

CHS, Inc.
Stormwater Assimilation Wetland
Monitoring Report

January-March 2019



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February 25, 2019

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CHS, Inc. Stormwater Assimilation Wetland Monitoring Report

Summary of Activities: January - March 2019

Site visits

February 6, 2019: Comite Resource's biologist Jason Day and Joel Mancuso visited the storm water assimilation wetlands at the CHS facility. They carried out a site evaluation and collected water samples for TOC and TSS analysis. Duplicate TOC and TSS samples were taken at the inflow and outflow of each pond. Samples were delivered to Pace Analytical in Baton Rouge. Diameter of tagged trees in the North and South ponds were measured and recorded as well as heights of selected trees. An excessive amount of Black-Bellied Whistling Ducks (*Dendrocygna autumnalis*) are present in the North Pond. Alligators have begun breeding in the ponds and some may need to be removed in future. Vegetation in both ponds is growing well. Overall the wetlands are doing very well. CHS continues to maintain the ponds in a positive manner.



Joel Mancuso collecting a water sample at the South pond on February 6, 2019.

Water Quality

Water quality data from the January 6th sampling were received from the laboratory (see data below). All parameters look normal with concentrations within expected ranges. Refer to the 2019 annual report for full analysis.

Annual Report

The annual report for the CHS stormwater wetland was prepared and sent to the plant manager in February 2019. The annual report has been appended to this report.



Whistling ducks (Anatidae Dendrocygninae) using the South Pond.

Raw water chemistry data from February 6, 2019.



Pace Analytical Services, LLC
11811 Industriplex Blvd. - Suite 3
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ANALYTICAL RESULTS

Project: CHS
Pace Project No.: 2095296

Sample: South Pond In		Lab ID: 2095296001	Collected: 02/06/19 10:00	Received: 02/06/19 13:00	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
2540D Total Suspended Solids		Analytical Method: SM 2540D							
Total Suspended Solids	187	mg/L	4.7	1		02/08/19 15:38			
5310B TOC		Analytical Method: SM 5310B							
Total Organic Carbon	27.9	mg/L	1.0	1		02/07/19 20:27	7440-44-0		
Sample: South Pond Out		Lab ID: 2095296002	Collected: 02/06/19 09:30	Received: 02/06/19 13:00	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
2540D Total Suspended Solids		Analytical Method: SM 2540D							
Total Suspended Solids	12.0	mg/L	4.0	1		02/08/19 15:38			
5310B TOC		Analytical Method: SM 5310B							
Total Organic Carbon	10.1	mg/L	1.0	1		02/07/19 20:39	7440-44-0		
Sample: North Pond In		Lab ID: 2095296003	Collected: 02/06/19 07:30	Received: 02/06/19 13:00	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
2540D Total Suspended Solids		Analytical Method: SM 2540D							
Total Suspended Solids	47.0	mg/L	4.0	1		02/08/19 15:38			
5310B TOC		Analytical Method: SM 5310B							
Total Organic Carbon	145	mg/L	10.0	10		02/08/19 08:54	7440-44-0		
Sample: North Pond Out		Lab ID: 2095296004	Collected: 02/06/19 08:30	Received: 02/06/19 13:00	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
2540D Total Suspended Solids		Analytical Method: SM 2540D							
Total Suspended Solids	77.0	mg/L	4.0	1		02/08/19 15:38			
5310B TOC		Analytical Method: SM 5310B							
Total Organic Carbon	23.6	mg/L	1.0	1		02/07/19 21:06	7440-44-0		
Sample: South Pond In DUP		Lab ID: 2095296005	Collected: 02/06/19 10:00	Received: 02/06/19 13:00	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
2540D Total Suspended Solids		Analytical Method: SM 2540D							
Total Suspended Solids	27.0	mg/L	4.0	1		02/08/19 15:38			



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ANALYTICAL RESULTS

Project: CHS
 Pace Project No.: 2095296

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
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5310B TOC		Analytical Method: SM 5310B						
Total Organic Carbon	30.3	mg/L	1.0	1		02/07/19 21:18	7440-44-0	

