Bullfrog Creek

STREAM HABITAT ASSESSMENT, STREAM CONDITIONS INDEX, LINEAR VEGETATION SURVEY, RAPID PERIPHYTON SURVEY AND WATER QUALITY

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Methods

STUDY AREA ANALYISIS

The watershed containing the stream being assessed was analyzed using ESRI ArcGIS 10.2. Using this software with 2016 Hillsborough County aerial, 2014 Land Use/ Land Cover (LULC) and Watershed boundary (WBID) layers courtesy of the Florida Department of Environmental Protection. The Landscape Development Intensity Index (LDI) was calculated for the WBID containing the stream. From FDEP "The Landscape Development Intensity index (LDI) is an estimate of how much humans have altered an area of interest around a waterbody. Various land use types (low density residential, row crops, industrial and natural) are assigned coefficients of land use intensity based on estimates of the amount of human energy that is put into those land use types.

The LDI is calculated by multiplying each land use coefficient by the percentage of the area of interest occupied by that land use, and then summing the results. The Florida Department of Environmental Protection (DEP) uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. LDI values less than two (≤ 2) can be considered minimally disturbed." In the Florida framework, the maximum LDI index score is approximately 42.

HABITAT AND VEGETATION ASSESSMENT

For small streams that are not easily navigated by Jonboat for bathymetric mapping and vegetation analysis, Hillsborough County requested the implementation of the Florida Department of Environmental Protection methods for Stream and River Habitat Assessment (FT 3100) (http://www.dep.state.fl.us/water/sas/sop/sops.htm) using forms FD 9000-3, FD 9000-4 and FD 9000-5, Rapid Periphyton Survey (FS 7230) using form FD 9000-25 and Linear Stream Vegetation Survey (FS 7320) using form FD 9000-32. These methods were utilized on two sampling locations on each stream, typically near access points along roadways.

Stream and River Habitat Assessment per FT3100 receives a score calculated in Form FD 9000-5. This score results from the ranking of the primary habitat components (substrate diversity, substrate availability, water velocity and habitat smothering) and secondary habitat components (Artificial channelization, bank stability, riparian buffer zone width and riparian zone vegetation quality). The maximum score possible in this method is a 160.

Two metrics are utilized in the Linear Vegetation Survey. The Mean Coefficient of Conservatism (CoC) applies a score of 0-10 to each species based on its ecological tolerances and fidelity to pre-settlement conditions. Species with higher scores show a high fidelity to native, undisturbed habitats and are typically sensitive to alterations. Available CoC scores can be obtained from LT 7000 from the Florida Department of Environmental Protection at: http://www.dep.state.fl.us/water/sas/sop/sops.htm. The Percent Florida Exotic Pest Plant Council (% FLEPPC) metric calculates the percent invasive exotics as the number of occurrences of FLEPPC Category I or II in the 100 m reach divided by the total number of taxa occurrences in the 100 m reach. The FLEPPC list can be found at: http://www.fleppc.org/list/11list.html

STREAM CONDITION INDEX ASSESSMENT

The Stream Condition Index (SCI) was sampled per DEP SOP FS7420 and calculated per DEP SOP LT7200. The SCI consists of collecting macroinvertebrates via 20 D-frame dipnet sweeps (0.5 m in length) in the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled, and identified to the lowest practical taxonomic level. The SCI is composed of ten metrics, eight of which decrease in response to human disturbance, with two metrics (% very tolerant and % dominant) increasing in response to human disturbance. According to DEP SOP LT 7000, the SCI score ranges and categories are: (68-100) Exceptional; (35-67) Healthy; and (0-34) Impaired. Proposed biological health assessment criteria state that a site is considered to meet designated uses if the average of the two most recent SCI scores is 40 or higher and neither of those scores is less than 35.

