Moore Lake Drain

Methods

Study Area Analysis

The watershed containing the stream being assessed was analyzed using ESRI ArcGIS 10.2. Using this software with 2011 Hillsborough County aerial, Land Use/ Land Cover (LULC) and Watershed boundary layers courtesy of the Southwest Florida Water Management District, Landscape Development Intensity (LDI) Index values were calculated for each watershed following the procedures of Reiss & Brown 2012(Reiss & Brown. 2012. Landscape Development Intensity (LDI) Index User's Manual. H.T. Odum Center for Wetlands, University of Florida. March 2012). According to Reiss and Brown "The LDI represents a human disturbance gradient for wetland systems. The LDI is an integrated measure of human activity, combining the effects from air and water pollutants, physical damage, changes in the suite of environmental conditions … on the structure and processes of landscapes and ecosystems… Natural , undeveloped LU/LC classes have a LDI index value of zero. In the Florida framework, the maximum LDI index score is approximately 42."

Habitat/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

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, Fecal Coliform, Enterococci, Ammonia, Nitrates/Nitrites, Total Phosphorous, Kjeldahl Nitrogen and Total Nitrogen.

Study Area

Moore Lake Drain located in Hillsborough County Florida was sampled at two localities on separate dates. The first sampling locality was sampled on 10/8/2014 and is located off of Glen Harwell Road in Dover Florida at 28.0242159 N and 82.2083388 W. The second sampling locality was sampled on 10/13/2014 and is located off of Bethlehem Road in Dover Florida at 28.0173914 N and 82.2031826 W. Moore Lake Drain discharges into Pemberton Creek. The watershed surrounding Moore Lake Drain is dominated by Residential (33.75%), Natural Land/Open Water (23.7%), Row/Tree Crops (22.16%), and Pasture/Livestock (10.7%) land uses. The Landscape Development Intensity Index of the watershed is 20.74.