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
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2540D Total Suspended Solids		Analytical Method: SM 2540D						
Total Suspended Solids	10.0	mg/L	4.0	1		02/08/19 15:38		

5310B TOC		Analytical Method: SM 5310B						
Total Organic Carbon	10.2	mg/L	1.0	1		02/07/19 21:29	7440-44-0	

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
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2540D Total Suspended Solids		Analytical Method: SM 2540D						
Total Suspended Solids	92.1	mg/L	5.3	1		02/09/19 08:51		

5310B TOC		Analytical Method: SM 5310B						
Total Organic Carbon	185	mg/L	10.0	10		02/08/19 09:14	7440-44-0	

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
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2540D Total Suspended Solids		Analytical Method: SM 2540D						
Total Suspended Solids	81.8	mg/L	7.3	1		02/09/19 08:51		

5310B TOC		Analytical Method: SM 5310B						
Total Organic Carbon	23.8	mg/L	1.0	1		02/07/19 21:56	7440-44-0	

NATURE'S POTENTIAL MEETS HUMANITY

CHS, INC. STORMWATER ASSIMILATION WETLAND
2018 MONITORING REPORT

February 13, 2019



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CHS, INC. STORMWATER ASSIMILATION WETLAND 2018 MONITORING REPORT

INTRODUCTION

During rainfalls, grain dust from the CHS, Inc. bulk grain transfer facility washes into drainage ditches where total organic carbon (TOC) concentrations regularly exceed the LPDES permit limit of 50 mg/L. In an effort to reduce TOC concentrations from the stormwater runoff, CHS implemented aggressive stormwater management practices and regular cleaning of earthen swales and other areas. Despite these changes, TOC concentrations continued to exceed permitted concentrations.

In 2011, Comite Resources designed and directed construction of two ~2-acre stormwater wetlands directly north and south of the facility (Figure 1). Several hundred baldcypress seedlings were planted along the edge of the ponds and weirs were installed to control water levels. Herbaceous wetland vegetation established itself naturally, and alligators and a large population of whistling ducks, along with other wildlife are also currently using the ponds.



Figure 1. Map showing the locations of the CHS stormwater ponds.

Stormwater from the CHS facility is now routed through these wetlands prior to release into the local drainage network (Figure 2). Comite Resources monitors the wetlands for TOC and Total Suspended Sediment (TSS) reduction, vegetative growth, and general overall health. Influent TOC concentrations are at times as high as ~300 mg/L, but outflow effluent TOC concentrations are generally below 40 mg/L, demonstrating that these wetlands are effectively reducing TOC concentrations of surface water runoff.

During March 2012, approximately 700 baldcypress (*Taxodium distichum*) seedlings were planted in the two wetlands and herbaceous species, such as cattail (*Typha sp.*), colonized the areas naturally. To determine tree growth in the wetlands, diameter-at-breast-height (DBH) of the seedlings is measured annually.



Figure 2. The North pond stormwater wetland at CHS, inc.

OBJECTIVES OF MONITORING

Comite Resources completed the following tasks between January and December 2018, including:

- 1) Collected quarterly water samples from each wetland (e.g., North pond and South pond) for analysis of TOC and TSS concentrations;
- 2) Measured diameter-at-breast-height (DBH) of a subset (i.e., 50 trees) of the baldcypress seedlings at the two wetlands in February 2018 and 2019; and
- 3) Performed a visual inspection of the wetlands four times (items listed in Table 1);
- 4) Willow trees growing at the stormwater ponds were cut down in April 2018 to reduce shading of the baldcypress trees. In addition, invasive vines were growing in some of the baldcypress trees and these were removed in April as well to prevent shading.

MONITORING METHODS

Water Quality

Water samples were collected for analysis of TOC and TSS concentrations at the inlet and outlet of each wetland (Figure 3). These samples were collected on February 22, May 11, August 28, and December 5, 2018. Water samples were taken to an EPA-certified laboratory (i.e., Pace Analytical in Baton Rouge) for analysis of TOC and TSS using EPA-recommended methods.