WATER QUALITY ASSESSMENT

Physical water quality samples were taken using a Eureka Manta Sub-2 multiprobe pre and post calibrated daily. Measurements taken with this device include: depth, conductivity, pH, Dissolved Oxygen (mg/l and % Saturation) and salinity. Chemical water parameters were collected and preserved on ice by USF Water Institute staff and analyzed at the Environmental Protection Commission of Hillsborough County Laboratory. Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, E. Coli, Enterococci, Ammonia, Nitrates/Nitrites, Total Phosphorous, Kjeldahl Nitrogen and Total Nitrogen.

Study Area

Bullfrog Creek is located in central Hillsborough County. Its headwaters are located west of Balm Wimauma Rd and the outfall of Bullfrog Creek is in Hillsborough Bay. The assessment of Bullfrog Creek was conducted on February 6, 2019. At the time of the assessment, the water levels were normal. The Bullfrog Creek WBID covers 27.04 square miles and is dominated by agricultural (24.5%), natural (32.3%), residential (19.14%), transportation (2.6%) and commercial (2.1%) land uses. The resulting calculated landscape development intensity index score was 3.78.

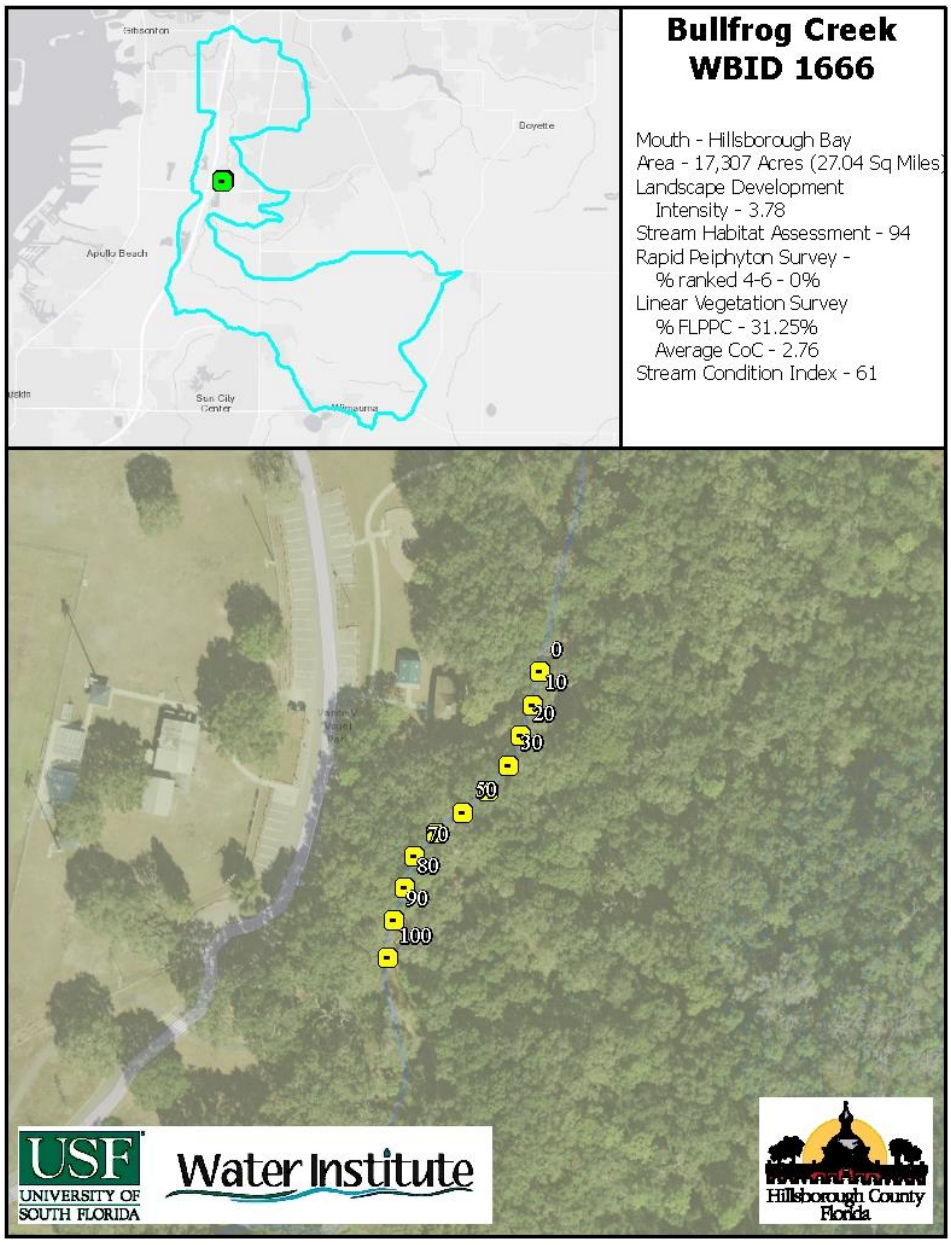

Figure 1 2019 Bullfrog Creek Study Area Map

Habitat and Vegetation Assessment

The region of Bullfrog Creek where the assessment was conducted is in a dominant natural area along Vance Vogel Park. The region was heavily shaded with a mean canopy cover measurement of 73.0%. Bullfrog Creek averaged 0.35 meters in depth, approximately 7.5 meters wide with a flow of 0.27 m/s.

The primary habitat components of the FDEP Habitat Assessment focus on in-water habitat. The primary habitat components score in the optimal category for Water Velocity. Suboptimal scores were achieved for Substrate Diversity (Presence of three major productive habitats (snags, roots, leaf)) and Habitat Smothering (Many of the productive habitats were affected by sand smothering). Substrate Availability scored in the marginal category due to low overall percentage of productive habitats and sand smothering. Minor habitats included sand and silt deposits. The total score for the primary habitat components was a 47 out of 80.

