the Pond B outflow (Site 2) during the field monitoring program. A relatively close agreement is also apparent in measured alkalinity values between the western sub-basin inflow (Site 3) and the Pond C outfall (Site 4). Measured alkalinity values at Sites 3 and 4 were consistently higher in value than measurements conducted at Sites 1 and 2. Alkalinity values measured in bulk precipitation were generally low throughout the field monitoring program.

A graphical summary of temporal variability in conductivity and color measurements conducted on inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-13. A very close agreement in field measured conductivity values was observed at the northern sub-basin inflow (Site 1) and the Pond B outfall (Site 2) during the entire field monitoring program. Measured values at these sites ranged from approximately 250-400 μmho/cm on most dates. In contrast, a lower degree of similarity was observed in measured conductivity values from the western sub-basin (Site 3) and the Pond C outfall (Site 4). Measured conductivity values at these two sites were substantially higher than values measured at Sites 1 and 2 throughout the entire field monitoring program. Low conductivity measurements were observed in bulk precipitation samples throughout the study period.

A high degree of variability was observed in measured color concentrations at each of the four inflow/outflow monitoring sites during the first half of the field monitoring program. However, beginning in approximately September 2010, color concentrations began to be relatively similar between each of the four monitoring sites. The measured color concentrations in bulk precipitation were low in value throughout the entire field monitoring program.

A graphical summary of temporal variability in concentrations of ammonia and NO_x in inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-14. A moderately close agreement was observed between measured ammonia concentrations in the northern sub-basin inflow (Site 1), Pond B outfall (Site 2), the western sub-basin inflow (Site 3), and the Pond C outfall (Site 4). Measured ammonia concentrations at these sites were consistently low in value and similar in concentration. In contrast, measured ammonia concentrations in bulk precipitation were highly variable, and typically higher in concentration, throughout the field monitoring program.

Measured concentrations of NO_x at the inflow/outflow monitoring sites, as well as in bulk precipitation, were highly variable throughout the field monitoring program. NO_x concentrations measured in the northern sub-basin inflow (Site 1) and the Pond B outfall (Site 2) appear to follow a similar pattern throughout much of the field monitoring program. Measured NO_x concentrations at the western sub-basin inflow (Site 3) and the Pond C outfall (Site 4) were highly variable with a poor degree of correlation.



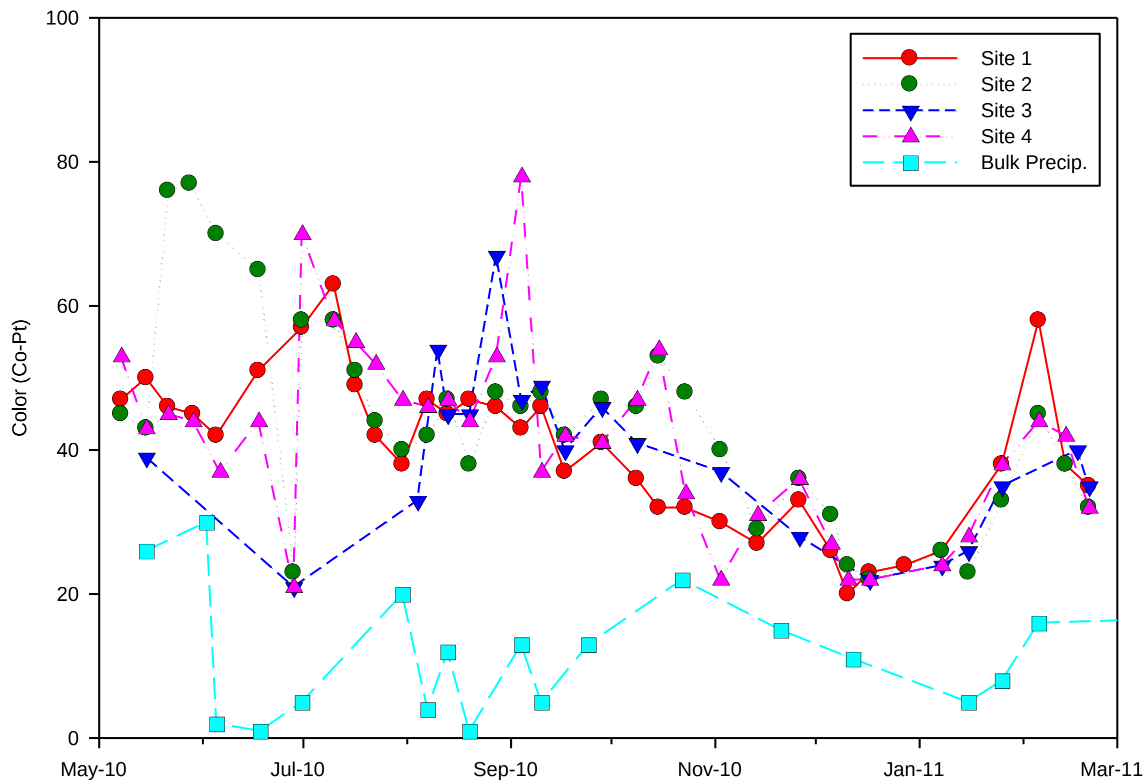
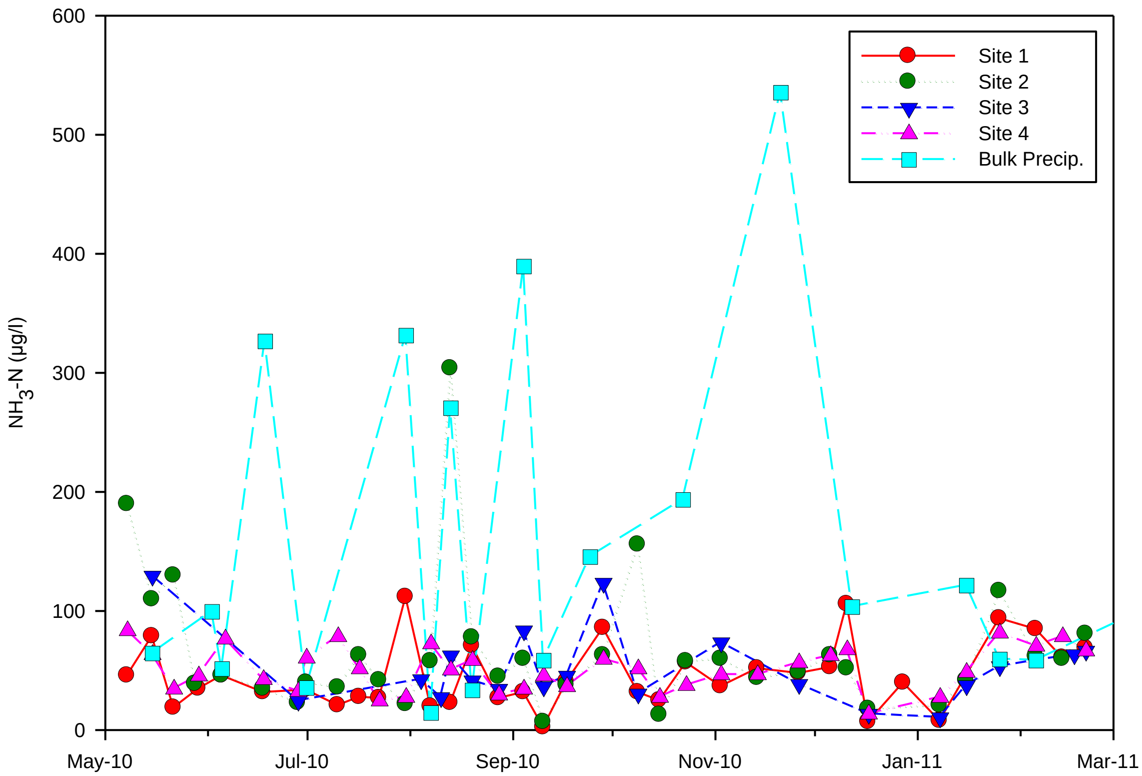


Figure 3-13. Temporal Variability in Conductivity and Color in Inflow/Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.



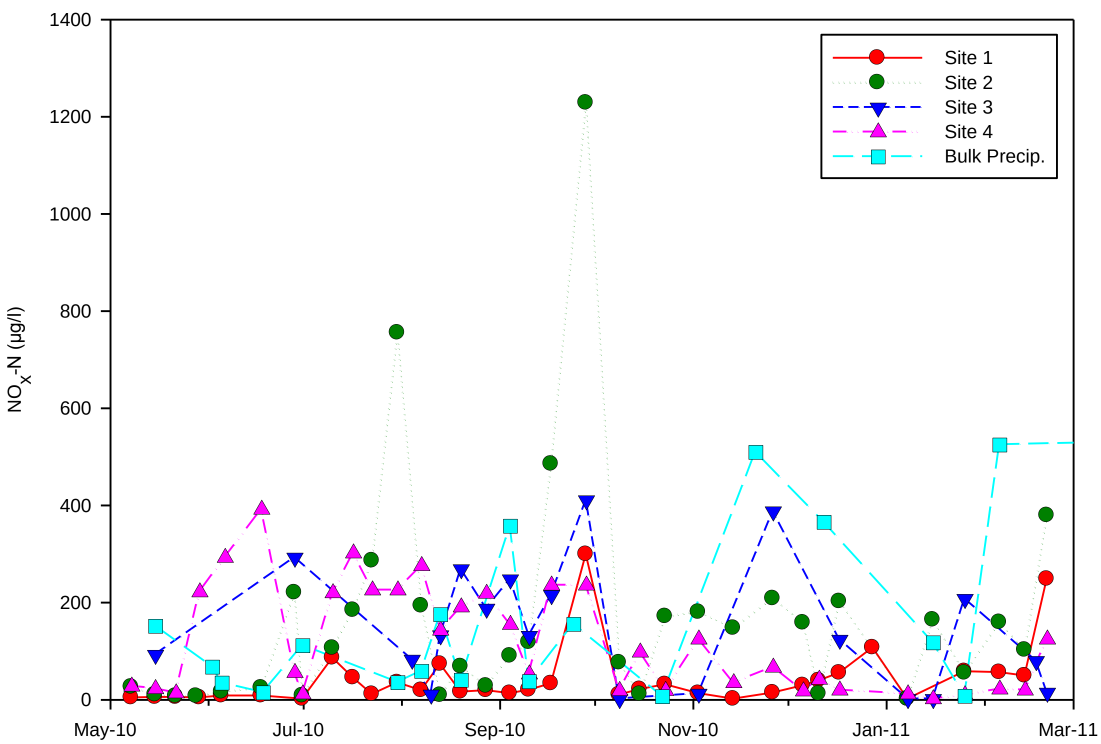


Figure 3-14. Temporal Variability in Ammonia and NO_x in Inflow/Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.

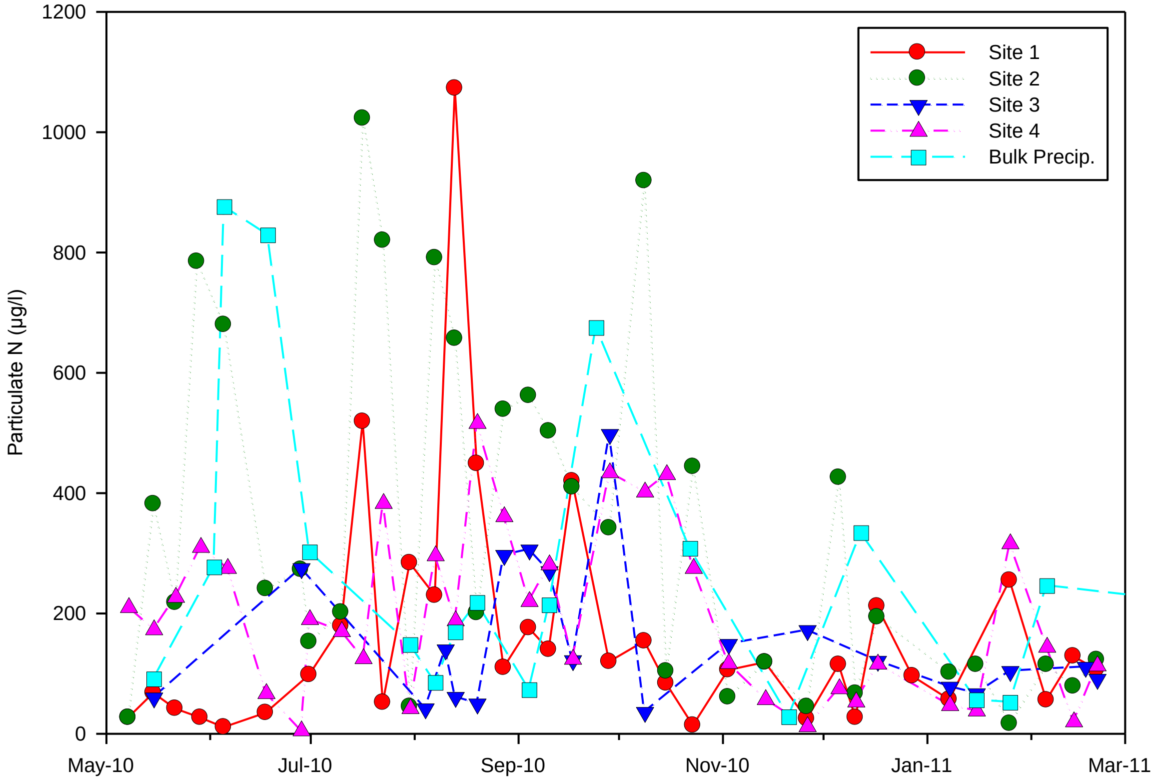
A graphical summary of temporal variability in concentrations of particulate nitrogen and total nitrogen in inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-15. Measured concentrations of particulate nitrogen were highly variable at each of the monitoring sites during the first six months of the 10-month field monitoring program. However, beginning in November 2010, measured particulate nitrogen concentrations at the inflow/outflow monitoring sites, as well as bulk precipitation, tend to become more uniform in value. A similar pattern is also present for total nitrogen, with a high degree of variability between the monitoring sites during the initial six months of the 10-month field monitoring program, and a much closer level of agreement during the final four months.

A graphical summary of temporal variability in SRP and dissolved organic phosphorus in inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-16. A moderately close level of agreement appears to occur between SRP concentrations measured in the northern sub-basin inflow (Site 1) and the Pond B outfall (Site 2). Measured SRP in bulk precipitation samples appears to follow a similar pattern. However, highly variable levels of SRP were observed at the western sub-basin inflow (Site 3) during virtually all of the field monitoring program. Measured SRP concentrations at this site during many of the monitored events were approximately 2-10 times greater than concentrations measured at the remaining sites. Highly elevated concentrations of SRP were also observed at Site 1 on multiple occasions. The elevated SRP concentrations observed at Sites 1 and 3 appear to be associated with the non-rain event inflows at these sites discussed in Section 3.1.3 which suggests that the non-rain event inflows contain elevated levels of SRP. The SRP concentrations measured during these events appear to be inconsistent with the type of land use and vegetated drainage systems within the sub-basin areas.

A similar pattern also appears to occur for concentrations of dissolved organic phosphorus. Measured dissolved organic phosphorus concentrations at the northern sub-basin inflow (Site 1), the Pond B outfall (Site 2), the Pond C outfall (Site 4), as well as in bulk precipitation appear to exhibit similar trends throughout much of the field monitoring program. However, in contrast, highly variable, and sometimes elevated, concentrations of dissolved organic phosphorus were measured at the inflow from the western sub-basin (Site 4).

A graphical summary of temporal variability in particulate phosphorus and total phosphorus concentrations in inflow/outflow and bulk precipitation samples collected at the Cameron Ditch site during the field monitoring program is given on Figure 3-17. A high degree of variability was observed in particulate phosphorus concentrations at each of the inflow/outflow monitoring sites, as well as in bulk precipitation, throughout the field monitoring program. Periods exist where a relatively close agreement occurs between particulate phosphorus concentrations at the various monitoring sites, with other periods exhibiting highly variable concentrations. A similar pattern is also apparent for measured concentrations of total phosphorus, with periods of relatively close agreement in concentrations combined with periods exhibiting a high degree of variability.

A tabular summary of flow-weighted inflow and outflow concentrations for Ponds A and B during the field monitoring program is given on Table 3-20. Inflows into Ponds A and B are assumed to occur as a result of inflow from the northern sub-basin (Site 1) and bulk precipitation, with discharges from Ponds A and B assumed to occur through the Pond B outfall (Site 2). Flow-weighted mean characteristics for these inflows and outflows are summarized on Table 3-19. The chemical characteristics of each inflow and outflow were weighted according to the relative hydrologic inputs and losses for each inflow and outflow source, summarized in Table 3-9.



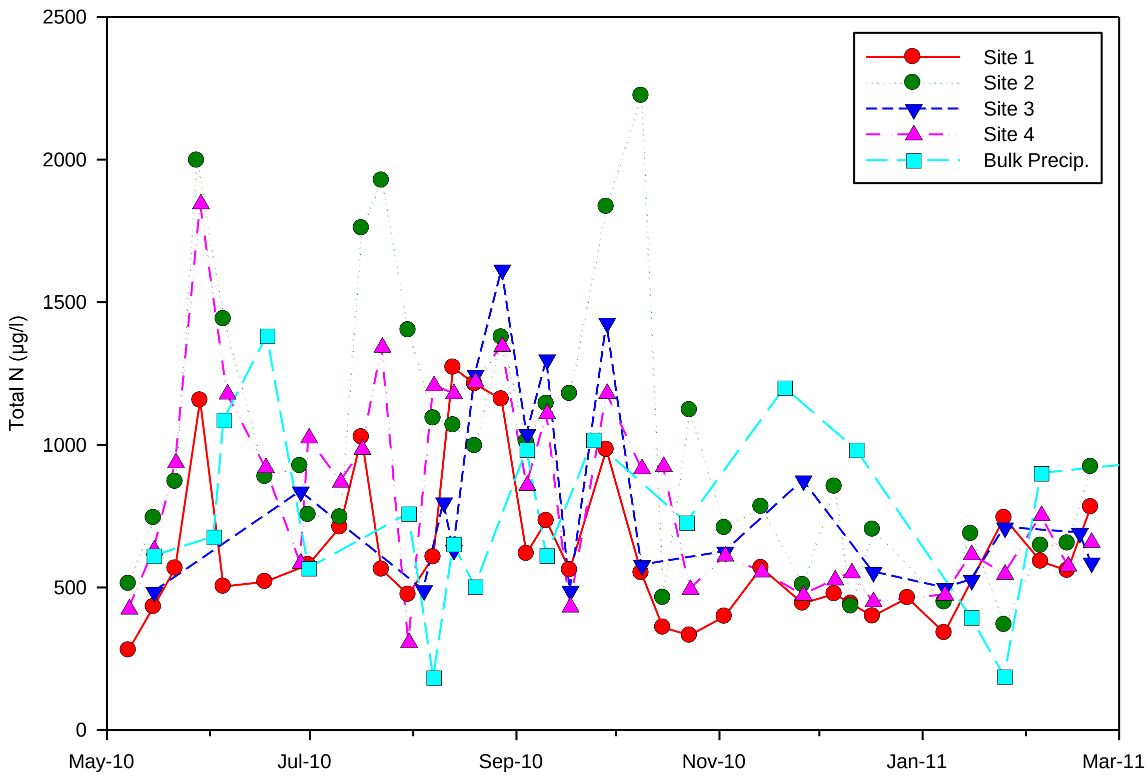
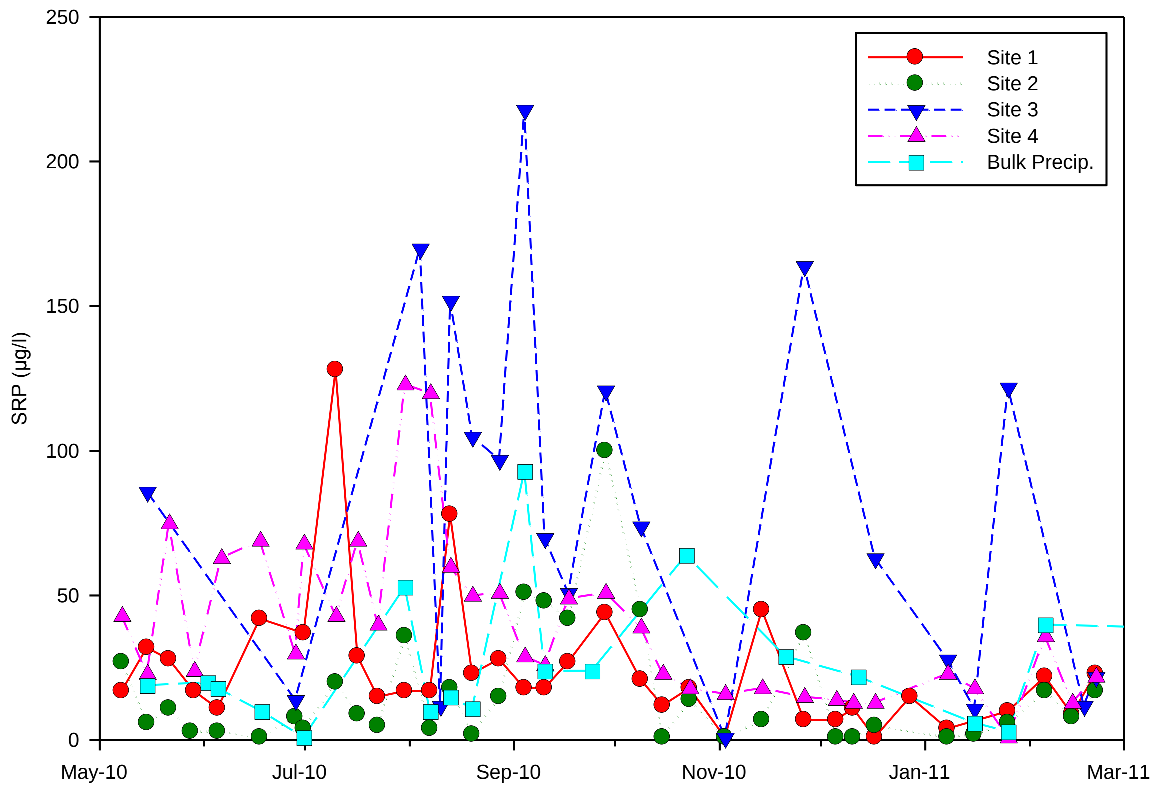


Figure 3-15. Temporal Variability in Particulate Nitrogen and Total Nitrogen in Inflow/Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.



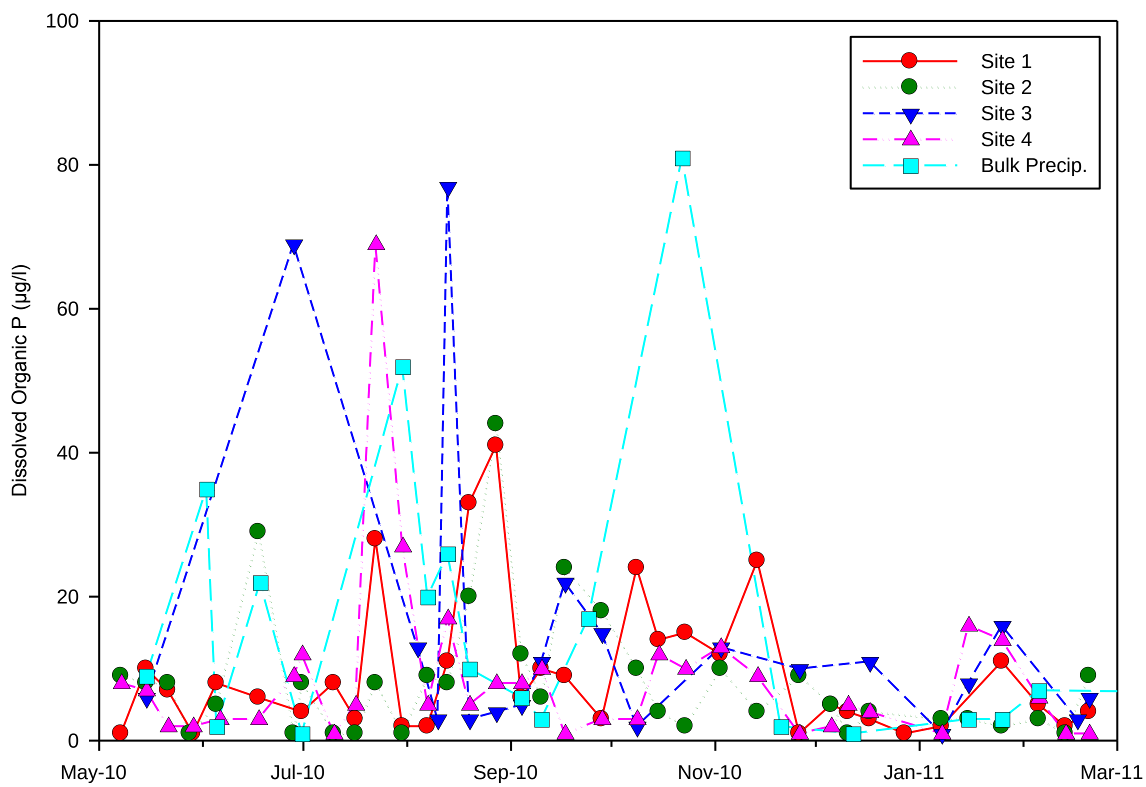


Figure 3-16. Temporal Variability in SRP and Dissolved Organic Phosphorus in Inflow/Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.

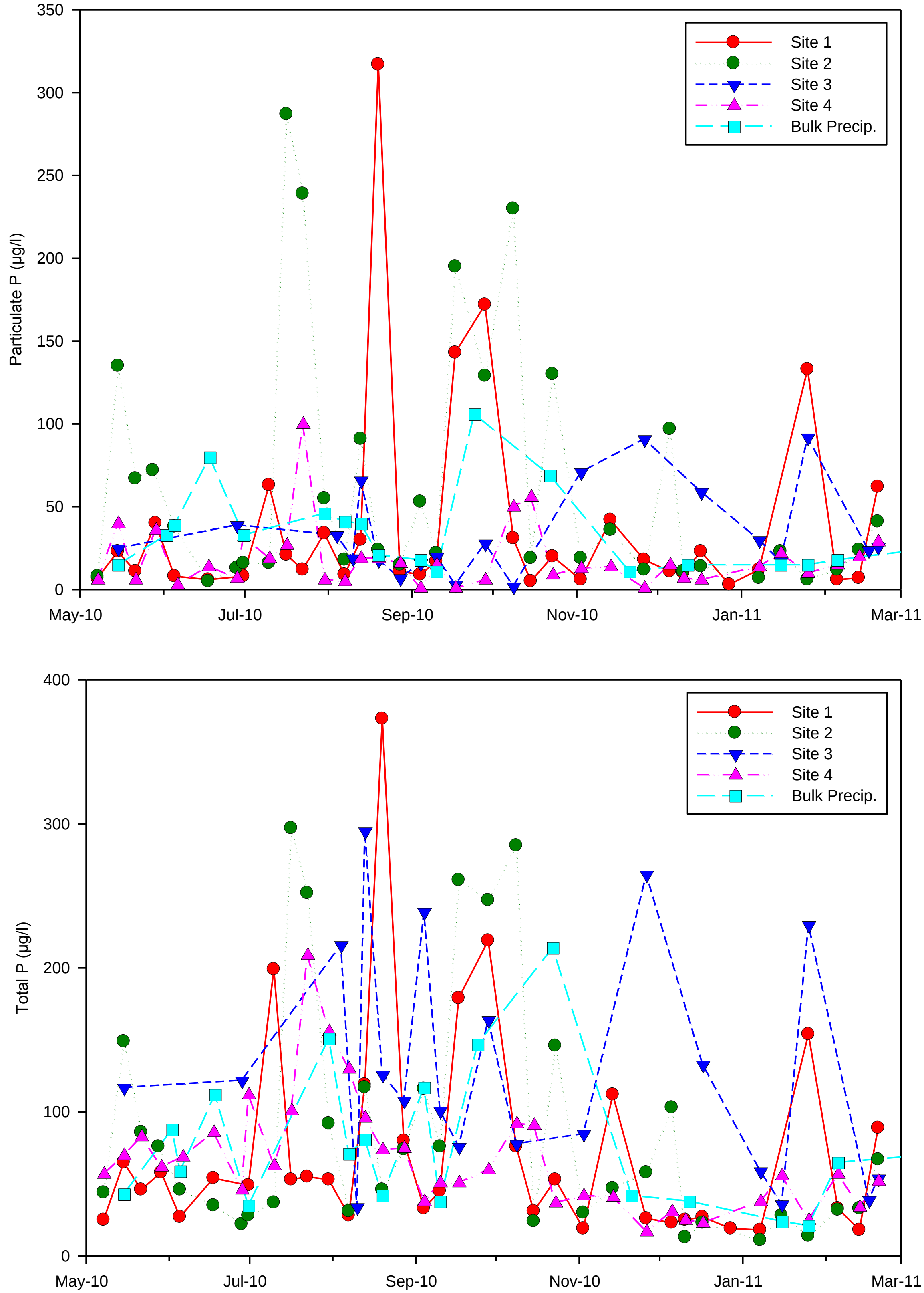


Figure 3-17. Temporal Variability in Particulate Phosphorus and Total Phosphorus in Inflow/ Outflow and Bulk Precipitation Samples Collected at the Cameron Ditch Site.

TABLE 3-20

COMPARISON OF FLOW-WEIGHTED INFLOW AND OUTFLOW CONCENTRATIONS FOR CAMERON DITCH PONDS A AND B DURING THE FIELD MONITORING PROGRAM

PARAMETER	UNITS	MEAN INPUT CONCENTRATION	MEAN DISCHARGE CONCENTRATION	PERCENT CHANGE (%)
pH	s.u.	6.98	6.97	-0.2
Conductivity	µmho/cm	320	308	-4
Alkalinity	mg/l	48.8	50.7	4
NH_3	µg/l	38	51	35
NO_X	µg/l	23	72	217
Diss. Organic N	µg/l	311	368	18
Particulate N	µg/l	100	214	113
Total N	µg/l	585	906	55
SRP	µg/l	17	8	-54
Diss. Organic P	µg/l	6	5	-14
Particulate P	µg/l	19	33	74
Total P	µg/l	52	58	12
Turbidity	NTU	4.4	6.0	35
TSS	mg/l	9.7	13.7	41
Color	Pt-Co	38	42	10

As seen on Table 3-20, reductions in concentrations during migration through Ponds A and B were observed only for pH, conductivity, SRP, and dissolved organic phosphorus, with increases in concentrations observed for the remaining parameters. Flow-weighted concentrations of total nitrogen increased approximately 55% during migration through Ponds A and B, resulting from relatively large percentage increases in NO_x and particulate nitrogen. Measured concentrations of total phosphorus increased approximately 12% during migration through the two ponds, due primarily to the observed increases in particulate phosphorus. Measured concentrations of turbidity and TSS increased approximately 35-40% between the inflows and outflows.

A comparison of flow-weighted inflow and outflow concentrations for Cameron Ditch Pond C during the field monitoring program is given in Table 3-21. This analysis assumes that inputs into Pond C occur as a result of discharge from Pond B (Site 2), inflow from the western sub-basin (Site 3), and bulk precipitation. Discharges from Pond C are assumed to occur through the outfall structure for the pond. The identified inputs and outputs are weighted on a volumetric basis using the hydrologic inputs and losses summarized on Table 3-9.

TABLE 3-21

COMPARISON OF FLOW-WEIGHTED INFLOW AND OUTFLOW CONCENTRATIONS FOR CAMERON DITCH POND C DURING THE FIELD MONITORING PROGRAM

PARAMETER	UNITS	MEAN INPUT CONCENTRATION	MEAN DISCHARGE CONCENTRATION	PERCENT CHANGE (%)
pH	s.u.	7.08	7.34	3.8
Conductivity	µmho/cm	492	850	73
Alkalinity	mg/l	57.0	70.4	24
NH_3	µg/l	50	48	-4
NO_X	µg/l	71	65	-8
Diss. Organic N	µg/l	371	362	-2
Particulate N	µg/l	193	134	-30
Total N	µg/l	868	754	-13
SRP	µg/l	16	30	84
Diss. Organic P	µg/l	6	5	-12
Particulate P	µg/l	31	12	-62
Total P	µg/l	69	58	-16
Turbidity	NTU	5.4	3.0	-45
TSS	mg/l	11.9	4.5	-62
Color	Pt-Co	40	40	-2

Concentration reductions between inflow and outflow samples in Pond C were observed for all of the measured parameters with the exceptions of pH, conductivity, alkalinity, and SRP. Decreases in concentrations between the inflow and outflow were observed for the remaining parameters. Relatively significant reductions in concentrations were observed for particulate phosphorus, turbidity, and TSS in the Pond C system.

3.3 Mass Inputs and Losses

Mass loadings were calculated for each of the evaluated inputs and losses at the Cameron Ditch site over the 10-month monitoring program from May 2010-February 2011. Mass inputs into the system were calculated for inflows at Sites 1, 2, 3, and bulk precipitation. Mass losses were calculated for discharges through the various pond outfall structures as well as discharges from Pond C into the western sub-basin.

Due to the large degree of variability in the hydrologic budget for the two ponds, mass inputs and losses were calculated on a monthly basis. Information on monthly hydrologic inputs and losses were obtained from the information summarized in Table 3-10. Estimates of monthly water quality characteristics were calculated as the log-normal mean of the water quality data provided in Appendix C for the inflow/outflow samples and bulk precipitation, summarized on a monthly basis. Samples with collection periods that extended into two separate months were included in estimation of log-normal mean values for each of the two months during which sample collection occurred. If samples were not collected at a site during a monthly period for which measurable flow was recorded, the mean monthly concentration for a given parameter is calculated as the mean of concentrations measured during the preceding and following monthly periods.

A summary of mean monthly concentrations of measured parameters in pond inflow/ outflow and bulk precipitation samples is given on Table 3-22. Mean monthly concentrations are provided for general parameters, measured species of nitrogen and phosphorus, and TSS. In general, a relatively low degree of variability was observed in the monthly water quality characteristics of inflow samples collected from the northern sub-basin. Measured monthly concentrations for many species appear to be more variable and higher in concentration during wet season conditions than observed during dry season conditions. A much higher degree of variability is apparent in measured monthly concentrations at Site 2, particularly for species of nitrogen and phosphorus as well as TSS. Since the characteristics measured at Site 2 reflect the inputs from the northern sub-basin after migrating through Ponds A and B, it appears that processes are occurring within Ponds A and B which are impacting, and in some cases increasing, concentrations of constituents measured at Site 2.

A relatively low degree of variability was observed in monthly concentrations of constituents measured at the western sub-basin inflow (Site 3). A slight trend of higher concentrations is apparent during wet season conditions, particularly for nitrogen species. A moderate degree of variability was observed in mean monthly concentrations monitored at the Pond C outfall (Site 4) with a trend of more elevated concentrations for many parameters during wet season conditions.

Mean monthly concentrations of bulk precipitation samples collected at the Cameron Ditch site exhibit a relatively high degree of variability throughout the field monitoring program. No distinct seasonal pattern is apparent in the monthly average values.

Estimates of monthly mass loadings were generated for each evaluated parameter at each of the inflow/ouflow and bulk precipitation monitoring sites. Monthly mass loadings were calculated by multiplying the mean monthly concentrations for each of the inflow/outflow and bulk precipitation sites (summarized in Table 3-22) times the estimated monthly hydrologic inputs/ losses for each measured input and output (summarized in Table 3-10). Tabular summaries of estimated monthly mass inputs into Ponds A and B are given in Appendix D.1, with estimated monthly mass inputs to Pond C provided in Appendix D.2, and a summary of overall system inputs and outputs provided in Appendix D.3.

TABLE 3-22

MEAN MONTHLY CONCENTRATIONS FOR MEASURED PARAMETERS IN INFLOW / OUTFLOW AND BULK PRECIPITATION SAMPLES

SITE	MONTH	pH (s.u.)	COND. (µmho/cm)	ALK. (mg/l)	NH_3 (µg/l)	NO_x (µg/l)	DISS. ORG. N (µg/l)	PART. N (µg/l)	TOTAL N (µg/l)	SRP (µg/l)	DISS. ORG. P (µg/l)	PART. P (µg/l)	TOTAL P (µg/l)	TURB. (NTU)	TSS (mg/l)	COLOR (Pt-Co)
1	May	7.11	334	50.2	39	5	419	38	531	23	3	16	46	2.4	4.4	47
	June	6.82	261	45.6	37	6	442	34	533	26	6	7	41	2.0	4.3	50
	July	7.08	295	50.4	37	36	247	192	665	31	6	27	74	4.8	11.3	47
	August	6.98	238	49.8	31	27	389	332	1020	30	13	31	100	10.7	46.3	46
	September	7.06	282	49.0	23	42	290	188	707	25	6	44	87	12.7	36.4	42
	October	7.15	438	55.1	36	20	265	57	404	17	17	15	50	3.5	8.2	33
	November	6.97	280	45.2	45	8	324	68	465	7	7	17	38	3.5	5.5	30
	December	7.00	337	44.5	35	52	213	89	444	6	3	9	23	2.0	5.6	23
	January	6.76	346	48.6	27	12	303	121	503	6	5	40	53	10.9	22.0	31
	February	7.05	640	62.2	71	89	355	92	637	17	3	14	38	4.0	3.1	43
2	May	6.85	317	53.6	101	12	444	205	903	9	5	48	81	3.5	7.1	58
	June	6.72	292	52.7	40	16	610	293	989	2	11	14	36	4.3	9.9	64
	July	6.93	292	52.0	38	256	545	296	1372	13	2	88	126	11.5	42.7	48
	August	6.90	283	49.1	89	44	222	487	1125	7	16	28	59	4.8	8.8	44
	September	6.92	274	46.3	32	284	295	446	1258	57	13	74	154	13.9	42.3	46
	October	6.99	324	54.2	52	73	506	226	952	5	5	57	74	6.6	19.3	47
	November	7.16	272	46.2	46	176	312	73	631	16	6	21	52	7.1	9.8	32
	December	7.11	301	46.5	34	98	293	197	701	3	2	21	29	6.2	14.6	25
	January	7.03	310	48.0	47	28	276	58	485	2	3	10	16	2.6	6.3	27
	February	7.19	454	60.2	67	184	351	104	731	13	3	23	41	5.0	6.3	38
3	May	7.74	1463	84.2	130	94	201	61	486	86	6	25	117	1.3	2.0	39
	June	7.69	1393	87.5	108	94	298	68	582	84	7	24	119	2.1	4.1	41
	July	7.63	1323	90.9	85	93	396	75	679	83	7	24	121	2.9	6.1	43
	August	7.53	1184	97.5	41	93	591	89	871	79	8	22	124	4.5	10.3	47
	September	7.50	1240	80.5	65	233	345	267	987	99	12	13	132	3.8	5.7	45
	October	7.66	1290	80.5	66	26	428	140	804	21	7	16	103	2.5	3.4	41
	November	7.49	1192	70.9	54	74	328	161	742	13	11	80	150	6.5	9.0	32
	December	7.62	1343	77.5	24	243	270	180	742	52	20	59	163	5.2	11.1	23
	January	7.47	982	72.5	27	27	346	112	630	27	10	37	88	3.2	6.0	26
	February	7.44	1018	75.1	61	65	396	103	662	32	7	39	79	3.8	6.2	37

TABLE 3-22 -- CONTINUED

MEAN MONTHLY CONCENTRATIONS FOR MEASURED PARAMETERS IN INFLOW/OUTFLOW AND BULK PRECIPITATION SAMPLES

SITE	MONTH	pH (s.u.)	COND. (µmho/cm)	ALK. (mg/l)	NH_3 (µg/l)	NO_x (µg/l)	DISS. ORG. N (µg/l)	PART. N (µg/l)	TOTAL N (µg/l)	SRP (µg/l)	DISS. ORG. P (µg/l)	PART. P (µg/l)	TOTAL P (µg/l)	TURB. (NTU)	TSS (mg/l)	COLOR (Pt-Co)
4	May	6.95	703	63.8	54	39	422	226	827	37	4	15	67	2.4	4.0	46
	June	7.33	728	66.3	55	135	681	183	1198	52	4	15	80	3.5	6.7	47
	July	7.48	1033	75.7	45	135	260	147	818	63	10	25	118	6.5	10.9	56
	August	7.48	1011	80.5	45	207	277	214	938	74	10	11	102	1.7	3.1	47
	September	7.38	703	67.5	40	160	326	262	920	39	5	4	54	2.2	2.9	48
	October	7.42	1002	74.2	44	65	328	301	788	27	7	18	60	4.5	9.0	38
	November	7.53	921	73.0	53	49	359	51	540	16	4	7	31	3.2	3.4	29
	December	7.48	991	73.6	41	37	372	33	517	16	3	5	27	1.9	2.1	25
	January	7.30	751	64.7	44	13	342	43	554	11	7	12	40	2.1	2.8	27
	February	7.22	626	68.3	75	29	327	102	630	10	3	17	40	2.6	3.2	39
Bulk Precipitation	May	5.52	41	0.6	65	153	302	92	612	19	9	15	43	1.3	0.2	26
	June	5.20	23	2.2	88	46	162	498	872	8	6	43	67	5.7	18.1	4
	July	5.74	48	5.0	109	65	168	212	657	7	7	39	73	7.5	13.6	10
	August	5.61	54	3.8	82	64	81	148	464	17	23	35	78	3.3	12.5	6
	September	5.71	64	3.7	150	130	124	221	850	38	7	28	87	2.0	9.6	9
	October	6.11	113	10.1	168	35	92	457	861	39	37	86	177	2.7	11.8	17
	November	6.03	114	17.4	322	64	165	95	935	43	13	28	95	1.6	3.9	18
	December	6.13	99	10.8	241	468	141	114	1083	28	2	20	52	1.7	2.6	14
	January	5.56	52	3.9	123	84	94	77	431	9	4	22	35	1.6	2.1	9
	February	5.27	46	1.6	59	69	67	114	412	11	5	16	37	2.6	4.9	11

A tabular summary of calculated mass inputs and losses to Ponds A and B during the field monitoring program from May 2010-February 2011 is given in Table 3-23. The values summarized in this table reflect the sum of the monthly mass loading calculations for Ponds A and B provided in Appendix D.1. Of the measured parameters, a mass removal within the pond system was observed for only SRP and TSS, with outfall mass losses exceeding mass inputs for each of the remaining parameters. Relatively significant increases in mass loadings occurred within the pond system for NO_x, particulate nitrogen, and total nitrogen, with smaller relative increases for the remaining parameters.

