STREAM ECOSUMMARY

Weeki Wachee River near Brooksville, WBID 1382F, Hernando County, 06/26/2017 and 07/11/2019



Figure 1. Sampling reach along the Weeki Wachee River in Hernando County.

Physical, chemical, and biological sampling was conducted at Weeki Wachee River (WIN/STORET G5SW0131, SBIO WEEKI@ED) in Hernando County on June 26, 2017 and July 11, 2019 by the DEP, Division of Environmental Assessment and Restoration, Southwest Regional Operation Center (ROC) Field Office. This stream was sampled as part of the Strategic Monitoring Program and the Trend Monitoring Network. Overall, the water quality and macroinvertebrate community data indicated that the stream met expectations for a healthy, well-balanced stream. However, the aquatic macrophyte community indicated an imbalance.

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 Weeki Wachee River sampling location (Figure 1) is located at the Springs Coast Environmental Center (Hernando County) in the Springs Coast Watershed (WBID 1382F, Figure 2). It is a 7.4-mile first order stream originating from the Weeki Wachee Spring, and the river flows directly into the Gulf of Mexico. The Weeki Wachee River has a Landscape Development Intensity (LDI) Index score of 2.1. 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 2.1 suggests low to moderate human activity in the 100m buffer surrounding the stream.

The WBID is currently listed for Nutrients, specifically nitrate+nitrite nitrogen, on the Verified List of Impaired Waters. DEP adopted nutrient total maximum daily loads (TMDLs) for Weeki Wachee River in 2014. The TMDLs established monthly average nitrate+nitrite targets of 0.20 mg/L for the river (https://floridadep.gov/dear/water-quality-evaluation-tmdl/documents/weeki-wachee-spring-and-weeki-wachee-river-wbids-1382b).

In addition, the WBID is in the area of the Weeki Wachee Basin Management Action Plan (BMAP). BMAPs provide a framework to reduce nutrient loading into the watershed, and thus, improve water quality. Additional information about this WBID is available in the TMDL Tracker application: (http://prodenv.dep.state.fl.us/DearTmdl/welcomehz.do)

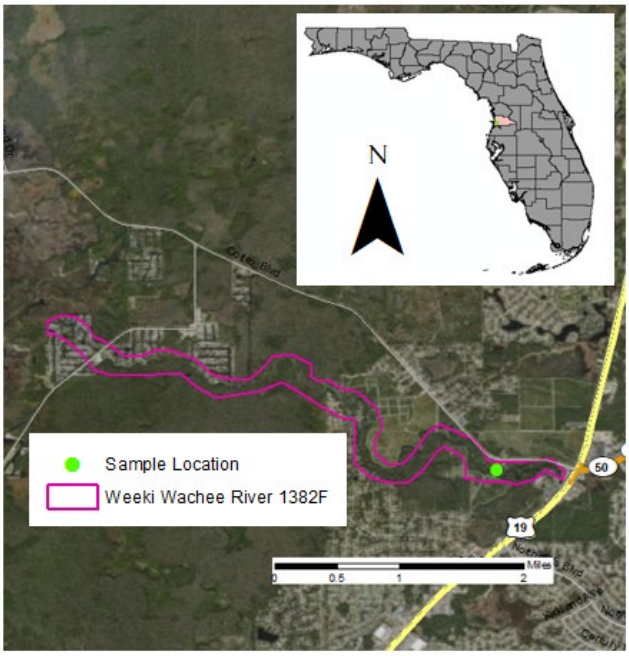


Figure 2. Location of Weeki Wachee River near Brooksville in Hernando County.

Methods

Water Quality

Surface water samples were collected for analysis of nutrients, color, 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.

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 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 Weeki Wachee River near Brooksville.

Results

Water Quality

The water quality results are displayed in Table 1. All analytes tested met the applicable Class III Water Quality Criteria except nitrate+nitrite concentrations, which did not meet the criterion set in the TMDL.

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 for TN and TP. 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. Because monthly water sampling is performed at this site, there are enough samples to provide enough data to calculate the annual geometric mean (AGM). The AGM for total nitrogen (TN) in 2017 was 0.84 mg/L and 0.87 mg/L in 2019, which is less than the surface water criterion of 1.54

mg/L. The annual geometric mean for total phosphorous (TP) in both 2017 and 2019 was 0.01 mg/L, which is also less than the surface water criterion of 0.12 mg/L.

However, the stream exceeds the threshold of 0.20 mg/L of annual arithmetic mean for nitrate+nitrite as specified in the Nutrient TMDL Report for Weeki Wachee Springs and Weeki Wachee River (WBIDs 1382B and 1382F). In 2017 the annual arithmetic mean for nitrate+nitrite was 0.81 mg/L, and it was 0.82 mg/L in 2019.

