STREAM ECOSUMMARY

Little Crooked Creek
WBID 907, Bay County
May 9, 2018 and November 30, 2021



Figure 1. Sampling reach along Little Crooked Creek in Bay County.

Physical, chemical, and biological sampling was conducted at Little Crooked Creek (STORET/WIN 32020063, SBIO LtCrkCkRef) in Bay County on May 9, 2018 and November 30, 2021 by the DEP, Division of Environmental Assessment and Restoration (DEAR), Aquatic Ecology and Quality Assurance Section (AEQAS). This stream was sampled as part of the DEP Ecoregional Reference Stream survey, which was designed to provide baseline information about the state's highest quality streams and monitor the water quality and biological community health of these streams through time. Overall, the water quality and macroinvertebrate community data indicated that the stream met expectations for a healthy, well-balanced stream.

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 Little Crooked Creek sampling location (Figure 1) is located in the northern portion of Bay County, within Pine Log State Forest. Little Crooked Creek is within the Little Crooked Creek Watershed (WBID 907, Figure 2) and in the Choctawhatchee-St. Andrew

Basin. The Little Crooked Creek sampling location is a third order stream draining the Gulf Coast Flatwoods, a subecoregion of the Southern Coastal Plain ecoregion. Little Crooked Creek is a headwater stream that flows into East River and has a Landscape Development Intensity (LDI) Index score of 1.2. The LDI is calculated for the 100 m buffer of the waterbody for 10 km upstream of the point of interest. 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 1.2 suggests minimal human activity in the 100m buffer surrounding the stream. The WBID is not currently listed for any parameters on the Verified List of Impaired Waters. Additional information about this WBID is available in the Water Quality Assessments, TMDLs, and BMAPs map application (https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77).

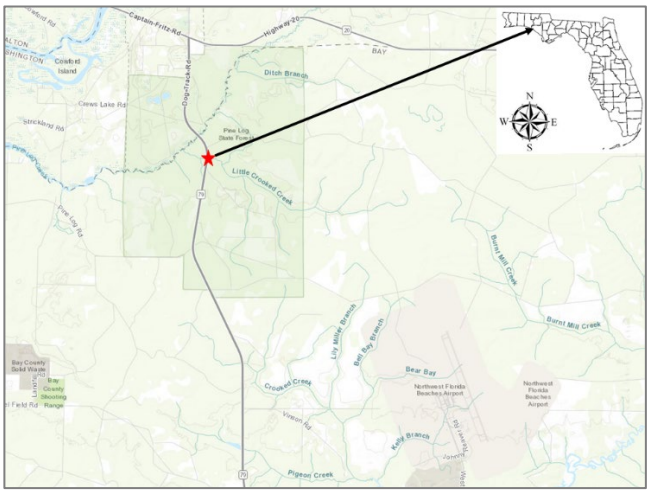


Figure 2. Location of Little Crooked Creek in Bay County. The darker green area shown is Pine Log State Forest.

Methods

Water Quality

Surface water samples were collected for analysis of alkalinity, turbidity, chloride, color, fluoride, sulfate, total dissolved solids, total suspended solids, nutrients, chlorophyll, *Escherichia coli* (*E. coli*), pesticides, herbicides, sucralose, 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.

Chapter 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 Panhandle West 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 Panhandle region for DO criteria assessment. Percent saturation considers 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 Little Crooked Creek.

Results

Water Quality

The water quality results are shown in Table 1. Alkalinity results were 2.0 mg $CaCO_3$/L and 1.8 mg $CaCO_3$/L for each sampling event, respectively. The water quality standard for alkalinity is that values shall not be depressed below 20 mg $CaCO_3$/L. However, historically, alkalinity at this Little Crooked Creek site is less than 2.0 mg $CaCo_3$/L. Thus, while 2.0 and 1.8 mg $CaCO_3$/L are below the water quality standard value of 20 mg $CaCO_3$/L, the system's historic alkalinity levels indicate alkalinity values below 20 mg $CaCO_3$/L may be due to natural conditions. The remaining water quality parameters did not exceed the water quality criteria.

NNC Threshold Assessment

Based on these two sampling events, the stream met the numeric nutrient thresholds for the Panhandle West; however, 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. Therefore, even though the thresholds were not exceeded, additional nutrient sampling may be

needed to meet data sufficiency requirements to calculate and assess attainment of the water quality standard.