TABLE 3-23

CALCULATED MASS INPUTS AND LOSSES FOR CAMERON DITCH PONDS A AND B FROM MAY 2010 – FEBRUARY 2011

PARAMETER	INPUTS (kg)			LOSSES (kg)	LOAD REMOVED (kg)
	Northern Sub-basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
Ammonia	24	1.3	26	39	-14
NO_x	17	1.0	18	64	-46
Diss. Organic N	234	1.6	235	254	-19
Particulate N	92	2.8	95	179	-85
Total N	427	7.9	435	625	-190
SRP	14	0.2	14	8	6
Diss. Organic P	5	0.1	5	5	-1
Particulate P	15	0.4	16	23	-7
Total P	40	0.8	41	53	-12
TSS	12,081	125	12,206	9,786	2420

A summary of calculated mass inputs and losses for Pond C during the field monitoring program from May 2010-February 2011 is given on Table 3-24. The values summarized in this table reflect the sum of the monthly mass loading calculations for Ponds A and B provided in Appendix D.2. In general, the performance of the Pond C treatment system appears to be substantially better than observed in Ponds A and B. Net retention within Pond C was observed for ammonia, particulate nitrogen, total nitrogen, dissolved organic phosphorus, particulate phosphorus, total phosphorus, and TSS.

A summary of calculated mass inputs and losses for the overall Cameron Ditch treatment system during the field monitoring program is given on Table 3-25. The values summarized in this table reflect the sum of the monthly mass loading calculations for Ponds A and B provided in Appendix D.3. Mass inputs and losses are provided for each of the evaluated hydrologic inputs and losses into the overall treatment system. Overall, the treatment system resulted in increases in loadings of ammonia, NO_x, dissolved organic nitrogen, particulate nitrogen, total nitrogen, and SRP, with net load reductions observed for dissolved organic phosphorus, particulate phosphorus, total phosphorus, and TSS.

TABLE 3-24

CALCULATED MASS INPUTS AND LOSSES FOR CAMERON DITCH POND C FROM MAY 2010 – FEBRUARY 2011

PARAMETER	INPUTS (kg)				LOSSES (kg)			LOAD REMOVED (kg)
	Pond B Inflow	Western Sub-basin	Bulk Precip.	Total Inputs	Western Sub-basin	Pond C Outfall	Total Losses	
Ammonia	39.3	13.5	0.8	53.6	5.6	36.2	41.8	12
NO_x	63.8	18.4	0.6	82.8	13.8	76.3	90.1	-7.3
Diss. Organic N	254	69.5	0.95	325	41.4	286	328	-3
Particulate N	179.3	20.7	1.64	202	18.4	125	143	58
Total N	625	133	4.7	762	96	618	714	49
SRP	7.9	12.2	0.11	20.3	5.4	30.1	35.5	-15.2
Diss. Organic P	5.4	1.6	0.06	7.1	0.80	4.3	5.1	1.9
Particulate P	23.1	5.3	0.22	28.6	1.50	9.9	11.4	17
Total P	42.8	22.5	0.46	65.8	8.7	51.2	60.0	5.8
TSS	9,786	1,143	74.09	11,003	459	3,714	4,173	6,830

TABLE 3-25

CALCULATED MASS INPUTS AND LOSSES FOR THE OVERALL TREATMENT SYSTEM AT CAMERON DITCH FROM MAY 2010 – FEBRUARY 2011

PARAMETER	TOTAL SYSTEM INPUTS (kg)				TOTAL SYSTEM LOSSES (kg)			LOAD REMOVED (kg)
	Northern Sub-basin	Bulk Precip.	Western Sub-basin	Total Inputs	Western Sub-basin	Pond C Outfall	Total Losses	
Ammonia	24.3	2.1	13.5	39.9	5.6	36.2	41.8	-1.9
NO_x	16.6	1.6	18.4	36.6	13.8	76.3	90.1	-54
Diss. Organic N	234	2.5	69.5	306	41.4	286	328	-22
Particulate N	92	4.4	20.7	117	18.4	125	143	-27
Total N	427	12.6	133	572	96	618	714	-141
SRP	14.1	0.3	12.2	26.6	5.4	30.1	35.5	-8.9
Diss. Organic P	4.6	0.2	1.6	6.4	0.8	4.3	5.1	1.3
Particulate P	15.4	0.6	5.3	21.3	1.5	9.9	11.4	9.9
Total P	40.1	1.2	22.5	63.9	8.7	51.2	60.0	3.9
TSS	12,081	199	1,143	13,423	459	3,714	4,173	9,250

3.4 Pond Performance Efficiency

Mass removal efficiencies were calculated for each of the evaluated parameters for the Ponds A and B system, Pond C, and for the overall treatment system. Mass removal efficiencies were calculated over the 10-month monitoring program using the following equation:

$$\textit{Mass Removal} = \frac{\textit{Input Mass} - \textit{Outflow Mass}}{\textit{Input Mass}} \times 100$$

A summary of total mass inputs and losses and calculated mass removal efficiencies for Ponds A and B during the field monitoring program from May 2010-February 2011 is given on Table 3-26. Based upon the field monitoring program, a net removal was observed in Ponds A and B only for TSS and SRP. Mass loadings of ammonia increased approximately 54% in Ponds A and B, with a 262% increase in NO_x, a 90% increase in particulate nitrogen, and a 44% increase in total nitrogen. Similarly, a 13% increase was observed for dissolved organic phosphorus, with a 46% increase in particulate phosphorus and 29% increase in total phosphorus. A net mass retention of approximately 45% was observed for SRP, with a 20% retention for TSS.

TABLE 3-26

CALCULATED MASS REMOVAL EFFICIENCIES FOR CAMERON DITCH PONDS A AND B FROM MAY 2010 – FEBRUARY 2011

PARAMETER	MEASURED MASS INPUTS (kg)	OUTFALL LOSSES (kg)	REMOVAL EFFICIENCY (%)
Ammonia	26	39	-54
NO_x	18	64	-262
Diss. Organic N	235	254	-8
Particulate N	95	179	-90
Total N	435	625	-44
SRP	14	8	45
Diss. Organic P	5	5	-13
Particulate P	16	23	-46
Total P	41	53	-29
TSS	12,206	9,786	20

A summary of calculated mass removal efficiencies for Pond C during the field monitoring program from May 2010-February 2011 is given in Table 3-27. Net retention within Pond C was observed for ammonia, particulate nitrogen, total nitrogen, dissolved organic phosphorus, particulate phosphorus, total phosphorus, and TSS, with a net removal of approximately 6% for total nitrogen and 62% for TSS. Although relatively good removals were observed for dissolved organic phosphorus and particulate phosphorus, the overall retention of total phosphorus within Pond C was only approximately 9% due to a substantial increase in SRP within the pond.

TABLE 3-27

CALCULATED MASS REMOVAL EFFICIENCIES FOR CAMERON DITCH POND C FROM MAY 2010 – FEBRUARY 2011

PARAMETER	MEASURED MASS INPUTS (kg)	OUTFALL LOSSES (kg)	REMOVAL EFFICIENCY (%)
Ammonia	53.6	41.8	22
NO_x	82.8	90.1	-9
Diss. Organic N	325	328	-1
Particulate N	202	143	29
Total N	762	714	6
SRP	20.3	35.5	-75
Diss. Organic P	7.1	5.1	27
Particulate P	28.6	11.4	60
Total P	65.8	60.0	9
TSS	11,003	4,173	62

A summary of calculated mass removal efficiencies for the overall Cameron Ditch treatment system during the field monitoring program from May 2010-February 2011 is given on Table 3-28. The overall treatment system exhibited net load reductions only for dissolved organic phosphorus, particulate phosphorus, total phosphorus, and TSS. Relatively good removals were observed for dissolved organic phosphorus and particulate phosphorus, but the total phosphorus removal of 6% is relatively poor due to the observed increase in mass loadings for SRP. Load increases within the overall treatment system were relatively low for both ammonia and dissolved organic nitrogen, and moderate in value for particulate nitrogen. However, a substantial increase in mass loading occurred for NO_x within the pond system, resulting in an overall export of approximately 25% for total nitrogen.

TABLE 3-28

CALCULATED MASS REMOVAL EFFICIENCIES FOR THE OVERALL TREATMENT SYSTEM AT CAMERON DITCH FROM MAY 2010 – FEBRUARY 2011

PARAMETER	MEASURED MASS INPUTS (kg)	OUTFALL LOSSES (kg)	REMOVAL EFFICIENCY (%)
Ammonia	39.9	41.8	-5
NO_x	36.6	90.1	-146
Diss. Organic N	306	328	-7
Particulate N	117	143	-23
Total N	572	714	-25
SRP	26.6	35.5	-33
Diss. Organic P	6.4	5.1	20
Particulate P	21.3	11.4	47
Total P	63.9	60.0	6
TSS	13,423	4,173	69

3.5 Discussion

The results of the field monitoring program conducted at the Cameron Ditch site indicate that the system achieved relatively poor removal efficiencies for each of the measured nitrogen species, with a net mass export observed for ammonia, NO_x, dissolved organic nitrogen, particulate nitrogen, and total nitrogen in the overall system. A large portion of the observed mass loading increases for nitrogen species appears to have occurred in Ponds A and B. Since groundwater impacts on pond performance are thought to be relatively minimal due to the low permeability of the on-site soils, the additional observed mass loadings of nitrogen species appears to originate within the pond system.

Relatively substantial increases in mass appear to occur within Ponds A and B for ammonia, NO_x, particulate nitrogen, and total nitrogen. The increase in mass loadings for particulate nitrogen can be explained, at least partially, by increases in algal biomass within Pond B resulting from the nutrient loadings into the Ponds A and B pond systems. However, the observed increases in mass loadings for ammonia and NO_x are unusual, since each of these parameters is removed relatively rapidly in stormwater pond systems. The most likely candidate for the source of these additional mass loadings is the muck soils which were incorporated into Pond A to support the planted aquatic vegetation. Both ammonia and NO_x are common constituents in wetland soils which can be released relatively rapidly under certain environmental conditions. Since the inflow concentrations for these parameters originating from the northern sub-basin are low in value, the observed increases for these parameters could simply reflect diffusion from sediments containing relatively elevated concentrations into the overlying water column which contained relatively low concentrations. If the organic sediments in Pond A are the source of the observed increases in ammonia and NO_x, the impacts of the sediments on water quality should decrease over time as the initial nitrogen concentrations are scrubbed from the sediments and a new chemical equilibrium is reached.

Mass loadings of SRP were removed relatively well in Ponds A and B, with an overall load reduction of approximately 45%. However, increases in mass loadings were observed during migration through Ponds A and B for dissolved organic phosphorus, particulate phosphorus, and total phosphorus. This behavior is extremely unusual for phosphorus species which are generally removed easily in aquatic pond systems. The observed mass load reduction of 45% for SRP is less than half of the mass removal commonly observed for this parameter. The increases in particulate phosphorus can potentially be explained by increases in algal biomass within Pond B which are measured as particulate phosphorus in collected samples. The mass load reduction observed for SRP is approximately equal to the mass increase observed for particulate phosphorus which further supports this theory. However, overall, total phosphorus loadings increased by approximately 29% in the Ponds A and B system, compared with removal efficiencies of approximately 50-65% typically observed in wet pond systems. The organic muck soils placed in Pond A are also a likely source of the additional phosphorus loadings, similar to the discussion previously provided for total nitrogen. As indicated on Table 3-11, the mean detention time in the Ponds A and B system was approximately 12 days which is similar to conditions observed in many wet detention ponds constructed in Central Florida. Therefore, residence time effects do not appear to be a factor in the reduced performance observed within Ponds A and B.

A mass load reduction of approximately 20% was observed for TSS in Ponds A and B which is substantially lower than the removal of approximately 80-90% commonly observed in wet ponds with similar detention times. The reduced efficiency for TSS may be related to several factors. First, much of the larger suspended matter may have been removed or retained within the densely vegetated conveyance system within the northern sub-basin which conveys runoff into Pond A. When the larger particles are removed, the remaining smaller particles are generally removed at a lower rate, reducing the overall observed removal efficiency. A second factor affecting the TSS load reduction efficiency is the growth of algae within Pond B which would be reflected as an increase in TSS in samples measured at the Pond B outfall.

In general, calculated mass load removal efficiencies for nitrogen, phosphorus, and TSS in Pond C appear to be substantially better than the removal efficiencies observed in Ponds A and B. Net reductions in mass loadings were observed for all of the measured parameters with the exceptions of NO_x, dissolved organic nitrogen, and SRP. However, the observed mass load reduction of 6% for total nitrogen and 9% for total phosphorus are substantially lower than values commonly observed for these parameters in wet detention ponds. Detention time within the pond does not appear to be an issue impacting the effectiveness, since the mean detention time within Pond C was approximately 7 days during the study period. The observed load increases for NO_x and dissolved organic nitrogen are relatively small and are likely related to the low concentrations present within Pond C for these parameters. However, the increase in SRP of 75% is surprising, particularly considering that SRP is typically removed virtually completely within wet detention ponds. It appears than an additional source of SRP may be present in Pond C which is resulting in a net increase in mass loading for this parameter. This is consistent with the discussion contained in Section 3.2.4 which suggests an additional source of SRP entering the treatment system, particularly into Pond C from Site 3. The large increase in SRP is largely responsible for the relatively poor removal efficiency of only 9% observed for total phosphorus within the pond. Typically, a wet detention pond would be expected to exhibit a removal efficiency of approximately 25% for total nitrogen and 50-60% for total phosphorus compared with the observed load reductions of 6% for total nitrogen and 9% for total phosphorus. The observed load reduction for TSS of 62% in Pond C was substantially better than observed in Ponds A and B.

A potential additional source for the elevated SRP loadings other than the unexplained inflows from Site 3 is the 450-ft long narrow outfall channel which connects Pond C to the outfall structure. This area is heavily vegetated which creates conditions of low dissolved oxygen within the water as it migrates through the outfall channel. Release of SRP from soils under near-anoxic conditions is commonly observed in both wetland and lake systems. It appears likely that SRP is released from sediments within the outfall channel as well as from particulate phosphorus that may have been trapped within the aquatic vegetation. Had the observed increase in SRP not occurred, the removal efficiency for total phosphorus would have been substantially higher.

Another factor which affects the removal processes in Ponds A and B and Pond C is color. Inputs into the Cameron Ditch system contained moderate levels of color, with log-normal mean values ranging from 37-42 Pt-Co units. Color in water reduces light penetration and limits algal production, an important nutrient removal mechanism in wet ponds, to a relatively shallow portion of the pond depth. In addition, color compounds can act as natural biocides for certain organisms, reducing the level of activity and subsequent nutrient uptake. Removal efficiencies for pond systems receiving colored inputs have been shown to be substantially lower than systems which receive uncolored inflows.

Overall, the combined treatment system resulted in mass load increases for each of the evaluated nitrogen species based upon a comparison of measured mass inputs and losses. The most significant increases were observed for NO_x and particulate nitrogen, most of which appeared to originate within the Ponds A and B system. These increases in mass loadings resulted in an overall increase in mass discharge of approximately 25% for total nitrogen compared with the measured inputs. As discussed previously, the observed increases in nitrogen species in Ponds A and B appear to be related to release of ammonia and NO_x from soils placed within Pond A.

On an overall basis, the treatment system resulted in a mass load retention for dissolved organic phosphorus, particulate phosphorus, and total phosphorus, with a mass load increase of 33% for SRP. Since SRP was removed on a mass basis in Ponds A and B, the additional SRP loadings must have originated within Pond C. Placement of organic wetland soils did not occur in the open water portions of Pond C, so it appears likely that the source of the additional SRP originates within the narrow outfall channel between the open water and the outfall structure. Since SRP is the largest phosphorus component in the overall system, the increase in SRP results in the substantially reduced performance efficiency of only 6% observed for total phosphorus.

Another significant factor impacting the performance efficiency of the Cameron Ditch system is the low inflow concentrations observed for both total nitrogen and total phosphorus in many of the collected samples. Measured inflow concentrations of ammonia and NO_x were extremely low in value and substantially lower than concentrations commonly observed in urban runoff. Input concentrations of particulate nitrogen were also low in value compared with commonly observed concentrations. Approximately 50% of the inflow total nitrogen was contributed by dissolved organic nitrogen which is typically removed very poorly in wet detention ponds. Therefore, inputs into the Cameron Ditch system were comprised of extremely low concentrations for ammonia, NO_x, and particulate nitrogen, all of which can be removed relatively easily in wet ponds, and more elevated concentrations of dissolved organic nitrogen, which cannot be easily removed. The observed inflow concentrations of total nitrogen at this site are approximately 20-35% of concentrations commonly observed in wet detention ponds, and are near irreducible concentrations, reflecting minimum concentrations which can be achieved in wet detention systems.

In general, low concentrations were also observed for measured phosphorus species at the Cameron Ditch site. The majority of measured concentrations for SRP, which are typically removed rapidly from wet detention ponds, are approximately 5-30% of concentrations commonly observed in urban runoff. Inflows were characterized by extremely low levels of both dissolved organic phosphorus and particulate phosphorus compared with concentrations commonly observed in urban runoff. Measured concentrations of phosphorus species were approximately 2-3 times greater than irreducible concentrations for these parameters observed in wet detention ponds which explains the relatively low, although positive, removal efficiency for total phosphorus observed in the overall system.

In summary, the performance efficiency of the Cameron Ditch stormwater facility appears to have been impacted by two significant factors. First, evidence suggests that muck soils placed within the ponds to support aquatic vegetation may be leaching nitrogen and phosphorus into the overlying water column due to initially low concentrations of inorganic nitrogen and phosphorus species in inflows to the ponds. Second, conditions of low dissolved oxygen are likely created within the densely vegetated outfall channel, resulting in increases in dissolved phosphorus species within this portion of Pond C.

Finally, input concentrations of both total nitrogen and phosphorus species are low in value, with inflow concentrations of ammonia and NO_x approaching irreducible concentrations. Although inflow concentrations for phosphorus species were low in value, the observed concentrations were above the level of irreducible concentrations which resulted in a net removal for total phosphorus within the system. The observed removal efficiencies for nitrogen and phosphorus species may increase over time as the impacts of the organic soils begin to decline.

3.6 System Improvements

The performance efficiency of the Cameron Ditch stormwater facility appears to have been negatively impacted by placement of muck soils within the ponds to support the aquatic vegetation. The initial design for the system did not include placement of organic soils, and the originally planted vegetation did not flourish as intended. As a result, the area within Pond A was regraded, and muck soils were added to enhance the growth of the vegetation. However, evidence suggests that the muck soils are leaching concentrations of inorganic nitrogen and phosphorus which is impacting the overall performance efficiency of the system.

Field and laboratory investigations were conducted by ERD over a 12-month period from April 2009-March 2010 to evaluate the effectiveness of the Elder Creek stormwater management facility. This facility was also constructed by Seminole County and consists of a wet detention pond followed by a shallow emergent wetland area for final polishing. However, the wetland vegetation at this site was planted into native soils without the addition of organic muck. The Elder Creek facility exhibited a mass removal efficiency of approximately 43% for total phosphorus compared with only 6% for the Cameron Ditch system. The Elder Creek facility exhibited a mass increase of approximately 10% for total nitrogen, presumably due to dense growth of nitrogen-fixing cyanobacteria within the pond, compared with a total nitrogen increase of approximately 25% for Cameron Ditch. Substantial increases in SRP concentrations were observed in the Cameron Ditch system following migration through the planted wetland area which were not observed at the Elder Creek site.

It is apparent that the performance efficiency of the Cameron Ditch system was negatively impacted by placement of the organic soils to support the aquatic vegetation. A very similar situation was observed by ERD at the Manatee Creek site in Martin County where phosphorus concentrations increased by 127% during migration through a planted wetland system with imported organic soils. Phosphorus release from the imported organic soils appears to have greatly exceeded the uptake capacity of the planted vegetation, resulting in net exports of phosphorus rather than the desired uptake. These studies suggest that importation of organic soils to support vegetation should be avoided since the negative impacts of the organic soils appears to far outweigh any positive benefits achieved by the vegetation. It is possible that the release of nutrients from the organic soils will decline over time, but the timing of these anticipated reductions is not known at this time.

BMP monitoring research conducted by ERD has indicated on multiple occasions that planted wetland systems provide highly variable and sometimes negative removal efficiencies for stormwater pollutants. In contrast, wet ponds provide consistent and reliable removal efficiencies for both total nitrogen and total phosphorus. It appears likely that open water wet detention ponds may be a more suitable choice for stormwater BMPs than shallow planted wetland systems. Wetland systems could easily be incorporated into the littoral zone functions of a wet detention pond without the negative water quality impacts often observed in shallow planted wetland systems. The performance efficiency of the Cameron Ditch system would likely have been enhanced if the ponds had been constructed as wet detention ponds with wetland plants incorporated in littoral zone areas. Introduction of organic soils into stormwater BMPs should be avoided, if possible.

3.7 Quality Assurance

Supplemental samples (such as equipment blanks and duplicate samples) were collected during the field monitoring program for quality assurance purposes. In addition, a number of supplemental laboratory analyses were performed to evaluate precision and accuracy of the collected data. Overall, more than 1000 additional laboratory analyses were conducted for quality assurance purposes. A summary of QA data collected as part of this project is given in Appendix E.

SECTION 4

SUMMARY

A field monitoring program was conducted by ERD from May 2010-February 2011 to evaluate the performance efficiencies of the Cameron Ditch stormwater facility. The Cameron Ditch facility consists of three interconnected wet detention ponds, including both shallow vegetated and deep open areas, which are designed to provide treatment for a 455-acre drainage basin area, consisting of a combination of open space, roadway, residential, and commercial land use activities. The three interconnected ponds have a combined surface area of approximately 5.13 acres at the respective control water levels for each pond and a combined volume of 35.69 ac-ft, corresponding to a mean water depth of 7.0 ft.

Automatic samplers with integral flow meters were installed at two significant inflows to the facility, as well as two pond outfalls, to provide a continuous record of hydrologic inputs and losses and to collect runoff and discharge samples in a flow-weighted mode. A recording rain gauge and evaporimeter were also installed at the monitoring sites. A water level recorder was installed inside two of the ponds to assist in evaluating changes in water surface elevations.

Continuous inflow and outflow hydrographs were recorded at the Cameron Ditch site at 10-minute intervals from May 1, 2010-February 28, 2011. During this time, approximately 98% of the inflow to Ponds A and B was contributed by the northern sub-basin inflow, with 2% contributed by direct rainfall. Approximately 77% of the inflow to Pond C was contributed by discharges from Pond B, with 22% contributed by inflow from the western sub-basin (Site 3), and 1% by direct rainfall. The mean hydraulic residence time during the field monitoring program was approximately 0.21 days for Pond A, 11.7 days for Pond B, and 7.2 days for Pond C, with an overall mean system residence time of 18.2 days.

Over the 10-month monitoring program, a total of 124 composite inflow and outflow samples was collected at the Cameron Ditch site, with 19 samples collected of bulk precipitation. Physical-chemical field measurements of pH, temperature, specific conductivity, dissolved oxygen, dissolved oxygen saturation, and ORP were conducted at each of the four monitoring sites during each weekly field visit. In addition, field measurements of discharge rates were conducted at each of the four sites for use in calibration and verification of discharge measurements collected by the flow monitoring equipment.

During the field monitoring program, the overall Cameron Ditch treatment system exhibited a 25% increase in total nitrogen loadings between measured mass inputs and outputs, with a 6% retention for total phosphorus and a 69% retention for TSS. Inflow concentrations into the treatment system were low in value, particularly for nitrogen species, where inflow concentrations of ammonia and NO_x approached the level of irreducible concentrations for wet detention systems. Inflow concentrations of total phosphorus were also low in value, although in general, phosphorus concentrations were approximately 2-3 times greater than irreducible concentration levels for phosphorus species. Inflow concentrations were also low in value for TSS, perhaps related to pre-treatment in the densely vegetated conveyance systems, which resulted in a relatively low removal efficiency of 62%.

The performance efficiency of the pond appears to have been impacted by several factors. First, organic muck soils placed at the site to support aquatic vegetation appear to be releasing both nitrogen and phosphorus into the overlying water column due to the low input concentrations for these species. These increases in concentrations are particularly apparent for NO_x within the system. Release of phosphorus also appears to be occurring within the 450-ft long densely vegetated outfall channel due to likely near-anoxic conditions which existed within this area. Third, inflows into the pond were moderately colored which reduces light penetration and inhibits biological uptake, providing a further reduction in anticipated removal effectiveness. The observed removal efficiencies within the system may increase over time as the impacts of the organic soils begin to diminish.

Based on BMP performance research conducted by ERD, wet detention ponds appear to exhibit superior performance efficiencies compared with constructed wetland systems, particularly in systems where organic soil have been imported to support aquatic vegetation. The use of aquatic vegetation to enhance BMP performance may be best utilized as a littoral zone planting around the perimeter of a wet detention pond. The wet detention pond provides a permanent pool volume where the majority of pollutant removal processes occur, and the larger water volume compared with a shallow wetland system reduces potential sediment/water column interactions which are likely to reduce the performance efficiency of the BMP.

APPENDICES

APPENDIX A

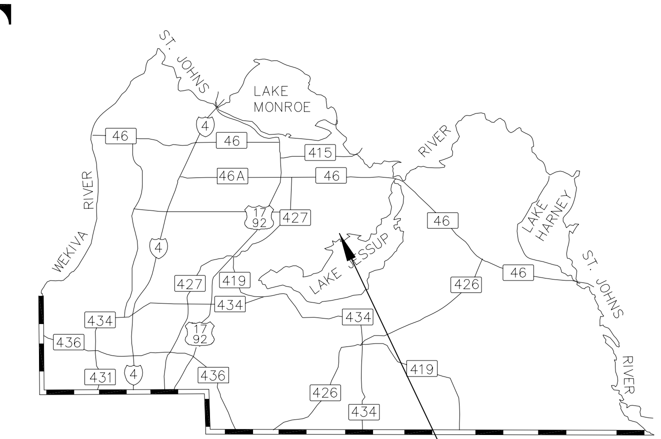
SELECTED CONSTRUCTION PLANS FOR THE CAMERON DITCH STORMWATER FACILITY

JOB FILE #	SHEET No.
6116-36157	1

SEMINOLE COUNTY
PUBLIC WORKS DEPARTMENT
STORMWATER DIVISION

THIS CONTRACT PLAN SET INCLUDES:

REGRADING PLANS
EROSION CONTROL MEASURES



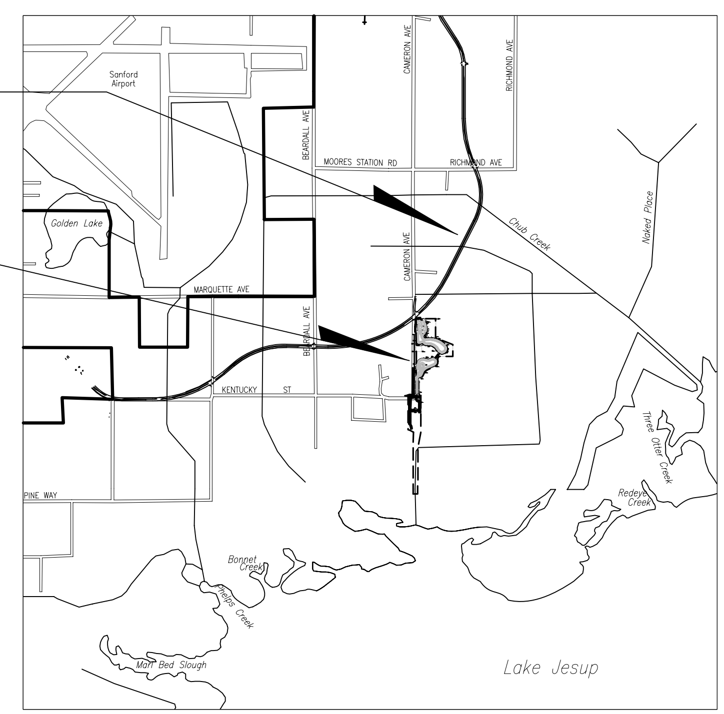
PUBLIC WORKS DIRECTOR
W. Gary Johnson, P.E.

STORMWATER MANAGER
Mark Flomerfelt. P.E.

INDEX OF PLANS

CAMERON DITCH STORMWATER FACILITY

THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH AND ARE GOVERNED BY THE STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION DESIGN STANDARDS (BOOKLET DATED JANUARY 2002)



LOCATION MAP

SECTION 16, TOWNSHIP 20 S, RANGE 31 E

GOVERNING SPECIFICATIONS: STATE OF FLORIDA, DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS, DATED 2000 AND SUPPLEMENTS THERETO IF NOTED IN THE SPECIAL TECHNICAL PROVISIONS FOR THIS PROJECT.

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN CHANGED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

PREPARED BY: CAMP DRESSER & MCKEE INC.
2301 MAITLAND CENTER PARKWAY, SUITE 300
MAITLAND, FLORIDA 32751
PHONE: (407) 660-2552
FAX: (407) 875-1161
FL COA NO: EB-0000020

BID PLANS

October, 2005

PLANS APPROVED BY ______________________
Mario F. Chavez, P.E. # 50713 DATE

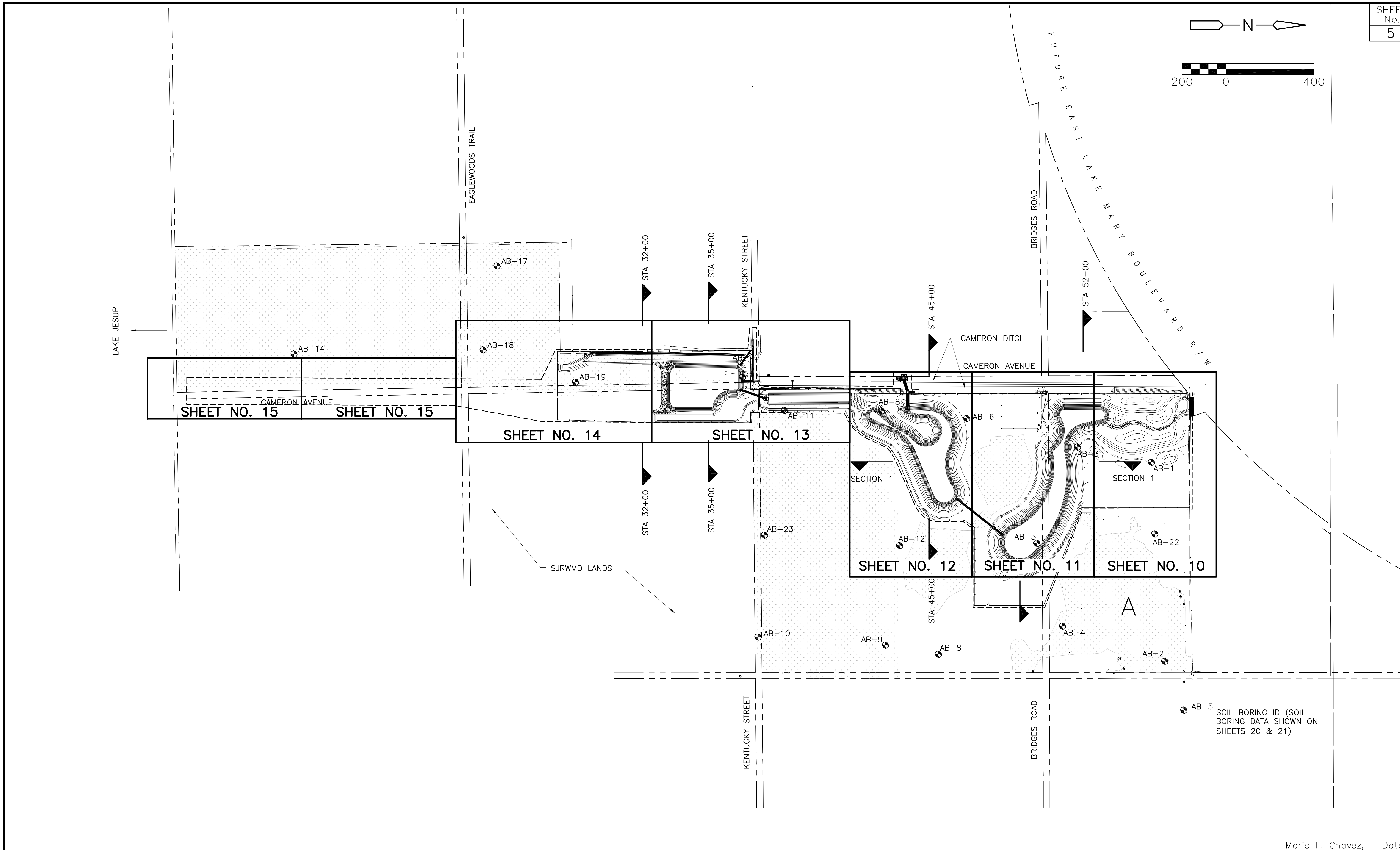
CONSTRUCTION COMPLETION DATE ______________________

FIELD VERIFIED BY ______________________

LENGTH OF PROJECT						
			SIDE STREETS		TOTAL	
	LIN.FT.	MILES	LIN.FT.	MILES	LIN.FT.	MILES
DITCH REGRADING	–	–	—	—	–	–
	—	—	—	—	—	—
NET LENGTH OF PROJECT	–	–	—	—	–	–
EXCEPTIONS	–	–	—	—	–	–
GROSS LENGTH OF PROJECT	–	–	—	—	–	–

REVISIONS		
BY	DATE	DESCRIPTION

SEMINOLE COUNTY PROJECT MANAGER: Robert (Bob) Walter, P.E.



