Twin Lake Outlet

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, 2011 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

Twin Lake Outlet is located in central Hillsborough County. Its headwaters are located in Twin Lake and the outfall is in Hillsborough River. The assessment of Twin Lake Outlet was conducted on January 2, 2018. At the time of the assessment, the water levels were low, corresponding to the end of the dry season. The FDEP WBID for Twin Lake Outlet (1553B) is largely residential (80.7%) and commercial (11%) with a calculated Landscape Development intensity Index of 8.27.

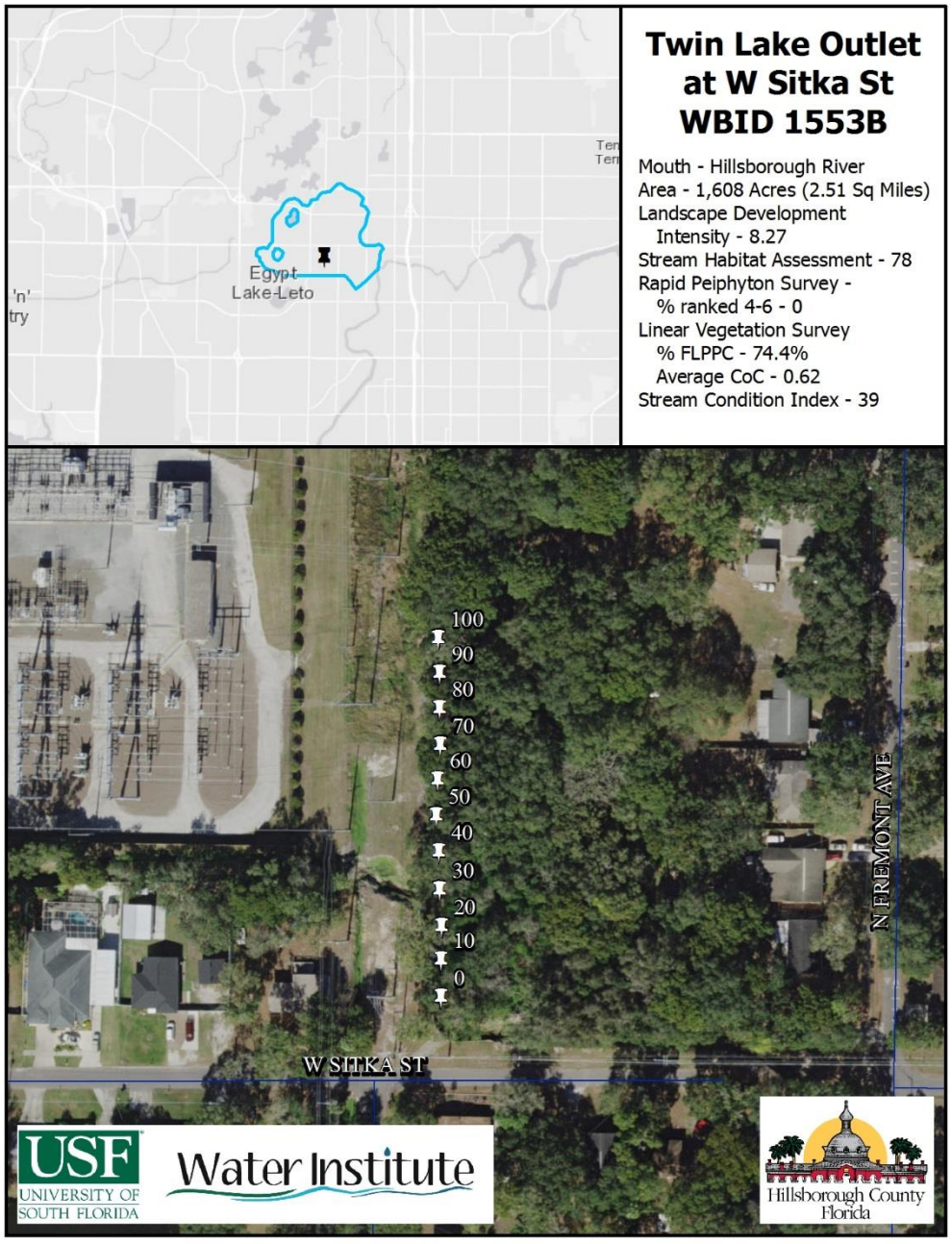

Figure 1 2018 Twin Lake Outlet Study Area Map

Habitat and Vegetation Assessment

Figure 2 Overview photograph of the Twin Lake Outlet

Although the water levels at the time of the assessment were low, sufficient habitat for macroinvertebrates was present. The FDEP Stream Habitat Assessment is split into Primary and Secondary Habitat Components. The primary habitat components focus on in-stream factors, whereas the secondary habitat components focus on the banks and surrounding vegetation.

The primary habitat components for Twin Lake Outlet scored in the Suboptimal category for Water Velocity (0.17 m/s) and Habitat Smothering (containing the appropriate number of stable pools but greater than 25% of habitat being affected by sand, silt or algae). Marginal scores were achieved for Substrate Diversity and Substrate Availability. Two major productive habitats were present, Aquatic Macrophytes (3.4% of total area) and Rock (6.6% of total area). Minor

habitats that were sampled were Snags (0.3%), Roots (0.6%), Leaf Pack (0.3%), Sand (68.8%) and Mud/Silt (20%). The total score for the primary habitat components was a 43 out of 80.

The secondary habitat components scored in the marginal category for Artificial Channelization (artificially straightened with trapezoidal cross section and some degree of sinuosity in the channelized area) and Bank Stability (1 of the 3 measures for optimal bank stability). The left bank (determined while looking