Floral Assessment

Results of the floral metrics show that this site is within the reference stream distribution and therefore attains the floral component of the NNC (Table 2). There were few instances of attached algae >6mm (2%) during the 2018 sampling event and no instances (0%) during the 2021 sampling event. No aquatic plants were observed and chlorophyll *a* was not detected during either sampling event. Therefore, the site achieves the RPS, LVS, and chlorophyll *a* components of the NNC floral metrics.

Table 1. Water quality results from May 9, 2018 and November 30, 2021 at Little Crooked Creek.

Analyte	Result 5/9/18	Result 11/30/21	Applicable Class III Water Quality Criteria
Field Temperature (°C)	19.49	12.6	N/A
Field pH (SU)	5.8	5.87	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	88.6	92.3	* 68%
Field Specific Conductance (µmhos/cm)	20	17.9	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	2.0 I	1.8 I	Shall not be depressed below 20
Color (PCU)	58 A	54 A	N/A
Total Phosphorus (mg/L) as P	0.004 I	0.003 I	**0.06
Nitrate+Nitrite (mg/L) as N	0.005 I	0.012	0.35 for spring vents only
Ammonia (mg/L) as N	0.002 U	0.003 I	***5.50 and 8.58
Total Kjeldahl Nitrogen (mg/L) as N	0.19 I	0.14	N/A
Total Nitrogen (mg/L) as N	0.2	0.15	**0.67

* Instantaneous DO criterion calculated per DO Saturation Calculator and adjusted for time of day.

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

*** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator, for single sample maximum.

A Qualifier: Value reported is the arithmetic mean (average) of two or more determinations.

I Qualifier: The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.

U Qualifier: Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed.

Table 2. Floral and faunal assessment results from May 9, 2018 and November 30, 2021 at Little Crooked Creek.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 5/9/18 Sample 78367	Result 11/30/21 Sample 83505
LVS C of C	Site average ≥ 2.5	Pass (<2m^2)	Pass (<2m^2)
LVS FLEPPC (%)	Site average ≤ 25%	Pass (<2m^2)	Pass (<2m^2)
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	2%	0%
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	0.55 U	0.82 U
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	82	70

U Qualifier: Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed.

Habitat Assessment

The stream and river habitat assessment scores were 135 and 134, which are in the optimal range. The typical velocity measured was 0.25 m/s, which resulted in an optimal 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 88.6% in 2018 and 92.3% saturation in 2021. The average width within the assessment stretch was 3.5 to 4 m. The banks were well-armored and low with a gradual slope which provides a good connection with the floodplain. The bank stability scores, as a result, were in the optimal range. Three major productive habitats were noted: woody debris, leaf packs, and roots which comprised roughly 13% of the stream area. During both sampling events, there was an adequate number of stable pools and less than 25% of habitats affected by sand, silt, or algae smothering which resulted in scores within the optimal range. Finally, no artificial channelization was evident and good quality and width of the riparian zone resulted in optimal scores for these parameters.

Faunal Assessment (SCI)

The SCI score for this site was 82 in 2018 and 70 in 2021 out of a possible 100 points, corresponding with an "Exceptional" designation (Table 2). These results were within or above the previous range of scores for this site, which varied from 53 to 73 (most recent version of SCI only, from 2013-2016). Total taxa in 2018 and 2021 were 46 and 33, respectively. The number of sensitive taxa were 17 in 2018 and 13 in 2021. In 2018, there was 6 long-lived taxa whereas in 2021 only 2 long-lived taxa were identified. The number of clinger taxa in 2018 and 2021 were 13 and 12, respectively. In minimally disturbed streams such as Little Crooked Creek, we expect high numbers for total taxa, sensitive taxa, lived taxa, and clinger taxa such as those observed for these sampling events. We would also expect to see high values for percent filter feeders, but low values for present very tolerant taxa in minimally disturbed streams. The values for percent filter feeder and percent very tolerant taxa were 26% and 1% in 2018, and 55% and 1% in 2021, respectively.

Conclusions

Sampling at Little Crooked Creek indicates that the stream met applicable State Water Quality Criteria. Alkalinity was below 20 mg $CaCO_3$/L, but the low alkalinity is typical for this system and was likely due to natural conditions. Standards were achieved for all other water quality parameters collected for both sampling events.

Habitat Assessment data indicated a near optimal physical condition of the creek with little disturbance in the watershed. Stream Condition Index data indicated the presence of an "Exceptional" macroinvertebrate community with sensitive and long-lived taxa that are indicative of good water quality conditions. The Linear Vegetation Survey and Rapid Periphyton Survey indicated vascular plant and algal communities, respectively, that are consistent with expectations for minimally disturbed sites.

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

Freshwater Algal Bloom information:
https://floridadep.gov/dear/algal-bloom