Mario F. Chavez, P.E. # 50713 Date

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
FI COA No. EB-0000020

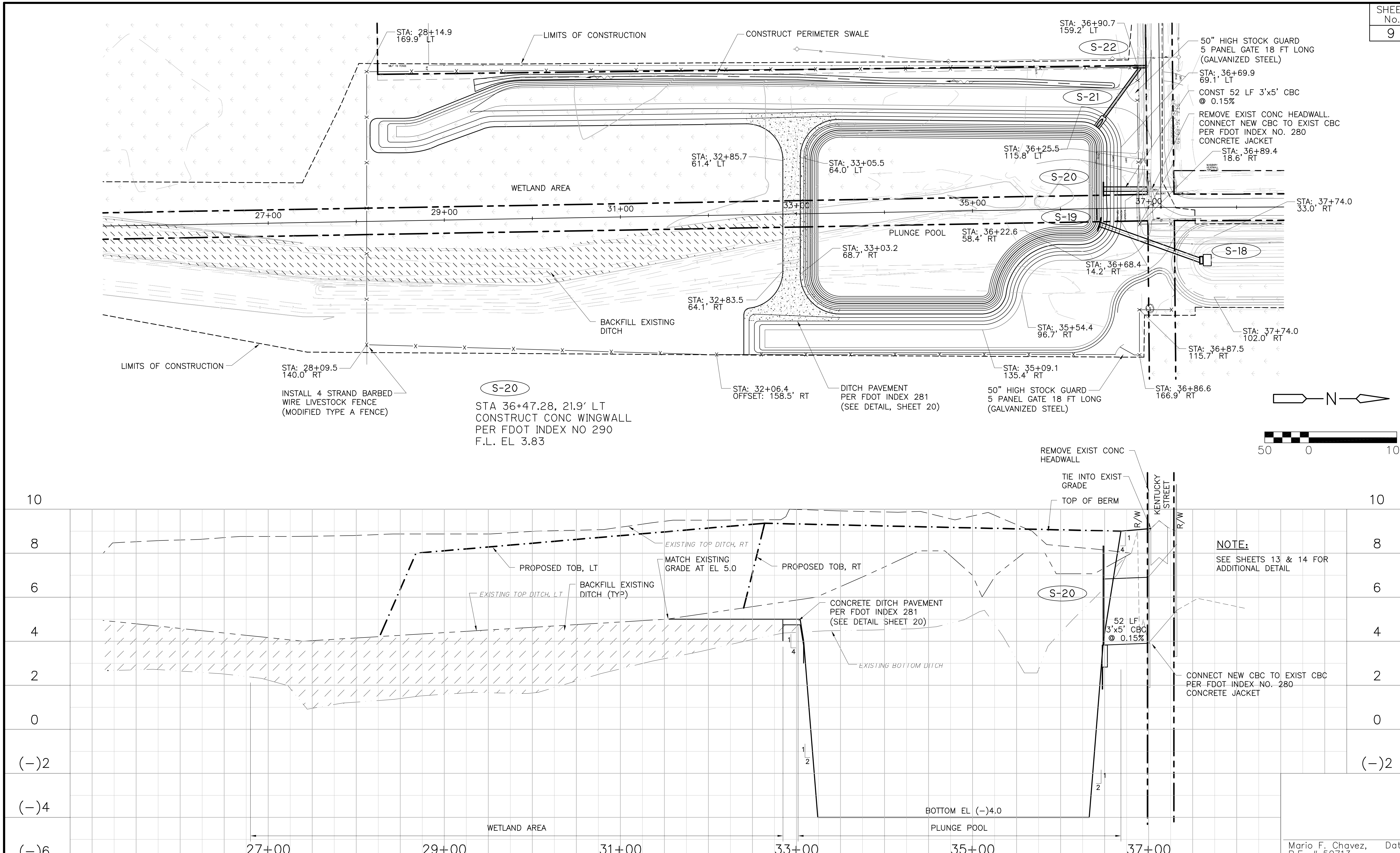
SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

KEY PLAN
AND WETLAND AREAS

G:\6116\36157\ACAD\100P\CIVIL\ 05keymap 10/06/05 13:53:29 9:44:53 stoltzbk

SHEET No. 9



Mario F. Chavez, P.E. # 50713 Date

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

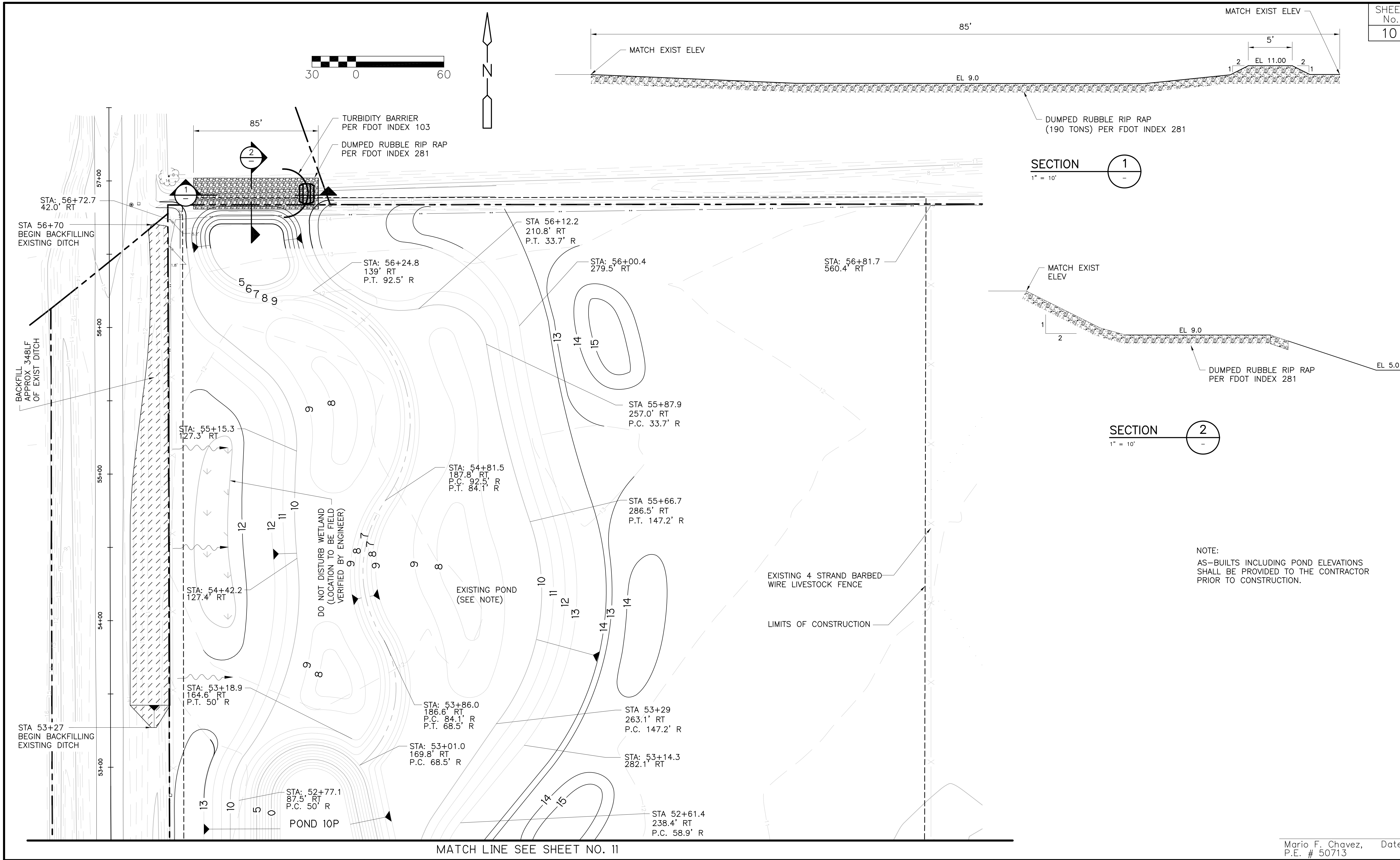
DESIGNED BY: B. Williams
DRAWN BY: B. Williams
SHEET CHK'D BY: M. Chavez
CROSS CHK'D BY: J. Wittig
APPROVED BY:
DATE: OCTOBER 2005

CDM Camp Dresser & McKee Inc.
consulting engineering construction operations
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

PLAN AND PROFILE



SHEET No. 10

Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

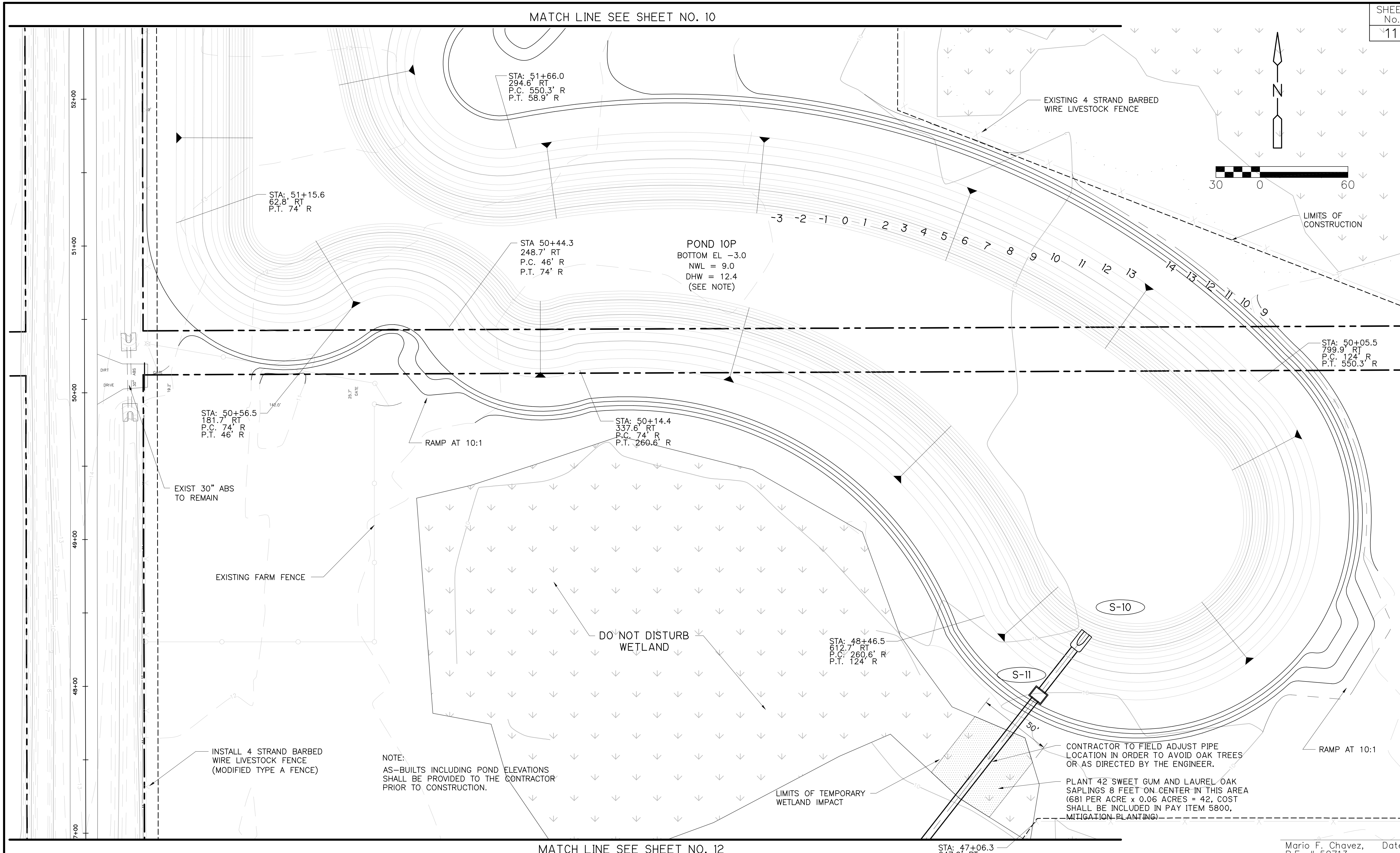
DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
FI COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA
CAMERON DITCH
STORMWATER FACILITY

POND PLAN

G:\6116\36157\ACAD\100P\CIVIL\ 10pndpln 10/06/05 15:37:57 19:56:35 stoltzbk



Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

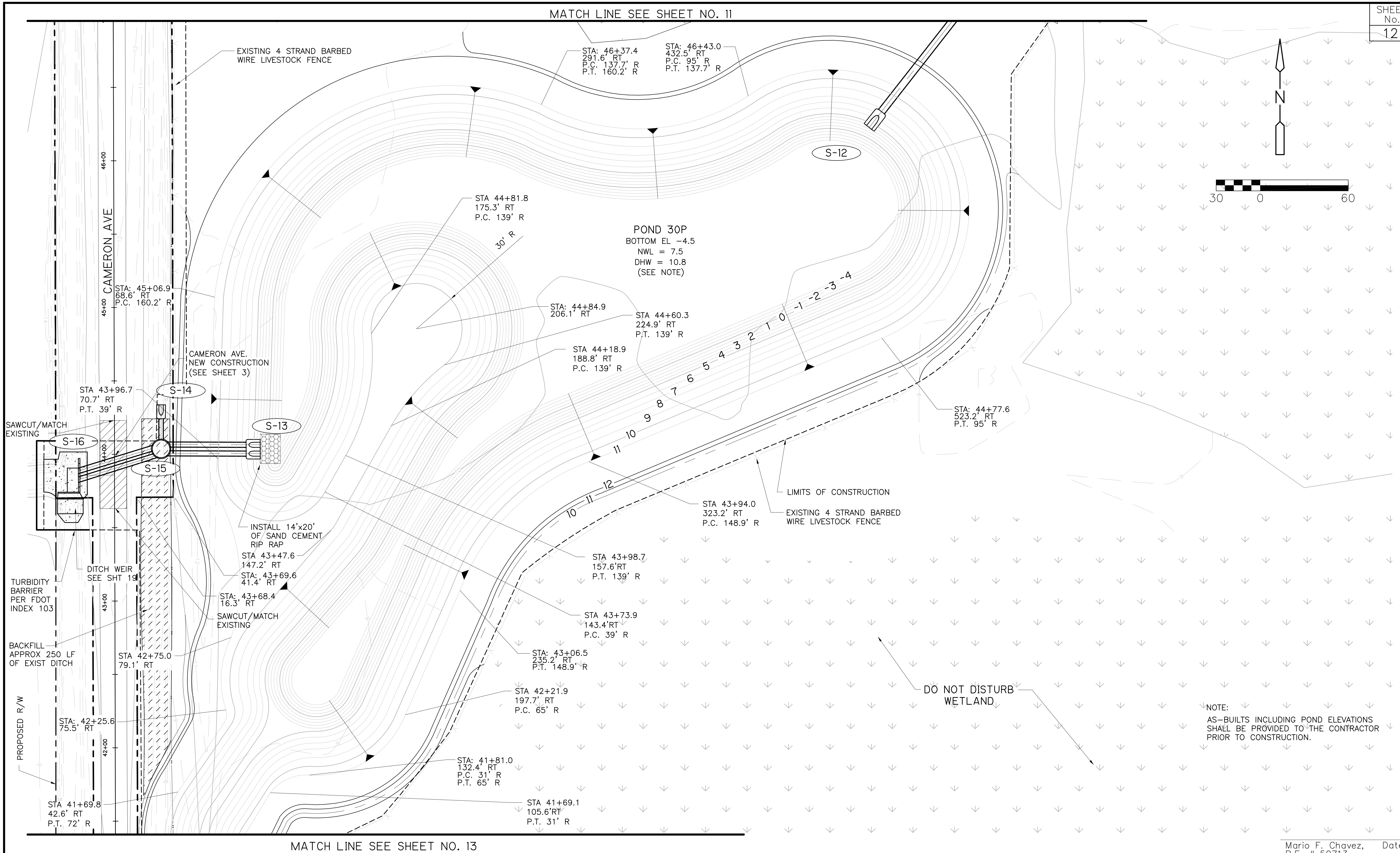
CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

POND PLAN

G:\6116\36157\ACAD\100P\CIVIL\ 11pndpln 10/06/05 16:35:55 11:30:38 stoltzbk



G:\6116\36157\ACAD\100P\CIVIL\ 12pndpln 10/06/05 16:58:53 16:29:06 stoltzbk

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

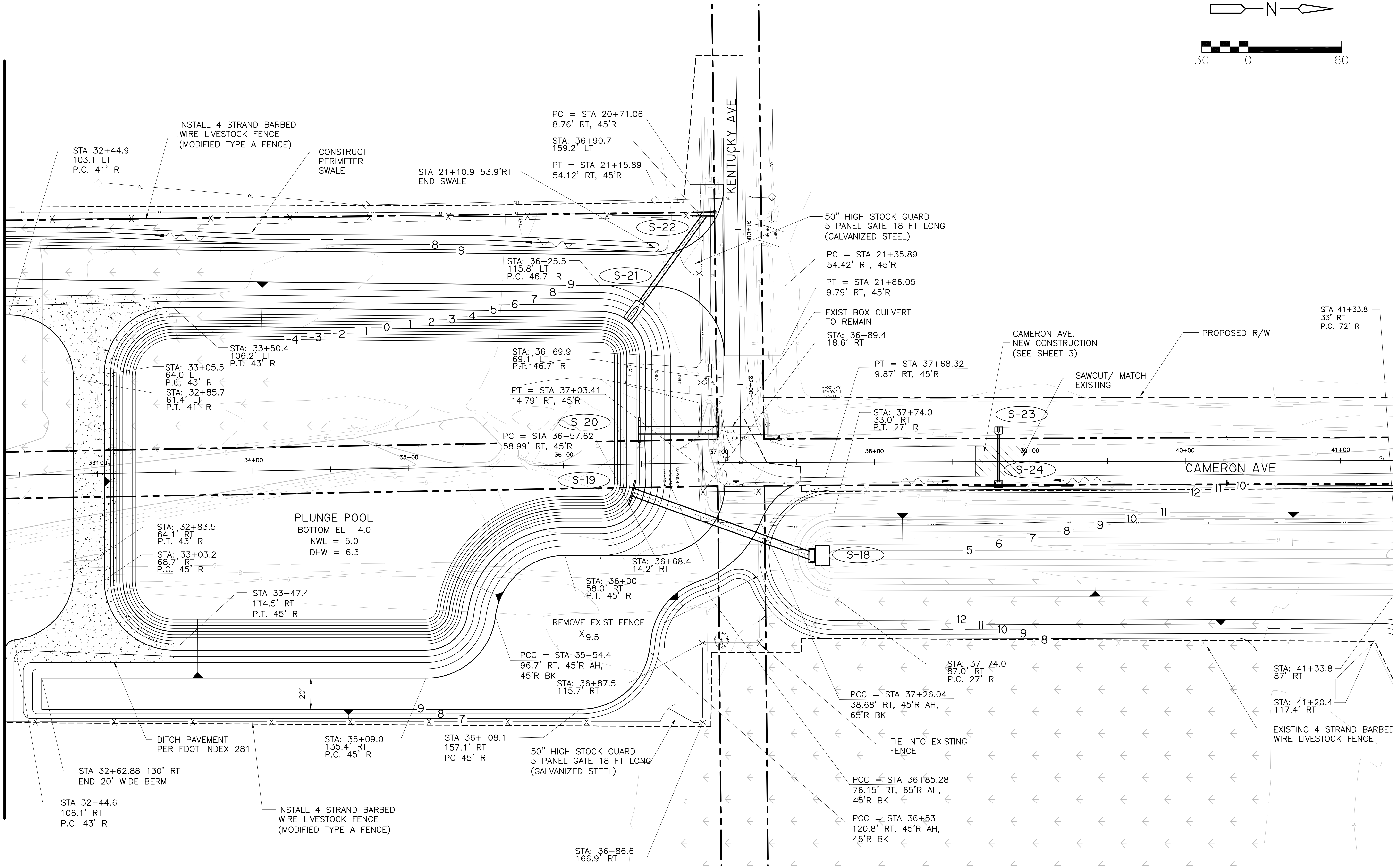
CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY FLORIDA

CAMERON DITCH STORMWATER FACILITY

POND PLAN

SHEET No. 13



Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

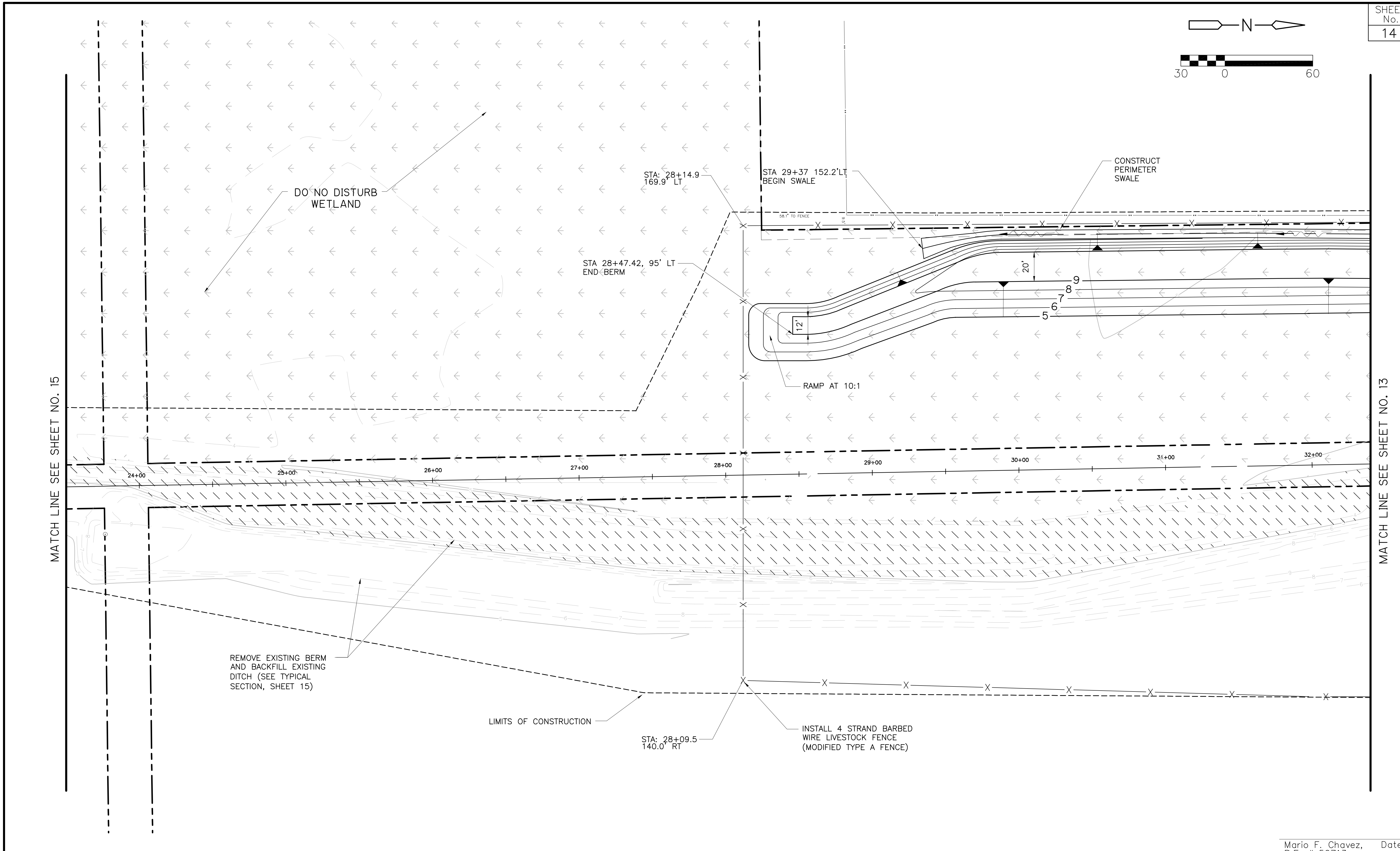
CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

POND PLAN

G:\6116\36157\ACAD\100P\CIVIL\ 13pndpln 10/07/05 10:53:32 16:18:25 stoltzbk



SHEET No. 14

Mario F. Chavez, P.E. # 50713 — Date

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

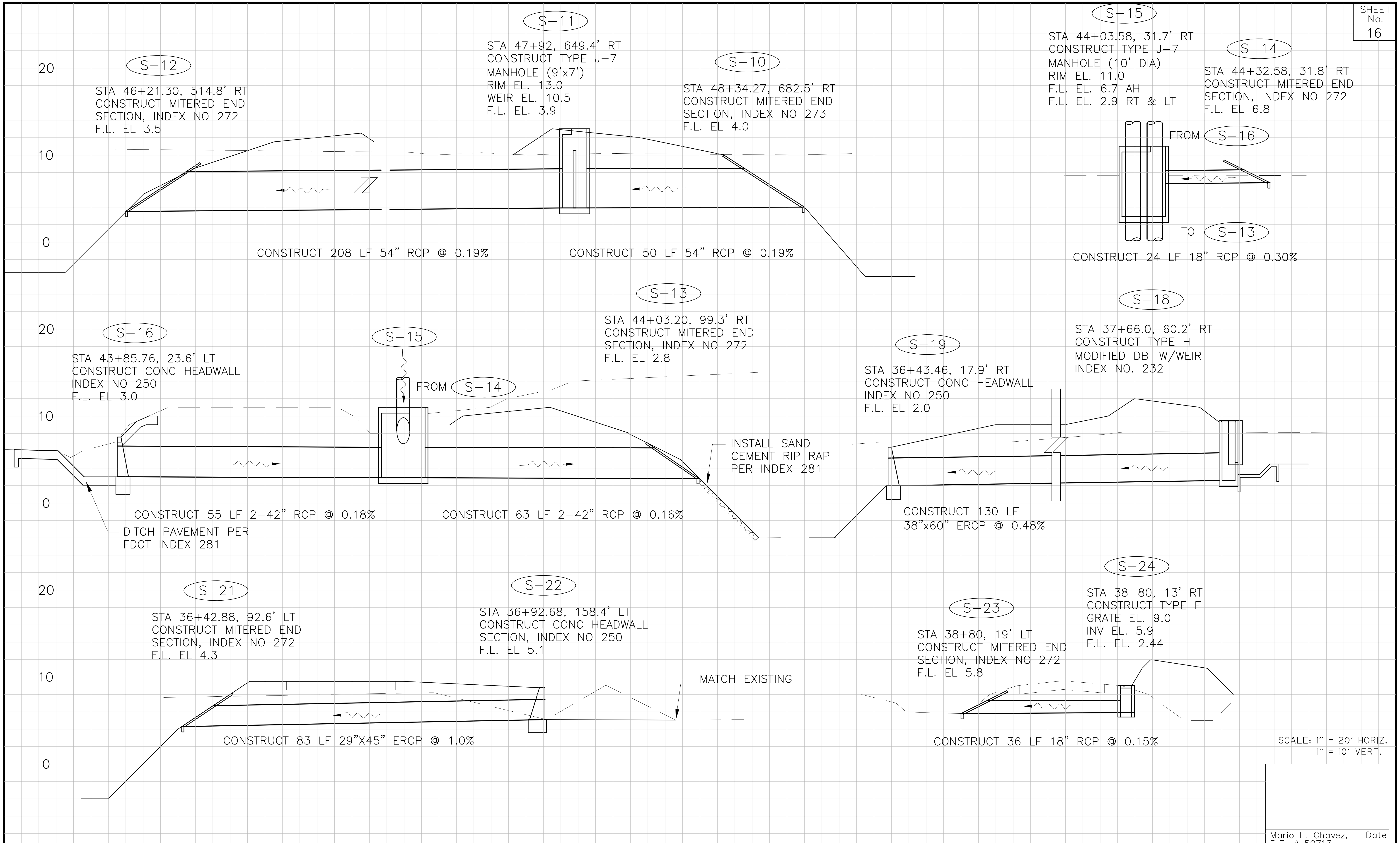
DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
FI COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

POND PLAN



SCALE: 1" = 20' HORIZ.
1" = 10' VERT.

Mario F. Chavez, P.E. # 50713 — Date

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. WILLIAMS
DRAWN BY: M. BANDA
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

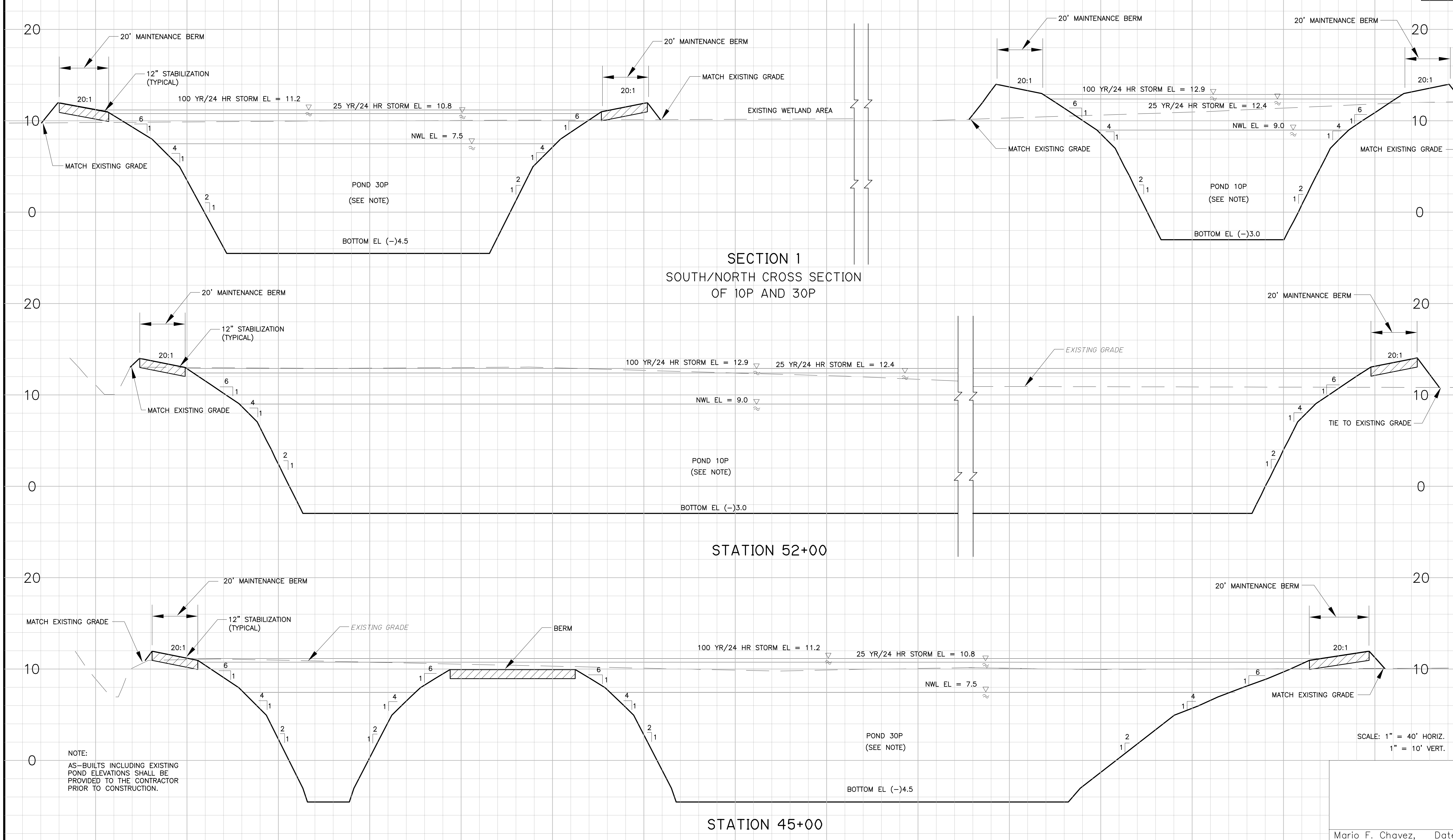
CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

DRAINAGE STRUCTURES

SHEET No. 18



Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

DESIGNED BY: J. WILLIAMS
DRAWN BY: M. BANDA
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660–2552
Fax: 407 875–1161
Fl COA No. EB–0000020

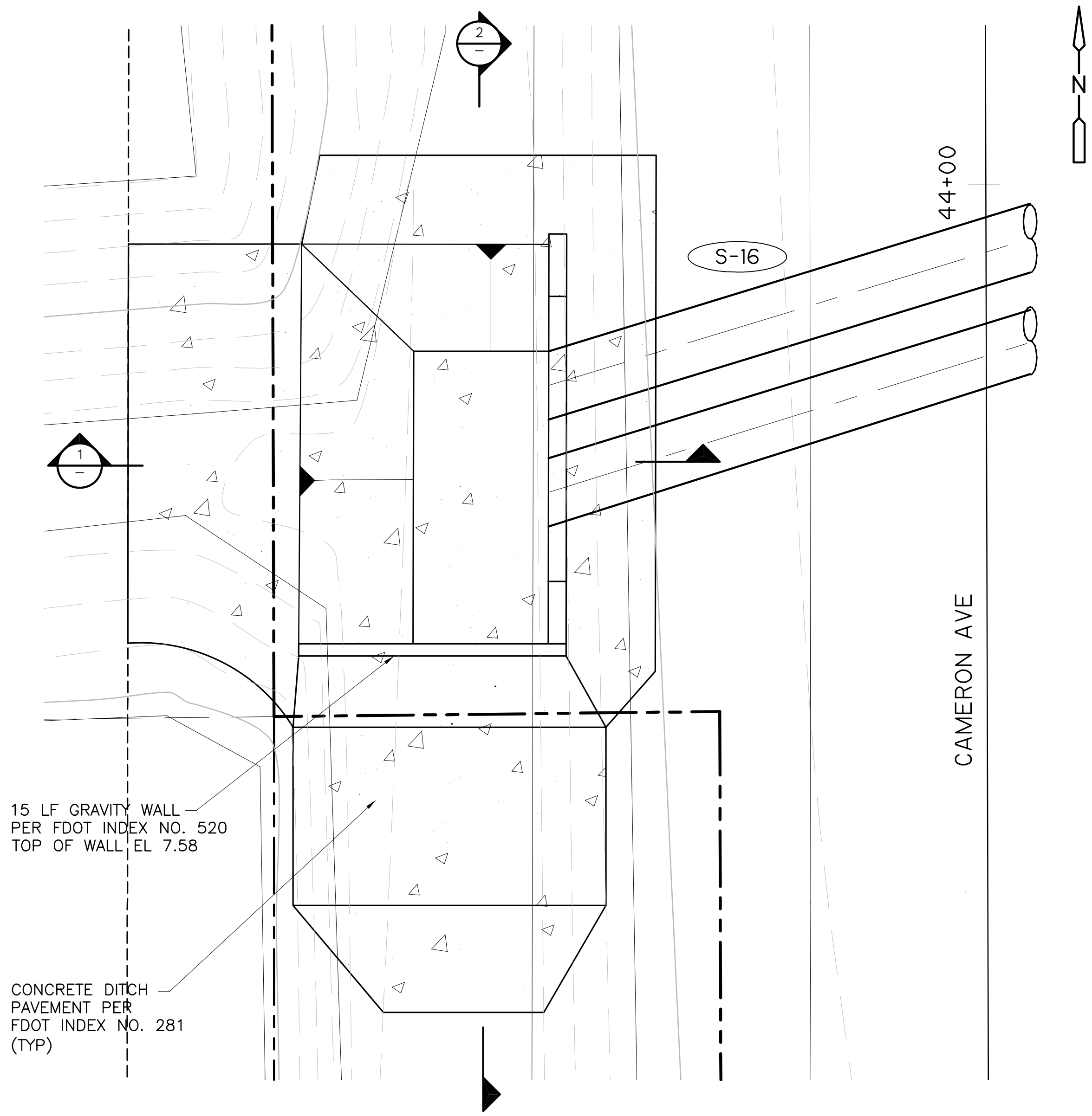
SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

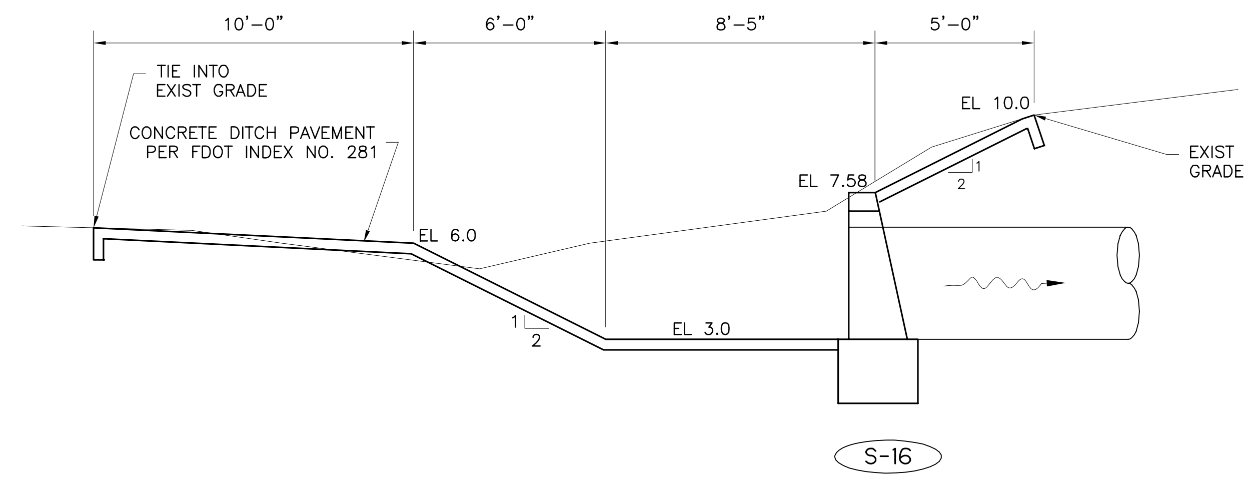
POND SECTIONS

G:\6116\36157\ACAD\100P\CIVIL\ 18pndxsc 10/07/05 13:34:29 8:55:26 stoltzbk

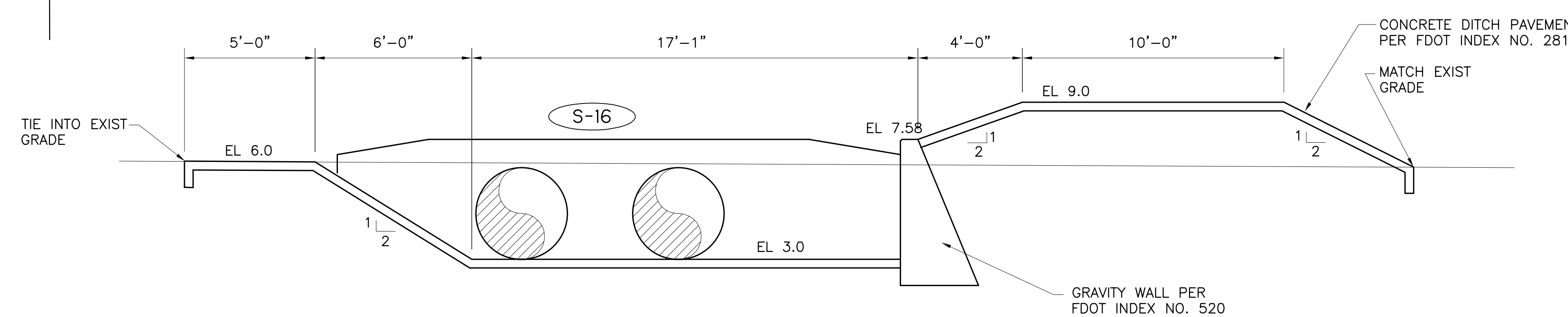
SHEET No. 19



PLAN
1"=10'



SECTION 1
1"=6'



SECTION 2
1"=6'

Mario F. Chavez, P.E. # 50713 Date

REV. NO.	DATE	DRWN	CHKD	REMARKS

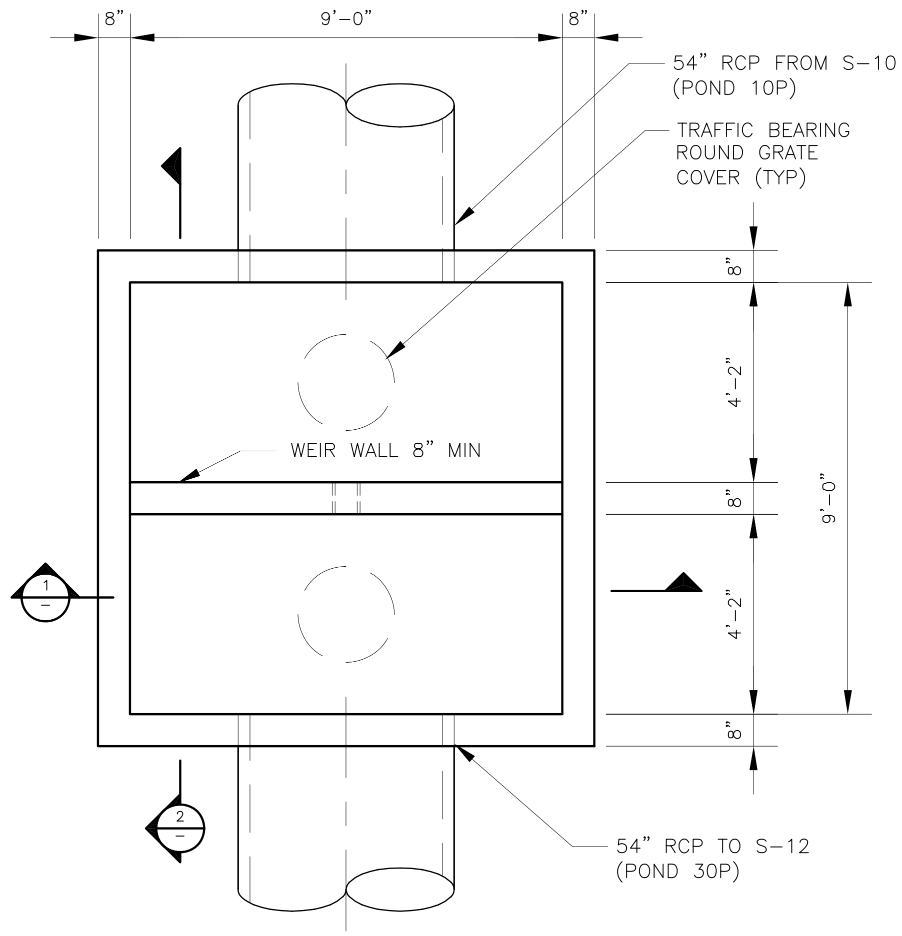
DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

