STREAM ECOSUMMARY

Withlacoochee River at Stokes Ferry
Citrus County, WBID 1329C

December 8, 2015 and June 22, 2016



Figure 1. Sampling reach along Withlacoochee River at Stokes Ferry in Citrus County.

Physical, chemical, and biological sampling were conducted at Withlacoochee River at Stokes Ferry (STORET 3513, SBIO Nickname FLO521150) in Citrus County on December 8, 2015 and June 22, 2016 by the DEP Southwest DEAR Field Office. This stream was sampled as part of the Trend Monitoring Network. Overall, the water quality and macroinvertebrate community met the expectations for a healthy, well-balanced stream. The algal and macrophyte community data confirmed that the water body may not attain one or more of its designated uses.

Background

Healthy, well-balanced stream and river communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP evaluates if human activities have resulted in the condition where a waterbody has exceeded water quality criteria (Chapter 62-302, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life use support), and exceedances of these standards is associated with interference with the designated use. Additionally, DEP evaluates the health of floral (plants and algae) and faunal (animal) communities and conducts habitat assessments to diagnose potential physical impacts.

Site Description

The Withlacoochee River at Stokes Ferry sampling location (Figure 1) is located along the border of Citrus and Marion counties in the Lower Withlacoochee Watershed (WBID 1329C, Figure 2). It is a large river draining the Green Swamp, which is in the Gulf Coast Flatwoods subecoregion (Figure 2). The Withlacoochee River at Stokes Ferry is a tributary of the Withlacoochee River that flows into the Gulf of Mexico and has a Landscape Development Intensity (LDI) Index score of 2.22. The LDI quantifies the intensity of human activity in the surrounding area based on land use and land cover, and is normalized on a scale from 1 to 10, where a natural land use has a coefficient of 1.0 and a central business district has a coefficient of 10.0. This site's score of 2.22 suggests minimal human activity in the 100m buffer surrounding the stream. The WBID is not currently listed on the Impaired Waters Verified List or Study List for any parameter. Additional information about

this WBID is available in the TMDL Tracker application (http://prodenv.dep.state.fl.us/DearTmdl/welcomehz.do).

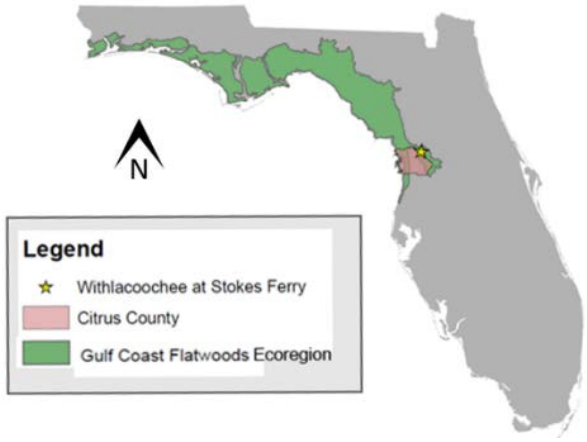


Figure 2. Location of the Withlacoochee River at Stokes Ferry sampling site in Citrus County.

Methods

Water Quality

Surface water samples were collected for analysis of color, nutrients, chlorophyll a, and metals following DEP Standard Operating Procedures (SOPs, see https://floridadep.gov/dear/quality-assurance/content/dep-sops for details) and met the requirements of the FDEP Quality Assurance Rule, Chapter 62-160, F.A.C. (https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-160). Results were compared with applicable Class III water quality criteria contained in 62-302, F.A.C., including nutrients, dissolved oxygen, and other indicators.

Rule 62-302.531, F.A.C., provides that Numeric Nutrient Criteria are achieved in streams if: Information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition do not indicate an imbalance in flora or fauna; AND EITHER

The average score of at least two temporally independent Stream Condition Indices (SCIs) is 40 or higher, with neither of the two most recent SCI scores less than 35, OR

The Nutrient Thresholds (expressed as annual geometric means) are not exceeded more than once in a three-year period. The nutrient thresholds are region-specific. This sampling site is in the Peninsula nutrient region. The floral and faunal measures are described below.

Dissolved Oxygen

Rule 62-302.533 (1), F.A.C., states that no more than 10 percent of the daily average percent dissolved oxygen (DO) saturation values shall be below 67 percent in the Panhandle West bioregion, 38 percent in the Peninsula and Everglades bioregions, or 34 percent in the Northeast and Big Bend bioregions. This site is in the Peninsula region for DO criteria assessment. Percent saturation incorporates factors such as temperature, atmospheric pressure, and salinity.

The daily average freshwater DO criteria is preferentially assessed using daily average values calculated from full days of diel (collected over a 24 hour period) monitoring data. If diel monitoring data are not available, as was the case for this report, instantaneous samples are used to assess the DO criterion by comparing the instantaeous value with a time-of-day-specific translation of the daily average criterion (62-303.420(9), F.A.C.).