upstream) had considerably more issues with eroding banks and a lack of vegetation buffer. The right bank scored in the optimal category for Riparian Buffer Zone Width (greater than 18 meters), however the left bank scored in the Poor category due to it being clear-cut and constantly mowed. The Riparian Zone Vegetation Quality received Poor scores for both banks as the left bank was largely absent for vegetation and the right bank contained many non-native species and species indicative of disturbance. The final score for Secondary habitat components was a 35 out of 80. The resulting Habitat Assessment score was a 78, in the Marginal category.

During the FDEP Rapid Periphyton Survey, 0% of samples contained periphyton 6mm -> 10cm. Periphyton was present in the system, but not on the sample transects. The average canopy coverage was 82.9%, correlating to a heavily shaded system.

The FDEP Linear Vegetation Survey identified 9 species rooted in the stream. Six of the nine species were non-native, invasive species. *Hygrophila polysprema* was dominant in 8 of the 10 vegetation regions. The calculated Mean Coefficient of Conservatism was 0.62 with 74.4% of observations consisting of FLEPPC listed plants.

Table 1 Linear Vegetation Survey Results – Twin Lake Outlet

Taxa Name	C of C Score	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	Total Occurrences
Hygrophila polysperma	0	D	1	1	D	D	D	D	D	D	D	10
Hydrilla verticillata	0	1		1	1	1	1	1	1	1	1	9
Hydrocotyle umbellata	1.92	1	1	1	1	1	1	1	1		1	9
Colocasia esculenta	0	1			1	1	1	1	1			6
Sphagneticola trilobata	0			1	1			1	1			4
Commelina diffusa	2.02									1	1	2
Alternanthera philoxeroides	0		1									1
Ludwigia octovalvis	2								1			1
Ludwigia repens	3.2									1		1
Total Observations	43	4	3	4	5	4	4	5	6	4	4	43
Mean CoC	0.62											
% FLEPPC	74.4											

Figure 3 Picture of Hygrophila polysperma in Twin Lake Outlet

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 Twin Lake Outlet was 39 out of a possible 100 points, corresponding with a "Impaired" designation, lacking the expected community of a healthy stream.