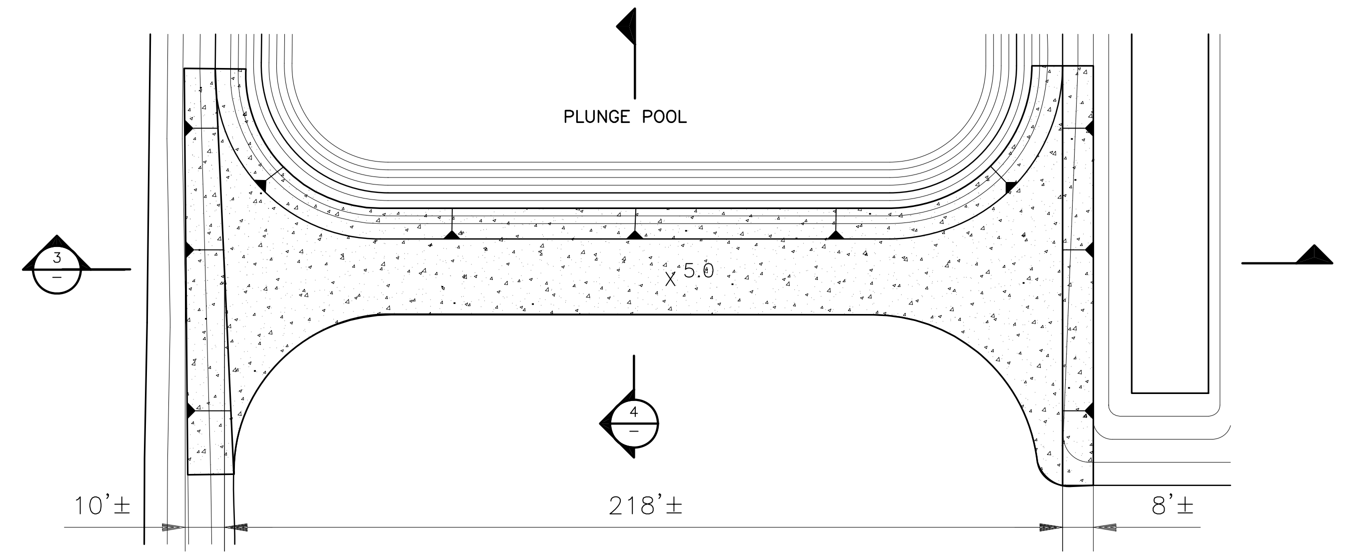
DRAINAGE DETAILS



S-11, MODIFIED TYPE J-7 MANHOLE INDEX 200

PLAN

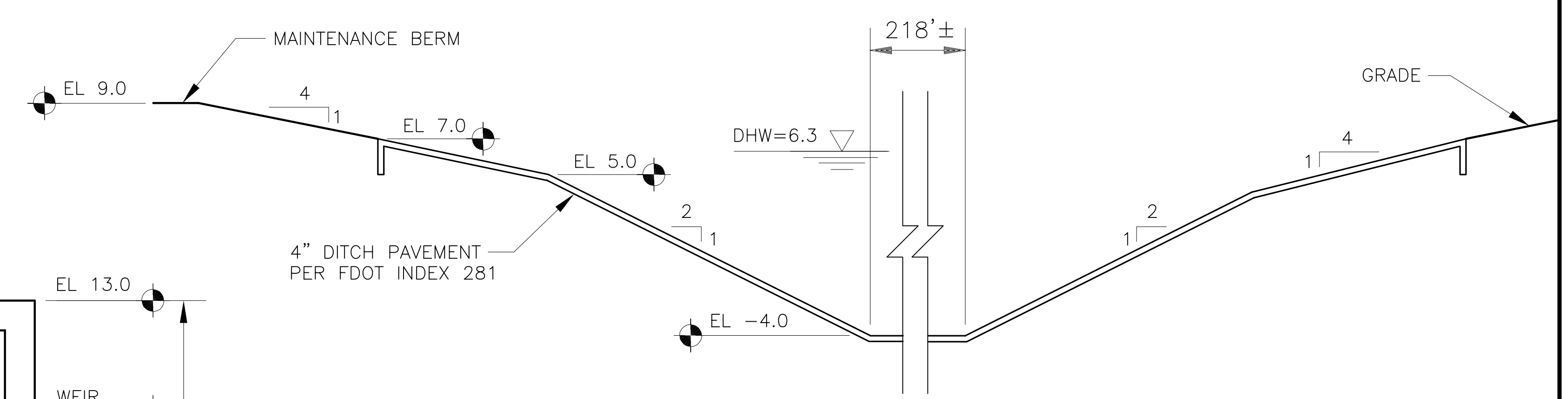
NTS



DITCH PAVEMENT

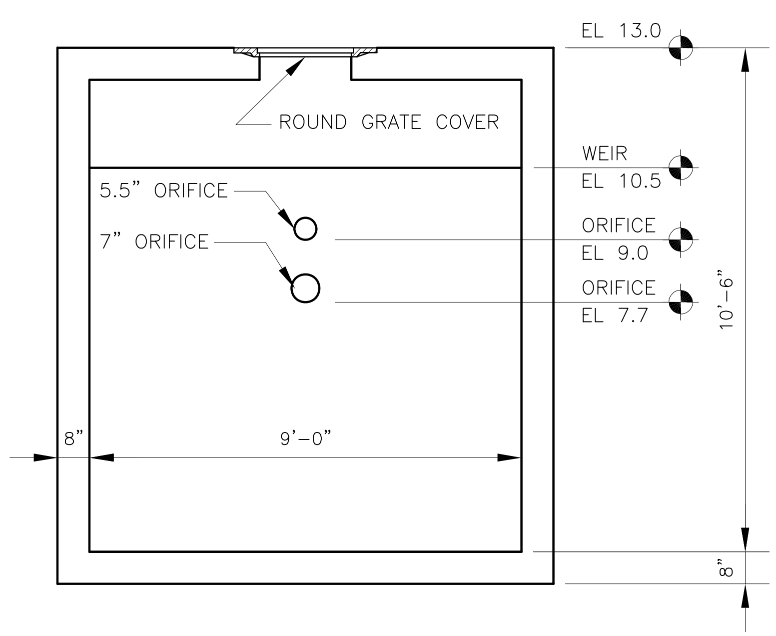
PLAN

NTS



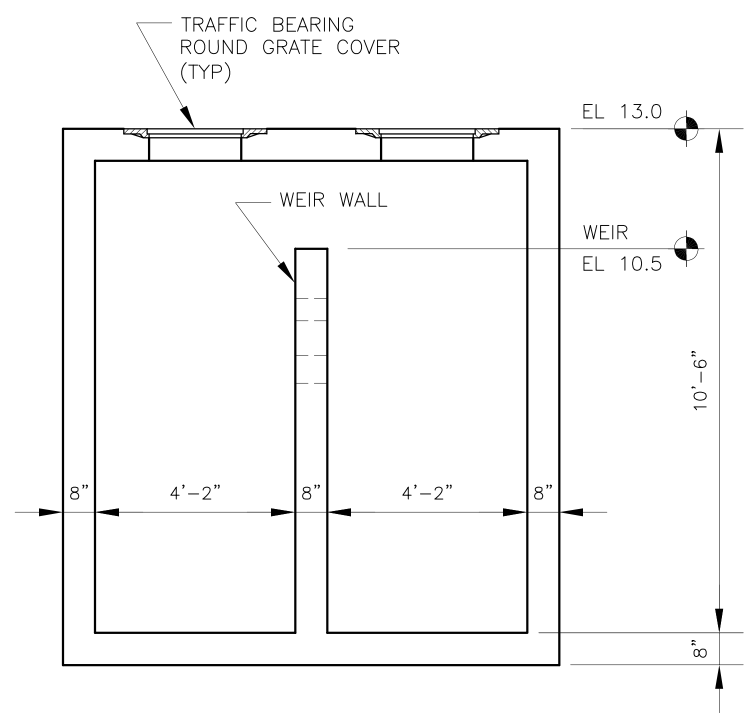
SECTION 3

1" = 10'



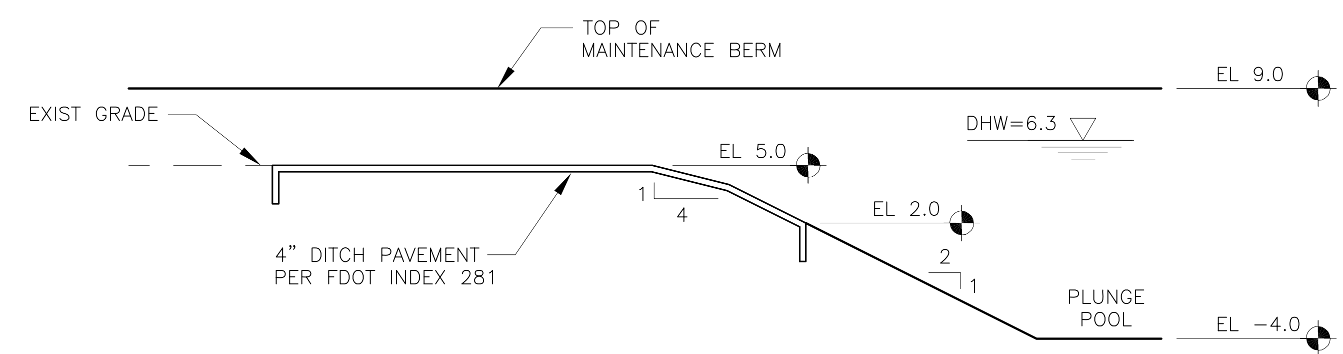
SECTION 1

NTS



SECTION 2

NTS



SECTION 4

1" = 10'

Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS

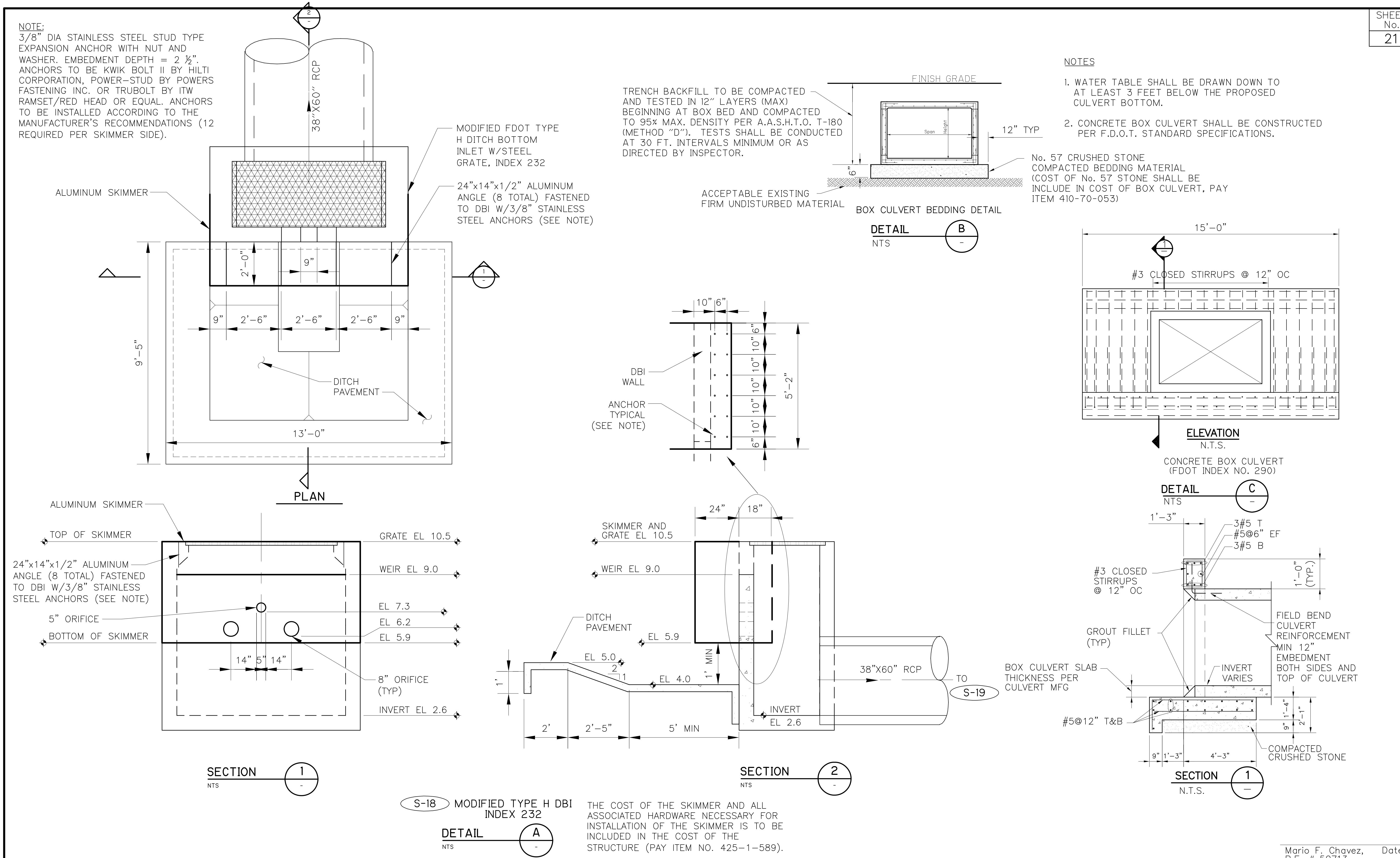
DESIGNED BY:
DRAWN BY: M. BANDA
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

DRAINAGE DETAILS



stoltzbk 20:12:27 10/07/05 13:51:52 G:\6116\36157\ACAD\100P\CIVIL\ 21drndtl

REV. NO.	DATE	DRWN	CHKD	REMARKS

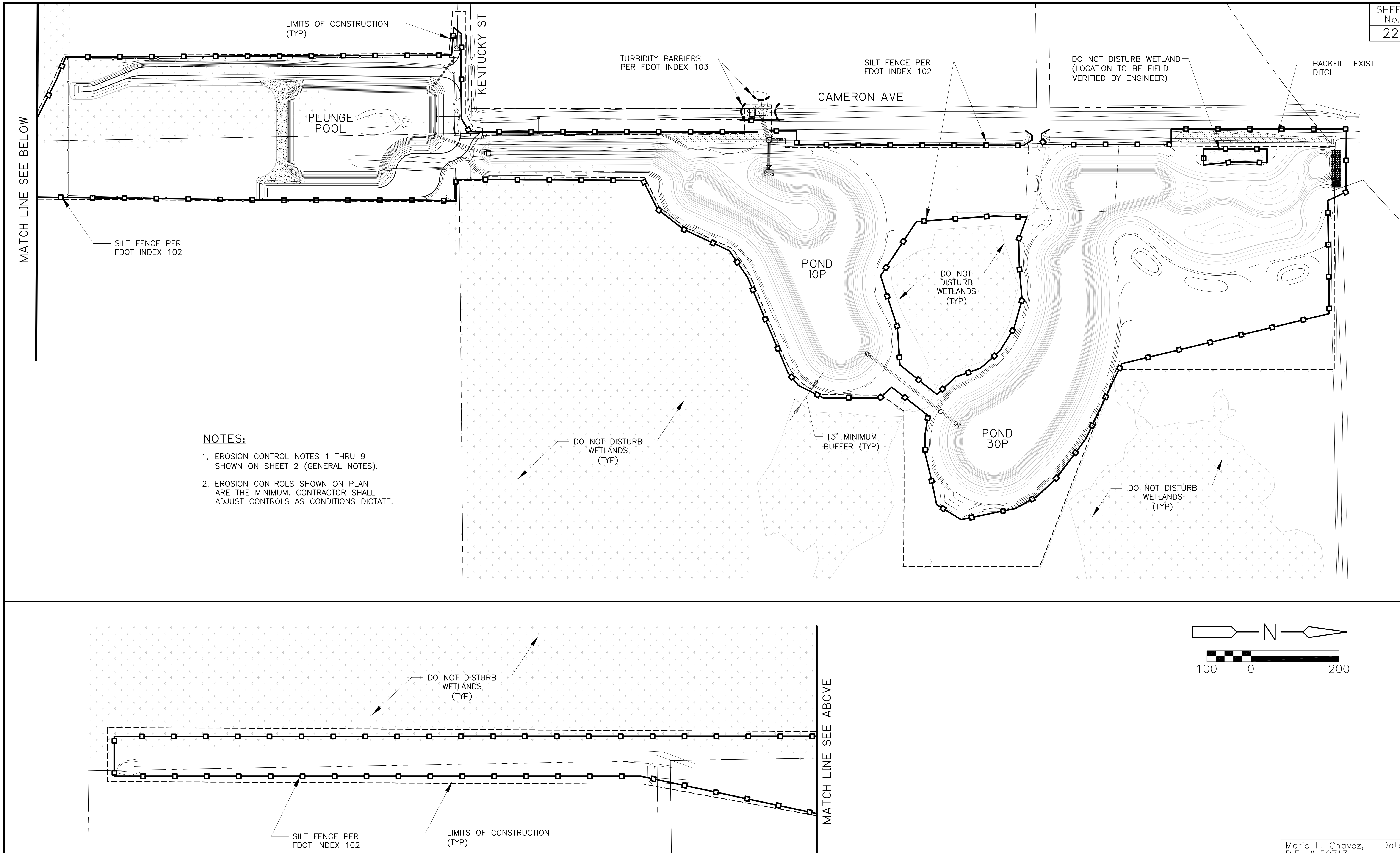
DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
FI COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

DRAINAGE DETAILS



NOTES:

1. EROSION CONTROL NOTES 1 THRU 9 SHOWN ON SHEET 2 (GENERAL NOTES).
2. EROSION CONTROLS SHOWN ON PLAN ARE THE MINIMUM. CONTRACTOR SHALL ADJUST CONTROLS AS CONDITIONS DICTATE.

Mario F. Chavez, Date
P.E. # 50713

REV. NO.	DATE	DRWN	CHKD	REMARKS
	2/04	JMW	MFC	REVISED PER FDEP FIELD COMMENTS (2/16/04)

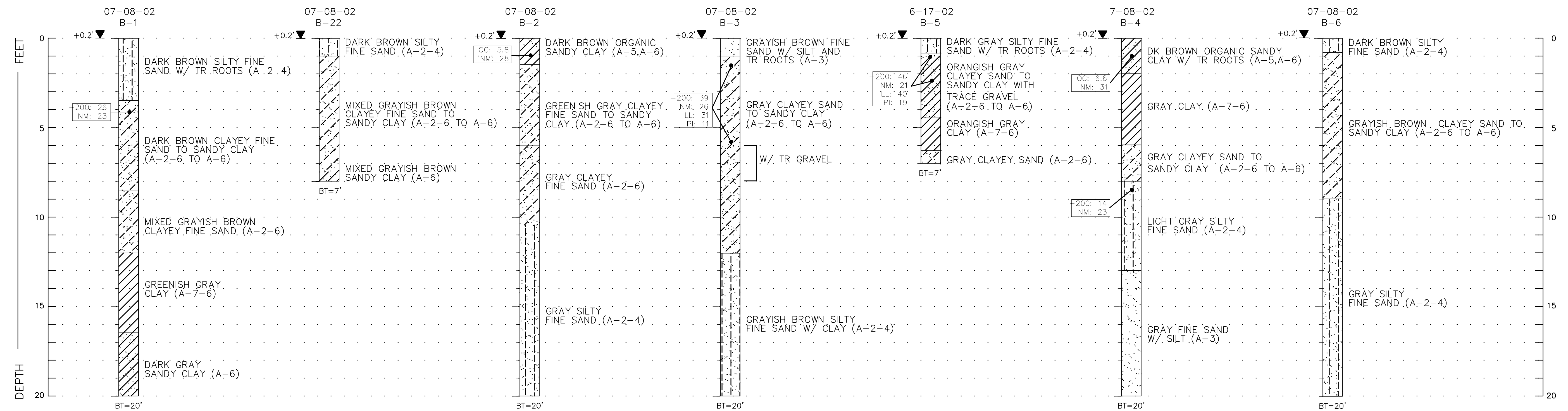
DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY FLORIDA

CAMERON DITCH STORMWATER FACILITY

EROSION CONTROL PLAN



LEGEND

NOTES:

1. UPON COMPLETION OF BORINGS, THE BOREHOLES WERE BACKFILLED WITH SOIL CUTTINGS.

SAND (A-3)
SAND W/SILT (A-3,A-2-4)

SILTY SAND (A-2-4)

CLAYEY SAND TO SANDY CLAY (A-2-6 TO A-6)

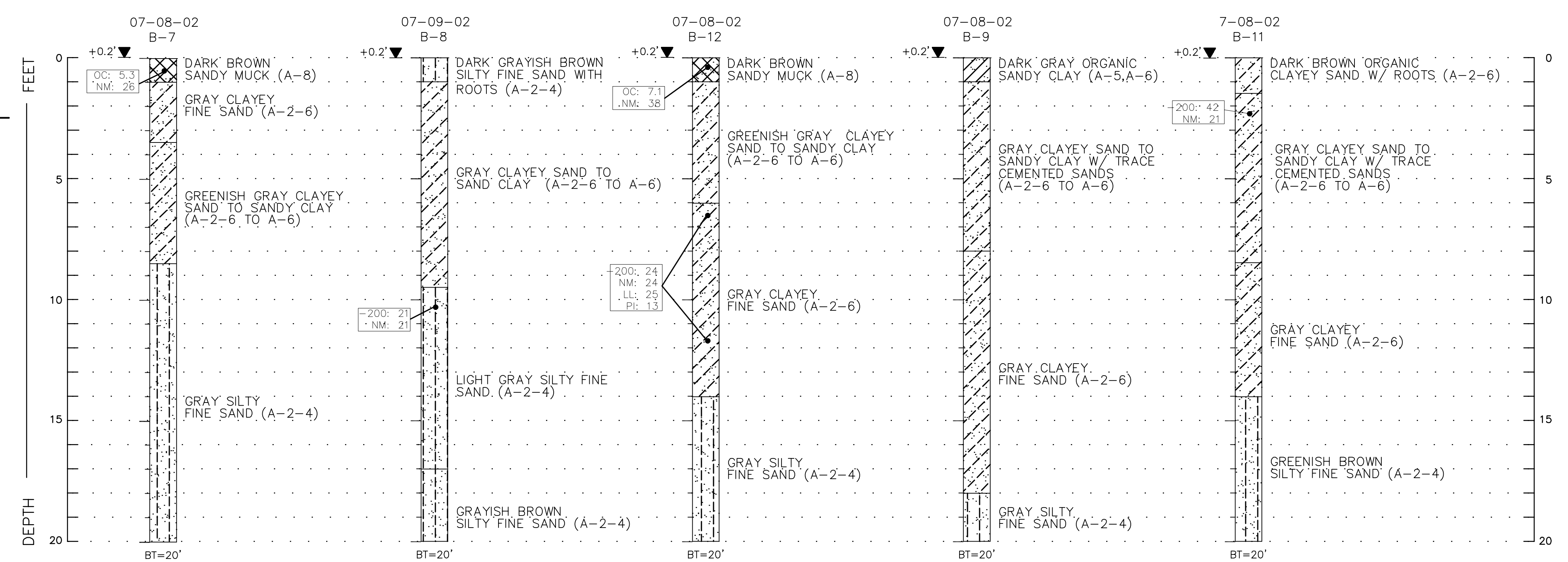
SANDY CLAY TO CLAY (A-4,A-5,A-6,A-7-6)

SANDY MUCK (A-8)

AB-	AUGER BORING LOCATION
FP-	FIELD PERMEABILITY TEST LOCATION
B.T.	BORING TERMINATION DEPTH IN FEET
▼	GROUNDWATER LEVEL MEASURED ON DATE DRILLED
GNE	GROUNDWATER NOT ENCOUNTERED ON DATE DRILLED
-200	PERCENT FINES (PERCENT PASSING NO. 200 SIEVE)
NM	NATURAL MOISTURE CONTENT (IN PERCENT)
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
A-3 A-2-4	AASHTO SOIL CLASSIFICATION SYSTEM

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



CHRISTOPHER P. MEYER, P.E.
FL/REG. NO. 49328
GEOTECHNICAL PROFESSIONAL ASSOC., INC.
5780 HOFFNER AVENUE, SUITE 403
ORLANDO, FL 32822
GPA

REV. NO.	DATE	DRWN	CHKD	REMARKS

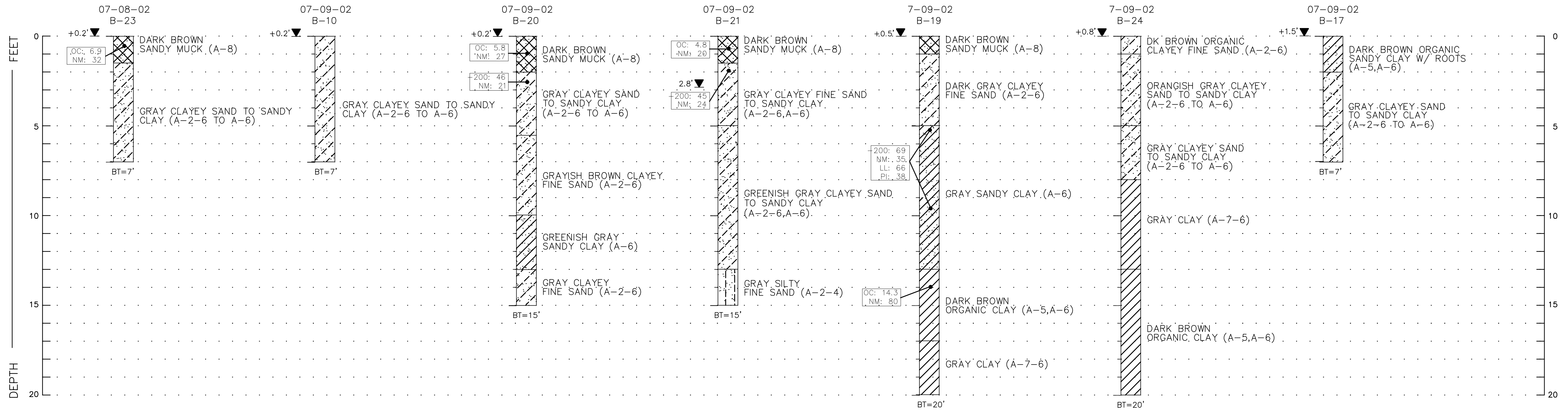
DESIGNED BY:
DRAWN BY:
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: OCTOBER 2005

CDM Camp Dresser & McKee Inc.
consulting engineering construction operations
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

SOIL BORING PROFILES



LEGEND

NOTES:

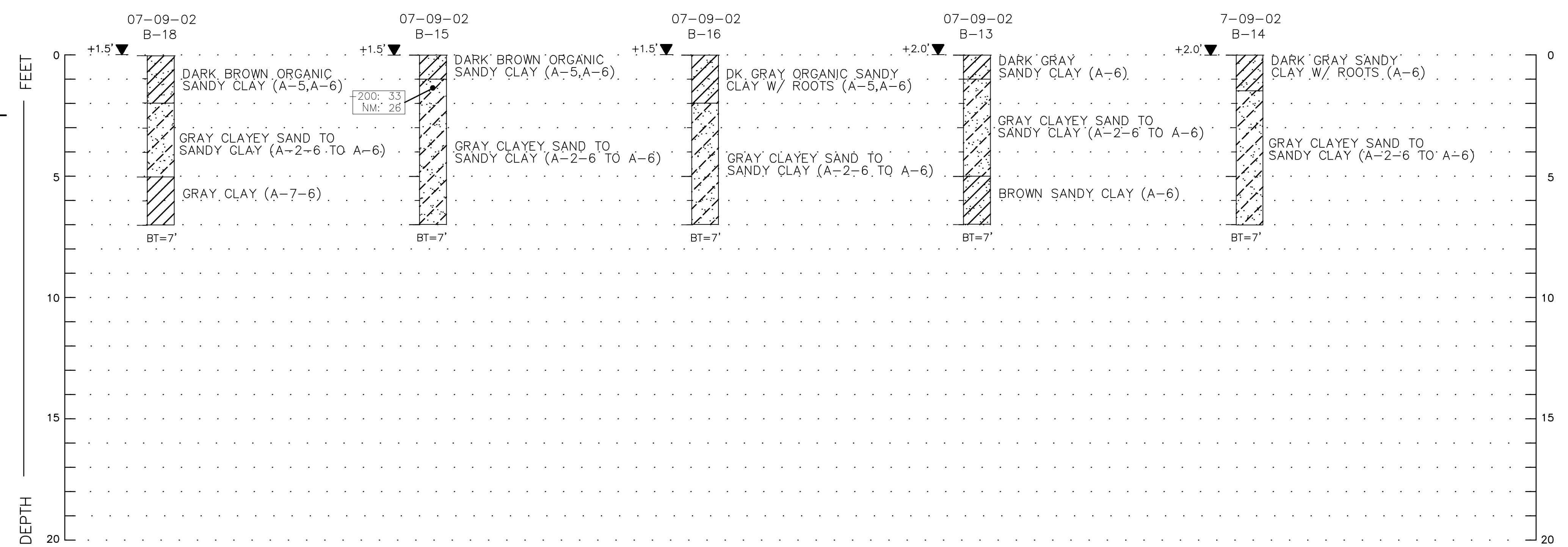
1. UPON COMPLETION OF BORINGS, THE BOREHOLES WERE BACKFILLED WITH SOIL CUTTINGS.

- CLAYEY SAND TO SANDY CLAY (A-2-6 TO A-6)
- SAND (A-3) SAND W/SILT (A-3,A-2-4)
- SANDY CLAY TO CLAY (A-4,A-5,A-6,A-7-6)
- SILTY SAND (A-2-4)
- SANDY MUCK (A-8)

AB-	AUGER BORING LOCATION
FP- ●	FIELD PERMEABILITY TEST LOCATION
B.T.	BORING TERMINATION DEPTH IN FEET
▼	GROUNDWATER LEVEL MEASURED ON DATE DRILLED
GNE	GROUNDWATER NOT ENCOUNTERED ON DATE DRILLED
-200	PERCENT FINES (PERCENT PASSING NO. 200 SIEVE)
NM	NATURAL MOISTURE CONTENT (IN PERCENT)
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
A-3 A-2-4	AASHTO SOIL CLASSIFICATION SYSTEM

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.



CHRISTOPHER P. MEYER, P.E.
FL./REG. NO. 49328
GEOTECHNICAL PROFESSIONAL ASSOC., INC.
5780 HOFFNER AVENUE, SUITE 403
ORLANDO, FL 32822

GPA

REV. NO.	DATE	DRWN	CHKD	REMARKS

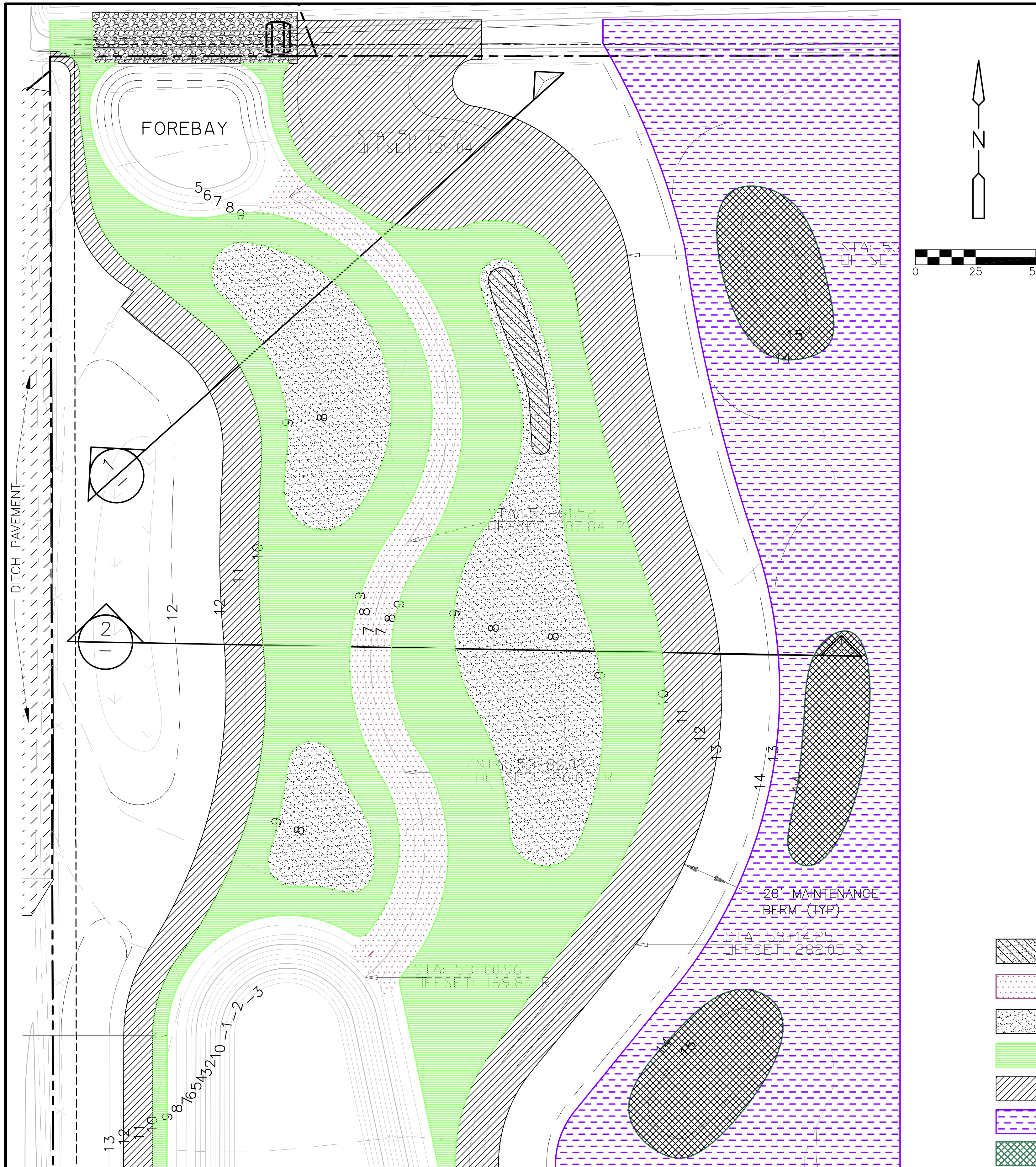
DESIGNED BY:
DRAWN BY:
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: OCTOBER 2005

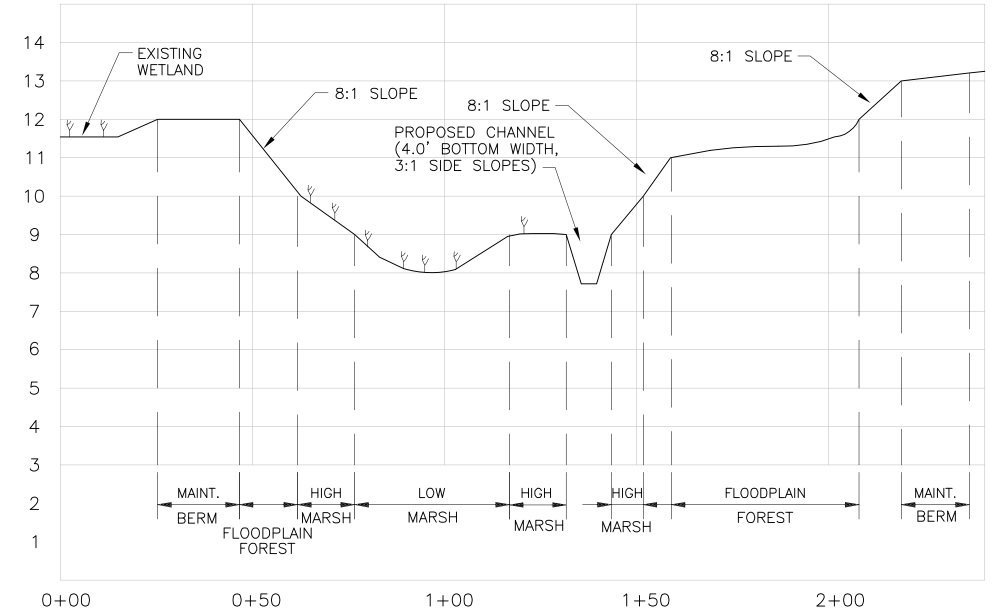
CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
Fl COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH
STORMWATER FACILITY

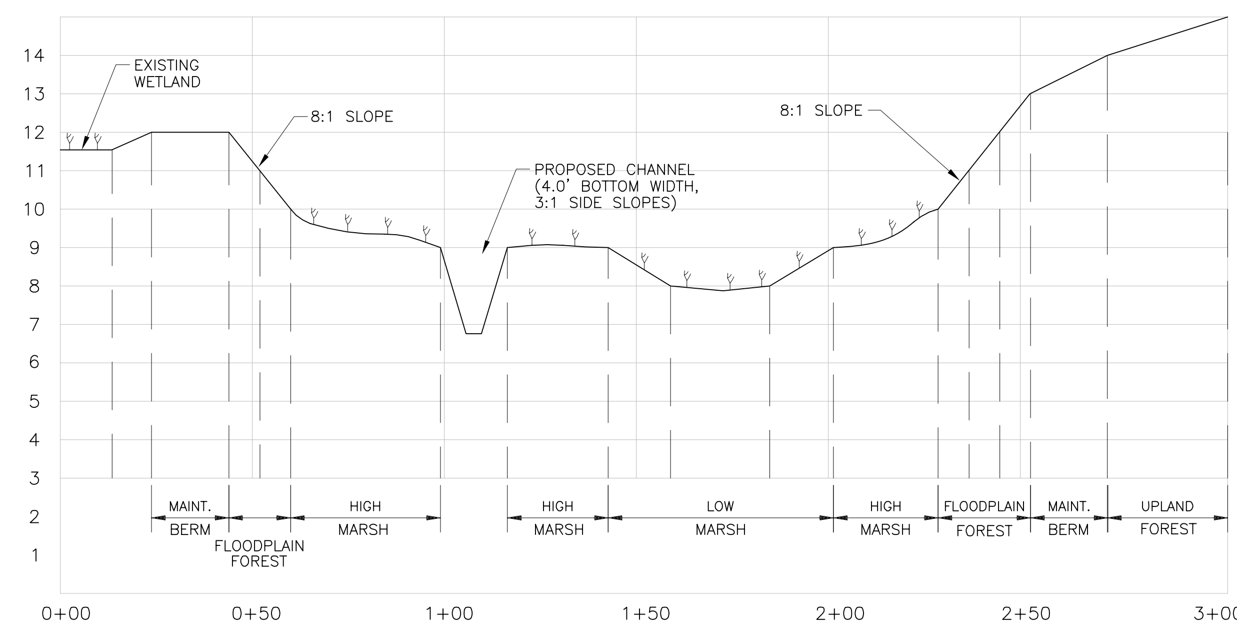
SOIL BORING PROFILES





SECTION 1

1" = 50'



SECTION 2

1" = 50'

LEGEND

- LEATHER FERN PLANTING AREA
- STREAM CHANNEL (0.14 AC)
- LOW MARSH (0.35 AC)
- HIGH MARSH (0.73 AC)
- FLOODPLAIN FOREST (0.56 AC)
- UPLAND FOREST (0.74 AC)
- UPLAND SCRUB FOREST (0.18 AC)

NOTE:
COST OF MITIGATION PLANTING SHALL BE INCLUDED IN PAY ITEM 5800.