Figure 1 2014 Moore Lake Drain Assessment Study Area Map

Habitat Assessment

Moore Lake Drain at Glenn Harwell Rd

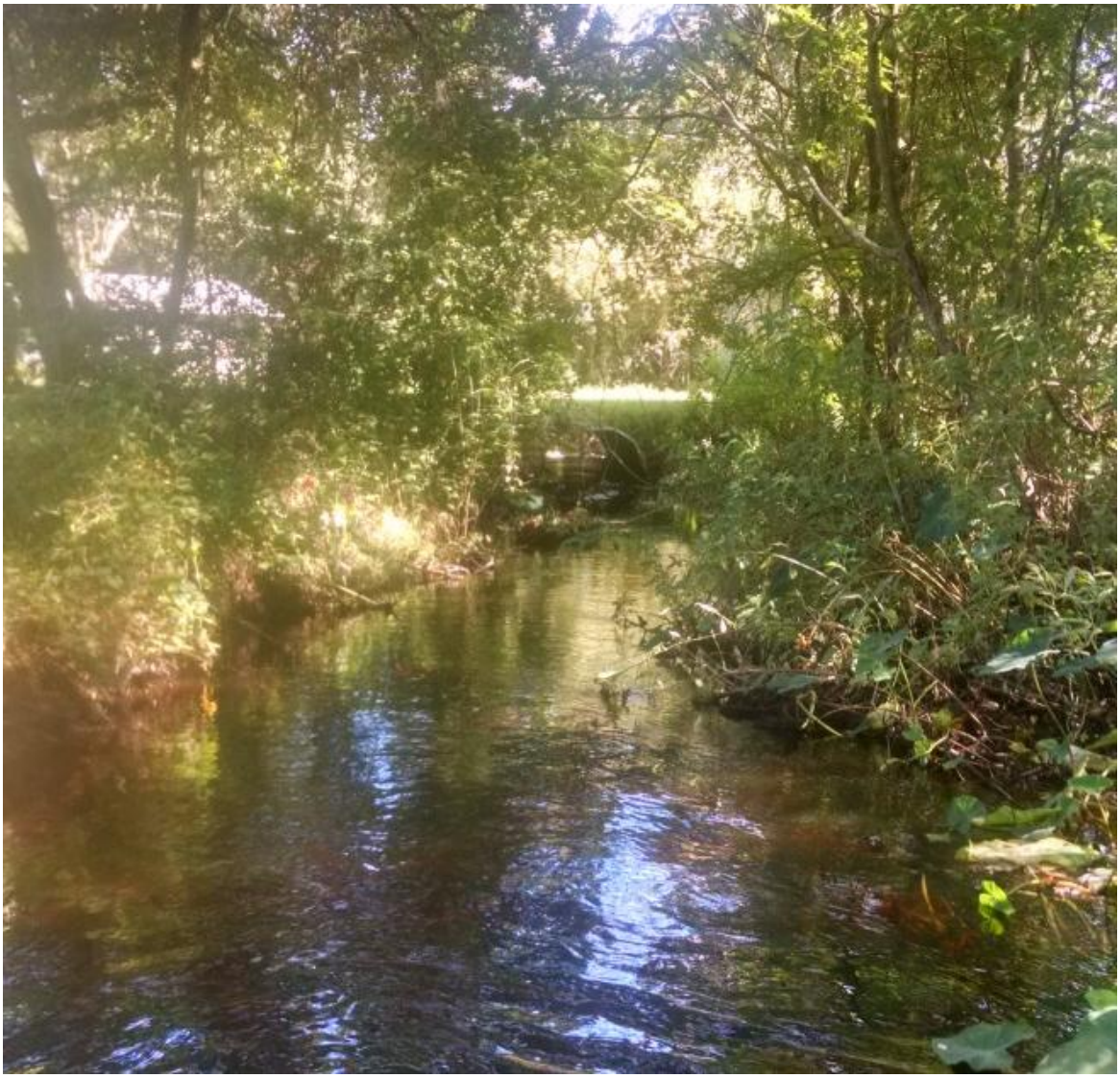

Figure 2 Overview photograph of Moore Lake Drain at Glen Harwell Rd, note the artificially straight channel and the presence of heavy shade.

Moor Lake Drain on Glen Harwell Rd received a habitat assessment score of 75 due to low substrate availability, habitat smothering by sand/silt (resulting in an absence of pools), a very low riparian buffer zone, and high degree of invasive vegetation. The observed section at Glen Harwell consisted of an artificially straightened channel that lacked sinuosity that would be expected in a typical coastal plain flow regime. Slope angle on both banks was greater than 60 degrees over the entire section but presence of good armoring vegetation and roots were noted as well as bankful being >60% of bank height. Due to the smothering noted from excessive sand and silt, no stable pools were noted

over the 100 m transect. Flow velocity was measured at both the 40 m and 100 m marks and average velocity was recorded at 0.17 m/s at the time of assessment. The thickness of the riparian zone was measured at 11-15 m and 40 m for the left and right banks respectively.

During the Rapid Periphyton Survey, periphyton was not observed in the 99 individual grab samples performed. The average canopy cover in the 100 meter region was 97%. The Secchi Disk Depth was measured as 2' and visible on the bottom at the 50 meter mark. The average water depth at the time of the assessment was 2.5'.

The Linear Vegetation Survey identified 11 species rooted in the water at the time of the assessment. Close to half of these species (5) are non-native, invasive species. The remaining 6 species are native to this region. Of the plants present within each site, no one plant was clearly dominant over the other species present. There were a total of 45 species observations in the 100 meter study area. The mean Coefficient of Conservatism (CoC) metric for the study area was 1.2 and the % FLEPPC metric for the study area was 64.44%.