Table 2 summarizes the scoring metrics for the two subsamples for Twin Lake Outlet. Neither sample contained any Sensitive taxa. The highest scoring metrics were % Dominance in both samples and Total Long Lived Taxa in subsample A.

Table 2 SCI metric summaries for Twin Lake Outlet Subsample A (Top) and Subsample B (Bottom)

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	27.00	5.00	5.00
Total Ephemeroptera	0.00	0.00	0.00
Total Trichoptera	1.00	1.43	1.43
% Filter Feeders	14.84	3.29	3.29
Total Clingers	2.00	2.86	2.86
Total Long-lived Taxa	2.00	6.67	6.67
% Dominance	16.77	9.45	9.45
% Tanytarsini	5.81	5.64	5.64
Total Sensitive Taxa	0.00	0.00	0.00
% Very Tolerant Individuals	27.74	3.35	3.35
SCI Sum	37.68		
Final SCI score	41.87		

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	21.00	2.50	2.50
Total Ephemeroptera	0.00	0.00	0.00
Total Trichoptera	2.00	2.86	2.86
% Filter Feeders	21.81	4.91	4.91
Total Clingers	1.00	1.43	1.43
Total Long-lived Taxa	1.00	3.33	3.33
% Dominance	24.16	7.97	7.97
% Tanytarsini	6.04	5.74	5.74
Total Sensitive Taxa	0.00	0.00	0.00
% Very Tolerant Individuals	16.11	4.65	4.65
SCI Sum	33.39		
Final SCI score	37.10		

The full results of the SCI sampling are shown in Table 3 (Sample A) and Table 4 (Sample B) for Twin Lake Outlet.

Lake Twin Outlet SCIA
Stream Condition Index (SCI)
Samples Collected 01/02/2018
Project #: 6063170278

Stream Condition Index Results for Lake Twin Outlet SCIA

Phylum	Class	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera Taxa	Trichoptera Taxa	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant Individuals
Annelida	Clitellata	Tubificida	Naididae	Tubificinae spp.	1	1	1	0	0	0	0	0	0		0	0	0
Annelida	Clitellata	Tubificida	Naididae	*Aulodrilus pigueti*	1	1	1	0	0	0	0	0	0		0	0	0
Annelida	Clitellata	Tubificida	Naididae	*Dero* spp.	1	1	1	0	0	0	0	0	0		0	0	1
Annelida	Clitellata	Tubificida	Naididae	*Dero pectinata*	1	1	1	0	0	0	0	0	0		0	0	1
Annelida	Clitellata	Tubificida	Naididae	*Slavina appendiculata*	1	1	1	0	0	0	0	0	0		0	0	0
Mollusca	Gastropoda		Pleuroceridae	*Pleurocera floridensis*	13	13	1	0	0	0	0	0	0		0	0	0
Mollusca	Gastropoda	Hygrophila	Physidae	*Physella cubensis*	1	1	1	0	0	0	0	0	0		0	0	1
Mollusca	Gastropoda	Littorinimorpha	Hydrobiidae	Hydrobiidae spp.	26	26	1	0	0	0	0	0	0	26	0	0	0
Mollusca	Gastropoda	Littorinimorpha	Hydrobiidae	*Pyrgophorus platyrachis*	2	2	1	0	0	0	0	0	0		0	0	2
Mollusca	Bivalvia	Veneroida	Corbiculidae	*Corbicula* spp.	4	4	1	0	0	0	4	0	1		0	0	0
Mollusca	Bivalvia	Veneroida	Sphaeriidae	Sphaeriidae spp.	11	11	1	0	0	0	11	0	0		0	0	0
Arthropoda	Malacostraca	Amphipoda	Dogielinotidae	*Hyalella azteca* sp. complex	7	7	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Corduliidae	*Epitheca princeps regina*	1	1	1	0	0	0	0	0	1		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	Coenagrionidae spp.	11		0	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	*Argia* spp.	7		0	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	*Argia sedula*	3	19	1	0	0	0	0	0	0		0	0	19
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma* spp.	2	4	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* spp.	1	1	1	0	1	0	0	1	0		0	0	0
Arthropoda	Insecta	Diptera		Diptera spp.	2		0	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Polypedilum scalaenum* group	2	2	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Polypedilum illinoense* group	16	17	1	0	0	0	0	0	0		0	0	17
Arthropoda	Insecta	Diptera	Chironomidae	*Rheotanytarsus exiguus* group	4	4	1	0	0	0	4	1	0		4	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Glyptotendipes* spp.	1	1	1	0	0	0	0	0	0		0	0	1
Arthropoda	Insecta	Diptera	Chironomidae	*Dicrotendipes* spp.	3	3	1	0	0	1.5	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Pentaneura inconspicua*	2	2	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Paratanytarsus* spp.	5	5	1	0	0	2.5	0	0	0		5	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Cricotopus* or *Orthocladius*	23	24	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Lepidoptera		Lepidoptera spp.	1	1	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Lepidoptera	Crambidae	*Petrophila santafealis*	1	1	1	0	0	0	0	0	0		0	0	1
Arthropoda	Arachnida	Sarcoptiformes		Oribatida spp.	1	1	1	0	0	0	0	0	0		0	0	0