Mario F. Chavez, P.E. # 50713 Date

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. WILLIAMS
DRAWN BY: J. WILLIAMS
SHEET CHK'D BY: M. CHAVEZ
CROSS CHK'D BY: J. WITTIG
APPROVED BY:
DATE: OCTOBER 2005

CDM consulting engineering construction operations
Camp Dresser & McKee Inc.
2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
Tel: 407 660-2552
Fax: 407 875-1161
FI COA No. EB-0000020

SEMINOLE COUNTY
FLORIDA

CAMERON DITCH STORMWATER FACILITY

PLANTING PLAN (NAVY CANAL MITIGATION)

G:\6116\36157\ACAD\100P\CIVIL\ 25plntpl 10/07/05 14:31:08 19:08:12 stoltzbk

APPENDIX B

PHYSICAL-CHEMICAL FIELD MEASUREMENTS COLLECTED AT THE CAMERON DITCH SITE FROM MAY 2010 – FEBRUARY 2011

Field Measurements Conducted at the Cameron Ditch Site from May 2010 - February 2011

Site	Date MMDDYY	Time HHMMSS	Temp degC	pH units	SpCond uS/cm	DO mg/l	DO %Sat	Redox mV
Site 1	05/05/10	0:00	31.38	7.51	289	5.1	69	157
Site 1	05/15/10	0:00	28.39	7.57	390	5.9	76	228
Site 1	06/25/10	13:06	33.39	7.58	395	6.7	95	107
Site 1	07/06/10	11:38	29.38	7.44	226	5.5	72	102
Site 1	07/14/10	10:13	30.34	7.05	436	4.8	64	95
Site 1	07/19/10	10:50	30.21	7.35	362	4.5	60	82
Site 1	07/26/10	8:16	27.85	7.45	296	3.9	49	193
Site 1	08/04/10	8:06	26.58	7.10	307	5.0	63	348
Site 1	08/10/10	11:04	29.92	7.36	247	4.8	63	58
Site 1	08/16/10	10:35	30.20	7.19	401	6.8	91	55
Site 1	08/23/10	0:00	28.72	6.98	130	5.1	65	304
Site 1	09/01/10	0:00	25.54	7.21	124	6.2	75	153
Site 1	09/07/10	0:00	25.66	6.99	286	5.9	72	249
Site 1	09/13/10	0:00	27.57	7.11	328	6.5	83	271
Site 1	09/21/10	0:00	27.56	7.17	361	7.6	96	139
Site 1	10/06/10	0:00	28.01	7.50	162	6.2	79	164
Site 1	10/28/10	11:27	27.56	7.39	517	7.5	95	294
Site 1	11/08/10	12:40	18.21	7.37	280	9.2	98	395
Site 1	11/19/10	10:38	19.57	7.16	156	8.4	92	440
Site 1	12/03/10	12:31	14.35	7.41	416	7.4	73	408
Site 1	12/08/10	13:11	14.56	7.82	400	7.9	78	458
Site 1	12/21/10	13:58	15.37	7.41	377	9.4	94	467
Site 1	01/03/11	11:27	16.67	7.34	350	9.8	100	678
Site 1	01/12/11	11:35	9.67	7.38	333	11.4	101	467
Site 1	01/19/11	9:53	16.51	7.27	255	8.6	89	481
Site 1	02/01/11	9:48	15.22	7.09	570	9.0	90	473
Site 1	02/17/11	12:29	20.67	7.43	741	9.3	104	487
Site 1	02/24/11	12:37	24.87	7.33	742	7.9	95	445
Minimum Value:			**9.67**	**6.98**	**124**	**3.9**	**49**	**55**
Maximum Value:			**33.39**	**7.82**	**742**	**11.4**	**104**	**678**
Median Value:			**27.07**	**7.36**	**342**	**6.8**	**81**	**283**
Log-Normal Mean:			**23.04**	**7.32**	**322**	**6.8**	**80**	**237**

Field Measurements Conducted at the Cameron Ditch Site from May 2010 - February 2011

Site	Date MMDDYY	Time HHMMSS	Temp degC	pH units	SpCond uS/cm	DO mg/l	DO %Sat	Redox mV
Site 2	5/15/10	0:00	28.35	8.01	331	5.8	74	201
Site 2	6/5/10	0:00	31.12	7.95	367	6.2	83	127
Site 2	6/25/10	13:46	37.67	7.41	232	3.7	56	117
Site 2	7/6/10	11:58	30.13	7.38	274	5.8	76	87
Site 2	7/14/10	10:58	33.15	8.43	268	8.1	113	95
Site 2	7/19/10	11:26	34.65	8.73	279	5.4	77	55
Site 2	7/26/10	8:39	30.71	7.72	302	3.4	46	183
Site 2	8/4/10	9:41	31.54	7.75	286	7.1	97	261
Site 2	8/10/10	11:23	31.02	7.37	283	4.8	65	65
Site 2	8/16/10	11:02	36.11	8.38	283	7.3	107	38
Site 2	8/23/10	0:00	28.94	6.93	255	4.7	62	524
Site 2	9/1/10	0:00	28.20	6.98	122	5.8	74	194
Site 2	9/7/10	0:00	28.21	7.15	295	6.6	85	263
Site 2	9/13/10	0:00	31.57	8.38	300	8.8	119	227
Site 2	9/21/10	0:00	30.18	7.34	117	7.6	101	159
Site 2	10/28/10	11:44	27.87	8.10	353	8.5	108	271
Site 2	11/8/10	13:53	21.90	8.25	288	9.6	109	382
Site 2	12/3/10	12:57	18.21	7.96	266	5.9	63	408
Site 2	12/8/10	13:33	16.47	7.73	272	7.5	77	463
Site 2	12/21/10	14:24	17.54	8.13	288	9.3	97	449
Site 2	1/3/11	11:48	17.33	8.57	322	11.7	122	515
Site 2	1/12/11	12:27	13.33	7.93	243	10.2	97	450
Site 2	1/19/11	10:18	16.73	7.19	301	8.7	89	493
Site 2	2/1/11	10:19	17.15	7.26	389	8.6	90	461
Site 2	2/17/11	12:44	21.38	8.77	256	11.6	131	415
Site 2	2/24/11	13:00	24.97	9.09	595	12.0	146	389
Minimum Value:			**13.33**	**6.93**	**117**	**3.4**	**46**	**38**
Maximum Value:			**37.67**	**9.09**	**595**	**12.0**	**146**	**524**
Median Value:			**28.28**	**7.94**	**285**	**7.4**	**89**	**262**
Log-Normal Mean:			**25.33**	**7.86**	**279**	**7.1**	**88**	**223**

Field Measurements Conducted at the Cameron Ditch Site from May 2010 - February 2011

Site	Date MMDDYY	Time HHMMSS	Temp degC	pH units	SpCond uS/cm	DO mg/l	DO %Sat	Redox mV
Site 3	8/4/10	10:48	29.02	7.60	3025	7.0	92	219
Site 3	8/10/10	12:20	31.81	7.50	569	5.5	76	72
Site 3	8/16/10	11:57	32.93	7.39	1224	6.2	87	76
Site 3	8/23/10	0:00	29.27	7.10	354	4.9	64	334
Site 3	9/7/10	0:00	27.68	7.22	298	5.8	74	267
Site 3	9/7/10	0:00	27.62	7.31	299	5.9	75	266
Site 3	9/13/10	0:00	30.17	7.57	267	7.0	94	273
Site 3	9/21/10	0:00	30.30	7.84	852	8.5	113	149
Site 3	11/8/10	13:20	22.13	8.40	281	9.9	113	367
Site 3	11/19/10	10:01	18.96	7.61	679	7.9	86	442
Site 3	1/3/11	12:13	17.01	8.20	1192	10.9	113	461
Site 3	1/12/11	11:51	11.69	7.73	926	9.6	90	458
Site 3	1/19/11	10:28	16.26	7.32	629	8.0	82	489
Site 3	2/1/11	10:27	16.66	7.35	531	9.1	94	464
Site 3	2/24/11	13:34	24.36	7.43	1028	7.8	94	418
Minimum Value:			**11.69**	**7.10**	**267**	**4.9**	**64**	**72**
Maximum Value:			**32.93**	**8.40**	**3025**	**10.9**	**113**	**489**
Median Value:			**27.62**	**7.50**	**629**	**7.8**	**90**	**334**
Log-Normal Mean:			**23.39**	**7.56**	**635**	**7.4**	**89**	**274**

Field Measurements Conducted at the Cameron Ditch Site from May 2010 - February 2011

Site	Date MMDDYY	Time HHMMSS	Temp degC	pH units	SpCond uS/cm	DO mg/l	DO %Sat	Redox mV
Site 4	5/5/10	0:00	29.97	7.14	750	3.8	50	150
Site 4	5/15/10	0:00	29.89	7.00	857	3.6	48	220
Site 4	6/6/10	0:00	30.39	7.23	255	3.9	52	170
Site 4	6/25/10	13:28	37.15	7.17	445	2.9	43	117
Site 4	7/6/10	12:12	30.59	7.38	616	4.8	64	101
Site 4	7/14/10	11:12	33.40	7.43	909	4.1	57	105
Site 4	7/19/10	11:43	33.01	7.60	1204	3.2	45	67
Site 4	7/26/10	8:54	30.50	7.18	1506	1.4	19	133
Site 4	8/4/10	10:07	31.12	7.02	1556	1.8	24	217
Site 4	8/10/10	11:43	31.38	7.28	423	3.3	45	67
Site 4	8/16/10	11:18	35.59	7.16	879	2.7	39	59
Site 4	8/23/10	0:00	28.21	7.05	186	5.2	67	343
Site 4	9/1/10	0:00	28.15	6.87	515	3.7	48	177
Site 4	9/7/10	0:00	27.56	6.97	785	3.9	49	241
Site 4	9/13/10	0:00	29.91	7.09	718	4.1	54	279
Site 4	9/21/10	0:00	31.03	7.20	382	6.3	85	163
Site 4	10/28/10	12:25	28.98	7.15	1288	3.4	44	300
Site 4	11/8/10	13:02	21.24	7.53	921	7.6	86	403
Site 4	11/19/10	9:33	18.64	7.36	279	7.6	81	425
Site 4	12/3/10	13:40	18.66	7.52	311	5.0	54	398
Site 4	12/8/10	13:46	15.36	7.57	997	5.5	55	466
Site 4	1/3/11	12:24	16.36	7.48	1190	8.6	88	504
Site 4	1/12/11	12:06	12.66	7.54	1035	8.6	81	458
Site 4	1/19/11	10:51	17.19	7.36	751	8.2	85	487
Site 4	2/1/11	10:45	16.59	7.29	489	8.2	84	475
Site 4	2/17/11	13:21	19.33	7.61	633	9.0	97	436
Site 4	2/24/11	13:20	27.35	7.56	761	6.8	86	431
Minimum Value:			**12.66**	**6.87**	**186**	**1.4**	**19**	**59**
Maximum Value:			**37.15**	**7.61**	**1556**	**9.0**	**97**	**504**
Median Value:			**28.98**	**7.28**	**751**	**4.1**	**54**	**241**
Log-Normal Mean:			**25.29**	**7.28**	**669**	**4.6**	**56**	**225**

APPENDIX C

LABORATORY ANALYSES ON INFLOW AND OUTFLOW SAMPLES

C.1 Inflow/Outflow Samples
C.2 Bulk Precipitation

C.1 Inflow/Outflow Samples

Characteristics of Inflow Samples Collected At Cameron Ditch Site 1

Site	Date Collected	pH (s.u.)	Conductivity (µmho/cm)	Alkalinity (mg/l)	NH_3 (µg/l)	NO_X (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turbidity (NTU)	TSS (mg/l)	Color (Pt-Co)
Site #1	5/03/10 - 5/12/10	7.00	314	48.0	46	5	202	27	280	17	1	7	25	2.5	8.4	47
Site #1	5/12/10 - 5/18/10	7.29	329	50.8	79	6	279	68	432	32	10	23	65	3.4	3.1	50
Site #1	5/18/10 - 5/25/10	7.22	308	50.0	19	6	500	42	567	28	7	11	46	1.2	1.2	46
Site #1	05/25/10 - 6/2/10	6.94	391	52.2	35	5	1089	27	1156	17	1	40	58	3.2	11.7	45
Site #1	5/31/10 - 6/10/10	6.95	275	50.4	46	9	437	11	503	11	8	8	27	1.3	4.8	42
Site #1	6/10/10 - 6/25/10	6.59	247	42.0	32	9	444	35	520	42	6	6	54	0.9	0.6	51
Site #1	6/25/10 - 7/06/10	6.94	261	44.8	34	3	445	98	580	37	4	8	49	6.8	28.5	57
Site #1	7/06/10 - 7/14/10	7.15	258	48.0	21	87	424	179	711	128	8	63	199	11.6	44.0	63
Site #1	07/14/10-07/19/10	6.94	362	53.4	28	46	434	519	1027	29	3	21	53	3.6	3.2	49
Site #1	7/19/10 - 7/26/10	6.92	385	53.4	27	12	472	52	563	15	28	12	55	1.2	2.0	42
Site #1	7/26/10 - 8/4/10	7.33	212	47.2	112	36	43	284	475	17	2	34	53	10.8	57.9	38
Site #1	8/4/10 - 8/10/10	6.86	269	47.6	20	20	336	230	606	17	2	9	28	1.9	3.7	47
Site #1	8/10/10 - 8/16/10	7.12	191	55.8	23	74	101	1073	1271	78	11	30	119	4.5	24.0	45
Site #1	8/16/10 - 8/23/10	6.86	256	50.4	71	17	676	449	1213	23	33	317	373	92.5	553	47
Site #1	8/23/10 - 9/1/10	7.08	244	46.0	27	20	1003	110	1160	28	41	11	80	16.8	93.2	46
Site #1	9/1/10 - 9/7/10	6.79	298	49.4	32	14	396	176	618	18	6	9	33	9.7	15.4	43
Site #1	9/7/10 - 9/13/10	7.42	273	52.2	3	21	570	140	734	18	10	17	45	5.1	22.8	46
Site #1	9/13/10 - 9/21/10	6.99	305	48.2	41	34	66	420	561	27	9	143	179	17.5	61.6	37
Site #1	9/21/10 - 10/5/10	7.06	255	46.2	86	300	477	120	983	44	3	172	219	29.6	81.1	41
Site #1	10/5/10 - 10/12/10	7.02	366	51.4	32	11	354	154	551	21	24	31	76	8.0	42.4	36
Site #1	10/12/10 - 10/18/10	7.10	459	57.6	25	22	229	84	360	12	14	5	31	2.4	2.6	32
Site #1	10/18/10 - 10/28/10	7.34	500	56.4	57	32	229	14	332	18	15	20	53	2.3	5.0	32
Site #1	10/28/10 - 11/8/10	6.92	209	50.0	37	14	241	106	398	1	12	6	19	1.3	1.0	30
Site #1	11/8/10 - 11/19/10	6.82	473	40.2	52	3	395	119	569	45	25	42	112	16.4	17.4	27
Site #1	11/19/10 - 12/3/10	7.17	223	45.8	48	15	356	25	444	7	1	18	26	2.0	9.6	33
Site #1	12/3/10 - 12/8/10	7.02	503	48.0	53	30	279	115	477	7	5	11	23	1.3	2.0	26
Site #1	12/8/10 - 12/13/10	6.93	344	45.2	106	40	270	27	443	11	4	10	25	1.7	7.9	20
Site #1	12/13/10 - 12/21/10	7.14	236	40.6	7	56	124	212	399	1	3	23	27	3.7	42.2	23
Site #1	12/21/10 - 1/3/11	6.93	315	44.6	40	108	219	96	463	15	1	3	19	1.9	1.5	24
Site #1	1/3/11 - 1/12/11	6.73	277	41.8	8	3	273	57	341	4	2	12	18	2.3	2.6	26
Site #1	1/19/11 - 2/1/11	6.79	432	56.6	94	59	336	255	744	10	11	133	154	51.2	187	38
Site #1	2/1/11 - 2/10/11	7.14	540	64.4	85	57	393	56	591	22	5	6	33	3.2	1.3	58
Site #1	2/10/11 - 2/17/11	6.92	667	61.6	61	50	319	129	559	9	2	7	18	1.9	0.8	38
Site #1	2/17/11 - 2/24/11	7.08	727	60.8	69	249	357	107	782	23	4	62	89	10.8	28.2	35
Minimum Value:		**6.59**	**191**	**40.2**	**3**	**3**	**43**	**11**	**280**	**1**	**1**	**3**	**18**	**0.9**	**0.6**	**20**
Maximum Value:		**7.42**	**727**	**64.4**	**112**	**300**	**1089**	**1073**	**1271**	**128**	**41**	**317**	**373**	**92.5**	**553**	**63**
Median Value:		**7.00**	**307**	**49.7**	**39**	**21**	**355**	**109**	**562**	**18**	**6**	**15**	**51**	**3.3**	**9.0**	**42**
Log-Normal Mean:		**7.01**	**325**	**50**	**36**	**21**	**315**	**99**	**583**	**17**	**6**	**19**	**52**	**4.4**	**9.8**	**39**
No. of Samples:		**34**														

Characteristics of Inflow Samples Collected At Cameron Ditch Site 2

Site	Date Collected	pH (s.u.)	Conductivity (µmho/cm)	Alkalinity (mg/l)	NH_3 (µg/l)	NO_X (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turbidity (NTU)	TSS (mg/l)	Color (Pt-Co)
Site #2	5/03/10 - 5/12/10	6.74	310	52.2	190	27	269	27	513	27	9	8	44	1.2	1.3	45
Site #2	5/12/10 - 5/18/10	7.26	300	52.6	110	11	241	382	744	6	8	135	149	10.2	31.7	43
Site #2	5/18/10 - 5/25/10	6.69	309	53.8	130	8	515	218	871	11	8	67	86	3.1	5.8	76
Site #2	5/25/10 - 5/31/10	6.73	352	55.8	39	8	1165	785	1997	3	1	72	76	3.9	10.4	77
Site #2	5/31/10 - 6/10/10	6.65	302	58.2	46	17	698	680	1441	3	5	38	46	8.6	26.9	70
Site #2	6/10/10 - 6/25/10	6.74	292	50.6	35	25	587	241	888	1	29	5	35	3.4	5.8	65
Site #2	6/25/10 - 7/06/10	6.78	282	49.6	40	9	553	153	755	4	8	16	28	2.8	6.3	58
Site #2	7/06/10 - 7/14/10	6.90	248	46.4	36	107	401	202	746	20	1	16	37	5.5	15.4	58
Site #2	7/14/10 - 7/19/10	6.67	295	51.2	63	185	489	1023	1760	9	1	287	297	48.1	122	51
Site #2	07/19/10-07/26/10	6.88	310	51.2	42	287	778	820	1927	5	8	239	252	7.6	54.5	44
Site #2	7/26/10 - 8/4/10	7.30	321	60.2	22	756	579	45	1402	36	1	55	92	8.8	32.6	40
Site #2	8/4/10 - 8/10/10	6.59	295	48.2	58	194	50	791	1093	4	9	18	31	3.7	3.0	42
Site #2	8/10/10 - 8/16/10	6.76	317	54.2	304	10	98	657	1069	18	8	91	117	4.5	8.5	47
Site #2	8/16/10 - 8/23/10	6.90	293	49.4	78	69	648	201	996	2	20	24	46	5.0	10.5	38
Site #2	8/23/10 - 9/1/10	7.36	235	45.2	45	29	764	539	1377	15	44	15	74	6.5	22.5	48
Site #2	9/1/10 - 9/7/10	6.67	253	46.8	60	91	298	562	1011	51	12	53	116	13.6	44.0	46
Site #2	9/7/10 - 9/13/10	7.19	265	50.6	7	119	515	503	1144	48	6	22	76	10.7	33.2	48
Site #2	9/13/10 - 9/21/10	6.75	285	43.0	38	486	245	410	1179	42	24	195	261	14.8	52.6	42
Site #2	9/21/10 - 10/5/10	7.10	294	45.0	63	1229	201	342	1835	100	18	129	247	17.3	41.6	47
Site #2	10/5/10 - 10/12/10	6.93	293	52.2	156	77	1072	919	2224	45	10	230	285	12.5	57.7	46
Site #2	10/12/10 - 10/18/10	7.08	314	57.2	13	12	335	104	464	1	4	19	24	2.2	3.7	53
Site #2	10/18/10 - 10/28/10	6.81	369	55.2	58	172	448	444	1122	14	2	130	146	16.7	52.1	48
Site #2	10/28/10 - 11/8/10	7.16	325	52.2	60	181	407	61	709	1	10	19	30	4.2	12.5	40
Site #2	11/8/10 - 11/19/10	7.13	312	47.2	44	148	472	119	783	7	4	36	47	10.5	9.5	29
Site #2	11/19/10 - 12/3/10	7.20	238	45.2	49	209	206	45	509	37	9	12	58	4.7	10.1	36
Site #2	12/3/10 - 12/8/10	6.89	342	46.8	63	159	206	426	854	1	5	97	103	24.0	63.9	31
Site #2	12/8/10 - 12/13/10	7.06	289	47.0	52	13	302	67	434	1	1	11	13	2.9	5.5	24
Site #2	12/13/10 - 12/21/10	7.45	293	46.4	18	203	288	194	703	5	4	14	23	5.3	11.8	22
Site #2	12/21/10 - 1/3/10	7.07	283	46.0	23	221	409	273	926	8	1	13	22	3.9	10.9	23
Site #2	1/3/11 - 1/12/11	7.10	293	47.8	21	3	323	102	448	1	3	7	11	2.4	3.0	26
Site #2	1/12/11 - 1/19/11	7.02	306	46.2	42	165	366	115	688	2	3	23	28	4.8	12.3	23
Site #2	1/19/11 - 2/1/11	6.98	331	50.0	117	56	179	17	369	6	2	6	14	1.6	6.8	33
Site #2	2/1/11 - 2/10/11	7.32	411	62.8	62	160	310	115	647	17	3	12	32	4.4	2.8	45
Site #2	2/10/11 - 2/17/11	7.15	416	56.6	60	103	413	79	655	8	1	24	33	5.0	5.8	38
Site #2	2/17/11 - 2/24/11	7.09	546	61.4	81	380	339	123	923	17	9	41	67	6	15	32
	Minimum Value:	**6.59**	**235**	**43**	**7**	**3**	**50**	**17**	**369**	**1**	**1**	**5**	**11**	**1.2**	**1.3**	**22**
	Maximum Value:	**7.45**	**546**	**63**	**304**	**1229**	**1165**	**1023**	**2224**	**100**	**44**	**287**	**297**	**48.1**	**122**	**77**
	Median Value:	**6.98**	**300**	**51**	**52**	**107**	**401**	**218**	**888**	**8**	**6**	**24**	**47**	**5.0**	**11.8**	**44**
	Log-Normal Mean:	**6.97**	**308**	**51**	**51**	**72**	**368**	**214**	**906**	**8**	**5**	**33**	**58**	**6.0**	**13.7**	**42**
	No. of Samples:	**35**														

Characteristics of Inflow Samples Collected At Cameron Ditch Site 3

Site	Date Collected	pH (s.u.)	Conductivity (µmho/cm)	Alkalinity (mg/l)	NH_3 (µg/l)	NO_X (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turbidity (NTU)	TSS (mg/l)	Color (Pt-Co)
Site #3	5/12/10 - 5/18/10	7.74	1463	84	130	94	201	61	486	86	6	25	117	1.3	2.0	39
Site #3	8/4/10	7.68	2853	121	43	84	322	43	492	170	13	33	216	5.6	16.2	33
Site #3	8/10/10	7.21	532	71	28	12	619	141	800	12	3	19	34	5.0	5.3	54
Site #3	8/10/10 - 8/16/10	7.63	2594	125	63	134	374	62	633	152	77	66	295	4.9	9.2	45
Site #3	8/16/10 - 8/23/10	7.52	505	94	42	270	884	51	1247	105	3	18	126	4.2	13.1	45
Site #3	8/23/10 - 9/1/10	7.60	1168	88	35	189	1094	298	1616	97	4	7	108	3.3	11.2	67
Site #3	9/1/10 - 9/7/10	7.37	1375	83	84	249	399	307	1039	218	5	16	239	4.4	7.3	47
Site #3	9/7/10 - 9/13/10	7.59	1323	87	37	133	860	271	1301	70	11	20	101	3.4	1.7	49
Site #3	9/13/10 - 9/21/10	7.35	850	67	46	217	104	123	490	51	22	3	76	4.9	8.2	40
Site #3	9/21/10 - 10/5/10	7.71	1528	87	124	412	395	499	1430	121	15	28	164	2.8	10.2	46
Site #3	10/5/10 - 10/12/10	7.72	1453	83	31	3	509	37	580	74	2	2	78	1.4	1.0	41
Site #3	10/28/10 - 11/8/10	7.54	967	73	74	14	389	150	627	1	13	71	85	4.0	3.8	37
Site #3	11/19/10 - 12/3/10	7.45	1470	69	39	389	276	173	877	164	10	91	265	10.6	21.5	28
Site #3	12/13/10 - 12/21/10	7.84	1582	95	14	125	295	122	556	63	11	59	133	4.8	11.1	22
Site #3	12/21/10 - 1/3/10	7.57	1042	71	25	294	243	276	838	14	69	39	122	2.8	5.8	21
Site #3	1/3/11 - 1/12/11	7.43	1074	77	11	3	407	79	500	28	1	30	59	2.7	3.2	24
Site #3	1/12/11 - 1/19/11	7.18	590	56	38	3	419	68	528	11	8	17	36	2.9	2.1	26
Site #3	1/19/11 - 2/1/11	7.71	1411	90	54	209	344	105	712	122	16	92	230	4.8	33.7	35
Site #3	2/17/11	7.42	765	59	64	81	436	112	693	12	3	24	39	3.3	1.9	40
Site #3	2/17/11 - 2/24/11	7.20	977	80	67	16	414	92	589	22	6	26	54	3.4	3.8	35
Minimum Value:		**7.18**	**505**	**56.4**	**11**	**3**	**104**	**37**	**486**	**1**	**1**	**2**	**34**	**1.3**	**1.0**	**21**
Maximum Value:		**7.84**	**2853**	**125**	**130**	**412**	**1094**	**499**	**1616**	**218**	**77**	**92**	**295**	**10.6**	**33.7**	**67**
Median Value:		**7.56**	**1246**	**82.9**	**43**	**129**	**397**	**117**	**663**	**72**	**9**	**26**	**113**	**3.7**	**6.6**	**40**
Log-Normal Mean:		**7.52**	**1156**	**81.3**	**44**	**66**	**395**	**119**	**743**	**47**	**8**	**24**	**106**	**3.6**	**5.8**	**37**
No. of Samples:		**20**														

Characteristics of Inflow Samples Collected At Cameron Ditch Site 4

Site	Date Collected	pH (s.u.)	Conductivity (µmho/cm)	Alkalinity (mg/l)	NH_3 (µg/l)	NO_X (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turbidity (NTU)	TSS (mg/l)	Color (Pt-Co)
Site #4	5/03/10 - 5/12/10	7.39	582	60.8	84	29	102	211	426	43	8	6	57	1.8	3.4	53
Site #4	5/12/10 - 5/18/10	5.97	826	68.4	64	24	371	174	633	23	7	40	70	2.5	5.4	43
Site #4	5/18/10 - 5/25/10	7.33	610	59.4	35	15	661	228	939	75	2	6	83	4.3	4.3	45
Site #4	5/25/10 - 6/2/10	7.23	831	67.0	46	223	1267	311	1847	24	2	36	62	1.6	3.3	44
Site #4	6/2/10 - 6/10/10	7.43	709	66.2	77	294	533	276	1180	63	3	3	69	3.4	8.8	37
Site #4	6/10/10 - 6/25/10	7.29	665	58.6	43	393	418	68	922	69	3	14	86	2.6	3.4	44
Site #4	6/25/10 - 7/06/10	7.37	716	74.4	61	13	761	191	1026	68	12	32	112	10.8	19.9	70
Site #4	7/06/10 - 7/14/10	7.29	689	59.0	79	221	400	171	871	43	1	19	63	4.6	3.8	58
Site #4	7/14/10 - 7/19/10	7.22	1074	73.6	52	303	505	126	986	69	5	27	101	12.0	13.8	55
Site #4	7/19/10 - 7/26/10	7.76	1377	83.6	25	227	708	384	1344	40	69	100	209	5.2	15.5	52
Site #4	7/26/10 - 8/4/10	7.76	1610	92.0	28	227	11	43	309	123	27	6	156	3.8	9.6	47
Site #4	8/4/10 - 8/10/10	7.51	1413	83.6	73	277	562	297	1209	120	5	5	130	2.8	12.5	46
Site #4	8/10/10 - 8/16/10	7.34	968	78.2	51	144	797	189	1181	60	17	19	96	1.1	0.9	47
Site #4	8/16/10 - 8/23/10	7.24	1062	71.0	59	192	454	517	1222	50	5	19	74	1.5	2.6	44
Site #4	8/23/10 - 9/1/10	7.58	452	79.4	30	220	735	362	1347	51	8	16	75	0.9	1.0	53
Site #4	9/1/10 - 9/7/10	7.20	705	60.0	35	156	448	221	860	29	8	1	38	10.3	15.7	78
Site #4	9/7/10 - 9/13/10	7.34	755	65.4	46	54	729	282	1111	26	10	15	51	4.7	4.0	37
Site #4	9/13/10 - 9/21/10	7.40	780	65.6	37	237	34	125	433	49	1	1	51	0.9	1.0	42
Site #4	9/21/10 - 10/5/10	7.41	912	68.4	60	237	450	435	1182	51	3	6	60	1.3	3.3	41
Site #4	10/5/10 - 10/12/10	7.36	829	74.2	52	20	443	403	918	39	3	50	92	7.1	14.5	47
Site #4	10/12/10 - 10/18/10	7.36	962	72.8	28	99	367	432	926	23	12	56	91	8.1	17.0	54
Site #4	10/18/10 - 10/28/10	7.40	1151	75.0	38	20	161	276	495	18	10	9	37	4.5	8.7	34
Site #4	10/28/10 - 11/8/10	7.59	1208	81.2	47	126	321	118	612	16	13	13	42	5.6	8.3	22
Site #4	11/8/10 - 11/19/10	7.61	906	68.2	47	36	415	58	556	18	9	14	41	7.8	6.1	31
Site #4	11/19/10 - 12/3/10	7.55	671	75.8	57	68	337	13	475	15	1	1	17	0.9	0.9	36
Site #4	12/3/10 - 12/8/10	7.39	981	67.8	63	19	370	76	528	14	2	15	31	2.7	3.1	27
Site #4	12/8/10 - 12/13/10	7.35	1709	83.4	68	43	388	54	553	13	5	7	25	2.5	6.2	22
Site #4	12/13/10 - 12/21/10	7.74	962	72.2	14	21	300	117	452	13	4	6	23	2.0	1.8	22
Site #4	12/21/10 - 1/3/10	7.36	885	69.8	33	57	491	6	587	30	9	7	46	1.9	1.4	21
Site #4	1/3/11 - 1/12/11	7.34	966	69.8	28	13	386	48	475	23	1	14	38	1.6	3.5	24
Site #4	1/12/11 - 1/19/11	7.24	720	61.2	49	3	526	39	617	18	16	22	56	3.1	4.4	28
Site #4	1/19/11 - 2/1/11	7.26	518	58.8	82	11	138	317	548	1	14	10	25	2.0	2.8	38
Site #4	2/1/11 - 2/10/11	7.17	684	74.4	71	23	515	145	754	36	6	15	57	1.8	1.4	44
Site #4	2/10/11 - 2/17/11	7.11	608	74.0	79	21	456	21	577	13	1	20	34	3.3	3.2	42
Site #4	2/17/11 - 2/24/11	7.35	712	67.4	67	126	353	114	660	22	1	29	52	3.8	8.6	32
Minimum Value:		**5.97**	**452**	**59**	**14**	**3**	**11**	**6**	**309**	**1**	**1**	**1**	**17**	**0.9**	**0.9**	**21**
Maximum Value:		**7.76**	**1709**	**92**	**84**	**393**	**1267**	**517**	**1847**	**123**	**69**	**100**	**209**	**12.0**	**19.9**	**78**
Median Value:		**7.36**	**829**	**70**	**51**	**68**	**443**	**174**	**754**	**30**	**5**	**14**	**57**	**2.8**	**4.0**	**43**
Log-Normal Mean:		**7.34**	**850**	**70**	**48**	**65**	**362**	**134**	**754**	**30**	**5**	**12**	**58**	**3.0**	**4.5**	**40**
No. of Samples:		**35**														

C.2 Bulk Precipitation

Characteristics of Bulk Precipitation Samples Collected At Cameron Ditch

Site	Date Collected	pH (s.u.)	Conductivity (µmho/cm)	Alkalinity (mg/l)	NH_3 (µg/l)	NO_X (µg/l)	Diss. Org. N (µg/l)	Part. N (µg/l)	Total N (µg/l)	SRP (µg/l)	Diss. Org. P (µg/l)	Part. P (µg/l)	Total P (µg/l)	Turbidity (NTU)	TSS (mg/l)	Color (Pt-Co)
Bulk Precip.	5/12/10 - 5/18/10	5.52	41	0.6	65	153	302	92	612	19	9	15	43	1.3	0.2	26
Bulk Precip.	6/2/10	5.91	52	10.6	100	69	231	278	678	20	35	33	88	10.2	50.5	30
Bulk Precip.	05/31/10-06/10/10	5.01	12	1.6	52	36	123	877	1088	18	2	39	59	5.5	16.8	2
Bulk Precip.	6/11 - 6/25/10	4.88	24	1.0	327	16	210	830	1383	10	22	80	112	6.2	21.0	1
Bulk Precip.	06/25/10-07/06/10	5.05	18	1.4	36	113	116	303	568	1	1	33	35	3.1	6.0	5
Bulk Precip.	7/26/10 - 8/4/10	6.53	129	18.0	332	37	242	149	760	53	52	46	151	18.2	31.0	20
Bulk Precip.	8/4/10 - 8/10/10	4.81	83	1.0	15	60	24	86	185	10	20	41	71	1.1	5.7	4
Bulk Precip.	8/10/10 - 8/16/10	5.82	24	6.2	271	177	35	170	653	15	26	40	81	3.0	43.0	12
Bulk Precip.	8/16/10 - 8/23/10	5.43	34	1.8	34	42	209	219	504	11	10	21	42	1.9	3.2	1
Bulk Precip.	9/1/10 - 9/7/10	5.65	71	4.2	390	359	161	74	984	93	6	18	117	1.3	10.4	13
Bulk Precip.	9/7/10 - 9/13/10	5.42	41	2.6	59	39	300	215	613	24	3	11	38	1.6	3.2	5
Bulk Precip.	9/13/10 - 10/5/10	6.09	92	4.6	146	157	39	676	1018	24	17	106	147	4.1	26.7	13
Bulk Precip.	10/5/10 - 11/8/10	6.13	140	22.2	194	8	217	309	728	64	81	69	214	1.8	5.2	22
Bulk Precip.	11/8/10 - 12/3/10	5.94	93	13.6	536	511	125	29	1201	29	2	11	42	1.4	3.0	15
Bulk Precip.	12/3/10 - 12/21/10	6.16	99	6.0	104	367	177	335	983	22	1	15	38	1.4	1.8	11
Bulk Precip.	12/21/11 - 1/12/11	6.29	105	15.4	252	547	127	151	1077	35	6	47	88	2.3	3.2	18
Bulk Precip.	1/12/11 - 1/19/11	5.33	36	2.8	122	119	98	57	396	6	3	15	24	1.0	0.8	5
Bulk Precip.	1/19/11 - 2/1/11	5.13	37	1.4	60	9	66	53	188	3	3	15	21	1.8	3.8	8
Bulk Precip.	2/1/11 - 2/10/11	5.41	58	1.8	59	526	69	247	901	40	7	18	65	3.7	6.4	16
Minimum Value:		**4.81**	**12**	**0.6**	**15**	**8**	**24**	**29**	**185**	**1**	**1**	**11**	**21**	**1.0**	**0.2**	**1**
Maximum Value:		**6.53**	**140**	**22.2**	**536**	**547**	**302**	**877**	**1383**	**93**	**81**	**106**	**214**	**18.2**	**50.5**	**30**
Median Value:		**5.52**	**52**	**2.8**	**104**	**113**	**127**	**215**	**728**	**20**	**7**	**33**	**65**	**1.9**	**5.7**	**12**
Log-Normal Mean:		**5.58**	**51**	**4**	**111**	**89**	**122**	**183**	**678**	**17**	**8**	**28**	**64**	**2.6**	**6.1**	**8**
No. of Samples:		**19**														

APPENDIX D

MONTHLY MASS LOADING CALCULATIONS FOR THE CAMERON DITCH STORMWATER FACILITY

D.1 Ponds A and B
D.2 Pond C
D.3 Overall System

D.1 Ponds A and B

Ammonia

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	3.1	0.04	3.2	8.0	-4.9
June	4.3	0.26	4.5	4.7	-0.1
July	1.9	0.18	2.1	2.0	0.1
August	3.9	0.17	4.1	11.4	-7.3
September	1.5	0.27	1.7	2.0	-0.3
October	0.9	0.00	0.9	1.3	-0.4
November	2.2	0.15	2.3	2.2	0.1
December	0.7	0.06	0.8	0.7	0.1
January	2.1	0.16	2.2	3.5	-1.3
February	3.8	0.01	3.8	3.6	0.2
Totals	24.3	1.31	25.6	39.3	-13.7

NOx

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	0.4	0.10	0.5	0.9	-0.4
June	0.7	0.13	0.8	1.8	-1.0
July	1.9	0.11	2.0	13.2	-11.2
August	3.4	0.13	3.5	5.7	-2.1
September	2.6	0.24	2.9	18.0	-15.1
October	0.5	0.00	0.5	1.9	-1.4
November	0.4	0.03	0.4	8.4	-8.0
December	1.0	0.12	1.1	1.9	-0.8
January	0.9	0.11	1.0	2.1	-1.1
February	4.8	0.01	4.8	9.9	-5.1
Totals	16.6	0.98	17.6	63.8	-46.2

Diss. Organic N

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	33	0.20	33	35	-1.8
June	51	0.47	52	71	-19.0
July	13	0.28	13	28	-15.1
August	50	0.17	50	28	21.7
September	18	0.23	19	19	-0.1
October	7	0.00	7	13	-6.2
November	15	0.08	16	15	0.6
December	4	0.04	4	6	-1.5
January	23	0.12	23	21	2.1
February	19	0.01	19	19	0.2
Totals	234	1.59	235	254	-19.0

Particulate N

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	3.0	0.06	3.1	16.2	-13.1
June	3.9	1.44	5.3	34.0	-28.7
July	9.9	0.35	10.3	15.2	-5.0
August	42.6	0.31	42.9	62.5	-19.6
September	11.9	0.40	12.3	28.3	-16.0
October	1.4	0.01	1.4	5.8	-4.3
November	3.2	0.04	3.3	3.5	-0.2
December	1.7	0.03	1.8	3.9	-2.1
January	9.1	0.10	9.2	4.4	4.8
February	4.9	0.01	4.9	5.6	-0.6
Totals	91.8	2.76	94.5	179	-84.7

Total Nitrogen

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	42	0.4	42	71	-29
June	62	2.5	64	115	-50
July	34	1.1	35	71	-35
August	131	1.0	132	144	-12
September	45	1.6	46	80	-33
October	10	0.0	10	24	-14
November	22	0.4	23	30	-8
December	9	0.3	9	14	-5
January	38	0.6	38	37	2
February	34	0.0	34	39	-5
Totals	427	7.9	435	625	-190

SRP

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	1.8	0.01	1.8	0.7	1.1
June	3.0	0.02	3.0	0.3	2.7
July	1.6	0.01	1.6	0.7	0.9
August	3.9	0.04	3.9	0.9	3.1
September	1.6	0.07	1.6	3.6	-1.9
October	0.4	0.00	0.4	0.1	0.3
November	0.3	0.02	0.3	0.8	-0.4
December	0.1	0.01	0.1	0.0	0.1
January	0.5	0.01	0.5	0.2	0.3
February	0.9	0.00	0.9	0.7	0.2
Totals	14.1	0.19	14.3	7.9	6.4

Diss. Organic P

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	0.2	0.01	0.2	0.4	-0.2
June	0.7	0.02	0.7	1.2	-0.5
July	0.3	0.01	0.3	0.1	0.2
August	1.7	0.05	1.7	2.0	-0.3
September	0.4	0.01	0.4	0.8	-0.4
October	0.4	0.00	0.4	0.1	0.3
November	0.3	0.01	0.3	0.3	0.0
December	0.1	0.00	0.1	0.0	0.0
January	0.4	0.00	0.4	0.2	0.2
February	0.2	0.00	0.2	0.2	0.0
Totals	4.6	0.11	4.8	5.4	-0.6

Particulate P

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	1.3	0.01	1.3	3.8	-2.5
June	0.8	0.12	1.0	1.7	-0.7
July	1.4	0.06	1.5	4.5	-3.1
August	4.0	0.07	4.1	3.6	0.5
September	2.8	0.05	2.8	4.7	-1.8
October	0.4	0.00	0.4	1.5	-1.1
November	0.8	0.01	0.8	1.0	-0.2
December	0.2	0.01	0.2	0.4	-0.2
January	3.0	0.03	3.0	0.7	2.3
February	0.7	0.00	0.7	1.2	-0.5
Totals	15.4	0.37	15.8	23.1	-7.3

Total P

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	3.6	0.03	3.6	6.4	-2.8
June	4.8	0.19	5.0	2.8	2.2
July	3.8	0.12	4.0	10.0	-6.0
August	12.8	0.16	13.0	4.7	8.3
September	5.5	0.16	5.7	12.2	-6.5
October	1.3	0.00	1.3	5.8	-4.6
November	1.8	0.04	1.9	4.1	-2.3
December	0.5	0.01	0.5	2.3	-1.8
January	4.0	0.05	4.0	1.3	2.7
February	2.0	0.00	2.0	3.3	-1.3
Totals	40.1	0.77	40.9	52.9	-12.0

TSS

Month	Ponds A & B				
	Inputs (kg)			Losses (kg)	Load Removed (kg)
	Northern Sub-Basin	Bulk Precipitation	Total Inputs	Pond B Outfall	
May	346	0.1	346	558	-212
June	505	52.2	557	1,155	-598
July	583	22.7	605	2,203	-1,598
August	5,932	26.0	5,958	1,130	4,828
September	2,307	17.5	2,324	2,680	-356
October	209	0.1	209	493	-283
November	263	1.9	265	468	-203
December	110	0.7	111	286	-175
January	1,662	2.8	1,664	475	1,189
February	165	0.5	166	337	-172
Totals	12,081	125	12,206	9,786	2,420

D.2 Pond C

Ammonia

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
8.0	2.4	0.0	10.5	0.6	4.7	5.3	5.2
4.7	2.9	0.2	7.7	0.9	7.1	8.0	-0.2
2.0	3.4	0.1	5.4	0.3	3.8	4.0	1.4
11.4	1.1	0.1	12.6	2.1	4.9	7.0	5.6
2.0	0.9	0.2	3.1	0.0	3.1	3.1	-0.1
1.3	1.5	0.0	2.8	0.0	2.1	2.1	0.7
2.2	0.7	0.1	3.0	0.2	3.0	3.2	-0.2
0.7	0.3	0.0	1.0	0.0	1.3	1.3	-0.3
3.5	0.3	0.1	3.9	0.9	2.9	3.8	0.1
3.6	0.0	0.0	3.6	0.7	3.3	4.0	-0.4
39.35	13.5	0.8	53.6	5.6	36.2	41.8	11.8

NOx

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
0.9	1.8	0.1	2.8	0.4	3.4	3.8	-1.1
1.8	2.5	0.1	4.4	2.1	17.4	19.5	-15.1
13.2	3.7	0.1	16.9	0.8	11.4	12.2	4.7
5.7	2.6	0.1	8.3	9.6	22.6	32.2	-23.9
18.0	3.2	0.1	21.3	0.2	12.3	12.4	8.9
1.9	0.6	0.0	2.5	0.0	3.2	3.2	-0.7
8.4	0.9	0.0	9.4	0.2	2.7	3.0	6.4
1.9	2.9	0.1	4.9	0.0	1.2	1.2	3.7
2.1	0.3	0.1	2.5	0.3	0.8	1.1	1.4
9.9	0.0	0.0	9.9	0.3	1.3	1.5	8.4
63.8	18.4	0.6	82.8	13.8	76.3	90.1	-7.3