Table 1 Linear Vegetation Survey Results – Moore Lake Drain @ Glenn Harwell Rd

Plant Species	Sample Site										Observations /Species	CoC
	0-10 m	10-20 m	20-30 m	30-40 m	40-50 m	50-60 m	60-70 m	70-80 m	80-90 m	90-100 m		
Ludwigia peruviana	1	1	1	1	1	1	1	1	1	1	10	0
Colocasia esculenta	1	1	1	1	1	1		1	1	1	9	0
Salvinia minima	1	1	1	1	1	1		1	1	1	9	0
Crinum americanum	1			1	1	1					4	9
Paederia foetida				1	1				1		3	0
Bidens alba			1	1							2	1
Boehmeria cylindrica			1	1							2	5
Epipremium aureum						1	1				2	0
Hydrocotyl umbellata						1		1			2	1.92
Eclipta alba (prostrata)			1								1	2
Sphagneticola (Wedelia) trilobata							1				1	0
Observations/Station	4	3	6	7	5	6	3	4	4	3	45	

Total Observations	**45**
Mean CoC	**1.20**
% FLEPPC	**64.44**

Moore Lake Drain at Bethlehem Road

Figure 3 Overview photo of Moore Drain at East of Bethlehem Rd, Right - Photo taken West of Bethlehem Rd showing very heavy smothering by escaped domesticated Ginger (*Hedychium coronatum*)

Moore Lake Drain at Bethlehem Road received an overall habitat assessment score of 99 primarily due to suboptimal substrate diversity and availability and due to much of the creek being smothered by a single plant species (see Figure 3 Right). Available habitats were notably sand smothered and while the creek was overall very shallow, stable pools were noted though not as many as would be optimal. Artificial channelization was not noted within the section to the East of Bethlehem road. However, there was a more than notably heavy presence of Ginger (Hedychium coronarium) growing within the transect area especially to the West of Bethlehem Rd. We noted the presence of productive leaf packs as well as a number of snags within heavily wooded areas. Given the shallow depth of the creek and lack of artificial channelization, banks were observed stable on both sides. All three parameters for stable banks (slope <60 degrees, armored banks, and bankful <60% bank height) were met with few exceptions. Water velocity was slightly suboptimal 0.25 m/s at the time of assessment at the 55 meter mark. The width of the riparian buffer zone to the East of Bethlehem was >18 meters on average whereas to the West of Bethlehem was 10 m.

During the Rapid Periphyton Survey, periphyton was not observed in the 99 individual grab samples performed. The average canopy cover in the 100 meter region was 42% though the section east of Bethlehem Rd was more heavily shaded than the West. The Secchi Disk Depth was measured as 0.33’ and visible on the bottom at the 50 meter mark. The average water depth at the time of the assessment was 1’.

The Linear Vegetation Survey identified 5 species rooted in the water at the time of the assessment. Two of these species were non-native, invasive species. One of the invasive species Ginger (*Hedychium coronatum*) covered 100% of both the left and right banks within the sites to the West of Bethlehem Rd. The remaining 3 species are native to this region. There were a total of 19 species observations in the 100 meter study area. The mean Coefficient of Conservatism (CoC) metric for the study area was 0.43 and the % FLEPPC metric for the study area was 15.79%.

Table 2 Linear Vegetation Survey Results - Moore Lake Drain @ Bethlehem Road

Plant Species	Sample Site										Observations /Species	CoC
	0-10 m	10-20 m	20-30 m	30-40 m	40-50 m	50-60 m	60-70 m	70-80 m	80-90 m	90-100 m		
Hedychium coronarium	1	1	1	1	1	D	D	D	D	D	10	0
Ludwigia peruviana	1	1				1					3	0
Lemna spp.			1	1							2	1
Vitis rotundifolia	1		1								2	1.18
Hydrocotyl umbellata		1		1							2	1.92
Observations/Station	3	3	3	3	1	2	1	1	1	1	19	

Total Observations	**19**
Mean CoC	**0.43**
% FLEPPC	**68.42**

Water Quality Assessment

No long-term water quality data is available for Moore Lake Drain. This means that comparison to past geometric means is not possible and therefore no way to examine how the 2014 data fit within the range of data collected for previous years. Table 3 provides a summary of the Physical/Chemical conditions recorded at both sites. Of note in the physical water quality table is the overall low Dissolved oxygen in the system at each site (most DO values measured this year were in the 70% or higher range).