Figure 3. Collecting water samples at the North pond.

Tree Growth

When the bald cypress seedlings were planted during March 2012, a subset of approximately 50 out of the 700 trees were tagged with identification numbers and tree heights and diameters were recorded above and below the tag. Diameters were measured on February 8, 2017 and March 2, 2018. Tree height was measured in 2015 but discontinued the following years because the trees have grown very tall (Figure 4).



Figure 4. Baldcypress trees growing at the North pond.

Visual Inspection

During each of the four visits, Comite Resources staff visually inspected the wetlands for the items listed in Table 1.

Table 1. General maintenance schedule for a stormwater wetland (Kadlec and Wallace 2009).

Activity	Frequency
Inspect to ensure bank stability, sufficient vegetation growth, and expected drainage.	After the first 3 post-construction storm events
Inspect for invasive vegetation, trash and debris, clogging of inlet/outlet structures, excessive erosion, sediment buildup in basin or outlet, cracking or settling of the dam, bank stability, tree growth on dam or embankment, excessive algal growth, signs of pollution such as oil sheens, discolored water, or unpleasant odors, and signs of flooding.	Twice a year and after large storm events
Re-plant if needed to maintain vegetation; remove vegetation from bottom of wet pond area.	Once a year
Monitor avian, reptile, and amphibian populations	Quarterly

RESULTS AND DISCUSSION

Water Quality

At the North pond, influent TOC concentrations ranged between 11.4 and 97.9 mg/L and effluent TOC concentrations ranged between 19 and 70.9 mg/L (Table 2). TOC removal was between 0 and 78%. With the exception of the February 2018 sampling, effluent TOC was consistently below 23 mg/L (Table 3). Effluent TOC concentrations were reduced in February but were higher than the LPDES permit limit of 50 mg/L. Mean TOC concentration in the water leaving the North pond was 31.1 ± 7.2 mg/L, demonstrating that the North pond is effectively reducing TOC concentrations of surface water runoff. At the South pond, influent TOC concentrations ranged from 10.6 to 75.4 mg/L and effluent TOC concentrations ranged from 1.0 to 31.1 mg/L (Table 2). TOC removal ranged between 0 and 93.2%.

Generally, the higher the concentration of TOC coming into a wetland, the greater the amount of removal (Figure 5). When the influent TOC is low, little or no TOC removal is typically achieved because there is a background TOC concentration within the wetland below which TOC concentration is not reduced. Typical background TOC concentrations in wetlands range between 10 and 20 mg/L (DeLaune et al. 2008).

Total suspended solids concentration in surface water running into the North pond ranged between 19 and 418 mg/L, with the variation most likely to due rainfall events (Table 2). Mean TSS concentration in surface water leaving the North pond was 40.8 ± 3.8 mg/L. At the South pond mean influent TSS ranged between 24 and 222 mg/L and mean effluent TSS concentration was 38.0 ± 18.7 mg/L (Table 3).

Table 2. TOC and TSS concentrations of surface waters at the North and South ponds in 2018.

Pond	Date	TOC In (mg/L)	TOC Out (mg/L)	TOC % removal	TSS In (mg/L)	TSS Out (mg/L)	TSS % removal
North	2/22/18	31.4	20.6	34.4	149	33.6	77.4
North	2/22/18	29.6	19.8	33.1	110	55.6	49.5
North	5/11/18	97.9	56.2	42.6	135	24.8	81.6
North	5/11/18	92.4	70.9	23.3	177	31.7	82.1
North	8/28/18	11.4	19.6	0.0	418	39.2	90.6
North	8/28/18	13.1	22.9	0.0	284	41.2	85.5
North	12/5/18	37	19	48.6	22	52	0.0
North	12/5/18	87	19.6	77.5	19	48	0.0
South	2/22/18	6.9	9	0.0	52	7.6	85.4
South	2/22/18	8.3	8.9	0.0	30	10	66.7
South	5/11/18	69.5	30	56.8	31.6	14.4	54.4
South	5/11/18	75.4	31.1	58.8	42.6	19.2	54.9
South	8/28/18	71	16.3	77.0	222	135	39.2
South	8/28/18	68.2	16.4	76.0	101	110	0.0
South	12/5/18	14.7	1	93.2	36	4	88.9
South	12/5/18	10.6	9.2	13.2	24	4	83.3

Table 3. Mean total organic carbon (TOC) and total suspended solids (TSS) concentrations of surface water flowing into and out of the two constructed wetlands in 2018.