Diss. Organic N

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
35	3.8	0.12	39	4.5	37	41	-2
71	8.1	0.28	79	10.7	87	98	-19
28	15.6	0.17	44	1.5	22	24	20
28	16.3	0.10	45	12.9	30	43	2
19	4.7	0.13	24	0.3	25	25	-2
13	9.8	0.00	23	0.0	16	16	7
15	4.2	0.05	19	1.6	20	22	-2
6	3.2	0.02	9	0.0	12	12	-3
21	3.7	0.07	25	7.0	22	29	-5
19	0.1	0.00	19	2.9	15	18	1
254	69.5	0.95	325	41.4	286	328	-3

Particulate N

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
16.2	1.1	0.04	17.4	2.4	19.7	22.1	-4.7
34.0	1.8	0.85	36.7	2.9	23.5	26.3	10.4
15.2	3.0	0.21	18.4	0.9	12.4	13.3	5.1
62.5	2.5	0.18	65.1	9.9	23.4	33.3	31.8
28.3	3.6	0.24	32.2	0.3	20.1	20.4	11.8
5.8	3.2	0.01	9.0	0.0	14.7	14.7	-5.7
3.5	2.1	0.03	5.6	0.2	2.8	3.1	2.5
3.9	2.1	0.02	6.0	0.0	1.0	1.0	5.0
4.4	1.2	0.06	5.7	0.9	2.9	3.7	1.9
5.6	0.0	0.01	5.6	0.9	4.6	5.5	0.1
179.3	20.7	1.64	201.6	18.4	125.0	143.4	58.2

Total Nitrogen

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
71	9	0.2	81	8.9	72	81	0
115	16	1.5	132	18.8	154	173	-41
71	27	0.6	98	4.8	69	74	24
144	24	0.6	169	43.5	102	146	23
80	13	0.9	94	0.9	71	72	22
24	19	0.0	43	0.0	38	38	4
30	9	0.3	40	2.4	30	32	7
14	9	0.2	23	0.0	16	16	6
37	7	0.3	44	11.3	36	48	-4
39	0	0.0	39	5.6	28	34	6
625	133	4.7	762	96	618	714	49

SRP

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
0.7	1.6	0.01	2.3	0.4	3.2	3.6	-1.3
0.3	2.3	0.01	2.6	0.8	6.6	7.4	-4.9
0.7	3.3	0.01	4.0	0.4	5.3	5.7	-1.7
0.9	2.2	0.02	3.1	3.4	8.1	11.5	-8.5
3.6	1.3	0.04	5.0	0.0	3.0	3.1	1.9
0.1	0.5	0.00	0.6	0.0	1.3	1.3	-0.7
0.8	0.2	0.01	0.9	0.1	0.9	0.9	0.0
0.0	0.6	0.00	0.7	0.0	0.5	0.5	0.2
0.2	0.3	0.01	0.5	0.2	0.7	0.9	-0.4
0.7	0.0	0.00	0.7	0.1	0.5	0.5	0.2
7.9	12.2	0.11	20.3	5.4	30.1	35.5	-15.2

Diss. Organic P

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
0.4	0.1	0.00	0.5	0.04	0.3	0.4	0.1
1.2	0.2	0.01	1.4	0.06	0.5	0.6	0.9
0.1	0.3	0.01	0.4	0.06	0.9	0.9	-0.6
2.0	0.2	0.03	2.3	0.46	1.1	1.5	0.8
0.8	0.2	0.01	1.0	0.00	0.3	0.4	0.7
0.1	0.2	0.00	0.3	0.00	0.3	0.3	0.0
0.3	0.1	0.00	0.4	0.02	0.2	0.2	0.2
0.0	0.2	0.00	0.3	0.00	0.1	0.1	0.2
0.2	0.1	0.00	0.3	0.14	0.4	0.6	-0.3
0.2	0.0	0.00	0.2	0.03	0.1	0.2	0.0
5.4	1.6	0.06	7.1	0.80	4.3	5.1	1.9

Particulate P

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
3.8	0.5	0.01	4.3	0.16	1.3	1.5	2.8
1.7	0.7	0.07	2.4	0.23	1.9	2.1	0.3
4.5	0.9	0.04	5.5	0.15	2.1	2.3	3.2
3.6	0.6	0.04	4.2	0.52	1.2	1.7	2.5
4.7	0.2	0.03	4.9	0.00	0.3	0.3	4.5
1.5	0.4	0.00	1.8	0.00	0.9	0.9	0.9
1.0	1.0	0.01	2.0	0.03	0.4	0.4	1.6
0.4	0.7	0.00	1.1	0.00	0.2	0.2	0.9
0.7	0.4	0.02	1.2	0.25	0.8	1.0	0.1
1.2	0.0	0.00	1.2	0.15	0.8	0.9	0.3
23.1	5.3	0.22	28.6	1.50	9.9	11.4	17.2

Total P

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
6.4	2.2	0.02	8.6	0.7	5.9	6.6	2.0
4.1	3.2	0.12	7.5	1.3	10.3	11.5	-4.1
6.5	4.7	0.07	11.3	0.7	10.0	10.7	0.6
7.6	3.4	0.10	11.1	4.7	11.1	15.8	-4.7
9.8	1.8	0.09	11.7	0.1	4.1	4.2	7.5
1.9	2.4	0.00	4.3	0.0	2.9	2.9	1.3
2.5	1.9	0.03	4.4	0.1	1.7	1.9	2.6
0.6	1.9	0.01	2.5	0.0	0.8	0.8	1.6
1.2	1.0	0.03	2.2	0.8	2.6	3.4	-1.2
2.2	0.0	0.00	2.2	0.4	1.8	2.1	0.1
42.8	22.5	0.46	65.8	8.7	51.2	60.0	5.8

TSS

Pond C							
Inputs (kg)				Losses (kg)			Load Removed (kg)
Pond B Inflow	Western Sub-Basin	Bulk Precipitation	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses	
558	38	0.08	596	43.1	350	393	203
1,155	110	31.00	1,296	104.3	855	959	337
2,203	242	13.46	2,459	64.4	924	988	1,471
1,130	284	15.40	1,430	143.2	337	480	949
2,680	77	10.43	2,768	2.9	223	226	2,542
493	78	0.15	571	0.0	439	439	132
468	115	1.12	584	15.3	192	207	377
286	131	0.41	417	0.0	67	67	350
475	65	1.68	542	57.1	183	240	302
337	2	0.36	340	28.7	144	173	167
9,786	1,143	74.09	11,003	459	3,714	4,173	6,830

D.3 Overall System

Ammonia

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
3.1	0.07	2.4	5.6	0.6	4.7	5.3	0.3	6
4.3	0.41	2.9	7.6	0.9	7.1	8.0	-0.4	-5
1.9	0.29	3.4	5.5	0.3	3.8	4.0	1.5	27
3.9	0.27	1.1	5.3	2.1	4.9	7.0	-1.7	-31
1.5	0.44	0.9	2.8	0.0	3.1	3.1	-0.4	-13
0.9	0.00	1.5	2.4	0.0	2.1	2.1	0.3	13
2.2	0.24	0.7	3.1	0.2	3.0	3.2	-0.1	-3
0.7	0.10	0.3	1.1	0.0	1.3	1.3	-0.2	-20
2.1	0.26	0.3	2.6	0.9	2.9	3.8	-1.2	-44
3.8	0.01	0.0	3.8	0.7	3.3	4.0	-0.2	-4
24.3	2.1	13.5	39.9	5.6	36.2	41.8	-1.9	-5

NOx

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
0.4	0.16	1.8	2.4	0.4	3.4	3.8	-1.5	-62
0.7	0.21	2.5	3.4	2.1	17.4	19.5	-16.1	-469
1.9	0.17	3.7	5.7	0.8	11.4	12.2	-6.5	-114
3.4	0.21	2.6	6.2	9.6	22.6	32.2	-26.0	-421
2.6	0.38	3.2	6.2	0.2	12.3	12.4	-6.2	-101
0.5	0.00	0.6	1.1	0.0	3.2	3.2	-2.1	-189
0.4	0.05	0.9	1.4	0.2	2.7	3.0	-1.6	-115
1.0	0.20	2.9	4.1	0.0	1.2	1.2	2.9	72
0.9	0.18	0.3	1.4	0.3	0.8	1.1	0.3	22
4.8	0.01	0.0	4.8	0.3	1.3	1.5	3.3	68
16.6	1.6	18.4	36.6	13.8	76.3	90.1	-53.5	-146

Diss. Organic N

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
33	0.32	3.8	37	4.5	37	41	-4	-11
51	0.75	8.1	60	10.7	87	98	-38	-63
13	0.44	15.6	29	1.5	22	24	5	18
50	0.27	16.3	67	12.9	30	43	23	35
18	0.36	4.7	23	0.3	25	25	-2	-8
7	0.00	9.8	17	0.0	16	16	1	4
15	0.12	4.2	20	1.6	20	22	-2	-9
4	0.06	3.2	7	0.0	12	12	-4	-58
23	0.20	3.7	27	7.0	22	29	-3	-10
19	0.01	0.1	19	2.9	15	18	2	8
234	2.5	69.5	306	41.4	286	327.7	-22	-7

Particulate N

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
3.0	0.10	1.15	4.2	2.42	20	22	-18	-420
3.9	2.29	1.84	8.0	2.86	23	26	-18	-228
9.9	0.56	2.96	13.4	0.86	12	13	0	1
42.6	0.49	2.47	45.6	9.94	23	33	12	27
11.9	0.64	3.64	16.2	0.26	20	20	-4	-26
1.4	0.01	3.23	4.7	0.00	15	15	-10	-213
3.2	0.07	2.06	5.4	0.23	3	3	2	43
1.7	0.05	2.12	3.9	0.00	1	1	3	74
9.1	0.16	1.21	10.5	0.89	3	4	7	64
4.9	0.02	0.03	5.0	0.91	5	5	-1	-11
92	4.4	20.7	116.9	18.4	125	143	-27	-23

Total Nitrogen

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
42	0.6	9.1	52	9	72	81	-29	-56
62	4.0	15.7	82	19	154	173	-91	-111
34	1.7	26.7	63	5	69	74	-11	-18
131	1.5	24.0	156	43	102	146	11	7
45	2.5	13.4	61	1	71	72	-11	-18
10	0.0	18.5	29	0	38	38	-10	-33
22	0.7	9.5	32	2	30	32	0	0
9	0.5	8.7	18	0	16	16	1.6	9
38	0.9	6.8	46	11	36	48	-2	-4
34	0.1	0.2	34	6	28	34	1	2
427	12.6	132.8	572	96	618	714	-141	-25

SRP

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
1.8	0.02	1.6	3.4	0.4	3.2	3.6	-0.1	-4
3.0	0.04	2.3	5.3	0.8	6.6	7.4	-2.1	-40
1.6	0.02	3.3	4.9	0.4	5.3	5.7	-0.8	-17
3.9	0.06	2.2	6.1	3.4	8.1	11.5	-5.4	-88
1.6	0.11	1.3	3.0	0.0	3.0	3.1	0.0	-1
0.4	0.00	0.5	0.9	0.0	1.3	1.3	-0.4	-44
0.3	0.03	0.2	0.5	0.1	0.9	0.9	-0.4	-81
0.1	0.01	0.6	0.7	0.0	0.5	0.5	0.2	32
0.5	0.02	0.3	0.8	0.2	0.7	0.9	-0.1	-16
0.9	0.00	0.0	0.9	0.1	0.5	0.5	0.4	40
14.1	0.3	12.2	26.6	5.4	30.1	35.5	-8.9	-33

Diss. Organic P

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
0.2	0.01	0.1	0.4	0.0	0.3	0.4	0.0	-8
0.7	0.03	0.2	0.9	0.1	0.5	0.6	0.3	37
0.3	0.02	0.3	0.6	0.1	0.9	0.9	-0.3	-52
1.7	0.08	0.2	2.0	0.5	1.1	1.5	0.5	23
0.4	0.02	0.2	0.6	0.0	0.3	0.4	0.2	39
0.4	0.00	0.2	0.6	0.0	0.3	0.3	0.3	46
0.3	0.01	0.1	0.5	0.0	0.2	0.2	0.2	51
0.1	0.00	0.2	0.3	0.0	0.1	0.1	0.2	64
0.4	0.01	0.1	0.5	0.1	0.4	0.6	-0.1	-24
0.2	0.00	0.0	0.2	0.0	0.1	0.2	0.0	13
4.6	0.2	1.6	6.4	0.8	4.3	5.1	1.3	20

Particulate P

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
1.3	0.02	0.5	1.8	0.2	1.3	1.5	0.3	17
0.8	0.20	0.7	1.7	0.2	1.9	2.1	-0.4	-26
1.4	0.10	0.9	2.4	0.1	2.1	2.3	0.2	7
4.0	0.12	0.6	4.7	0.5	1.2	1.7	3.0	63
2.8	0.08	0.2	3.0	0.0	0.3	0.3	2.7	89
0.4	0.00	0.4	0.7	0.0	0.9	0.9	-0.1	-20
0.8	0.02	1.0	1.8	0.0	0.4	0.4	1.4	76
0.2	0.01	0.7	0.9	0.0	0.2	0.2	0.7	81
3.0	0.05	0.4	3.5	0.2	0.8	1.0	2.4	70
0.7	0.00	0.0	0.8	0.2	0.8	0.9	-0.2	-23
15.4	0.6	5.3	21.3	1.5	9.9	11.4	9.9	47

Total P

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
3.6	0.05	2.2	5.9	0.7	5.9	6.6	-0.7	-12
4.8	0.31	3.2	8.3	1.3	10.3	11.5	-3.2	-38
3.8	0.19	4.7	8.8	0.7	10.0	10.7	-1.9	-22
12.8	0.26	3.4	16.5	4.7	11.1	15.8	0.7	4
5.5	0.25	1.8	7.6	0.1	4.1	4.2	3.4	45
1.3	0.00	2.4	3.6	0.0	2.9	2.9	0.7	20
1.8	0.07	1.9	3.8	0.1	1.7	1.9	2.0	51
0.5	0.02	1.9	2.4	0.0	0.8	0.8	1.5	65
4.0	0.07	1.0	5.0	0.8	2.6	3.4	1.6	32
2.0	0.01	0.0	2.0	0.4	1.8	2.1	-0.1	-5
40.1	1.2	22.5	63.9	8.7	51.2	60.0	3.9	6

TSS

Overall System								
Total System Inputs (kg)				Total System Losses (kg)			Load Removed (kg)	Removal Efficiency (%)
Northern Sub-Basin	Bulk Precipitation	Western Sub-Basin	Total Inputs	Western Sub-Basin	Pond C Outfall	Total Losses		
346	0.2	37.6	384	43	350	393	-9	-2
505	83.2	110.1	698	104	855	959	-261	-37
583	36.2	242	861	64	924	988	-128	-15
5,932	41.4	284	6,258	143	337	480	5,778	92
2,307	28.0	77	2,412	3	223	226	2,186	91
209	0.3	77.9	288	0	439	439	-152	-53
263	3.0	115	381	15	192	207	174	46
110	1.1	131	242	0	67	67	175	72
1,662	4.5	65	1,731	57	183	240	1,491	86
165	0.9	2	168	29	144	173	-5	-3
12,081	199	1,143	13,423	459	3,714	4,173	9,250	69

APPENDIX E

LABORATORY QUALITY ASSURANCE DATA

- **E.1 Precision**
- **E.2 Accuracy**
- **E.3 Control Standard Recovery**
- **E.4 Continuing calibration Verification**
- **E.5 Method Blanks**

E.1 Precision

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
pH	s.u.	08-1024	Rain	5/24 - 6/1/8	06/01/08	06/04/08	5.65	5.67	5.7	0.0	**0.25**	0-2
pH	s.u.	08-2033	Site 2 F.D.	9/6 - 9/15/08	09/15/08	09/17/08	7.07	7.09	7.1	0.0	**0.20**	0-2
pH	s.u.	08-2220	Rain	9/15 - 9/13/08	09/13/08	09/29/08	6.12	6.15	6.1	0.0	**0.35**	0-2
pH	s.u.	08-2481	Site 4	10/9 - 10/13/08	10/13/08	10/15/08	7.13	7.12	7.1	0.0	**0.10**	0-2
pH	s.u.	08-2456	Rain	10/5 - 10/8/08	10/08/08	10/22/08	6.20	6.22	6.2	0.0	**0.23**	0-2
pH	s.u.	08-2658	Rain	10/23 - 10/25/08	10/25/08	10/29/08	6.49	6.53	6.5	0.0	**0.43**	0-2
pH	s.u.	08-2715	Site 4 F.D.	10/27 - 11/3/08	11/03/08	11/04/08	7.37	7.41	7.4	0.0	**0.38**	0-2
pH	s.u.	08-2958	Site 4	11/10 - 11/17/08	11/17/08	11/17/08	7.47	7.49	7.5	0.0	**0.19**	0-2
pH	s.u.	10-2063	Rain	8/10 - 8/16/10	08/16/10	08/21/10	5.82	5.79	5.8	0.0	**0.37**	0-2
pH	s.u.	10-2127	Rain	8/16 - 8/23/10	08/23/10	08/26/10	5.43	5.41	5.4	0.0	**0.26**	0-2
pH	s.u.	10-1960	Rain Blank	08/04/10	08/04/10	08/05/10	5.67	5.65	5.7	0.0	**0.25**	0-2
pH	s.u.	10-2356	Site #3	9/7 – 9/13/10	09/13/10	09/17/10	7.59	7.61	7.6	0.0	**0.19**	0-2
pH	s.u.	10-1955	Rain	7/26 - 8/4/10	08/04/10	08/05/10	6.53	6.50	6.5	0.0	**0.33**	0-2
pH	s.u.	10-2278	Rain Blank	09/01/10	09/01/10	09/02/10	5.68	5.69	5.7	0.0	**0.12**	0-2
pH	s.u.	10-2273	Site #4	8/23 - 9/1/10	09/01/10	09/02/10	7.58	7.61	7.6	0.0	**0.28**	0-2
pH	s.u.	10-1629	Rain	6/25 - 7/6/10	07/06/10	07/07/10	5.05	5.06	5.1	0.0	**0.14**	0-2
pH	s.u.	10-1166	Site #2	5/12 - 5/18/10	05/18/10	05/20/10	7.26	7.29	7.3	0.0	**0.29**	0-2
pH	s.u.	10-1115	Rain Blank	05/12/10	05/12/10	05/17/10	5.46	5.45	5.5	0.0	**0.13**	0-2
pH	s.u.	10-1169	Rain	5/12 - 5/18/10	05/18/10	05/20/10	5.97	5.99	6.0	0.0	**0.24**	0-2
pH	s.u.	10-1217	Site #4	5/18 - 5/25/10	05/25/10	05/27/10	7.33	7.31	7.3	0.0	**0.19**	0-2
pH	s.u.	10-1326	Rain	5/25 - 5/31/10	05/31/10	06/08/10	5.91	5.89	5.9	0.0	**0.24**	0-2
pH	s.u.	10-1407	Rain Blank	06/10/10	06/10/10	06/14/10	5.61	5.60	5.6	0.0	**0.13**	0-2
pH	s.u.	10-3020	Rain Blank	11/08/10	11/08/10	11/10/10	5.71	5.71	5.7	0.0	**0.00**	0-2
pH	s.u.	10-3254	Rain	11/8 - 12/3/10	12/03/10	12/07/10	5.94	5.94	5.9	0.0	**0.00**	0-2
pH	s.u.	11-0200	Site #1	1/12 - 1/19/11	01/19/11	01/21/11	6.80	6.83	6.8	0.0	**0.31**	0-2
pH	s.u.	11-0009	Rain Blank	01/03/11	01/03/11	01/06/11	5.52	5.50	5.5	0.0	**0.26**	0-2
pH	s.u.	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/17/11	6.29	6.31	6.3	0.0	**0.22**	0-2
pH	s.u.	11-0205	Rain	1/12 - 1/19/11	01/19/11	01/21/11	5.33	5.35	5.3	0.0	**0.26**	0-2
pH	s.u.	11-0499	Rain	2/1 - 2/10/11	02/10/11	02/14/11	5.41	5.40	5.4	0.0	**0.13**	0-2

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Alkalinity	mg/l	08-1024	Rain	5/24 - 6/1/8	06/01/08	06/04/08	2	2	2.4	0.0	**0.00**	0-4
Alkalinity	mg/l	08-2033	Site 2 F.D.	9/6 - 9/15/08	09/15/08	09/17/08	64	64	63.8	0.3	**0.44**	0-4
Alkalinity	mg/l	08-2220	Rain	9/15 - 9/13/08	09/13/08	09/29/08	7	7	7.3	0.1	**1.94**	0-4
Alkalinity	mg/l	08-2481	Site 4	10/9 - 10/13/08	10/13/08	10/15/08	60	60	60.1	0.4	**0.71**	0-4
Alkalinity	mg/l	08-2456	Rain	10/5 - 10/8/08	10/08/08	10/22/08	3.8	4.0	3.9	0.1	**3.63**	0-4
Alkalinity	mg/l	08-2658	Rain	10/23 - 10/25/08	10/25/08	10/29/08	6.2	6.0	6.1	0.1	**2.32**	0-4
Alkalinity	mg/l	08-2715	Site 4 F.D.	10/27 - 11/3/08	11/03/08	11/04/08	58.8	58.6	58.7	0.1	**0.24**	0-4
Alkalinity	mg/l	08-2958	Site 4	11/10 - 11/17/08	11/17/08	11/17/08	65.2	64.8	65.0	0.3	**0.44**	0-4
Alkalinity	mg/l	10-1629	Rain	6/25 - 7/6/10	07/06/10	07/07/10	1.4	1.4	1.4	0.0	**0.00**	0-4
Alkalinity	mg/l	10-2063	Rain	8/10 - 8/16/10	08/16/10	08/21/10	6.2	5.9	6.0	0.1	**2.34**	0-4
Alkalinity	mg/l	10-2127	Rain	8/16 - 8/23/10	08/23/10	08/26/10	2	2	2	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1955	Rain	7/26 - 8/4/10	08/04/10	08/05/10	18.0	17.4	17.7	0.4	**2.40**	0-4
Alkalinity	mg/l	10-2356	Site #3	9/7 – 9/13/10	09/13/10	09/17/10	86.6	87.2	86.9	0.4	**0.49**	0-4
Alkalinity	mg/l	10-2278	Rain Blank	09/01/10	09/01/10	09/02/10	0.6	0.6	0.6	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1960	Rain Blank	08/04/10	08/04/10	08/05/10	0.6	0.6	0.6	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1115	Rain Blank	05/12/10	05/12/10	05/17/10	0.4	0.4	0.4	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1169	Rain	5/12 - 5/18/10	05/18/10	05/20/10	4	4	4.4	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1217	Site #4	5/18 - 5/25/10	05/25/10	05/27/10	59.4	58.8	59.1	0.4	**0.72**	0-4
Alkalinity	mg/l	10-1326	Rain	5/25 - 5/31/10	05/31/10	06/08/10	10.6	10.4	10.5	0.1	**1.35**	0-4
Alkalinity	mg/l	10-1407	Rain Blank	06/10/10	06/10/10	06/14/10	0.4	0.4	0.4	0.0	**0.00**	0-4
Alkalinity	mg/l	10-1166	Site #2	5/12 - 5/18/10	05/18/10	05/20/10	52.6	53.2	52.9	0.4	**0.80**	0-4
Alkalinity	mg/l	10-2273	Site #4	8/23 - 9/1/10	09/01/10	09/02/10	79.4	78.8	79.1	0.4	**0.54**	0-4
Alkalinity	mg/l	10-3020	Rain Blank	11/08/10	11/08/10	11/10/10	0.6	0.6	0.6	0.0	**0.00**	0-4
Alkalinity	mg/l	10-3254	Rain	11/8 - 12/3/0	12/03/00	12/07/10	14	14	14	0.3	**2.05**	0-4
Alkalinity	mg/l	11-0200	Site #1	1/12 - 1/19/11	01/19/11	01/21/11	42.0	42.2	42.1	0.1	**0.34**	0-4
Alkalinity	mg/l	11-0009	Rain Blank	01/03/11	01/03/11	01/06/11	0.4	0.4	0.4	0.0	**0.00**	0-4
Alkalinity	mg/l	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/17/11	15.4	16.0	15.7	0.4	**2.70**	0-4
Alkalinity	mg/l	11-0205	Rain	1/12 - 1/19/11	01/19/11	01/21/11	2.8	2.8	2.8	0.0	**0.00**	0-4
Alkalinity	mg/l	11-0499	Rain	2/1 - 2/10/11	02/10/11	02/14/11	1.8	1.8	1.8	0.0	**0.00**	0-4

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Conductivity	μΩ	08-0793	Site 4 Sampler Blank	04/30/08	04/30/08	05/13/08	2	2	2	0.0	**0.00**	0-5
Conductivity	μΩ	08-1145	Rain	6/17 - 6/23/08	06/23/08	07/07/08	13.1	13.0	13.1	0.1	**0.54**	0-5
Conductivity	μΩ	08-2037	Site 1	9/6 - 9/15/8	09/15/08	09/17/08	248	245	247	2.1	**0.86**	0-5
Conductivity	μΩ	08-2220	Rain	9/15 - 9/23/8	09/23/08	09/30/08	104.0	103.0	103.5	0.7	**0.68**	0-5
Conductivity	μΩ	08-2457	Rain Blank	10/09/08	10/09/08	10/23/08	2.3	2.2	2.3	0.1	**3.14**	0-5
Conductivity	μΩ	08-2482	Rain	10/09/08	10/09/08	10/23/08	17.8	18.0	17.9	0.1	**0.79**	0-5
Conductivity	μΩ	08-0968	Rain	5/20 - 5/24/08	05/24/08	05/28/08	68	67.6	68	0.3	**0.42**	0-5
Conductivity	μΩ	08-2715	Site 4 Field Dup	10/27 - 11/3/8	11/03/08	11/18/08	365	366	366	0.7	**0.19**	0-5
Conductivity	μΩ	10-1761	Site #4	7/6 - 7/14/10	07/14/10	07/15/10	689.0	689.0	689.0	0.0	**0.00**	0-5
Conductivity	μΩ	10-1872	Site #4	7/19 - 7/26/10	07/26/10	08/02/10	1377	1373	1375	2.8	**0.21**	0-5
Conductivity	μΩ	10-1954	Site #4	7/26 - 8/4/10	08/04/10	08/13/10	1610.0	1576.0	1593.0	24.0	**1.51**	0-5
Conductivity	μΩ	10-1407	Rain Blank	06/10/10	06/10/10	06/21/10	2	2	2	0.0	**0.00**	0-5
Conductivity	μΩ	10-1481	Rain	6/11 - 6/25/10	06/25/10	07/07/10	24	24	24	0.4	**1.49**	0-5
Conductivity	μΩ	10-1768	Site #4	7/14 - 7/19/10	07/19/10	08/02/10	1074	1081	1078	4.9	**0.46**	0-5
Conductivity	μΩ	10-1982	Rain	8/4 - 8/10/10	08/10/10	08/13/10	83	83	83	0.4	**0.43**	0-5
Conductivity	μΩ	10-2631	Rain Blank	10/05/10	10/05/10	10/14/10	2	2	2	0.0	**0.00**	0-5
Conductivity	μΩ	10-2680	Site #4	10/5 - 10/12/10	10/12/10	11/03/10	829.0	827.0	828.0	1.4	**0.17**	0-5
Conductivity	μΩ	10-2903	Site #4	10/18 - 10/28/10	10/28/10	11/16/10	1151.0	1146.0	1148.5	3.5	**0.31**	0-5
Conductivity	μΩ	10-3090	Site #4	11/8 - 11/19/10	11/19/10	11/30/10	906.0	913.0	909.5	4.9	**0.54**	0-5
Conductivity	μΩ	10-3254	Rain	11/18 - 12/3/10	12/03/10	12/17/10	93	93.0	93	0.3	**0.30**	0-5
Conductivity	μΩ	10-2278	Rain Blank	09/01/10	09/01/10	09/21/10	2	2	2	0.0	**0.00**	0-5
Conductivity	μΩ	10-2622	Site #1	9/21 - 10/5/10	10/05/10	10/14/10	255.0	255.0	255.0	0.0	**0.00**	0-5
Conductivity	μΩ	10-2713	Site #4	10/12 - 10/18/10	10/18/10	11/03/10	962	960	961	1.4	**0.15**	0-5
Conductivity	μΩ	10-3014	Site #4	10/28 - 11/8/10	11/08/10	11/30/10	1208.0	1210.0	1209.0	1.4	**0.12**	0-5
Conductivity	μΩ	11-0009	Rain Blank	01/03/11	01/03/11	01/24/11	2	2	2	0.0	**0.00**	0-5
Conductivity	μΩ	11-0371	Rain	1/19 - 2/1/11	02/01/11	02/17/11	37	37	37	0.1	**0.38**	0-5
Conductivity	μΩ	11-0499	Rain	2/1 - 2/10/11	02/10/11	03/01/11	58	58	58	0.1	**0.12**	0-5
Conductivity	μΩ	11-0600	Site #4	2/10 - 2/17/11	02/17/11	03/01/11	608	612	610	2.8	**0.46**	0-5
Conductivity	μΩ	11-0205	Rain	1/12 - 1/19/11	01/19/11	02/07/11	36	36	36	0.1	**0.39**	0-5

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Turbidity	NTU	08-1413	rain	7/15 – 7/17/08	07/17/08	07/23/08	2	2	2	0.0	**0.00**	0 - 3.7
Turbidity	NTU	08-2457	Rain blank	10/09/08	10/09/08	10/19/08	0.01	0.01	0.0	0.0	**0.00**	0 - 3.7
Turbidity	NTU	08-2481	site 4	10/9 – 10/13/08	10/13/08	10/10/08	8	8	8	0.0	**0.00**	0 - 3.7
Turbidity	NTU	08-2716	site 4 blank	11/03/08	11/03/08	11/03/08	0.01	0.01	0.0	0.0	**0.00**	0 - 3.7
Turbidity	NTU	08-2656	site 4	10/30 – 10/27/08	10/27/08	10/28/08	3.9	4.1	4.0	0.1	**3.54**	0 - 3.7
Turbidity	NTU	08-2037	Site #1	9/6 - 9/15/08	09/15/08	09/16/08	4.7	4.6	4.7	0.1	**1.52**	0 - 3.7
Turbidity	NTU	08-2658	Rain	10/23 - 10/25/08	10/25/08	10/28/08	2.2	2.2	2.2	0.0	**0.00**	0 - 3.7
Turbidity	NTU	08-2958	Site 4	11/10 - 11/17/08	11/17/08	11/17/08	3.8	3.9	3.9	0.1	**1.84**	0 - 3.7
Turbidity	NTU	10-1166	Site #2	5/12 - 5/18/10	05/18/10	05/19/10	10.2	10.5	10.4	0.2	**2.05**	0 - 3.7
Turbidity	NTU	10-1326	Rain	5/25 - 5/31/10	05/31/10	06/03/10	10.2	10	10.1	0.1	**1.40**	0 - 3.7
Turbidity	NTU	10-1403	Rain	5/31 - 6/10/10	06/10/10	06/11/10	5.5	5.7	5.6	0.1	**2.53**	0 - 3.7
Turbidity	NTU	10-1407	Rain Equipment Blank	06/10/10	06/10/10	06/11/10	0.3	0.3	0.3	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-1629	Rain	6/25 - 7/9/10	07/09/10	07/07/10	3	3	3	0.1	**3.34**	0 - 3.7
Turbidity	NTU	10-1761	Site #4	7/6 - 7/14/10	07/14/10	07/15/10	5	5	5	0.1	**1.55**	0 - 3.7
Turbidity	NTU	10-1960	Rain Blank	08/04/10	08/04/10	08/05/10	0.2	0.2	0.2	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-2063	Rain	8/10 - 8/16/10	08/16/10	08/18/10	3	3	3	0.1	**2.32**	0 - 3.7
Turbidity	NTU	10-2477	Site #4	9/13 - 9/21/10	09/21/10	09/22/10	0.9	0.9	0.9	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-2626	Rain	9/13 - 10/5/10	10/05/10	10/06/10	4.1	4	4.1	0.1	**1.75**	0 - 3.7
Turbidity	NTU	10-2713	Site #4	10/12 - 10/18/10	10/18/10	10/19/10	8.1	7.9	8.0	0.1	**1.77**	0 - 3.7
Turbidity	NTU	10-2901	Site #1	10/18 - 10/28/10	10/28/10	10/29/10	2.3	2.3	2.3	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-1982	Rain	8/4 - 8/10/10	08/10/10	08/11/10	1.1	1.1	1.1	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-3015	Rain	10/28 - 11/8/10	11/08/10	11/09/10	1.8	1.8	1.8	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-3020	Rain Blank	11/08/10	11/08/10	11/09/10	0.2	0.2	0.2	0.0	**0.00**	0 - 3.7
Turbidity	NTU	10-3327	Rain Blank	12/13/10	12/13/10	12/15/10	0.3	0.3	0.3	0.0	**0.00**	0 - 3.7
Turbidity	NTU	11-0009	Rain Blank	01/03/11	01/03/11	01/05/11	0.5	0.5	0.5	0.0	**0.00**	0 - 3.7
Turbidity	NTU	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/13/11	2	2	2	0.1	**3.14**	0 - 3.7
Turbidity	NTU	11-0499	Rain	2/1 - 2/10/11	02/10/11	02/11/11	3.7	3.85	3.8	0.1	**2.81**	0 - 3.7
Turbidity	NTU	11-0600	Site #4	2/10 - 2/17/11	02/17/11	02/18/11	3.3	3.3	3.3	0.0	**0.00**	0 - 3.7
Turbidity	NTU	11-0205	Rain	1/12 - 1/19/11	01/19/11	01/20/11	1	1	1.0	0.0	**0.00**	0 - 3.7

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
TSS	mg/L	08-2034	Site 2 Blank	09/15/08	09/15/08	09/18/08	0.10	0.10	0.1	0.0	**0.00**	0 - 13
TSS	mg/L	08-2342	Rain	09/30/08	09/30/08	10/06/08	8.00	8.00	8.0	0.0	**0.00**	0 - 13
TSS	mg/L	08-2454	Site 4	10/3 - 10/9/08	10/09/08	10/20/08	4.30	4.05	4.2	0.2	**4.23**	0 - 13
TSS	mg/L	08-2563	Site 1	10/14 - 10/20/08	10/20/08	10/20/08	30.20	28.30	29.3	1.3	**4.59**	0 - 13
TSS	mg/L	08-2037	Site #1	9/6 - 9/15/08	09/15/08	09/18/08	15.40	16.00	15.7	0.4	**2.70**	0 - 13
TSS	mg/L	08-2219	Site #4	9/15 - 9/27/08	09/27/08	09/29/08	4.00	4.10	4.1	0.1	**1.75**	0 - 13
TSS	mg/L	08-2715	Site 4 F.D.	10/27 - 11/3/08	11/03/08	11/04/08	4.44	4.75	4.6	0.2	**4.77**	0 - 13
TSS	mg/L	08-2958	Site 4	11/10 - 11/17/08	11/17/08	11/18/08	5.30	5.40	5.4	0.1	**1.32**	0 - 13
TSS	mg/L	10-1166	Site #2	5/12 - 5/18/10	05/18/10	05/19/10	31.7	29.1	30.4	1.8	**6.05**	0 - 13
TSS	mg/L	10-1324	Site #2	5/25 - 5/31/10	05/31/10	06/04/10	10.4	11.4	10.9	0.7	**6.49**	0 - 13
TSS	mg/L	10-1326	Rain	5/25 - 5/31/10	05/31/10	06/04/10	50.5	49.0	49.8	1.1	**2.13**	0 - 13
TSS	mg/L	10-1407	Rain Blank	06/10/10	06/10/10	06/14/10	0.3	0.3	0.3	0.0	**0.00**	0 - 13
TSS	mg/L	10-1481	Rain	6/11 - 6/25/10	06/25/10	06/28/10	21.0	17.5	19.3	2.5	**12.86**	0 - 13
TSS	mg/L	10-1629	Rain	6/25 - 7/6/10	07/06/10	07/07/10	6	6.5	6.3	0.4	**5.66**	0 - 13
TSS	mg/L	10-1955	Rain	7/26 - 8/4/10	08/04/10	08/06/10	31	29.4	30.2	1.1	**3.75**	0 - 13
TSS	mg/L	10-2063	Rain	8/10 - 8/16/10	08/16/10	08/20/10	43	43	43.0	0.0	**0.00**	0 - 13
TSS	mg/L	10-2127	Rain	8/16 - 8/23/10	08/23/10	08/25/10	3.2	2.7	3.0	0.4	**11.98**	0 - 13
TSS	mg/L	10-2278	Rain Blank	09/01/10	09/01/10	09/06/10	0.4	0.4	0.4	0.0	**0.00**	0 - 13
TSS	mg/L	10-2355	Site #2	9/7 - 9/13/10	09/13/10	09/14/10	33.2	28.8	31.0	3.1	**10.04**	0 - 13
TSS	mg/L	10-2628	Site #2 Blank	10/05/10	10/05/10	10/06/10	0.3	0.3	0.3	0.0	**0.00**	0 - 13
TSS	mg/L	10-2358	Rain	9/7 - 9/13/10	09/13/10	09/14/10	3.2	3.4	3.3	0.1	**4.29**	0 - 13
TSS	mg/L	10-2631	Rain Blank	10/05/10	10/05/10	10/06/10	0.3	0.3	0.3	0.0	**0.00**	0 - 13
TSS	mg/L	10-2903	Site #4	10/18 - 10/28/10	10/28/10	11/02/10	8.7	9.3	9.0	0.4	**4.71**	0 - 13
TSS	mg/L	10-3015	Rain	10/28 - 11/8/10	11/08/10	11/13/10	5.2	4.6	4.9	0.4	**8.66**	0 - 13
TSS	mg/L	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/18/11	3.2	3.4	3.3	0.1	**4.29**	0 - 13
TSS	mg/L	11-0376	Rain Blank	02/01/11	02/01/11	02/06/11	0.3	0.3	0.3	0.0	**0.00**	0 - 13
TSS	mg/L	11-0499	Rain	2/1 - 2/10/11	02/10/11	02/15/11	6.4	5.8	6.1	0.4	**6.96**	0 - 13
TSS	mg/L	11-0600	Site #4	2/10 - 2/17/11	02/17/11	02/22/11	3.2	2.9	3.1	0.2	**6.96**	0 - 13
TSS	mg/L	11-0205	Rain	1/12 - 1/19/11	01/19/11	01/20/11	0.8	0.7	0.8	0.1	**9.43**	0 - 13