The secondary habitat components of the FDEP Habitat Assessment focus on the surrounding features of the stream. Bullfrog Creek flows through an area of preserve property in a county park. At the water level at the time of assessment, Bullfrog Creek was low on its banks revealing the eroded sand banks from the wet season. The secondary habitat components scored in the optimal category for Artificial Channelization, Riparian Buffer Width for the left bank when facing upstream and Riparian Zone Vegetation Quality for the left bank when facing upstream. Bank Stability, Riparian Buffer Width for the right bank when facing upstream and Riparian Zone Vegetation Quality for the right bank when facing upstream. There were several areas of raw eroded banks where the sand had collapsed. The riparian buffer zone surrounding the stream was greater than 18 meters on the left bank and consisted of native trees including *Taxodium and*

Quercus. The right bank had a buffer averaging 13 meters and contained a mixture of invasive species and species indicative of disturbance (Urena lobata) The vegetation in the stream itself was dominated by mostly native species with 2 non-native invasive species likely from an upstream source. The secondary habitat components received a score of 47 out of 80. The resulting FDEP Habitat Assessment score was a 94.

Periphyton was not encountered during the 85 samples taken during the Rapid Periphyton Survey. The tree canopy in the assessment area averaged 73.0% limiting available sunlight for macrophytes and algae.

The FDEP Linear Vegetation Survey encountered six herbaceous species in Bullfrog Creek. *Alternanthera philoxeroides* and *Hydrilla verticillata* are non-native invasive species. Both species are typically transmitted from upstream sources. None of the species encountered were abundant.

Table 1 Linear Vegetation Survey Results – Bullfrog Creek

Taxa Name	C of C Score	Sample Site										Total Occurrences
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	
Acrostichum danaeifolium	5.79	1			1	1	1					4
Alternanthera philoxeroides	0	1	1	1			1					4
Phanopyrum gymnocarpon	4.25	1	1	1	1							4
Lemna	1	1	1									2
Hydrilla verticillata	0					1						1
Hydrocotyle umbellata	1.92										1	1
Mean Coefficient of Conservatism	2.76											
% FLEPPC	31.25%											

Stream Condition Index

The analysis of the SCI sample involves splitting the sample into 2 aliquots for analysis. The SCI metrics are then calculated on each separately. The final SCI score is an average of the two scores. The SCI score for Bullfrog Creek was 61 out of a possible 100 points, corresponding with a "Healthy" designation, with the expected community of a healthy stream.