Wetland	Mean Influent TOC (mg/L)	Mean Effluent TOC (mg/L)	Mean Influent TSS (mg/L)	Mean Effluent TSS (mg/L)
North	50.0±12.8	31.1±7.2	164.3±47.1	40.8±3.8
South	40.6±11.6	15.2±3.8	67.4±23.7	38.0±18.7

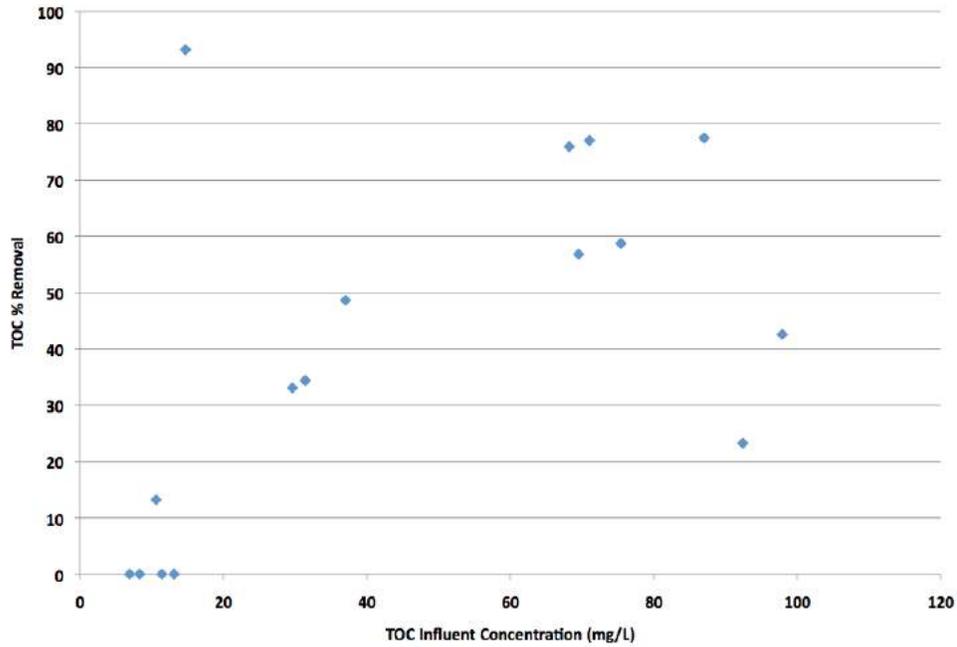


Figure 5. Percent total organic carbon removal (TOC) as a function of influent TOC concentration (2018 data).

Since monitoring of the constructed wetlands began in 2012, mean TOC influent and effluent concentrations in the North pond were 126.6±17.1 and 35.5±3.0 mg/L, respectively. Mean TSS influent and effluent concentrations in the North pond were 438.6±144.3 and 82.9±13.8 mg/L, respectively. During the same time period, mean TOC influent and effluent concentrations in the South pond were 27.1±3.2 and 19.6±2.1 mg/L, respectively. Mean TSS influent and effluent concentrations in the South pond were 34.3±6.3 and 31.4±5.2 mg/L, respectively. Overall TOC removal increases as the influent TOC concentration increases (Figure 6)