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
SRP	µg/l	10-1112F	Site # 2 Sampler Blank	05/12/10	05/12/10	05/13/10	3	3	3.0	0.0	**0.00**	0-5
SRP	µg/l	10-1166F	Site #2	5/12/10 - 5/18/10	05/18/10	05/20/10	6	6	6.0	0.0	**0.00**	0-5
SRP	µg/l	10-1407F	Rain Equipment Blank	06/10/10	06/10/10	06/11/10	0	0	0.0	0.0	**0.00**	0-5
SRP	µg/l	10-1629F	Rain	06/25/10-07/06/10	07/06/10	07/08/10	0	0	0.0	0.0	**0.00**	0-5
SRP	µg/l	10-1960f	Rain Equipment Blank	08/04/10	08/04/10	08/04/10	213	213	213.0	0.0	**0.00**	0-5
SRP	µg/l	10-2063F	Rain	8/10/10 - 8/16/10	08/16/10	08/18/10	155	155	155	0.0	**0.00**	0-5
SRP	µg/l	10-2126F	Site #4	8/16/10 - 8/23/10	08/23/10	08/25/10	74	74	0.0	0.0	**0.00**	0-5
SRP	µg/l	10-2626F	Rain	9/13/10 - 10/5/10	10/06/10	10/08/10	241	243	242	1.4	**0.58**	0-5
SRP	µg/l	10-2901F	Site # 1	10/18/10 - 10/28/10	10/28/10	11/08/10	18	18	18.0	0.0	**0.00**	0-5
SRP	µg/l	10-3017F	Site #2 Sampler Blank	11/08/10	11/08/10	11/21/10	0	0	0.0	0.0	**0.00**	0-5
SRP	µg/l	10-3303F	Site # 4	12/3/10 - 12/8/10	12/08/10	12/09/10	13.5	13	13	0.4	**2.67**	0-5
SRP	µg/l	10-3324F	Site # 2 Sampler Blank	12/13/10	12/13/10	12/15/10	0.001	0.001	0.0	0.0	**0.00**	0-5
SRP	µg/l	10-3327F	Rain Equipment Blank	12/13/10	12/13/10	12/15/10	0	0	0	0.0	**0.00**	0-5
SRP	µg/l	11-0373F	Site # 2 Sampler Blank	02/01/11	02/01/11	02/08/11	0	0	0.0	0.0	**0.00**	0-5
SRP	µg/l	11-0797F	Site #4	2/17/11 - 2/24/11	02/24/11	03/02/11	22	23	22.5	0.0	**0.03**	0-5
NOx	µg/l	10-1112F	Site # 2 Sampler Blank	05/12/10	05/12/10	05/13/10	0	0	0	0.0	**0.00**	0-4
NOx	µg/l	10-1166F	Site #2	5/12/10 - 5/18/10	05/18/10	05/20/10	11.4	12	11.7	0.4	**3.63**	0-4
NOx	µg/l	10-1407F	Rain Equipment Blank	06/10/10	06/10/10	06/11/10	0	0	0.0	0.0	**0.00**	0-4
NOx	µg/l	10-1629F	Rain	06/25/10-07/06/10	07/06/10	07/08/10	2	3	2.5	0.1	**2.89**	0-4
NOx	µg/l	10-1960f	Rain Equipment Blank	08/04/10	08/04/10	08/04/10	0.001	0.001	0.0	0.0	**0.00**	0-4
NOx	µg/l	10-2063F	Rain	8/10/10 - 8/16/10	08/16/10	08/18/10	177	171	174.0	4.2	**2.44**	0-4
NOx	µg/l	10-2126F	Site #4	8/16/10 - 8/23/10	08/23/10	08/25/10	192	194	193.0	1.4	**0.73**	0-4
NOx	µg/l	10-2626F	Rain	9/13/10 - 10/5/10	10/06/10	10/08/10	157	163	160.0	4.2	**2.65**	0-4
NOx	µg/l	10-2901F	Site # 1	10/18/10 - 10/28/10	10/28/10	11/08/10	32	32	32.0	0.0	**0.00**	0-4
NOx	µg/l	10-3017F	Site #2 Sampler Blank	11/08/10	11/08/10	11/21/10	0	0.001	0.0	0.0	**0.00**	0-4
NOx	µg/l	10-3303F	Site # 4	12/3/10 - 12/8/10	12/08/10	12/09/10	19.49	20.5	20.0	0.7	**3.57**	0-4
NOx	µg/l	10-3324F	Site # 2 Sampler Blank	12/13/10	12/13/10	12/15/10	0.001	0.001	0.0	0.0	**0.00**	0-4
NOx	µg/l	10-3327F	Rain Equipment Blank	12/13/10	12/13/10	12/15/10	0.001	0.001	0.0	0.0	**0.00**	0-4
NOx	µg/l	10-0720F	Site # 2	03/21/10	03/25/10	03/26/10	771	770	770.5	0.7	**0.09**	0-4
NOx	µg/l	11-0373F	Site # 2 Sampler Blank	02/01/11	02/01/11	02/08/11	0	0	0	0.0	**0.00**	0-4
NOx	µg/l	11-0797F	Site #4	2/17/11 - 2/24/11	02/24/11	03/02/11	126	129	127.5	2.1	**1.66**	0-4

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Total N	µg/l	10-1110P	Site # 4	05/03/10-05/12/10	05/12/10	05/26/10	426	450	438.0	17.0	**3.87**	0-10
Total N	µg/l	10-1112FP	Site # 2 Sampler Blank	05/12/10	05/12/10	05/26/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1168P	Site #4	5/12/10 - 5/18/10	05/18/10	06/01/10	633	610	621.5	16.3	**2.62**	0-10
Total N	µg/l	10-1215P	Site #1	05/18/10-05/25/10	05/25/10	06/04/10	521	568	544.5	33.2	**6.10**	0-10
Total N	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/23/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1478FP	Site #1	6/11 - 6/25/10	06/26/10	07/02/10	485	483	484.0	1.4	**0.29**	0-10
Total N	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/13/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1634FP	Rain Equipment Blank	06/25/10-07/06/10	07/06/10	07/13/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1761P	Site #4	7/06 - 7/14/10	07/14/10	07/26/10	700	685	693	10.6	**1.53**	0-10
Total N	µg/l	10-1767P	Site #2	07/14/10-07/19/10	07/19/10	07/27/10	1760	1833	1796.5	51.6	**2.87**	0-10
Total N	µg/l	10-1956P	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1956FP	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1960FP	Rain Equipment Blank	08/04/10	08/04/10	08/16/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-1981P	Site #4	8/4/10 - 8/10/10	08/10/10	08/17/10	1209	1185	1197	17.0	**1.42**	0-10
Total N	µg/l	10-2061FP	Site #3	8/10/10 - 8/16/10	08/16/10	08/20/10	371	378	374.5	4.9	**1.32**	0-10
Total N	µg/l	10-2125FP	Site #3	8/16/10 - 8/23/10	08/23/10	10/07/10	1196	1159	1177.5	26.2	**2.22**	0-10
Total N	µg/l	10-2270FP	Site # 1	8/23/10 - 9/1/10	09/01/10	11/29/10	69	61	65.0	5.7	**8.70**	0-10
Total N	µg/l	10-2278FP	Rain Equipment Blank	09/01/10	09/01/10	11/29/10	0	0	0	0.0	**0.00**	0-10
Total N	µg/l	10-2291FP	Site # 1	9/1/10 - 9/7/10	09/07/10	12/02/10	12.4	13.5	13.0	0.8	**6.01**	0-10
Total N	µg/l	10-2356FP	Site # 3	9/7/10 - 9/13/10	09/13/10	12/06/10	1551	1528	1539.5	16.3	**1.06**	0-10
Total N	µg/l	10-2475FP	Site # 2	9/13/10 - 9/21/10	09/21/10	12/16/10	769	792	781	16.3	**2.08**	0-10
Total N	µg/l	10-2477FP	Site # 4	9/13/10 - 9/21/10	09/21/10	12/16/10	308	302	305	4.2	**1.39**	0-10
Total N	µg/l	10-2623P	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	1835	1866	1850.5	21.9	**1.18**	0-10
Total N	µg/l	10-2623FP	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	1493	1383	1438.0	77.8	**5.41**	0-10
Total N	µg/l	10-2713FP	Site # 4	10/12/10 - 10/18/10	10/18/10	12/28/10	494	457	475.5	26.2	**5.50**	0-10
Total N	µg/l	11-0008p	Site # 4 Sampler Blank	01/03/11	01/03/11	03/28/11	0.001	0.001	0.0	0.0	**0.00**	0-10
Total N	µg/l	11-0009fp	Rain Equipment Blank	01/03/11	01/03/11	03/28/11	0.001	0.001	0.0	0.0	**0.00**	0-10
Total N	µg/l	11-0118fp	Rain	12/21/11 - 1/12/11	01/12/11	03/28/11	2897	2955	2926.0	41.0	**1.40**	0-10
Total N	µg/l	11-0203fp	Site # 3	1/12/11 - 1/19/11	01/19/11	03/28/11	457	433	445.0	17.0	**3.81**	0-10
Total N	µg/l	11-0374p	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0.001	0.001	0.0	0.0	**0.00**	0-10
Total N	µg/l	11-0374fp	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0.001	0.001	0.0	0.0	**0.00**	0-10
Total N	µg/l	11-0499fp	Rain	2/1/11 - 2/10/11	02/10/11	03/28/11	1271	1311	1291.0	28.3	**2.19**	0-10
Total N	µg/l	11-0797fp	Site #4	2/17/11 - 2/24/11	02/24/11	03/28/11	546	567	556.5	14.8	**2.67**	0-10

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Total P	µg/l	10-1110P	Site # 4	05/03/10-05/12/10	05/12/10	05/26/10	57	58	57.5	0.7	**1.23**	0-5
Total P	µg/l	10-1112FP	Site # 2 Sampler Blank	05/12/10	05/12/10	05/26/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1168P	Site #4	5/12/10 - 5/18/10	05/18/10	06/01/10	70	67	68.5	2.1	**3.10**	0-5
Total P	µg/l	10-1215P	Site #1	05/18/10-05/25/10	05/25/10	06/04/10	46	45	45.5	0.7	**1.55**	0-5
Total P	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/23/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1478FP	Site #1	6/11 - 6/25/10	06/26/10	07/02/10	40	42.5	41.3	1.8	**4.29**	0-5
Total P	µg/l	10-1406P REDO	Site #4 Sampler Blank	06/10/10	06/10/10	07/07/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/13/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1634FP	Rain Equipment Blank	06/25/10-07/06/10	07/06/10	07/13/10	0	0	0	0.0	**0.00**	0-5
Total P	µg/l	10-1761P	Site #4	7/06 - 7/14/10	07/14/10	07/26/10	29	32	30	1.5	**4.88**	0-5
Total P	µg/l	10-1767P	Site #2	07/14/10-07/19/10	07/19/10	07/27/10	297	306	301.5	6.4	**2.11**	0-5
Total P	µg/l	10-1956P	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1956FP	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0	0	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1960FP	Rain Equipment Blank	08/04/10	08/04/10	08/16/10	0	0	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-1981P	Site #4	8/4/10 - 8/10/10	08/10/10	08/17/10	120	128.5	124.3	6.0	**4.84**	0-5
Total P	µg/l	10-2061FP	Site #3	8/10/10 - 8/16/10	08/16/10	08/20/10	229	246	237.7	11.7	**4.94**	0-5
Total P	µg/l	10-2125FP	Site #3	8/16/10 - 8/23/10	08/23/10	10/07/10	98	103	100.5	3.5	**3.52**	0-5
Total P	µg/l	10-2270FP	Site # 1	8/23/10 - 9/1/10	09/01/10	11/29/10	1060	1010	1035.0	35.4	**3.42**	0-5
Total P	µg/l	10-2278FP	Rain Equipment Blank	09/01/10	09/01/10	11/29/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Total P	µg/l	10-2291FP	Site # 1	9/1/10 - 9/7/10	09/07/10	12/02/10	442	457	449.5	10.6	**2.36**	0-5
Total P	µg/l	10-2356FP	Site # 3	9/7/10 - 9/13/10	09/13/10	12/06/10	21	23	22.0	0.8	**3.54**	0-5
Total P	µg/l	10-2475FP	Site # 2	9/13/10 - 9/21/10	09/21/10	12/16/10	66	67	67	0.7	**1.06**	0-5
Total P	µg/l	10-2623P	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	247	235	241	8.5	**3.52**	0-5
Total P	µg/l	10-2623FP	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	98	104	101.0	4.2	**4.20**	0-5
Total P	µg/l	10-2713FP	Site # 4	10/12/10 - 10/18/10	10/18/10	12/28/10	15	16	15.5	0.1	**0.46**	0-5
Total P	µg/l	11-0008p	Site # 4 Sampler Blank	01/03/11	01/03/11	03/28/11	0	0	0.0	0.0	**0.00**	0-5
Total P	µg/l	11-0009fp	Rain Equipment Blank	01/03/11	01/03/11	03/28/11	0	0	0.0	0.0	**0.00**	0-5
Total P	µg/l	11-0118fp	Rain	12/21/11 - 1/12/11	01/12/11	03/28/11	315	330	322.5	10.6	**3.29**	0-5
Total P	µg/l	11-0203fp	Site # 3	1/12/11 - 1/19/11	01/19/11	03/28/11	19	21	20.0	0.8	**3.90**	0-5
Total P	µg/l	11-0374p	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0	0	0.0	0.0	**0.00**	0-5
Total P	µg/l	11-0374fp	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0	0	0.0	0.0	**0.00**	0-5
Total P	µg/l	11-0499fp	Rain	2/1/11 - 2/10/11	02/10/11	03/28/11	37	40	38.5	1.5	**3.86**	0-5
Total P	µg/l	11-0797fp	Site #4	2/17/11 - 2/24/11	02/24/11	03/28/11	23	22	22.5	0.7	**3.14**	0-5

Sample Duplicate Recovery

For the Cameron Ditch Project Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	REPEAT 1	REPEAT 2	MEAN	s	% RELATIVE STD. DEVIATION (RSD)	ACCEPTANCE RANGE (% RSD)
Ammonia	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/29/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-1481P	Rain	6/11 - 6/25/10	06/26/10	06/29/10	327	325	326.0	1.4	**0.43**	0-10
Ammonia	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/15/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-1759P	Site #1	7/06 - 7/14/10	07/14/10	07/15/10	21	20	21	0.7	**3.45**	0-10
Ammonia	µg/l	10-1957P	Site #2 Sampler Blank	08/04/10	08/04/10	08/19/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-2062P	Site #4	8/10/10 - 8/16/10	08/16/10	08/22/10	51	50	50.5	0.7	**1.40**	0-10
Ammonia	µg/l	10-2126P	Site #4	8/16/10 - 8/23/10	08/23/10	09/28/10	59	61	60.0	1.4	**2.36**	0-10
Ammonia	µg/l	10-2477P	Site # 4	9/13/10 - 9/21/10	09/21/10	10/07/10	4	4	4.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-2629P	Site # 3 Sampler Blank	10/05/10	10/06/10	12/08/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-2680P	Site # 4	10/5/10 - 10/12/10	10/13/10	12/14/10	52	57	54.5	3.5	**6.49**	0-10
Ammonia	µg/l	10-2903P	Site # 4	10/18/10 - 10/28/10	10/28/10	12/15/10	38	44	41.2	3.9	**9.45**	0-10
Ammonia	µg/l	10-3090P	Site #4	11/8/10 - 11/19/10	11/19/10	12/17/10	47	45	46.0	1.4	**3.07**	0-10
Ammonia	µg/l	10-3018P	Site #3 Sampler Blank	11/08/10	11/08/10	12/17/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-3252P	Site # 3	11/19/10 - 12/3/10	12/03/10	12/21/10	39	39	39.0	0.0	**0.00**	0-10
Ammonia	µg/l	10-3324P	Site # 2 Sampler Blank	12/13/10	12/13/10	12/21/10	0	0	0.0	0.0	**0.00**	0-10
Ammonia	µg/l	11-0118P	Rain	12/21/11 - 1/12/11	01/12/11	02/04/11	2523	2524	2523.5	0.7	**0.03**	0-10
Ammonia	µg/l	11-0376p	Rain Equipment Blank	02/01/11	02/01/11	04/06/11	106	107	106.5	0.7	**0.66**	0-10
Ammonia	µg/l	11-0794P	Site #1	2/17/11 - 2/24/11	02/24/11	04/06/11	0	0	0	0.0	**0.00**	0-10
Color	PCU	10-1115F	Rain Blank	05/12/10	05/12/10	05/12/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Color	PCU	10-1166F	Site #2	05/12/10-05/18/10	05/18/10	05/19/10	43	43	43.0	0.0	**0.00**	0-5
Color	PCU	10-1326F	Rain	05/25/10-05/31/10	05/31/10	06/03/10	30	30	30.0	0.0	**0.00**	0-5
Color	PCU	10-1407F	Rain Blank	06/10/10	06/10/10	06/11/10	0.1	0.1	0.1	0.0	**0.00**	0-5
Color	PCU	10-1629F	Rain	06/25-07/06/10	07/06/10	07/07/10	5	5	5.0	0.0	**0.00**	0-5
Color	PCU	10-1760F	Site #2	07/06-07/14/10	07/14/10	07/14/10	58	58	58.0	0.0	**0.00**	0-5
Color	PCU	10-1761F	Site #4	07/06-07/14/10	07/14/10	07/14/10	58	58	58	0.0	**0.00**	0-5
Color	PCU	10-1768F	Site #4	07/14-07/19/10	07/19/10	07/20/10	55	55	55.0	0.0	**0.00**	0-5
Color	PCU	10-1957F	Site #2 SB	08/04/10	08/04/10	08/05/10	0	0	0.0	0.0	**0.00**	0-5
Color	PCU	10-1960F	Rain Equip. Blank	08/04/10	08/04/10	08/05/10	0	0	0.0	0.0	**0.00**	0-5
Color	PCU	10-2063F	Rain	08/10-08/16/10	08/16/10	08/17/10	12	12	12	0.0	**0.00**	0-5
Color	PCU	10-2626F	Rain	09/13-10/05/10	10/05/10	10/07/10	13	12	12.5	0.7	**5.66**	0-5
Color	PCU	11-0376F	Rain Equip. Blank	02/01/11	02/01/11	02/02/11	0	0	0	0.0	**0.00**	0-5
Color	PCU	11-0499F	Rain	02/01-02/10/11	02/10/11	02/10/11	16	16	16	0.0	**0.00**	0-5
Color	PCU	11-0596F	Site #1	02/10-02/17/11	02/17/11	02/17/11	38	37	38	0.7	**1.89**	0-5
Color	PCU	11-0796F	Site #3	02/17-02/24/11	02/24/11	02/24/11	35	34	35	0.7	**2.05**	0-5

E.2 Accuracy

Matrix Spike Recovery Study
Cameron Ditch Treatment Facility Samples Collected from:
April 2008 - February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	Dilution Factor	ACTUAL CONC.	THEOR. CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE
Alkalinity	mg/l	10-1955	Rain	7/26 - 8/4/10	08/04/10	11/02/09	18	50	1000	0.4	1	25.4	26.0	98%	95.6 - 105
Alkalinity	mg/l	10-2063	Rain	8/10 - 8/16/10	08/16/10	11/16/09	6.2	50	1000	0.4	1	14.6	14.2	103%	95.6 - 105
Alkalinity	mg/l	10-1115	Rain Blank	05/12/10	05/12/10	11/30/09	0.4	50	1000	0.2	1	4.6	4.4	105%	95.6 - 105
Alkalinity	mg/l	10-1326	Rain	5/25 - 5/31/10	05/31/10	12/31/09	10.6	50	1000	0.2	1	15.0	14.6	103%	95.6 - 105
Alkalinity	mg/l	10-1407	Rain Blank	06/10/10	06/10/10	01/20/10	0.4	50	1000	0.2	1	4.4	4.4	100%	95.6 - 105
Alkalinity	mg/l	10-1481	Rain	6/8 - 6/26/10	06/26/10	02/09/10	1	50	1000	0.2	1	5.2	5.0	104%	95.6 - 105
Alkalinity	mg/l	10-2273	Site #4	8/23 - 9/1/10	09/01/10	11/02/09	79.4	50	1000	0.4	1	86.0	87.4	98%	95.6 - 105
Alkalinity	mg/l	10-3020	Rain Blank	11/08/10	11/08/10	11/16/09	0.6	50	1000	0.6	1	12.4	12.6	98%	95.6 - 105
Alkalinity	mg/l	11-0009	Rain Blank	01/03/11	01/03/11	01/06/11	0.4	50	1000	0.3	1	6.6	6.4	103%	95.6 - 105
Alkalinity	mg/l	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/17/11	15.4	50	1000	0.3	1	21.8	21.4	102%	95.6 - 105
Alkalinity	mg/l	11-0205	Rain	1/12 - 1/19/11	01/19/11	01/21/11	2.8	50	1000	0.3	1	8.4	8.8	95%	95.6 - 105
Turbidity	NTU	10-1407	Rain	06/10/10	06/10/10	06/11/10	0.3	50	4000	0.125	1	10.1	10.3	98%	87.4 - 110
Turbidity	NTU	10-1761	Site #4	7/6 - 7/14/10	07/14/10	07/15/10	4.6	50	4000	0.5	1	46.3	44.6	104%	87.4 - 110
Turbidity	NTU	10-1960	Rain Blank	08/04/10	08/04/10	08/05/10	0.2	50	4000	0.5	1	38.9	40.2	97%	87.4 - 110
Turbidity	NTU	10-2477	Site #4	9/13 - 9/21/10	09/21/10	09/22/10	0.9	25	1000	0.25	1	10.8	10.9	99%	87.4 - 110
Turbidity	NTU	10-2713	Site #4	10/12 - 10/18/10	10/18/10	10/19/10	8.1	25	1000	0.25	1	18.1	18.1	100%	87.4 - 110
Turbidity	NTU	10-2127	Rain	8/16 - 8/23/10	08/23/10	08/24/10	1.9	25	1000	0.25	1	12	11.9	101%	87.4 - 110
Turbidity	NTU	10-3015	Rain	10/28 - 11/8/10	11/08/10	11/09/10	1.8	25	1000	0.25	1	10.3	11.8	88%	87.4 - 110
Turbidity	NTU	10-3327	Rain Blank	12/13/10	12/13/10	12/15/10	0.3	25	1000	0.25	1	9.6	10.3	93%	87.4 - 110
Turbidity	NTU	11-0118	Rain	12/21 - 1/12/11	01/12/11	01/13/11	2.3	50	4000	0.25	1	22	22.3	99%	87.4 - 110
Turbidity	NTU	11-0499	Rain	2/1 - 2/10/11	02/10/11	02/11/11	3.7	50	4000	0.25	1	22.6	23.7	95%	87.4 - 110
Turbidity	NTU	11-0600	Site #4	2/10 - 2/17/11	02/17/11	02/18/11	3.3	50	4000	0.25	1	22.1	23.3	95%	87.4 - 110
SRP	µg/l	10-1112F	Site # 2 Sampler Blank	05/12/10	05/12/10	05/13/10	3	10	20000	0.2	1	424	403	105%	90-110
SRP	µg/l	10-1407F	Rain Equipment Blank	06/10/10	06/10/10	06/11/10	0	10	20000	0.1	1	209	200	105%	90-110
SRP	µg/l	10-3017F	Site #2 Sampler Blank	11/08/10	11/08/10	11/21/10	0	10	20000	0.175	1	342	350	98%	90-110
SRP	µg/l	10-3303F	Site # 4	12/3/10 - 12/8/10	12/08/10	12/09/10	14	10	20000	0.175	1	341	364	94%	90-110
SRP	µg/l	10-3324F	Site # 2 Sampler Blank	12/13/10	12/13/10	12/15/10	0	10	20000	0.175	1	336	350	96%	90-110
SRP	µg/l	10-3327F	Rain Equipment Blank	12/13/10	12/13/10	12/15/10	0	10	20000	0.175	1	339	350	97%	90-110
SRP	µg/l	11-0797F	Site #4	2/17/11 - 2/24/11	02/24/11	03/02/11	22	10	20000	0.200	1	425	422	101%	90-110
NOx	µg/l	10-1112F	Site # 2 Sampler Blank	05/12/10	05/12/10	05/13/10	0	10	11300	0.200	1	449	452.0	99%	92-111
NOx	µg/l	10-1407F	Rain Equipment Blank	06/10/10	06/10/10	06/11/10	0	10	11300	0.100	1	228	226.0	101%	92-111
NOx	µg/l	10-3017F	Site #2 Sampler Blank	11/08/10	11/08/10	11/21/10	0	10	22600	0.200	1	447	452.0	99%	92-111
NOx	µg/l	10-3303F	Site # 4	12/3/10 - 12/8/10	12/08/10	12/09/10	19	10	22600	0.150	1	353	358.0	99%	92-111
NOx	µg/l	10-3324F	Site # 2 Sampler Blank	12/13/10	12/13/10	12/15/10	0	10	22600	0.150	1	377	339.0	111%	92-111
NOx	µg/l	10-3327F	Rain Equipment Blank	12/13/10	12/13/10	12/15/10	0	10	22600	0.200	1	467	452.0	103%	92-111
NOx	µg/l	11-0797F	Site #4	2/17/11 - 2/24/11	02/24/11	03/02/11	126	10	11300	0.400	1	605	578.0	105%	92-111

Matrix Spike Recovery Study
Cameron Ditch Treatment Facility Samples Collected from:
April 2008 - February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	Dilution Factor	ACTUAL CONC.	THEOR. CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE
Total N	µg/l	10-1112FP	Site # 2 Sampler Blank	05/12/10	05/12/10	05/26/10	0	5	100000	0.05	1	2171	2260.0	96%	90-110
Total N	µg/l	10-1168P	Site #4	5/12/10 - 5/18/10	05/18/10	06/01/10	633	5	226000	0.05	1	3148	2893.0	109%	90-110
Total N	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/23/10	0	5	226000	0.1	1	4886	4520.0	108%	90-110
Total N	µg/l	0-1168P RED	Site #4	5/12/10 - 5/18/10	05/18/10	06/24/10	633	5	226000	0.05	1	3262	2893.0	113%	90-110
Total N	µg/l	10-1478FP	Site #1	6/11 - 6/25/10	06/26/10	07/02/10	485	5	226000	0.1	1	5163	5005.0	103%	90-110
Total N	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	07/07/10	0	5	226000	0.1	1	4676	4520.0	103%	90-110
Total N	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/13/10	0	5	100000	0.125	1	5161	5650.0	91%	90-110
Total N	µg/l	10-1761FP	Site #4	7/06 - 7/14/10	07/14/10	07/26/10	700	5	226000	0.11	1	5773	5672.0	102%	90-110
Total N	µg/l	10-1956FP	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0	5	226000	0.1	1	215	226.0	95%	90-110
Total N	µg/l	10-1960FP	Rain Equipment Blank	08/04/10	08/04/10	08/16/10	0	5	226000	0.05	1	103	113.0	91%	90-110
Total N	µg/l	10-2061FP	Site #3	8/10/10 - 8/16/10	08/16/10	08/20/10	371	5	226000	0.02	1	799	823.0	97%	90-110
Total N	µg/l	10-2125FP	Site #3	8/16/10 - 8/23/10	08/23/10	09/17/10	1196	5	226000	0.15	1	1859	1874.0	99%	90-110
Total N	µg/l	10-2270P	Site # 1	8/23/10 - 9/1/10	09/01/10	11/29/10	1060	5	226000	0.15	1	1667	1738.0	96%	90-110
Total N	µg/l	10-2278FP	Rain Equipment Blank	09/01/10	09/01/10	11/29/10	0	5	226000	0.35	1	1657	1582.0	105%	90-110
Total N	µg/l	10-2477FP	Site # 4	9/13/10 - 9/21/10	09/21/10	12/16/10	308	5	226000	0.15	1	1035	986.0	105%	90-110
Total N	µg/l	10-2623FP	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	1493	5	50000	0.15	1	2390	2171.0	110%	90-110
Total N	µg/l	10-3323p	Site # 1 Sampler Blank	12/13/10	12/13/10	03/28/11	0	5	10000	0.03	1	634	600.0	106%	90-110
Total N	µg/l	10-3362fp	Site # 3	12/13/10 - 12/21/10	12/21/10	03/28/11	434	5	10000	0.03	1	972	1034.0	94%	90-110
Total N	µg/l	11-0009fp	Rain Equipment Blank	01/03/11	01/03/11	03/28/11	0	5	22600	0.15	1	668	678.0	99%	90-110
Total N	µg/l	11-0203fp	Site # 3	1/12/11 - 1/19/11	01/19/11	03/28/11	457	5	22600	0.125	1	1004	1022.0	98%	90-110
Total N	µg/l	11-0374fp	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0	5	22600	0.125	1	563	565.0	100%	90-110
Total N	µg/l	11-0600fp	Site # 4	02/17/11	02/17/11	03/28/11	556	5	22600	0.125	1	1108	1121.0	99%	90-110
Total N	µg/l	11-0797fp	Site #4	2/17/11 - 2/24/11	02/24/11	03/28/11	675	5	22600	0.1	1	1121	1127.0	99%	90-110

Matrix Spike Recovery Study
Cameron Ditch Treatment Facility Samples Collected from:
April 2008 - February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	Dilution Factor	ACTUAL CONC.	THEOR. CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE
Total P	µg/l	10-1112FP	Site # 2 Sampler Blank	05/12/10	05/12/10	05/26/10	0	5	20000	0.05	1	220	200.0	110%	94-106
Total P	µg/l	10-1168P	Site #4	5/12/10 - 5/18/10	05/18/10	06/01/10	70	5	20000	0.25	1	1053	1070.0	98%	94-106
Total P	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/23/10	0	5	20000	0.1	1	424	400.0	106%	94-106
Total P	µg/l	)-1112FP RED	Site # 2 Sampler Blank	05/12/10	05/12/10	06/24/10	0	5	20000	0.2	1	816	800.0	102%	94-106
Total P	µg/l	10-1478FP	Site #1	6/11 - 6/25/10	06/26/10	07/02/10	40	5	20000	0.125	1	508	540.0	94%	94-106
Total P	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	07/07/10	0	5	20000	0.125	1	504	500.0	101%	94-106
Total P	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/13/10	0	5	20000	0.125	1	515	500.0	103%	94-106
Total P	µg/l	10-1761FP	Site #4	7/06 - 7/14/10	07/14/10	07/26/10	29	5	20000	0.125	1	559	529.0	106%	94-106
Total P	µg/l	10-1956FP	Site #1 Sampler Blank	08/04/10	08/04/10	08/16/10	0	5	20000	0.05	1	195	200.0	98%	94-106
Total P	µg/l	10-1960FP	Rain Equipment Blank	08/04/10	08/04/10	08/16/10	0	5	20000	0.05	1	205	200.0	103%	94-106
Total P	µg/l	10-2061FP	Site #3	8/10/10 - 8/16/10	08/16/10	08/20/10	229	5	20000	0.075	1	532	529.0	101%	94-106
Total P	µg/l	10-2125FP	Site #3	8/16/10 - 8/23/10	08/23/10	09/17/10	98	5	20000	0.15	1	731	698.0	105%	94-106
Total P	µg/l	10-2270P	Site # 1	8/23/10 - 9/1/10	09/01/10	11/29/10	69	5	20000	0.1	1	450	469.0	96%	94-106
Total P	µg/l	10-2278FP	Rain Equipment Blank	09/01/10	09/01/10	11/29/10	0	5	10000	0.075	1	151	150.0	101%	94-106
Total P	µg/l	10-2477FP	Site # 4	9/13/10 - 9/21/10	09/21/10	12/16/10	16	5	20000	0.15	1	631	616.0	102%	94-106
Total P	µg/l	10-2623FP	Site # 2	9/21/10 - 10/5/10	10/05/10	12/28/10	98	5	20000	0.15	1	699	698.0	100%	94-106
Total P	µg/l	10-3323p	Site # 1 Sampler Blank	12/13/10	12/13/10	03/28/11	0	5	20000	0.1	1	417	400.0	104%	94-106
Total P	µg/l	10-3362fp	Site # 3	12/13/10 - 12/21/10	12/21/10	03/28/11	74	5	20000	0.1	1	503	474.0	106%	94-106
Total P	µg/l	11-0009fp	Rain Equipment Blank	01/03/11	01/03/11	03/28/11	0	5	20000	0.1	1	424	400	106%	94-106
Total P	µg/l	11-0203fp	Site # 3	1/12/11 - 1/19/11	01/19/11	03/28/11	19	5	20000	0.1	1	440	419	105%	94-106
Total P	µg/l	11-0374fp	Site # 3 Sampler Blank	02/01/11	02/01/11	03/28/11	0	5	20000	0.1	1	419	400	105%	94-106
Total P	µg/l	11-0600fp	Site # 4	02/17/11	02/17/11	03/28/11	14	5	20000	0.1	1	439	414	106%	94-106
Total P	µg/l	11-0797fp	Site #4	2/17/11 - 2/24/11	02/24/11	03/28/11	27	5	20000	0.1	1	447	427	105%	94-106

Matrix Spike Recovery Study
Cameron Ditch Treatment Facility Samples Collected from:
April 2008 - February 2011

PARAMETERS	UNITS	SAMPLE ID	SAMPLE DESCRIPTION	DATE COLLECTED	DATE RECEIVED	DATE ANALYZED	INITIAL CONC.	INITIAL VOLUME (ml)	SPIKE CONC.	SPIKE VOLUME ADDED (ml)	Dilution Factor	ACTUAL CONC.	THEOR. CONC.	PERCENT RECOVERY	ACCEPTANCE RANGE
Ammonia	µg/l	10-1406P	Site #4 Sampler Blank	06/10/10	06/10/10	06/29/10	0	10	10000	2.00	1	1977	2000.0	99%	80-120
Ammonia	µg/l	10-1481P	Rain	6/11 - 6/25/10	06/26/10	06/29/10	327	10	10000	2.00	1	2081	2327.0	89%	80-120
Ammonia	µg/l	10-1633P	Site #4 Sampler Blank	06/25/10-07/06/10	07/06/10	07/15/10	0	10	10000	0.15	1	132	150.0	88%	80-120
Ammonia	µg/l	10-1759P	Site #1	7/06 - 7/14/10	07/14/10	07/15/10	21	10	10000	0.10	1	135	121.0	112%	80-120
Ammonia	µg/l	10-1957P	Site #2 Sampler Blank	08/04/10	08/04/10	08/19/10	0	10	10000	0.10	1	80	100.0	80%	80-120
Ammonia	µg/l	10-2062P	Site #4	8/10/10 - 8/16/10	08/16/10	08/22/10	51	10	10000	0.10	1	128	151.0	85%	80-120
Ammonia	µg/l	10-2629P	Site # 3 Sampler Blank	10/05/10	10/06/10	12/08/10	0	10	10000	0.40	1	445	400.0	111%	80-120
Ammonia	µg/l	10-3090P	Site #4	11/8/10 - 11/19/10	11/19/10	12/17/10	47	10	10000	1.00	1	1069	1047.0	102%	80-120
Ammonia	µg/l	10-3018P	Site #3 Sampler Blank	11/08/10	11/08/10	12/17/10	0	10	10000	1.50	1	1584	1500.0	106%	80-120
Ammonia	µg/l	10-3252P	Site # 3	11/19/10 - 12/3/10	12/03/10	12/21/10	39	10	10000	0.15	1	179	189.0	95%	80-120
Ammonia	µg/l	11-0118P	Rain	12/21/11 - 1/12/11	01/12/11	02/04/11	2523	10	10000	0.2	1	2984	2723.0	110%	80-120
Ammonia	µg/l	11-0794P	Site #1	2/17/11 - 2/24/11	02/24/11	04/06/11	69	10	10000	0.2	1	283	269.0	105%	80-120

E.3 Control Standard Recovery

Laboratory Control Standard Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE (%)
Alkalinity	mg/l	LCS	11/02/09	11/02/09	8.8	8.6	102%	95.6 - 105
Alkalinity	mg/l	LCS	11/16/09	11/16/09	8.4	8.6	98%	95.6 - 105
Alkalinity	mg/l	LCS	11/30/09	11/30/09	8.4	8.4	100%	95.6 - 105
Alkalinity	mg/l	LCS	12/31/09	12/31/09	4.4	4.6	96%	95.6 - 105
Alkalinity	mg/l	LCS	01/20/10	01/20/10	4.2	4.4	95%	95.6 - 105
Alkalinity	mg/l	LCS	02/09/10	02/09/10	4.4	4.6	96%	95.6 - 105
Alkalinity	mg/l	LCS	11/02/09	11/02/09	4.4	4.6	96%	95.6 - 105
Alkalinity	mg/l	LCS	11/16/09	11/16/09	4.4	4.6	96%	95.6 - 105
Alkalinity	mg/l	LCS	01/06/11	01/06/11	4.2	4.4	95%	95.6 - 105
Alkalinity	mg/l	LCS	01/17/11	01/17/11	12.2	12.4	98%	95.6 - 105
Alkalinity	mg/l	LCS	01/21/11	01/21/11	12.8	12.6	102%	95.6 - 105
Turbidity	NTU	LCS	06/11/10	06/11/10	19.9	20.0	100%	85-115
Turbidity	NTU	LCS	07/15/10	07/15/10	19.8	20.1	99%	85-115
Turbidity	NTU	LCS	08/05/10	08/05/10	19.3	20.1	96%	85-115
Turbidity	NTU	LCS	09/22/10	09/22/10	19.7	20.0	99%	85-115
Turbidity	NTU	LCS	10/19/10	10/19/10	9.9	10.1	98%	85-115
Turbidity	NTU	LCS	08/24/10	08/24/10	9.9	10.1	98%	85-115
Turbidity	NTU	LCS	11/09/10	11/09/10	9.9	10.1	98%	85-115
Turbidity	NTU	LCS	12/15/10	12/15/10	10.0	10.1	99%	85-115
Turbidity	NTU	LCS	01/13/11	01/13/11	39.7	40.3	99%	85-115
Turbidity	NTU	LCS	02/11/11	02/11/11	40.2	40.5	99%	85-115
Turbidity	NTU	LCS	02/18/11	02/18/11	38.8	40.5	96%	85-115
SRP	mg/l	LCS	05/13/10	05/13/10	220	220	100%	90-110
SRP	mg/l	LCS	06/11/10	06/11/10	228	220	104%	90-110
SRP	mg/l	LCS	11/21/10	11/21/10	230	220	105%	90-110
SRP	mg/l	LCS	12/09/10	12/09/10	228	220	104%	90-110
SRP	mg/l	LCS	12/15/10	12/15/10	322	330	98%	90-110
SRP	mg/l	LCS	12/15/10	12/15/10	333	330	101%	90-110
SRP	mg/l	LCS	03/02/11	03/02/11	321	330	97%	90-110
NOx	mg/l	LCS	05/13/10	05/13/10	271	249	109%	90-110
NOx	mg/l	LCS	06/11/10	06/11/10	257	249	103%	90-110
NOx	mg/l	LCS	11/21/10	11/21/10	259	249	104%	90-110
NOx	mg/l	LCS	12/09/10	12/09/10	323	373	87%	90-110
NOx	mg/l	LCS	12/15/10	12/15/10	345	373	93%	90-110
NOx	mg/l	LCS	12/15/10	12/15/10	348	373	93%	90-110
NOx	mg/l	LCS	03/02/11	03/02/11	351	373	94%	90-110

Laboratory Control Standard Recovery
For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE (%)
Total N	mg/l	LCS	05/26/10	05/26/10	4909	4520	109%	90-110
Total N	mg/l	LCS	06/01/10	06/01/10	4767	4520	105%	90-110
Total N	mg/l	LCS	06/23/10	06/23/10	4967	4520	110%	90-110
Total N	mg/l	LCS	06/24/10	06/24/10	3947	3616	109%	90-110
Total N	mg/l	LCS	07/02/10	07/02/10	3970	3616	110%	90-110
Total N	mg/l	LCS	07/07/10	07/07/10	4656	4520	103%	90-110
Total N	mg/l	LCS	07/13/10	07/13/10	5154	5424	95%	90-110
Total N	mg/l	LCS	07/26/10	07/26/10	5158	5424	95%	90-110
Total N	mg/l	LCS	08/16/10	08/16/10	843	904	93%	90-110
Total N	mg/l	LCS	08/16/10	08/16/10	897	904	99%	90-110
Total N	mg/l	LCS	08/20/10	08/20/10	920	904	102%	90-110
Total N	mg/l	LCS	09/17/10	09/17/10	880	904	97%	90-110
Total N	mg/l	LCS	11/29/10	11/29/10	4871	4520	108%	90-110
Total N	mg/l	LCS	11/29/10	11/29/10	1180	1130	104%	90-110
Total N	mg/l	LCS	12/16/10	12/16/10	1409	1356	104%	90-110
Total N	mg/l	LCS	12/28/10	12/28/10	5932	6328	94%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	1408	1356	104%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	3963	4520	88%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	4185	4520	93%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	2286	2260	101%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	1926	1808	107%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	4172	4520	92%	90-110
Total N	mg/l	LCS	03/28/11	03/28/11	3194	3164	101%	90-110
Total P	mg/l	LCS	05/26/10	05/26/10	284	300	95%	90-110
Total P	mg/l	LCS	06/01/10	06/01/10	197	200	99%	90-110
Total P	mg/l	LCS	06/23/10	06/23/10	280	300	93%	90-110
Total P	mg/l	LCS	06/24/10	06/24/10	168	150	112%	90-110
Total P	mg/l	LCS	07/02/10	07/02/10	225	250	90%	90-110
Total P	mg/l	LCS	07/07/10	07/07/10	216	200	108%	90-110
Total P	mg/l	LCS	07/13/10	07/13/10	286	300	95%	90-110
Total P	mg/l	LCS	07/26/10	07/26/10	292	300	97%	90-110
Total P	mg/l	LCS	08/16/10	08/16/10	277	300	92%	90-110
Total P	mg/l	LCS	08/16/10	08/16/10	174	200	87%	90-110
Total P	mg/l	LCS	08/20/10	08/20/10	259	250	104%	90-110
Total P	mg/l	LCS	09/17/10	09/17/10	285	300	95%	90-110
Total P	mg/l	LCS	11/29/10	11/29/10	338	350	97%	90-110
Total P	mg/l	LCS	11/29/10	11/29/10	232	250	93%	90-110
Total P	mg/l	LCS	12/16/10	12/16/10	202	200	101%	90-110
Total P	mg/l	LCS	12/28/10	12/28/10	271	250	108%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	268	250	107%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	324	300	108%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	277	300	92%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	339	350	97%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	286	300	95%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	278	300	93%	90-110
Total P	mg/l	LCS	03/28/11	03/28/11	248	250	99%	90-110