High scores were achieved for the Total Ephemeroptera, % Very tolerant individuals metrics in both subsamples. Both subsamples contained multiplesensitive taxa. Subsample A contained three Long Lived Taxa. The full results of the SCI sampling are shown in Table 3 (Sample A) and Table 4 (Sample B) for Bullfrog Creek.

Table 2 SCI metric summaries for Bullfrog Creek

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	23.00	3.33	3.33
Total Ephemeroptera	5.00	10.00	10.00
Total Trichoptera	1.00	1.43	1.43
% Filter Feeders	28.29	6.42	6.42
Total Clingers	5.00	7.14	7.14
Total Long-lived Taxa	3.00	10.00	10.00
% Dominance	28.29	7.14	7.14
% Tanytarsini	1.32	2.47	2.47
Total Sensitive Taxa	4.00	5.71	5.71
% Very Tolerant Individuals	2.63	8.53	8.53

SCI Sum	62.17
Final SCI score	69.08

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	17.00	0.83	0.83
Total Ephemeroptera	4.00	8.00	8.00
Total Trichoptera	1.00	1.43	1.43
% Filter Feeders	30.57	6.95	6.95
Total Clingers	5.00	7.14	7.14
Total Long-lived Taxa	0.00	0.00	0.00
% Dominance	24.84	7.83	7.83
% Tanytarsini	0.64	1.45	1.45
Total Sensitive Taxa	3.00	4.29	4.29
% Very Tolerant Individuals	0.64	10.52	10.00

SCI Sum	47.92
Final SCI score	53.24

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Table 3 SCI full results for Sample A

Stream Condition Index Results for Bullfrog Creek @ Vance Vogel SCIA

Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera	Trichoptera Taxa	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant	Specimen Notes
Annelida		Clitellata	Oligochaeta	Enchytraeida	Enchytraeidae	Enchytraeidae spp.	1	1	1	0	0	0	0	0	0		0	0	0	
Mollusca		Gastropoda	Caenogastrop	Littorinimorph	Hydrobiidae	*Pyrgophorus platyrachis*	2	2	1	0	0	0	0	0	0		0	0	2	
Mollusca		Gastropoda	Caenogastrop		Thiaridae	*Melanoides tuberculata*	1	1	1	0	0	0	0	0	0		0	0	1	
Mollusca		Bivalvia	Heterodonta	Venerojda	Corbiculidae	*Corbicula* spp.	1	1	1	0	0	0	1	0	1		0	0	0	
Arthropoda	Crustacea	Malacostra	Eumalacostra	Amphipoda	Dogielinotidae	*Hyalella azteca* sp. complex	2	2	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Crustacea	Malacostra	Eumalacostra	Decapoda	Atyidae	Atyidae spp.	1	1	1	0	0	0	0	0	1		0	0	0	Reference collection
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Caenidae	*Caenis diminuta*	1	1	1	1	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	Baetidae spp.	5		0	0	0	0	0	0	0		0	0	0	Damaged, not A. pygmaea or L.
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Labiobaetis propinquus*	1	1	1	1	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Acerpenna pygmaea*	2	2	1	1	0	0	0	0	0		0	1	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Baetis intercalaris*	1	6	1	1	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Heptageniidae	Heptageniidae spp.	1		0	0	0	0	0	0	0		0	0	0	Damaged
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Heptageniidae	*Maccaffertium exiguum*	2	3	1	1	0	0	0	1	0		0	1	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Macromiidae	*Macromia* spp.	1	1	1	0	0	0	0	0	1		0	1	0	Immature
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Coenagrionida	Coenagrionidae spp.	2	2	1	0	0	0	0	0	0		0	0	0	Damaged and/or immature
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychida	Hydropsychidae spp.	1		0	0	0	0	0	0	0		0	0	0	Damaged and/or immature
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychida	*Cheumatopsyche* spp.	23	24	1	0	1	0	24	1	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Dubiraphia* spp.	8	8	1	0	0	0	0	0	0		0	0	0	1larvae, 7 adults
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Stenelmis* spp.	8	8	1	0	0	0	0	1	0		0	0	0	8 larvae
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Microcylloepus* spp.	43	43	1	0	0	0	0	0	0		0	0	0	18 larvae, 25 adults
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Polypedilum flavum*	24	24	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Polypedilum illinoense* group	1	1	1	0	0	0	0	0	0		0	0	1	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Rheotanytarsus exiguus*	2	2	1	0	0	0	2	1	0		2	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Pentaneura inconspicua*	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Corynoneura* spp.	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Simuliidae	*Simulium* spp.	15	15	1	0	0	0	15	1	0		0	1	0	larvae