Floral Assessment

Results of the floral metrics show that this site is not within the reference stream distribution for the LVS, 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. For both sampling dates, the % LVS FLEPPC macrophytes was greater than the NNC threshold of 25% of the total macrophytes observed. Thus, this represents an imbalance of flora in the Weeki Wachee River, and criteria in Rule 62-302.531(2)(c) is not achieved. Human activity often results in the spread of invasive species. The Weeki Wachee River has high recreational use which could disturb native plant species and make habitat for aggressive invasive plants to become established. FLEPPC species present included *Pistia stratioites* (water lettuce) and *Colocasia esculenta* (wild taro). Furthermore, the RPS evidentiary threshold was exceeded on 06/26/2017, but not on 07/11/2019. Thus, RPS results are inconclusive for this site and will continue to be monitored until a conclusive determination can be made. Chlorophyll *a* concentrations met the evidentiary threshold for that floral metric.

Table 1. Water quality results from 06/26/2017 and 06/24/2019 at Weeki Wachee River near Brooksville.

Analyte	Result 06/26/2017	Result 07/11/2019	Applicable Class III Water Quality Criteria
Field Temperature (°C)	25.2	23.9	
Field pH (SU)	7.1	8.1	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	86	54	* 43.8, and 35.9
Field Specific Conductance (µmhos/cm)	346	346	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	156 A	154 A	Shall not be depressed below 20 (or if natural alkalinity is low, shall not be reduced by more than 25%)
Color (PCU)	3.6 I	2.5 U	N/A
Total Phosphorus (mg/L) as P	0.009	0.011	** 0.12
Nitrate+Nitrite (mg/L) as N	0.75	0.83	0.20 as specified in TMDL for this WBID
Ammonia (mg/L) as N	0.008	0.005	***1.29, 3.24
Total Kjeldahl Nitrogen (mg/L) as N	0.2	0.09 I	N/A
Total Nitrogen (mg/L) as N	0.95	0.92	** 1.54

* Instantaneous DO criterion calculated per DO Saturation Calculator for Peninsula region

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

*** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator

A - Value reported is the mean of two or more determinations

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

U - 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 06/26/2017 and 07/11/2019 at Weeki Wachee River near Brooksville.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 06/26/17	Result 07/11/19
LVS C of C	Site average ≥ 2.5	3.6	3.4
LVS FLEPPC (%)	Site average ≤ 25%	33.33	29.41
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	39	5
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	3.1	0.88 I
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	52	54

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

Habitat Assessment

The stream and river habitat assessment scores were 130 (2017) and 143 (2019), which are in the optimal range. The typical velocity measured was ≥0.33 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 ranged from 54 to 86% saturation. The average width within the assessment stretch was 20 m. The banks were low with a gradual slope and well armored, preventing bank erosion**.** The bank stability scores, as a result, were in the optimal range. Three productive habitats were noted: aquatic macrophytes, snags, and rock, which comprised roughly 83% of the stream area, with macrophytes being the most prevalent. Macrophytes are important for stream systems because they provide habitat for macroinvertebrates, gastropods, and fish. For this river, they are also grazed on by manatees. Having greater than 30% of major productive habitats puts the Weeki Wachee River in the Optimal category and is good indication that this stream is in a healthy condition.

Faunal Assessment (SCI)

The average SCI score for this site was 53 out of a possible 100 points, corresponding with a "Healthy" (40-63) designation (Table 2). These results are within the range of previous scores for this site, which ranged from 50-59 (most recent version of SCI only, from 2015-2020). Some of the most common species found in the two SCIs performed were *Hyalella azteca* (amphipod) and *Pseudochironomus spp.* (midges).

Conclusions

Water quality met the designated use for the Weeki Wachee River except for nitrate+nitrite. In addition, Habitat Assessments were both in the Optimal range. Stream Condition Index data supported the water quality and Habitat Assessment results and indicated the presence of a "healthy" macroinvertebrate community.

Results from the Linear Vegetation Survey displayed a vascular plant community that does not attain the floral component of the numeric nutrient criteria due to the abundance of invasive exotic plants.

The RPS results were inconclusive and will continue be assessed until a determination can be made.

The Weeki Wachee River near Brooksville will continue to receive monthly water quality assessments and annual bioassessments 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

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

Nutrient TMDL for Weeki Wachee Spring and Weeki Wachee River (WBIDS 1382B and 1382F) https://floridadep.gov/sites/default/files/WeekiWachee-nutr-TMDL.pdf