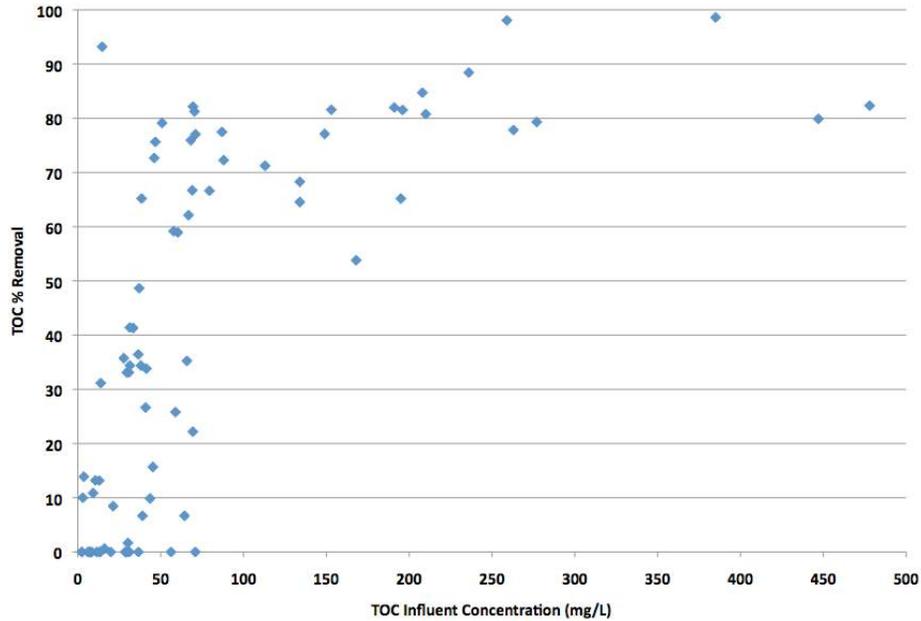


Figure 6. Percent total organic carbon removal (TOC) as a function of influent TOC concentration (2012 - 2018 data).

Tree Growth

At the North pond, mean DBH increased from 1.80 cm in 2012 to 16.67 cm in 2018 (Table 4). At the South pond, mean DBH increased from 1.89 cm in 2012 to 15.56 cm in 2018. While baldcypress mean DBH at the South pond was not as high as at the North wetland, seedlings did increase in both height and DBH. As the data show, the trees are growing very well in both stormwater ponds.

Table 4. Mean baldcypress seedling height and diameter at breast height (DBH) measured in the North and South wetlands.

Parameter	Wetland	Mean (cm)				
		2012	2015	2016	2017	2018
Height (cm)	North	234±11	>400	>500	>600	>600
	South	247±14	>400	>500	>600	>600
DBH (cm)	North	1.80±0.14	8.42±0.29	10.69±0.39	13.65±0.51	16.67±0.60
	South	1.89±0.19	6.98±0.20	9.47±0.28	12.59±0.32	15.56±0.43

Visual Inspection

The wetlands were visually inspected at every visit. Herbaceous species started colonizing the wetlands soon after construction. Normal wetland fauna, including alligators and black-bellied Whistling Ducks (*Dendrocygna autumnalis*), are using the pond (Figure 7). In a bird survey conducted in December 2018, over 600 black-bellied Whistling Ducks were using the pond.



Figure 7. Waterfowl utilizing the South pond.

SUMMARY

Baldcypress trees in the wetlands are thriving, along with various herbaceous wetland species. Black willow trees and invasive vines have been eliminated when found growing in the wetlands to prevent shading of baldcypress trees. The wetlands are removing TOC to concentrations below that stated in the LPDES permit (i.e., 50 mg/L). Mean effluent TOC concentrations in the North and South ponds were 31 and 15 mg/L, respectively. Mean TSS concentrations were lower at the outlet of both wetlands than at the respective inlets, and concentrations at the North wetland have been consistently lower than 2014 concentrations since the weir was installed.

REFERENCES

- DeLaune, R.D., C.B. Johnson, R.P. Gambrell, and A. Jugsujinda. 2008. Export of dissolved organic carbon from a ponded freshwater marsh receiving diverted Mississippi River water. *The Scientific World Journal* 8:1210-1218.
- Kadlec, R.H. and S.D. Wallace. 2009. *Treatment Wetlands*, 2nd edition. CRC Press, Boca Raton, Florida. 1016 pp.