Table 4 SCI full results for Sample B

Stream Condition Index Results for Bullfrog Creek @ Vance Vogel SCIB

Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera	Trichoptera Taxa	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant	Specimen Notes
Annelida		Clitellata	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Crustacea	Malacostra	Eumalacostra	Amphipoda	Dogielinotidae	*Hyalella azteca* sp. complex	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	Baetidae spp.	6		0	0	0	0	0	0	0		0	0	0	Damaged, not A. pygmaea or L.
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Labiobaetis propinquus*	2	2	1	1	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Acerpenna pygmaea*	1	1	1	1	0	0	0	0	0		0	1	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	*Baetis intercalaris*	1	7	1	1	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Heptageniidae	Heptageniidae spp.	1		0	0	0	0	0	0	0		0	0	0	Damaged and/or immature
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Heptageniidae	*Maccaffertium exiguum*	6	7	1	1	0	0	0	1	0		0	1	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Coenagrionida	Coenagrionidae spp.	2	2	1	0	0	0	0	0	0		0	0	0	Damaged and/or immature
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychida	*Cheumatopsyche* spp.	20	20	1	0	1	0	20	1	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Dubiraphia* spp.	5	5	1	0	0	0	0	0	0		0	0	0	1larva, 4 adults
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Stenelmis* spp.	6	6	1	0	0	0	0	1	0		0	0	0	2 larvae, 4 adults
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	*Microcylloepus* spp.	39	39	1	0	0	0	0	0	0		0	0	0	22 larvae, 17 adults
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Chironomidae spp.	1		0	0	0	0	0	0	0		0	0	0	pupa
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Polypedilum flavum*	34	35	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Polypedilum illinoense* group	1	1	1	0	0	0	0	0	0		0	0	1	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Rheotanytarsus exiguus*	1	1	1	0	0	0	1	1	0		1	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Pentaneura inconspicua*	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	*Labrundinia pilosella*	1	1	1	0	0	0	0	0	0		0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Simuliidae	*Simulium* spp.	27	27	1	0	0	0	27	1	0		0	1	0	1pupa, 26 larvae

Water Quality Assessment

Long-term water quality data is available for Bullfrog Creek. The data that is available was collected by the Hillsborough County Environmental Protection Commission. Values for the physical water parameters begin in 2005 and continue through present. Values for the laboratory water parameters begin in 2005 through present including the sample taken along with this assessment. The 2019 USF Water Institute Assessment fall within the range of the previous data collections. Table 5 provides a summary of the Physical/Chemical conditions recorded at the site.