Habitat Assessment

The Stream and River Habitat Assessment was conducted per DEP SOP FT 3100. The Habitat Assessment is a rapid field method in which a sampler scores eight in-stream and riparian components to estimate the influence of habitat factors on the resident aquatic organisms. Habitat Assessment scores range from 11-160 and overall habitat quality is assigned to one of four categories: Optimal (120-160 points), Suboptimal (80-119 points), Marginal (40-79 points), and Poor (11-39 points).

Floral Assessment

Evaluations of stream flora include the Rapid Periphyton Survey (RPS, DEP SOP FS 7230), community composition information associated with dominant algal taxa (where applicable), Linear Vegetation Survey (LVS, DEP SOP 7320), and chlorophyll *a*. The RPS assesses the extent and

thickness of algae in the stream reach, while the LVS assesses how closely the in-stream plant community resembles a minimally disturbed condition. Results are assessed as described beginning on page 8 of "*Implementation of Florida's Numeric Nutrient Standards*," dated April 2013, using evidentiary thresholds derived from a population of minimally disturbed reference sites.

Faunal Assessment

The Stream Condition Index (SCI) assesses how closely the macroinvertebrate community (*e.g.*, aquatic insects, clams, crayfish) of a stream resembles the macroinvertebrate community of an undisturbed or "reference" condition. The SCI was sampled and calculated per DEP SOP SCI 1000. For the SCI, ten measures of macroinvertebrate health are calculated and summed to yield a final score from 0-100. Average SCI scores ≥ 40 are considered "Healthy" (as long as neither of the latest two SCI scores were < 35) with scores ≥ 64 considered "Exceptional." The SCI is part of the NNC evaluation for streams, as described above, and also serves as a biological health assessment tool in 62-303, F.A.C., DEP's Impaired Waters Rule.

Evaluation of Stream Exclusions for Applying Nutrient Criteria

When assessing a stream for compliance with numeric nutrient criteria (NNC) in Rule 62-302.531, F.A.C., it is important to note that several waterbody types are excluded from the stream definition in Rule 62-302.200(36), F.A.C. These include lake-like portions of rivers (where the lake NNC apply) and ditches/canals used for water management purposes, non-perennial streams, wetlands, and tidally fluctuating areas (where the narrative criterion, "no imbalances in natural populations of aquatic flora or fauna," continues to apply). The NNC in Rule 62-302.531, F.A.C., were applicable to Withlacoochee River at Stokes Ferry.

Results

Water Quality

The water quality results are displayed in Table 1. All analytes tested met the Class III Water Quality Criteria. Thus, the Withlacoochee River at Stokes Ferry is a healthy system in terms of water quality.

NNC Threshold Assessment

Based on these two sampling events associated with faunal and floral assessments and additional monthly water quality sampling, the stream met the numeric nutrient thresholds for the Peninsula. The thresholds represent annual geometric mean concentrations (minimum of four samples) not to be exceeded more than once in any three-calendar year period and are used in combination with floral and faunal information. The annual geometric mean for total nitrogen (TN) in 2015 was 1.09 mg/L, and in 2016 it was 1.09 mg/L which is less then surface water criteria of 1.54 mg/L. The annual geometric mean for total phosphorous (TP) in 2015 was 0.06 mg/L, and in 2016 it was 0.07 mg/L which is less then surface water criteria of 0.12 mg/L. Therefore, TN and TP both meet the attainment of the NNC.

Floral Assessment

Results of the floral metrics show that this site is not within the reference stream distribution and therefore does not attain the floral component of the NNC (Table 2). All floral measures must pass for the stream to attain the NNC.

Less than $2m^2$ of in-stream vegetation and no algae thicker than 6 mm was observed on December 8, 2015. However, the floral assessment on June 22, 2016 exceeded the LVS mean C of C, LVS FLEPPC, RPS, and Chlorophyll *a* thresholds (Table 2), resulting in the floral component not being met. The differences between the two assessments may be explained by seasonal differences; warmer temperatures and longer daylight periods in the summer months encourage floral growth. Additionally, the flow and depth conditions have changed. In December 2015, the depth was 2.3 m compared to 1.2 m in June 2016 which marks the end of dry season. The flow velocity also decreased from 0.4 m/s in December 2015 to 0.25 m/s in June 2016. The river water was more

colored and contained higher concentrations of TKN on December 8 (Table 1), which indicates higher discharge from upstream wetlands.

Chlorophyll *a* exceeded the threshold on June 22, 2016. However, the chlorophyll *a* concentration was less than 20 µg/L (Table 1). However, NNC attainment is based off annual geometric means of Chlorophyll *a* concentration. The annual geometric mean in 2015 was 1.10 µg/L, and in 2016 it was 2.09 µg/L. Both annual geometric means are below the 3.2 ug/L threshold, so the chlorophyll *a* criterion has been attained.