Table 3 SCI full results for Sample A

Lake Twin Outlet SCIB
Stream Condition Index (SCI)
Samples Collected 01/02/2018
Project #: 6063170278

Stream Condition Index Results for Lake Twin Outlet SCIB

Phylum	Class	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera Taxa	Trichoptera Taxa	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant Individuals
Annelida	Clitellata	Tubificida	Naididae	Tubificinae spp.	6	6	1	0	0	0	0	0	0		0	0	0
Annelida	Clitellata	Tubificida	Naididae	*Pristina aequiseta*	1	1	1	0	0	0	0	0	0		0	0	0
Annelida	Clitellata	Tubificida	Naididae	*Dero pectinata*	1	1	1	0	0	0	0	0	0		0	0	1
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Helobdella stagnalis*	1	1	1	0	0	0	0	0	0		0	0	1
Mollusca	Gastropoda		Pleuroceridae	*Pleurocera floridensis*	11	11	1	0	0	0	0	0	0		0	0	0
Mollusca	Gastropoda	Littorinimorpha	Hydrobiidae	Hydrobiidae spp.	36	36	1	0	0	0	0	0	0	36	0	0	0
Mollusca	Bivalvia	Veneroida	Corbiculidae	*Corbicula* spp.	9	9	1	0	0	0	9	0	1		0	0	0
Mollusca	Bivalvia	Veneroida	Sphaeriidae	Sphaeriidae spp.	12	12	1	0	0	0	12	0	0		0	0	0
Arthropoda	Malacostraca	Amphipoda	Dogielinotidae	*Hyalella azteca* sp. complex	4	4	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	Coenagrionidae spp.	5		0	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	*Argia* spp.	4	7	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma* spp.	4	6	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* spp.	5	5	1	0	1	0	5	1	0		0	0	0
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Oxyethira* spp.	1	1	1	0	1	0	0	0	0		0	0	0
Arthropoda	Insecta	Diptera		Diptera spp.	1		0	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Chironomus* spp.	1	1	1	0	0	0	0	0	0		0	0	1
Arthropoda	Insecta	Diptera	Chironomidae	*Polypedilum illinoense* group	18	19	1	0	0	0	0	0	0		0	0	19
Arthropoda	Insecta	Diptera	Chironomidae	*Dicrotendipes* spp.	4	4	1	0	0	2	0	0	0		0	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Polypedilum beckae*	1	1	1	0	0	0	0	0	0		0	0	1
Arthropoda	Insecta	Diptera	Chironomidae	*Larsia* spp.	1	1	1	0	0	0	0	0	0		0	0	1
Arthropoda	Insecta	Diptera	Chironomidae	*Paratanytarsus* spp.	9	9	1	0	0	4.5	0	0	0		9	0	0
Arthropoda	Insecta	Diptera	Chironomidae	*Cricotopus* or *Orthocladius*	12	12	1	0	0	0	0	0	0		0	0	0
Arthropoda	Insecta	Lepidoptera		Lepidoptera spp.	2	2	1	0	0	0	0	0	0		0	0	0

Table 4 SCI full results for Sample B

Water Quality Assessment

Long-term water quality data is not available for Twin Lake Outlet. The data that is available was collected as the sample taken along with this assessment. Table 5 provides a summary of the Physical/Chemical conditions recorded at the site.