Table 5 Bullfrog Creek Physical Water Quality (Field)

Bullfrog Creek								
Date	**Depth (m)**	**Temp (°C)**	**pH**	**DO (mg/L)**	**DO (% Sat)**	**Cond (UMHO/cm**	**Salinity (PPT)**	**Secchi Depth (m)**
2/6/2019	0.02	20.16	8.14	8.07	87.4	292.7	0.14	2.0 VOB
Mean POR		23.87	7.54	8.17	92.82	262.81	0.17	

The chemical water quality analysis for Bullfrog Creek is shown in Table 6 along with mean values for the period of record for available parameters. Period of record mean and the sample for this assessment for Total Phosphorous values were below the nutrient region threshold developed by FDEP of 0.49 mg/L with a mean value of 0.203 mg/L (2005-2019). The three year geometric mean of Total Phosphorous was 0.185 mg/L. Total Phosphorous values for the sample from this assessment were 0.276mg/L. Total Nitrogen values were below the nutrient region threshold developed by FDEP of 1.65 mg/L with a mean value of 0.735 mg/L (2005-2019). The three year geometric mean of Total Nitrogen was 0.641 mg/L. The Total Nitrogen value from the assessment was below the threshold with a concentration of 0.901 mg/L. Chlorophyll-a corrected values fall below the site specific evaluation range of 3.2 µg/l to 20 µg/l for the period of record (3.06 µg/l 2005-2018), and in the site specific evaluation range for the most recent three year geomean (3.80 µg/l) . For sites with Chlorophyll-a values in this range, the assessment is inconclusive of conditions reflecting an imbalance in flora. Elevated biomass of the bacterial parameters was observed in the long term dataset with E. Coli having a geomean of 462 colonies/100 ml, 893/100 ml for Enterococci.

Table 6 Bullfrog Creek Water Quality (Laboratory)

Parameter	Bullfrog Creek	POR Mean	Units
Alkalinity	44.0		mg/LCaCO3
Nitrates/Nitrites	0.070	0.076	mg/L
E. Coli	227	462	#/100 ml
Enterococci	507	893	#/100 ml
Chlorophyll a	2.3	3.32	ug/L
Chlorophyll b	0.5	1.47	ug/L
Chlorophyll c	0.4	0.99	ug/L
Chlorophyll t	2.5		ug/L
Chlorophylla Corr	4.1	3.06	ug/L
Chlorophyll-pheo	5.4	3.03	ug/L
Ammonia	0.027	0.034	mg/L
Kjeldahl Nitrogen	0.831	0.635	mg/L
Total Nitrogen	0.901	0.735	mg/L
Total Phosphorus	0.276	0.203	mg/L
Color(345)F.45	23.2	45.3	Pt/Co

Conclusion

Bullfrog Creek at Vance Vogel Park is located in a preserve area in an agricultural area. The stream itself was primarily unaltered in the region assessed. At the time of the habitat assessment, the water levels were low, corresponding to the middle of the dry season, however sufficient habitat for macroinvertebrates was observed. Due to these factors, the Habit Assessment resulted in a suboptimal score of 94. Slight disruption to the vegetation community was observed in the results of the Linear Vegetation Survey with Bullfrog Creek meeting the metric for Average Coefficient of Conservatism but not the Percent FLEPPC. Bullfrog Creek did meet standards for the rapid periphyton survey with 0% of samples being ranked between 4 and 6. The historical water quality record for Bullfrog Creek showed acceptable concentrations of Total Phosphorous and Total Nitrogen. The results of the SCI sampling indicate that the stream is "healthy" based on the macroinvertebrate community. Table 7 summarizes the results of the nutrient sampling, floristic sampling, habitat assessment and SCI.

Table 7 Summary of Water Quality, Floristic Surveys and Habitat Assessments

Measure		Bullfrog Creek	Mean POR	Threshold
Total Phosphorous (mg/l)		0.276	0.203	< 0.49
Total Nitrogen (mg/l)		0.901	0.735	< 1.65
RPS (% Rank 4-6)		0.00%		< 25%
LVS	**Avg C of C**	2.76		≥ 2.5
	FLEPPC %	31.25%		< 25%
Chlorophyll (µg/l)		4.1	3.06	< 20 µg/l
Habitat Assessment		94		> 34
SCI		61		> 34