Laboratory Control Standard Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE (%)
Ammonia	mg/l	LCS	06/29/10	06/29/10	133	120	111%	80-120
Ammonia	mg/l	LCS	06/29/10	06/29/10	125	120	104%	80-120
Ammonia	mg/l	LCS	07/15/10	07/15/10	729	700	104%	80-120
Ammonia	mg/l	LCS	07/15/10	07/15/10	721	700	103%	80-120
Ammonia	mg/l	LCS	08/19/10	08/19/10	352	350	101%	80-120
Ammonia	mg/l	LCS	08/22/10	08/22/10	398	350	114%	80-120
Ammonia	mg/l	LCS	12/08/10	12/08/10	411	350	117%	80-120
Ammonia	mg/l	LCS	12/17/10	12/17/10	360	350	103%	80-120
Ammonia	mg/l	LCS	12/17/10	12/17/10	404	350	115%	80-120
Ammonia	mg/l	LCS	12/21/10	12/21/10	149	150	99%	80-120
Ammonia	mg/l	LCS	02/04/11	02/04/11	155	150	103%	80-120
Ammonia	mg/l	LCS	04/06/11	04/06/11	158	150	105%	80-120
Color	PCU	LCS	05/12/10	05/12/10	33	30	110%	85-115%
Color	PCU	LCS	05/18/10	05/19/10	33	30	110%	85-115%
Color	PCU	LCS	05/31/10	06/03/10	34	30	113%	85-115%
Color	PCU	LCS	06/10/10	06/11/10	34	30	113%	85-115%
Color	PCU	LCS	07/06/10	07/07/10	22	20	110%	85-115%
Color	PCU	LCS	07/14/10	07/14/10	22	20	110%	85-115%
Color	PCU	LCS	07/14/10	07/14/10	21	20	105%	85-115%
Color	PCU	LCS	07/19/10	07/20/10	21	20	105%	85-115%
Color	PCU	LCS	08/04/10	08/05/10	42	40	105%	85-115%
Color	PCU	LCS	08/04/10	08/05/10	42	40	105%	85-115%
Color	PCU	LCS	08/16/10	08/17/10	42	40	105%	85-115%
Color	PCU	LCS	10/05/10	10/07/10	42	40	105%	85-115%
Color	PCU	LCS	02/01/11	02/02/11	21	20	105%	85-115%
Color	PCU	LCS	02/10/11	02/10/11	21	20	105%	85-115%
Color	PCU	LCS	02/17/11	02/17/11	21	20	105%	85-115%
Color	PCU	LCS	02/24/11	02/24/11	21	20	105%	85-115%

E.4 Continuing Calibration Verification

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
pH	s.u.	CCV	06/04/08	06/04/08	8.8	8.6	102%	91-105%
pH	s.u.	CCV	09/17/08	09/17/08	8.6	8.4	102%	91-105%
pH	s.u.	CCV	09/29/08	09/29/08	8.8	8.8	100%	91-105%
pH	s.u.	CCV	10/15/08	10/15/08	8.6	8.6	100%	91-105%
pH	s.u.	CCV	10/22/08	10/22/08	8.6	8.6	100%	91-105%
pH	s.u.	CCV	10/29/08	10/29/08	8.6	8.6	100%	91-105%
pH	s.u.	CCV	11/04/08	11/04/08	8.6	8.4	102%	91-105%
pH	s.u.	CCV	11/17/08	11/17/08	6.6	6.4	103%	91-105%
pH	s.u.	CCV	08/21/10	08/21/10	6.0	6.2	97%	91-105%
pH	s.u.	CCV	08/26/10	08/26/10	6.6	6.4	103%	91-105%
pH	s.u.	CCV	08/05/10	08/05/10	6.4	6.6	97%	91-105%
pH	s.u.	CCV	09/17/10	09/17/10	6.6	6.6	100%	91-105%
pH	s.u.	CCV	08/05/10	08/05/10	6.2	6.2	100%	91-105%
pH	s.u.	CCV	09/02/10	09/02/10	6.2	6.4	97%	91-105%
pH	s.u.	CCV	09/02/10	09/02/10	6.8	6.6	103%	91-105%
Alkalinity	mg/l	CCV	06/04/08	06/04/08	12.8	12.6	102%	87.4-110%
Alkalinity	mg/l	CCV	09/17/08	09/17/08	13.0	12.8	102%	87.4-110%
Alkalinity	mg/l	CCV	09/29/08	09/29/08	12.4	12.6	98%	87.4-110%
Alkalinity	mg/l	CCV	10/15/08	10/15/08	12.6	12.8	98%	90-110%
Alkalinity	mg/l	CCV	10/22/08	10/22/08	12.4	12.6	98%	90-110%
Alkalinity	mg/l	CCV	10/29/08	10/29/08	12.2	12.6	97%	90-110%
Alkalinity	mg/l	CCV	11/04/08	11/04/08	12.2	12.6	97%	90-110%
Alkalinity	mg/l	CCV	11/17/08	11/17/08	12.4	12.6	98%	90-110%
Alkalinity	mg/l	CCV	07/07/10	07/07/10	12.4	12.8	97%	90-110%
Alkalinity	mg/l	CCV	08/21/10	08/21/10	12.8	12.6	102%	90-110%
Alkalinity	mg/l	CCV	08/26/10	08/26/10	12.4	12.6	98%	90-110%
Alkalinity	mg/l	CCV	08/05/10	08/05/10	12.6	12.6	100%	90-110%
Alkalinity	mg/l	CCV	09/17/10	09/17/10	12.8	12.4	103%	90-110%
Alkalinity	mg/l	CCV	09/02/10	09/02/10	12.6	12.4	102%	90-110%
Alkalinity	mg/l	CCV	08/05/10	08/05/10	12.4	12.6	98%	90-110%
Alkalinity	mg/l	CCV	05/17/10	05/17/10	12.8	12.4	103%	90-110%
Alkalinity	mg/l	CCV	05/20/10	05/20/10	12.8	12.4	103%	90-110%
Alkalinity	mg/l	CCV	05/27/10	05/27/10	12.8	12.4	103%	90-110%
Alkalinity	mg/l	CCV	06/08/10	06/08/10	12.4	12.6	98%	85-115%
Alkalinity	mg/l	CCV	06/14/10	06/14/10	12.8	12.6	102%	85-115%
Alkalinity	mg/l	CCV	05/20/10	05/20/10	12.8	12.4	103%	85-115%
Alkalinity	mg/l	CCV	09/02/10	09/02/10	12.6	12.6	100%	85-115%
Alkalinity	mg/l	CCV	11/10/10	11/10/10	12.4	12.8	97%	85-115%
Alkalinity	mg/l	CCV	12/07/10	12/07/10	12.8	12.4	103%	85-115%
Alkalinity	mg/l	CCV	01/21/11	01/21/11	13.0	12.6	103%	85-115%
Alkalinity	mg/l	CCV	01/06/11	01/06/11	12.8	12.4	103%	85-115%
Alkalinity	mg/l	CCV	01/17/11	01/17/11	12.4	12.6	98%	85-115%
Alkalinity	mg/l	CCV	01/21/11	01/21/11	12.8	12.8	100%	85-115%
Alkalinity	mg/l	CCV	02/14/11	02/14/11	12.6	12.4	102%	85-115%

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
Conductivity	μΩ	CCV	05/13/08	05/13/08	1975	2000	99%	85-115%
Conductivity	μΩ	CCV	07/07/08	07/07/08	1986	2000	99%	85-115%
Conductivity	μΩ	CCV	09/17/08	09/17/08	1979	2000	99%	85-115%
Conductivity	μΩ	CCV	09/30/08	09/30/08	1988	2000	99%	85-115%
Conductivity	μΩ	CCV	10/23/08	10/23/08	1993	2000	100%	90-110%
Conductivity	μΩ	CCV	10/23/08	10/23/08	1983	2000	99%	90-110%
Conductivity	μΩ	CCV	05/28/08	05/28/08	1982	2000	99%	90-110%
Conductivity	μΩ	CCV	11/18/08	11/18/08	1966	2000	98%	90-110%
Conductivity	μΩ	CCV	07/15/10	07/15/10	1973	2000	99%	90-110%
Conductivity	μΩ	CCV	08/02/10	08/02/10	1971	2000	99%	90-110%
Conductivity	μΩ	CCV	08/13/10	08/13/10	1966	2000	98%	90-110%
Conductivity	μΩ	CCV	06/21/10	06/21/10	1973	2000	99%	90-110%
Conductivity	μΩ	CCV	07/07/10	07/07/10	1975	2000	99%	90-110%
Conductivity	μΩ	CCV	08/02/10	08/02/10	1977	2000	99%	90-110%
Conductivity	μΩ	CCV	08/13/10	08/13/10	1979	2000	99%	90-110%
Conductivity	μΩ	CCV	10/14/10	10/14/10	1981	2000	99%	90-110%
Conductivity	μΩ	CCV	11/03/10	11/03/10	1969	2000	98%	90-110%
Conductivity	μΩ	CCV	11/16/10	11/16/10	1975	2000	99%	90-110%
Conductivity	μΩ	CCV	11/30/10	11/30/10	1975	2000	99%	90-110%
Conductivity	μΩ	CCV	12/17/10	12/17/10	2000	2000	100%	90-110%
Conductivity	μΩ	CCV	09/21/10	09/21/10	1997	2000	100%	90-110%
Conductivity	μΩ	CCV	10/14/10	10/14/10	1994	2000	100%	90-110%
Conductivity	μΩ	CCV	11/03/10	11/03/10	1994	2000	100%	90-110%
Conductivity	μΩ	CCV	11/30/10	11/30/10	1993	2000	100%	90-110%
Conductivity	μΩ	CCV	01/24/11	01/24/11	1990	2000	100%	90-110%
Conductivity	μΩ	CCV	02/17/11	02/17/11	1992	2000	100%	90-110%
Conductivity	μΩ	CCV	03/01/11	03/01/11	1997	2000	100%	90-110%
Conductivity	μΩ	CCV	03/01/11	03/01/11	1999	2000	100%	90-110%
Conductivity	μΩ	CCV	02/07/11	02/07/11	1954	2000	98%	90-110%

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
Turbidity	NTU	CCV	07/23/08	07/23/08	9.2	10.0	92%	90-110%
Turbidity	NTU	CCV	10/19/08	10/19/08	9.3	10.0	93%	90-110%
Turbidity	NTU	CCV	10/10/08	10/10/08	10.6	10.3	103%	90-110%
Turbidity	NTU	CCV	11/03/08	11/03/08	10.0	10.1	99%	90-110%
Turbidity	NTU	CCV	10/28/08	10/28/08	9.6	10.1	95%	90-110%
Turbidity	NTU	CCV	09/16/08	09/16/08	10.0	10.1	99%	90-110%
Turbidity	NTU	CCV	10/28/08	10/28/08	9.7	10.1	96%	90-110%
Turbidity	NTU	CCV	11/17/08	11/17/08	10.5	10.3	102%	90-110%
Turbidity	NTU	CCV	05/19/10	05/19/10	9.5	10.0	95%	90-110%
Turbidity	NTU	CCV	06/03/10	06/03/10	10.0	10.0	100%	90-110%
Turbidity	NTU	CCV	06/11/10	06/11/10	10.0	10.0	100%	90-110%
Turbidity	NTU	CCV	06/11/10	06/11/10	10.0	10.4	96%	90-110%
Turbidity	NTU	CCV	07/07/10	07/07/10	9.6	10.4	92%	90-110%
Turbidity	NTU	CCV	07/15/10	07/15/10	9.8	10.4	94%	90-110%
Turbidity	NTU	CCV	08/05/10	08/05/10	10.1	10.4	97%	90-110%
Turbidity	NTU	CCV	08/18/10	08/18/10	9.9	10.3	96%	90-110%
Turbidity	NTU	CCV	09/22/10	09/22/10	9.6	10.0	96%	90-110%
Turbidity	NTU	CCV	10/06/10	10/06/10	9.8	10.0	98%	90-110%
Turbidity	NTU	CCV	10/19/10	10/19/10	10.1	10.0	101%	90-110%
Turbidity	NTU	CCV	10/29/10	10/29/10	9.9	10.3	96%	90-110%
Turbidity	NTU	CCV	08/11/10	08/11/10	10.4	10.0	104%	90-110%
Turbidity	NTU	CCV	11/09/10	11/09/10	9.8	10.0	98%	85-115%
Turbidity	NTU	CCV	11/09/10	11/09/10	10.0	10.1	99%	85-115%
Turbidity	NTU	CCV	12/15/10	12/15/10	9.9	10.1	98%	85-115%
Turbidity	NTU	CCV	01/05/11	01/05/11	9.9	10.1	98%	85-115%
Turbidity	NTU	CCV	01/13/11	01/13/11	9.8	10.1	97%	85-115%
Turbidity	NTU	CCV	02/11/11	02/11/11	9.9	10.1	98%	85-115%
Turbidity	NTU	CCV	02/18/11	02/18/11	9.9	10.1	98%	85-115%
Turbidity	NTU	CCV	01/20/11	01/20/11	9.9	10.1	98%	85-115%

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
SRP	µg/l	CCV	05/13/10	05/13/10	102	100	102%	90-110
SRP	µg/l	CCV	05/20/10	05/20/10	108	100	108%	90-110
SRP	µg/l	CCV	06/11/10	06/11/10	109	100	109%	90-110
SRP	µg/l	CCV	07/08/10	07/08/10	95	100	95%	90-110
SRP	µg/l	CCV	08/04/10	08/04/10	106	100	106%	90-110
SRP	µg/l	CCV	08/18/10	08/18/10	102	100	102%	90-110
SRP	µg/l	CCV	08/25/10	08/25/10	98	100	98%	90-110
SRP	µg/l	CCV	10/08/10	10/08/10	97	100	97%	90-110
SRP	µg/l	CCV	11/08/10	11/08/10	102	100	102%	90-110
SRP	µg/l	CCV	11/21/10	11/21/10	104	100	104%	90-110
SRP	µg/l	CCV	12/09/10	12/09/10	108	100	108%	90-110
SRP	µg/l	CCV	12/15/10	12/15/10	107	100	107%	90-110
SRP	µg/l	CCV	12/15/10	12/15/10	110	100	110%	90-110
SRP	µg/l	CCV	02/08/11	02/08/11	103	100	103%	90-110
SRP	µg/l	CCV	03/02/11	03/02/11	108	100	108%	90-110
NOx	µg/l	CCV	05/13/10	05/13/10	1021	1000	102%	85-115
NOx	µg/l	CCV	05/20/10	05/20/10	1001	1000	100%	85-115
NOx	µg/l	CCV	06/11/10	06/11/10	1034	1000	103%	85-115
NOx	µg/l	CCV	07/08/10	07/08/10	1005	1000	101%	85-115
NOx	µg/l	CCV	08/04/10	08/04/10	1032	1000	103%	85-115
NOx	µg/l	CCV	08/18/10	08/18/10	990	1000	99%	85-115
NOx	µg/l	CCV	08/25/10	08/25/10	1015	1000	102%	85-115
NOx	µg/l	CCV	10/08/10	10/08/10	1019	1000	102%	85-115
NOx	µg/l	CCV	11/08/10	11/08/10	1000	1000	100%	85-115
NOx	µg/l	CCV	11/21/10	11/21/10	997	1000	100%	85-115
NOx	µg/l	CCV	12/09/10	12/09/10	1095	1000	110%	85-115
NOx	µg/l	CCV	12/15/10	12/15/10	1071	1000	107%	85-115
NOx	µg/l	CCV	12/15/10	12/15/10	1005	1000	101%	85-115
NOx	µg/l	CCV	03/26/10	03/26/10	1050	1000	105%	85-115
NOx	µg/l	CCV	02/08/11	02/08/11	980	1000	98%	85-115
NOx	µg/l	CCV	03/02/11	03/02/11	1049	1000	105%	85-115

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
Total N	µg/l	CCV	05/26/10	05/26/10	1986	2000	99%	90-110
Total N	µg/l	CCV	05/26/10	05/26/10	1841	2000	92%	90-110
Total N	µg/l	CCV	06/01/10	06/01/10	1910	2000	96%	90-110
Total N	µg/l	CCV	06/04/10	06/04/10	1805	2000	90%	90-110
Total N	µg/l	CCV	06/23/10	06/23/10	2173	2000	109%	90-110
Total N	µg/l	CCV	07/02/10	07/02/10	2036	2000	102%	90-110
Total N	µg/l	CCV	07/13/10	07/13/10	1952	2000	98%	90-110
Total N	µg/l	CCV	07/13/10	07/13/10	2356	2500	94%	90-110
Total N	µg/l	CCV	07/26/10	07/26/10	2487	2500	99%	90-110
Total N	µg/l	CCV	07/27/10	07/27/10	1942	2000	97%	90-110
Total N	µg/l	CCV	08/16/10	08/16/10	1574	1500	105%	90-110
Total N	µg/l	CCV	08/16/10	08/16/10	2010	2000	101%	90-110
Total N	µg/l	CCV	08/16/10	08/16/10	1887	2000	94%	90-110
Total N	µg/l	CCV	08/17/10	08/17/10	2378	2500	95%	90-110
Total N	µg/l	CCV	08/20/10	08/20/10	1790	2000	90%	90-110
Total N	µg/l	CCV	10/07/10	10/07/10	1990	2000	100%	90-110
Total N	µg/l	CCV	11/29/10	11/29/10	1879	2000	94%	90-110
Total N	µg/l	CCV	11/29/10	11/29/10	2641	2500	106%	90-110
Total N	µg/l	CCV	12/02/10	12/02/10	2521	2500	101%	90-110
Total N	µg/l	CCV	12/06/10	12/06/10	1976	2000	99%	90-110
Total N	µg/l	CCV	12/16/10	12/16/10	1902	2000	95%	90-110
Total N	µg/l	CCV	12/16/10	12/16/10	1884	2000	94%	90-110
Total N	µg/l	CCV	12/28/10	12/28/10	2655	2500	106%	90-110
Total N	µg/l	CCV	12/28/10	12/28/10	2616	2500	105%	90-110
Total N	µg/l	CCV	12/28/10	12/28/10	2667	2500	107%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2676	2500	107%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2629	2500	105%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2584	2500	103%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2639	2500	106%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2575	2500	103%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	1495	1500	100%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	2393	2500	96%	90-110
Total N	µg/l	CCV	03/28/11	03/28/11	1573	1500	105%	90-110

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
Total P	μg/l	CCV	05/26/10	05/26/10	185	200	93%	90-110
Total P	μg/l	CCV	05/26/10	05/26/10	186	200	93%	90-110
Total P	μg/l	CCV	06/01/10	06/01/10	188	200	94%	90-110
Total P	μg/l	CCV	06/04/10	06/04/10	164	150	109%	90-110
Total P	μg/l	CCV	06/23/10	06/23/10	155	150	103%	90-110
Total P	μg/l	CCV	07/02/10	07/02/10	183	200	92%	90-110
Total P	μg/l	CCV	07/07/10	07/07/10	155	150	103%	90-110
Total P	μg/l	CCV	07/13/10	07/13/10	157	150	105%	90-110
Total P	μg/l	CCV	07/13/10	07/13/10	152	150	101%	90-110
Total P	μg/l	CCV	07/26/10	07/26/10	134	125	107%	90-110
Total P	μg/l	CCV	07/27/10	07/27/10	142	150	95%	90-110
Total P	μg/l	CCV	08/16/10	08/16/10	135	150	90%	90-110
Total P	μg/l	CCV	08/16/10	08/16/10	146	150	97%	90-110
Total P	μg/l	CCV	08/16/10	08/16/10	177	175	101%	90-110
Total P	μg/l	CCV	08/17/10	08/17/10	194	200	97%	90-110
Total P	μg/l	CCV	08/20/10	08/20/10	180	175	103%	90-110
Total P	μg/l	CCV	10/07/10	10/07/10	191	200	96%	90-110
Total P	μg/l	CCV	11/29/10	11/29/10	134	150	89%	90-110
Total P	μg/l	CCV	11/29/10	11/29/10	132	150	88%	90-110
Total P	μg/l	CCV	12/02/10	12/02/10	104	100	104%	90-110
Total P	μg/l	CCV	12/06/10	12/06/10	157	150	105%	90-110
Total P	μg/l	CCV	12/16/10	12/16/10	171	175	98%	90-110
Total P	μg/l	CCV	12/28/10	12/28/10	211	200	106%	90-110
Total P	μg/l	CCV	12/28/10	12/28/10	164	150	109%	90-110
Total P	μg/l	CCV	12/28/10	12/28/10	107	100	107%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	162	150	108%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	104	100	104%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	172	175	98%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	131	125	105%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	158	150	105%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	120	125	96%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	148	150	99%	90-110
Total P	μg/l	CCV	03/28/11	03/28/11	126	125	101%	90-110

Continuing Calbration Verification Recovery

For Cameron Ditch Treatment Facility Collected from April 2008 to February 2011

PARAMETERS	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	THEOR. CONC.	% RECOVERY	ACCEPTANCE RANGE
Ammonia	µg/l	CCV	06/29/10	06/29/10	102	100	102%	90-110
Ammonia	µg/l	CCV	06/29/10	06/29/10	96	100	96%	90-110
Ammonia	µg/l	CCV	07/15/10	07/15/10	103	100	103%	90-110
Ammonia	µg/l	CCV	07/15/10	07/15/10	98	100	98%	90-110
Ammonia	µg/l	CCV	08/19/10	08/19/10	106	100	106%	90-110
Ammonia	µg/l	CCV	08/22/10	08/22/10	104	100	104%	90-110
Ammonia	µg/l	CCV	09/28/10	09/28/10	105	100	105%	90-110
Ammonia	µg/l	CCV	10/07/10	10/07/10	100	100	100%	90-110
Ammonia	µg/l	CCV	12/08/10	12/08/10	100	100	100%	90-110
Ammonia	µg/l	CCV	12/14/10	12/14/10	100	100	100%	90-110
Ammonia	µg/l	CCV	12/15/10	12/15/10	98	100	98%	90-110
Ammonia	µg/l	CCV	12/17/10	12/17/10	104	100	104%	90-110
Ammonia	µg/l	CCV	12/17/10	12/17/10	105	100	105%	90-110
Ammonia	µg/l	CCV	12/21/10	12/21/10	102	100	102%	90-110
Ammonia	µg/l	CCV	12/21/10	12/21/10	103	100	103%	90-110
Ammonia	µg/l	CCV	02/04/11	02/04/11	93	100	93%	90-110
Ammonia	µg/l	CCV	04/06/11	04/06/11	96	100	96%	90-110
Ammonia	µg/l	CCV	04/06/11	04/06/11	98	100	98%	90-110
Color	PCU	CCV	05/12/10	05/12/10	40	40	100%	85-115%
Color	PCU	CCV	05/19/10	05/19/10	40	40	100%	85-115%
Color	PCU	CCV	06/03/10	06/03/10	40	40	100%	85-115%
Color	PCU	CCV	06/11/10	06/11/10	40	40	100%	85-115%
Color	PCU	CCV	07/07/10	07/07/10	40	40	100%	85-115%
Color	PCU	CCV	07/14/10	07/14/10	40	40	100%	85-115%
Color	PCU	CCV	07/14/10	07/14/10	40	40	100%	85-115%
Color	PCU	CCV	07/20/10	07/20/10	40	40	100%	85-115%
Color	PCU	CCV	08/05/10	08/05/10	40	40	100%	85-115%
Color	PCU	CCV	08/05/10	08/05/10	40	40	100%	85-115%
Color	PCU	CCV	08/17/10	08/17/10	40	40	100%	85-115%
Color	PCU	CCV	10/07/10	10/07/10	40	40	100%	85-115%
Color	PCU	CCV	02/02/11	02/02/11	40	40	100%	85-115%
Color	PCU	CCV	02/10/11	02/10/11	40	40	100%	85-115%
Color	PCU	CCV	02/17/11	02/17/11	40	40	100%	85-115%
Color	PCU	CCV	02/24/11	02/24/11	40	40	100%	85-115%

E.5 Method Blanks

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
pH	s.u.	Method Blank	06/04/08	06/04/08	5.64	5.00-6.00
pH	s.u.	Method Blank	09/17/08	09/17/08	5.68	5.00-6.00
pH	s.u.	Method Blank	09/29/08	09/29/08	5.63	5.00-6.00
pH	s.u.	Method Blank	10/15/08	10/15/08	5.74	5.00-6.00
pH	s.u.	Method Blank	10/22/08	10/22/08	5.72	5.00-6.00
pH	s.u.	Method Blank	10/29/08	10/29/08	5.74	5.00-6.00
pH	s.u.	Method Blank	11/04/08	11/04/08	5.79	5.00-6.00
pH	s.u.	Method Blank	11/17/08	11/17/08	5.82	5.00-6.00
pH	s.u.	Method Blank	08/21/10	08/21/10	5.74	5.00-6.00
pH	s.u.	Method Blank	08/26/10	08/26/10	5.82	5.00-6.00
pH	s.u.	Method Blank	08/05/10	08/05/10	5.81	5.00-6.00
pH	s.u.	Method Blank	09/17/10	09/17/10	5.79	5.00-6.00
pH	s.u.	Method Blank	08/05/10	08/05/10	5.74	5.00-6.00
pH	s.u.	Method Blank	09/02/10	09/02/10	5.72	5.00-6.00
pH	s.u.	Method Blank	09/02/10	09/02/10	5.72	5.00-6.00
Alkalinity	mg/l	Method Blank	06/04/08	06/04/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	09/17/08	09/17/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	09/29/08	09/29/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	10/15/08	10/15/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	10/22/08	10/22/08	0.8	<1.0
Alkalinity	mg/l	Method Blank	10/29/08	10/29/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	11/04/08	11/04/08	0.6	<1.0
Alkalinity	mg/l	Method Blank	11/17/08	11/17/08	0.8	<1.0
Alkalinity	mg/l	Method Blank	07/07/10	07/07/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	08/21/10	08/21/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	08/26/10	08/26/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	08/05/10	08/05/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	09/17/10	09/17/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	09/02/10	09/02/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	08/05/10	08/05/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	05/17/10	05/17/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	05/20/10	05/20/10	0.8	<1.0
Alkalinity	mg/l	Method Blank	05/27/10	05/27/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	06/08/10	06/08/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	06/14/10	06/14/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	05/20/10	05/20/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	09/02/10	09/02/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	11/10/10	11/10/10	0.4	<1.0
Alkalinity	mg/l	Method Blank	12/07/10	12/07/10	0.6	<1.0
Alkalinity	mg/l	Method Blank	01/21/11	01/21/11	0.6	<1.0
Alkalinity	mg/l	Method Blank	01/06/11	01/06/11	0.8	<1.0
Alkalinity	mg/l	Method Blank	01/17/11	01/17/11	0.6	<1.0
Alkalinity	mg/l	Method Blank	01/21/11	01/21/11	0.8	<1.0
Alkalinity	mg/l	Method Blank	02/14/11	02/14/11	0.4	<1.0

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
Conductivity	µmho/cm	Method Blank	05/13/08	05/13/08	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	07/07/08	07/07/08	2	0.5-3.0
Conductivity	µmho/cm	Method Blank	09/17/08	09/17/08	2	0.5-3.0
Conductivity	µmho/cm	Method Blank	09/30/08	09/30/08	2	0.5-3.0
Conductivity	µmho/cm	Method Blank	10/23/08	10/23/08	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	10/23/08	10/23/08	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	05/28/08	05/28/08	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/18/08	11/18/08	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	07/15/10	07/15/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	08/02/10	08/02/10	2.0	0.5-3.0
Conductivity	µmho/cm	Method Blank	08/13/10	08/13/10	2.0	0.5-3.0
Conductivity	µmho/cm	Method Blank	06/21/10	06/21/10	2.1	0.5-3.0
Conductivity	µmho/cm	Method Blank	07/07/10	07/07/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	08/02/10	08/02/10	2.0	0.5-3.0
Conductivity	µmho/cm	Method Blank	08/13/10	08/13/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	10/14/10	10/14/10	2.0	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/03/10	11/03/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/16/10	11/16/10	2.0	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/30/10	11/30/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	12/17/10	12/17/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	09/21/10	09/21/10	2.1	0.5-3.0
Conductivity	µmho/cm	Method Blank	10/14/10	10/14/10	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/03/10	11/03/10	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	11/30/10	11/30/10	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	01/24/11	01/24/11	2.4	0.5-3.0
Conductivity	µmho/cm	Method Blank	02/17/11	02/17/11	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	03/01/11	03/01/11	2.3	0.5-3.0
Conductivity	µmho/cm	Method Blank	03/01/11	03/01/11	2.2	0.5-3.0
Conductivity	µmho/cm	Method Blank	02/07/11	02/07/11	2.3	0.5-3.0

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
Turbidity	NTU	Method Blank	07/23/08	07/23/08	0.0	<0.7
Turbidity	NTU	Method Blank	10/19/08	10/19/08	0.0	<0.7
Turbidity	NTU	Method Blank	10/10/08	10/10/08	0.1	<0.7
Turbidity	NTU	Method Blank	11/03/08	11/03/08	0.0	<0.7
Turbidity	NTU	Method Blank	10/28/08	10/28/08	0.1	<0.7
Turbidity	NTU	Method Blank	09/16/08	09/16/08	0.0	<0.7
Turbidity	NTU	Method Blank	10/28/08	10/28/08	0.1	<0.7
Turbidity	NTU	Method Blank	11/17/08	11/17/08	0.2	<0.7
Turbidity	NTU	Method Blank	05/19/10	05/19/10	0.1	<0.7
Turbidity	NTU	Method Blank	06/03/10	06/03/10	0.0	<0.7
Turbidity	NTU	Method Blank	06/11/10	06/11/10	0.2	<0.7
Turbidity	NTU	Method Blank	06/11/10	06/11/10	0.2	<0.7
Turbidity	NTU	Method Blank	07/07/10	07/07/10	0.1	<0.7
Turbidity	NTU	Method Blank	07/15/10	07/15/10	0.1	<0.7
Turbidity	NTU	Method Blank	08/05/10	08/05/10	0.1	<0.7
Turbidity	NTU	Method Blank	08/18/10	08/18/10	0.0	<0.7
Turbidity	NTU	Method Blank	09/22/10	09/22/10	0.0	<0.7
Turbidity	NTU	Method Blank	10/06/10	10/06/10	0.0	<0.7
Turbidity	NTU	Method Blank	10/19/10	10/19/10	0.2	<0.7
Turbidity	NTU	Method Blank	10/29/10	10/29/10	0.1	<0.7
Turbidity	NTU	Method Blank	08/11/10	08/11/10	0.1	<0.7
Turbidity	NTU	Method Blank	11/09/10	11/09/10	0.0	<0.7
Turbidity	NTU	Method Blank	11/09/10	11/09/10	0.0	<0.7
Turbidity	NTU	Method Blank	12/15/10	12/15/10	0.1	<0.7
Turbidity	NTU	Method Blank	01/05/11	01/05/11	0.2	<0.7
Turbidity	NTU	Method Blank	01/13/11	01/13/11	0.1	<0.7
Turbidity	NTU	Method Blank	02/11/11	02/11/11	0.1	<0.7
Turbidity	NTU	Method Blank	02/18/11	02/18/11	0.0	<0.7
Turbidity	NTU	Method Blank	01/20/11	01/20/11	0.2	<0.7

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
SRP	µg/l	Method Blank	05/13/10	05/13/10	0	0
SRP	µg/l	Method Blank	05/20/10	05/20/10	0	0
SRP	µg/l	Method Blank	06/11/10	06/11/10	0	0
SRP	µg/l	Method Blank	07/08/10	07/08/10	0	0
SRP	µg/l	Method Blank	08/04/10	08/04/10	0	0
SRP	µg/l	Method Blank	08/18/10	08/18/10	0	0
SRP	µg/l	Method Blank	08/25/10	08/25/10	0	0
SRP	µg/l	Method Blank	10/08/10	10/08/10	0	0
SRP	µg/l	Method Blank	11/08/10	11/08/10	0	0
SRP	µg/l	Method Blank	11/21/10	11/21/10	0	0
SRP	µg/l	Method Blank	12/09/10	12/09/10	0	0
SRP	µg/l	Method Blank	12/15/10	12/15/10	0	0
SRP	µg/l	Method Blank	12/15/10	12/15/10	0	0
SRP	µg/l	Method Blank	02/08/11	02/08/11	0	0
SRP	µg/l	Method Blank	03/02/11	03/02/11	0	0
NOx	µg/l	Method Blank	05/13/10	05/13/10	0	0
NOx	µg/l	Method Blank	05/20/10	05/20/10	0	0
NOx	µg/l	Method Blank	06/11/10	06/11/10	0	0
NOx	µg/l	Method Blank	07/08/10	07/08/10	0	0
NOx	µg/l	Method Blank	08/04/10	08/04/10	0	0
NOx	µg/l	Method Blank	08/18/10	08/18/10	0	0
NOx	µg/l	Method Blank	08/25/10	08/25/10	0	0
NOx	µg/l	Method Blank	10/08/10	10/08/10	0	0
NOx	µg/l	Method Blank	11/08/10	11/08/10	0	0
NOx	µg/l	Method Blank	11/21/10	11/21/10	0	0
NOx	µg/l	Method Blank	12/09/10	12/09/10	0	0
NOx	µg/l	Method Blank	12/15/10	12/15/10	0	0
NOx	µg/l	Method Blank	12/15/10	12/15/10	0	0
NOx	µg/l	Method Blank	03/26/10	03/26/10	0	0
NOx	µg/l	Method Blank	02/08/11	02/08/11	0	0
NOx	µg/l	Method Blank	03/02/11	03/02/11	0	0

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
Total N	µg/l	Method Blank	05/26/10	05/26/10	0	0
Total N	µg/l	Method Blank	05/26/10	05/26/10	0	0
Total N	µg/l	Method Blank	06/01/10	06/01/10	0	0
Total N	µg/l	Method Blank	06/04/10	06/04/10	0	0
Total N	µg/l	Method Blank	06/23/10	06/23/10	0	0
Total N	µg/l	Method Blank	07/02/10	07/02/10	0	0
Total N	µg/l	Method Blank	07/13/10	07/13/10	0	0
Total N	µg/l	Method Blank	07/13/10	07/13/10	0	0
Total N	µg/l	Method Blank	07/26/10	07/26/10	0	0
Total N	µg/l	Method Blank	07/27/10	07/27/10	0	0
Total N	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total N	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total N	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total N	µg/l	Method Blank	08/17/10	08/17/10	0	0
Total N	µg/l	Method Blank	08/20/10	08/20/10	0	0
Total N	µg/l	Method Blank	10/07/10	10/07/10	0	0
Total N	µg/l	Method Blank	11/29/10	11/29/10	0	0
Total N	µg/l	Method Blank	11/29/10	11/29/10	0	0
Total N	µg/l	Method Blank	12/02/10	12/02/10	0	0
Total N	µg/l	Method Blank	12/06/10	12/06/10	0	0
Total N	µg/l	Method Blank	12/16/10	12/16/10	0	0
Total N	µg/l	Method Blank	12/16/10	12/16/10	0	0
Total N	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total N	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total N	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total N	µg/l	Method Blank	03/28/11	03/28/11	0	0

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
Total P	µg/l	Method Blank	05/26/10	05/26/10	0	0
Total P	µg/l	Method Blank	05/26/10	05/26/10	0	0
Total P	µg/l	Method Blank	06/01/10	06/01/10	0	0
Total P	µg/l	Method Blank	06/04/10	06/04/10	0	0
Total P	µg/l	Method Blank	06/23/10	06/23/10	0	0
Total P	µg/l	Method Blank	07/02/10	07/02/10	0	0
Total P	µg/l	Method Blank	07/07/10	07/07/10	0	0
Total P	µg/l	Method Blank	07/13/10	07/13/10	0	0
Total P	µg/l	Method Blank	07/13/10	07/13/10	0	0
Total P	µg/l	Method Blank	07/26/10	07/26/10	0	0
Total P	µg/l	Method Blank	07/27/10	07/27/10	0	0
Total P	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total P	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total P	µg/l	Method Blank	08/16/10	08/16/10	0	0
Total P	µg/l	Method Blank	08/17/10	08/17/10	0	0
Total P	µg/l	Method Blank	08/20/10	08/20/10	0	0
Total P	µg/l	Method Blank	10/07/10	10/07/10	0	0
Total P	µg/l	Method Blank	11/29/10	11/29/10	0	0
Total P	µg/l	Method Blank	11/29/10	11/29/10	0	0
Total P	µg/l	Method Blank	12/02/10	12/02/10	0	0
Total P	µg/l	Method Blank	12/06/10	12/06/10	0	0
Total P	µg/l	Method Blank	12/16/10	12/16/10	0	0
Total P	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total P	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total P	µg/l	Method Blank	12/28/10	12/28/10	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0
Total P	µg/l	Method Blank	03/28/11	03/28/11	0	0

Method Blank Recovery

For Cameron Ditch Treatment System Samples Collected from April 2008 to February 2011

PARAMETER	UNITS	SAMPLE DESCRIPTION	DATE PREPPED	DATE ANALYZED	ACTUAL CONC.	ACCEPTANCE RANGE
Ammonia	µg/l	Method Blank	06/29/10	06/29/10	0	0
Ammonia	µg/l	Method Blank	06/29/10	06/29/10	0	0
Ammonia	µg/l	Method Blank	07/15/10	07/15/10	0	0
Ammonia	µg/l	Method Blank	07/15/10	07/15/10	0	0
Ammonia	µg/l	Method Blank	08/19/10	08/19/10	0	0
Ammonia	µg/l	Method Blank	08/22/10	08/22/10	0	0
Ammonia	µg/l	Method Blank	09/28/10	09/28/10	0	0
Ammonia	µg/l	Method Blank	10/07/10	10/07/10	0	0
Ammonia	µg/l	Method Blank	12/08/10	12/08/10	0	0
Ammonia	µg/l	Method Blank	12/14/10	12/14/10	0	0
Ammonia	µg/l	Method Blank	12/15/10	12/15/10	0	0
Ammonia	µg/l	Method Blank	12/17/10	12/17/10	0	0
Ammonia	µg/l	Method Blank	12/17/10	12/17/10	0	0
Ammonia	µg/l	Method Blank	12/21/10	12/21/10	0	0
Ammonia	µg/l	Method Blank	12/21/10	12/21/10	0	0
Ammonia	µg/l	Method Blank	02/04/11	02/04/11	0	0
Ammonia	µg/l	Method Blank	04/06/11	04/06/11	0	0
Ammonia	µg/l	Method Blank	04/06/11	04/06/11	0	0
Color	PCU	Method Blank	05/12/10	05/12/10	<1	<1
Color	PCU	Method Blank	05/19/10	05/19/10	<1	<1
Color	PCU	Method Blank	06/03/10	06/03/10	<1	<1
Color	PCU	Method Blank	06/11/10	06/11/10	<1	<1
Color	PCU	Method Blank	07/07/10	07/07/10	<1	<1
Color	PCU	Method Blank	07/14/10	07/14/10	<1	<1
Color	PCU	Method Blank	07/14/10	07/14/10	<1	<1
Color	PCU	Method Blank	07/20/10	07/20/10	<1	<1
Color	PCU	Method Blank	08/05/10	08/05/10	<1	<1
Color	PCU	Method Blank	08/05/10	08/05/10	<1	<1
Color	PCU	Method Blank	08/17/10	08/17/10	<1	<1
Color	PCU	Method Blank	10/07/10	10/07/10	<1	<1
Color	PCU	Method Blank	02/02/11	02/02/11	<1	<1
Color	PCU	Method Blank	02/10/11	02/10/11	<1	<1
Color	PCU	Method Blank	02/17/11	02/17/11	<1	<1
Color	PCU	Method Blank	02/24/11	02/24/11	<1	<1