Table 5 Twin Lake Outlet Physical Water Quality (Field)

Twin Lake Outlet								
Date	**Depth (m)**	**Temp (°C)**	**pH**	**DO (mg/L)**	**DO (% Sat)**	**Cond (UMHO/cm**	**Salinity (PPT)**	**Secchi Depth (m)**
1/2/18	0.39	15.5	6.16	8.3	82.0	244	0.11	1.1

The chemical water quality analysis for Twin Lake Outlet is shown in Table 6 along with mean values for the period of record for available parameters. 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 value of 0.04 mg/L. Total Nitrogen values were below the nutrient region threshold developed by FDEP of 1.65 mg/L with a value of 0.882 mg/L. Chlorophyll-a corrected values fall within the site specific evaluation range of 3.2 µg/l to 20 µg/l for the most recent sample with a value of 6.4 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 sample for this assessment.

Table 6 Twin Lake Outlet Water Quality (Laboratory)

Parameter	Twin lake Outlet	POR Mean	Units
Alkalinity	66.0	N/A	mg/LCaCO3
Nitrates/Nitrites	0.103	N/A	mg/L
E. Coli	760	N/A	#/100 ml
Enterococci	2600	N/A	#/100 ml
Chlorophyll a	7.6	N/A	ug/L
Chlorophyll b	5.1	N/A	ug/L
Chlorophyll c	0.7	N/A	ug/L
Chlorophyll t	8.3	N/A	ug/L
Chlorophylla Corr	6.4	N/A	ug/L
Chlorophyll-pheo	3.2	N/A	ug/L
Ammonia	0.130	N/A	mg/L
Kjeldahl Nitrogen	0.779	N/A	mg/L
Total Nitrogen	0.882	N/A	mg/L
Total Phosphorus	0.40	N/A	mg/L
Color(345)F.45	35.8	N/A	Pt/Co

Conclusion

Twin lake Outlet is located with some buffer of natural, undeveloped land partially surrounding it in an urban landscape. The stream itself showed significant alterations to the stream flow, buffer and banks in the region assessed. At the time of the habitat assessment, the water levels were low, corresponding to the end of the dry season, however sufficient habitat for macroinvertebrates was observed. Due to these factors, the Habit Assessment resulted in a Marginal score of 78. Disruption to the vegetation community was observed in the results of the Linear Vegetation Survey with Twin Lake Outlet not meeting either metric for Average Coefficient of Conservatism or the Percent FLEPPC. Twin Lake Outlet did meet standards for the rapid periphyton survey with 0% of samples being ranked between 4 and 6. The historical water quality record for Twin Lake Outlet was not available. The sample from this assessment showed acceptable concentrations of Total Phosphorous, Total Nitrogen and Chlorophyll-a corrected, but showed elevated biomass for Bacteria. The results of the SCI sampling indicate that the stream is impaired 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		Twin Lake Outlet	Mean POR	Threshold
Total Phosphorous (mg/l)		0.04	N/A	< 0.49
Total Nitrogen (mg/l)		0.882	N/A	< 1.65
RPS (% Rank 4-6)		0	N/A	< 25%
LVS	**Avg C of C**	0.62	N/A	≥ 2.5
	FLEPPC %	74.40%	N/A	< 25%
Chlorophyll-a Corr (µg/l)		7.6	N/A	< 20 µg/l
Habitat Assessment		78	N/A	> 34
SCI		39	N/A	> 34