Table 3 Moore Lake Drain Water Quality (Field)

Moore Lake Drain @ Glenn Harwell Rd

Depth (m)	T (ºC)	pH	DO mg/L	DO Sat %	Cond. (UMHO/cm)	Salinity (ppt)	Secchi Depth (ft)
0.06	19.02	6.49	4.7	48.7	204.3	0.09	2' (vob)

Moore Lake Drain @ Bethlehem Rd

Depth (m)	T (ºC)	pH	DO mg/L	DO Sat %	Cond. (UMHO/cm)	Salinity (ppt)	Secchi Depth (ft)
0.06	18.35	6.65	5.25	53.57	254.4	0.12	0.33' (vob)

The chemical water quality analysis for Moore Lake Drain is shown in Table 4. Total Phosphorous values were above the nutrient region threshold developed by FDEP of 0.49 mg/l. Total Nitrogen values were below the nutrient region threshold developed by FDEP of 1.65 mg/l. Chlorophyll-a values were measured within the acceptable FDEP site specific evaluation range of 3.2 µg/l to 20 µg/l for both sites. These results are interpreted as indicative of conditions reflecting an imbalance of flora. According to these results from the 2014 assessment, Moore Lake Drain would be considered to have not met the requirements for the Numeric Nutrient Criteria and would be considered impaired.

Table 4 Moore Lake Drain Water Quality (Laboratory)

Moore Lake Drain		
Parameter	**Glenn Harwell Rd**	**Bethlehem Rd**
Ammonia	0.181 mg/L	0.139 mg/L
Nitrates/Nitrites	0.039 mg/L	0.180 mg/L
Kjeldahl Nitrogen	1.317 mg/L	1.000 mg/L
Total Nitrogen	1.356 mg/L	1.180 mg/L
Total Phosphorous	0.849 mg/L	0.841 mg/L
Alkalinity		
Chlorophyll - a	3.2 ug/L	3.8 ug/L
Chlorophyll - a Corrected	3.0 ug/L	3.0 ug/L
Color	183.0 Pt/Co	126.8 Pt/Co
Fecal Coliform	80 #/100 ml	40 #/100 ml
Enterococci	1000 #/100 ml	2040 #/100 ml

Conclusion

The Moore Lake Drain sites assessed in this study show impairment based on the results of water quality sampling with elevated concentrations for phosphorous. This interpretation is supported by the results of the linear vegetation survey which show a high percentage of non-native invasive species. A notable invasive, Ginger (*Hedychium coronarium*) completely smothered half of the assessment site at Bethlehem Road. The habitat assessment performed on the two sample sites indicates similar conditions at each site with overall habitat assessment scores of 75 and 99 for the Glen Harwell and Bethlehem Road sites respectively. Available habitat as well as diversity of habitats for aquatic macrophytes good at the Bethlehem Road site whereas much smothering by sand and silt significantly reduced both availability and diversity at the Glenn Harwell site.

Measure		Glenn Harwe	Bethlehem	Threshold
Total Phosphorous (mg/l)		0.849	0.841	< 0.49
Total Nitrogen (mg/l)		1.356	1.18	< 1.65
RPS (% Rank 4-6)		0	0	< 25%
LVS	Avg C of C	1.2	0.43	≥ 2.5
	FLEPPC %	64.44%	68.42%	< 25%
Chlorophyll (µg/l)		3	3	< 20 µg/l
Habitat Assessment		75	99	