STREAM ECOSUMMARY

Newcastle Creek at Ft. Caroline Road WBID 2235, Duval County, February 29, 2012 and November 6, 2012



Figure 1. Sampling reach along the Newcastle Creek in Duval County.

Physical, chemical, and biological sampling was conducted at Newcastle Creek at Fort Caroline Road STORET # 20030655, in Duval County on February 29 and November 6, 2012, by the DEP Northeast Regional Operation Center. This stream was sampled "as part of strategic monitoring program. Overall, the water quality and macroinvertebrate community data indicated that the stream did not meet 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.

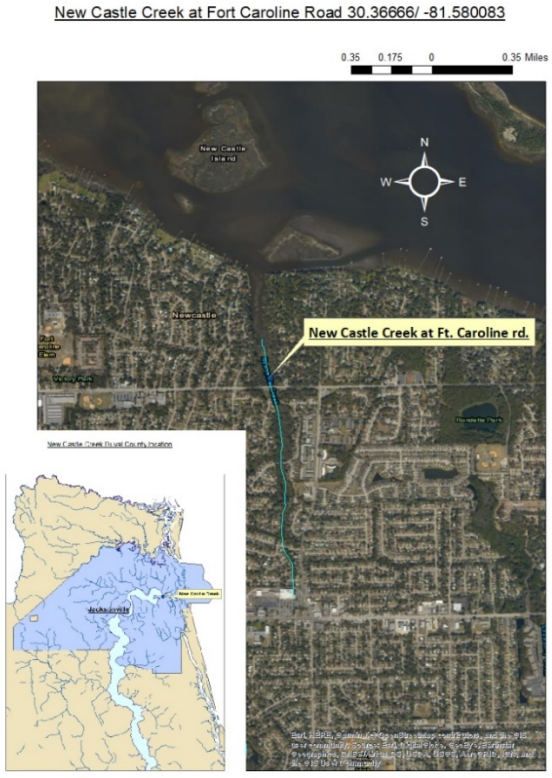


Figure 2. Location of Newcastle Creek Fort Caroline Road, Duval County

Site Description

The Newcastle Creek at Fort Caroline Road sampling location (Figure 1) is in Duval County in the Newcastle Creek Watershed WBID 2235 (Figure 2). It is a second order stream, and is in the Sea Islands flatwoods, a sub-ecoregion of the Southern Coastal Plain Ecoregion. New Castle Creek is a tributary of the St. Johns River. The Landscape Development Intensity (LDI) Index score quantifies the intensity of human activity in the surrounding area. The Landscape Development Intensity (LDI) is based on land use and land cover and is normalized on a scale from 1 to 10, for example; 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 7.04 suggests heavy human activity in the 100m buffer surrounding the stream. The WBID is verified impaired for *Escherichia coli* and included on the Verified List of Impaired Waters, adopted in 2020. The waterbody is also impaired for biology and included on the Study List in assessment category 4d, because there were failing bioassessments, but no causative pollutant has been identified. There is a DEP adopted fecal coliform TMDL for Newcastle Creek. Additional information about this WBID is available in the Water Quality Assessments, TMDLs, and BMAPs map.
https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77

http://publicfiles.dep.state.fl.us/DEAR/DEARweb/TMDL/Final_TMDL/gp2/newcastlecreekfecalfinal.pdf

Methods

Water Quality

Surface water samples were collected for analysis of (*nutrients, chlorophyll a, color, alkalinity*) following DEP Standard Operating Procedures (SOPs, see https://floridadep.gov/dear/quality-assurance/content/dep-sopsfor details) and met the requirements of the FDEP Quality Assurance Rule, Chapter62-160, 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 Peninsular 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. Newcastle Creek is in the Northeast 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 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 New Castle Creek.

Results

Water Quality

The water quality results are shown in Table 1. There were no exceedances of water quality parameters for the samples collected on February 29 and November 6, 2012.

NNC Threshold Assessment

Based on these two sampling events, the stream met the numeric nutrient thresholds for the Peninsula bioregion; 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). All floral measures must pass for the stream to attain the NNC.

Table 1. Water quality results for February 29 and November 6, 2012 at Newcastle Creek at Fort Caroline Road

Analyte	Result 2/29/2012	Result 11/06/2012	Applicable Class III Water Quality Criteria
Field Temperature (°C)	19.8	19.0	
Field pH (SU)	7.14	7.37	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	58	52	*Instantaneous Criteria* 34.2% and 34.5 % respectively
Field Specific Conductance (µmhos/cm)	293	326	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	38	45	Shall not be depressed below 20(or if natural alkalinity is low, shall not be reduced by more than 25%)
Color (PCU)	33	11	N/A
Total Phosphorus (mg/L) as P	0.040	0.086	**Peninsula: 0.12
Nitrate+Nitrite (mg/L) as N	0.24	0.44	0.35 for spring vents only
Ammonia (mg/L) as N	0.094	0.14	***Criterion *** 4.5, and 4.1 respectively
Total Kjeldahl Nitrogen (mg/L) as N	0.21	0.72	N/A
Total Nitrogen (mg/L) as N	0.45	1.16	** Peninsula: 1.54

* 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 February 29 and November 6, 2012 at Newcastle Creek at Fort Caroline Road

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 2/29/2012	Result 11/06/2012
LVS C of C	Site average ≥ 2.5	Pass <2sq.meter	Pass <2sq.meter
LVS FLEPPC (%)	Site average ≤ 25%	0%	0%
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	0%	0%
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	0.86 I*	0.57I*
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	24	39

*I indicate value was above MDL but below PQL

Habitat Assessment

The stream and river habitat assessment scores were 94 and 95 which are in the marginal range. The typical velocity measured was 0.12 m/s, which resulted in a

suboptimal, score for stream flow. Fish and aquatic insects require enough water velocity to maintain high dissolved oxygen concentrations in the stream; in this case the dissolved oxygen was 52% and 58% saturation. The average width within the assessment stretch was 2 meters. The banks were incised with some armoring. The bank stability scores, as a result, were in the marginal range. Two productive habitats were noted: woody debris, and roots, which comprised roughly 4% of the stream and as a result, substrate availability was in the poor category. The habitats had more than 25% sand smothering.

Faunal Assessment (SCI)

The SCI scores were 24 on February 29, 2012, and 39 on November 6, 2012. The average SCI score was 32 out of a possible 100 points, corresponding with an "Impaired" designation (Table 2). The Stream Condition Index, results indicated a low diversity of macroinvertebrates. There were no long-lived organisms in the sample, which suggests that there is hydrological stress to organisms.

The dominant macroinvertebrate species was *Amnicola sp*., a gastropod, in each sample, 40% and 37% respectively.

Conclusions

Water quality monitoring at Newcastle Creek indicated that it did meet applicable State Water Quality Criteria, however the Stream Condition Index failed. The failing Stream Condition Index is indicative of a highly altered landscape. The probable stressor to the system, is that the surrounding land use is >90% urban development, which modifies the hydrologic flow of the creek. The altered flow could scour the stream during high stormwater flows. The hydrologic modification and poor amount of habitat did not support a healthy, robust macroinvertebrate community.

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