The LVS exceedance was due the presence of the invasive exotics *Alternanthera philoxeroides*, *Pistia stratioides*, and *Salvinia minima*. Increased water levels and water velocity during the fall rainy season could have moved the floating exotic plants, *Pistia* and *Salvinia*, out of the 100 m assessment area for the December 8, 2015 sampling event. Native plants were also observed including *Nuphar sp.* and *Panicum hemitomon*.

The RPS on June 22, 2016 showed that 35% of randomly sampled algae was greater than 6 mm thick. *Vaucheria* was the dominant algal species in these samples, with *Closterium* and *Phormidium* also present. Deeper water resulting from the rainy season could prevent sunlight from reaching the streambed, restricting algal growth in the fall and winter months.

Table 1. Water quality results from 12/03/2015 and 06/07/2016 at Withlacoochee River at Stokes Ferry.

Analyte	Result 12/03/2015	Result 06/7/2016	Applicable Class III Water Quality Criteria
Field Temperature (°C)	21.8	26.9	N/A
Field pH (SU)	7.1	7.2	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	43.3	53.9	* Peninsula: 38%
Field Specific Conductance (µmhos/cm)	321	317	50% above background or 1275 µmhos/cm, whichever is greater
Color (PCU)	130	47	N/A
Total Phosphorus (mg/L) as P	0.052	0.07	** Peninsula: 0.12 mg/L
Nitrate+Nitrite (mg/L) as N	0.15	0.29	0.35 mg/L for spring vents only
Ammonia (mg/L) as N	0.018	0.049	*** 4.03, 2.76
Total Kjeldahl Nitrogen (mg/L) as N	0.93	0.6	N/A
Total Nitrogen (mg/L) as N	1.08	0.89	** Peninsula: 1.54 mg/L

* Instantaneous DO criterion calculated per DO Saturation Calculator.

** Annual geometric numeric nutrient threshold for Peninsula nutrient region, used in combination with information on flora and fauna.

*** Total ammonia criterion calculated per https://floridadep.gov/dear/water-quality-standards-program/documents/total-ammonia-nitrogen-calculator%C2%A0

Table 2. Floral and faunal assessment results from 12/08/2015 and 06/22/2016 at Withlacoochee River at Stokes Ferry.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 12/08/2015 Sample 75313	Result 06/22/2016 Sample 76321
LVS C of C	Site average ≥ 2.5	< $2m^2$ (Pass)	2.04
LVS FLEPPC (%)	Site average ≤ 25%	< $2m^2$ (Pass)	40
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	0	35
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	1.3 µg/L	4.7 µg/L
Algal Community Composition	No adverse shifts in dominant taxa	N/A	*Vaucheria* dominant, with *Closterium* and *Phormidium* present
SCI	Average ≥ 40	67	55

Habitat Assessment

The stream and river habitat assessment scores were 121 and 118, which are in the low-optimal (121) and high-suboptimal (118) range. The typical velocity measured was 0.25 m/s, which resulted in a suboptimal score for stream flow. Fish and aquatic insects require sufficient water velocity to maintain high dissolved oxygen concentrations in the stream; in this case the dissolved oxygen was 43.3 – 53.9% saturation. The average width within the assessment stretch was 35 m. The banks were well armored and gradual, preventing erosion during high flow events. The bank stability scores, as a result, were in the optimal range. Four productive habitats were noted: woody debris, aquatic vegetation, rocks, and roots which comprised roughly 2% of the stream area. Although there was a diverse composition of habitat, the actual percentage of habitat available was low and corresponded with a score of "poor." In addition, the little habitat available was moderately smothered with silt and algae, further limiting the ability for organisms to colonize.

Faunal Assessment (SCI)

The average SCI score for this site was 61 out of a possible 100 points, corresponding with a "Healthy" designation (Table 2). These results are within the range of previous scores for this site, which ranged from 34 to 67 (most recent version of SCI only, from 2009-2016). The most common species found in the two sampling events was *Tricorythodes albilineatus*, which is a species of mayfly. A high presence of this species indicates good water quality, as mayflies are a species known to be sensitive to poor water quality.

Conclusions

Sampling at Withlacoochee River at Stokes Ferry indicated good water quality results and mixed biological health results. All analytes tested in both sampling events met the applicable Class III water quality criteria but did not attain the required passing scores for both floral assessments. This difference could be attributed to seasonal differences within the watershed. As a result, this water body is on the Planning List, category 3c (3c – means enough data is available to meet the requirements of the Planning List in Chapter 62-303, F.A.C.) for algal mats and macrophytes. Additional RPS and LVS data will be

collected until two consecutive assessments either meet or do not meet the applicable thresholds.

Withlacoochee River at Stokes Ferry will continue to receive monthly water quality and semiannual biological assessments as part of the Trend Monitoring Network.

Thank you for your interest in maintaining the water quality of Florida's aquatic resources. Please contact us if you have any questions.

Contact and resources for more information

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DEP biological assessment resources: https://floridadep.gov/dear/bioassessment

Additional information about the Trend Monitoring Network: https://floridadep.gov/dear/watershed-monitoring-section/content/trend-network