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9 June, 2003

Boylan Environmental Consultants, Inc.
attn: Rae Ann Boylan
11000 Metro Parkway
Suite 4
Ft. Myers, FL 33912

Dear Ms. Boylan:

DHI has received comments from Bruce Boler of the United States Army Corp of Engineers recommending that the "concentration method" be used for all calculations for this project.

DHI conducted a planning level analysis of the potential for pollutant load retention in the Island Park sub-watershed of Hendry Creek. Lee County is considering changes in drainage patterns in the study area to direct stormwater runoff into newly created wetlands and existing wetlands. The drainage area for the Island Park area was determined from a field inspection of the study area and a review of permit files by Boylan Environmental Consultants, Inc. (memo dated January 24, 2003). The study area is shown in Figure 1.

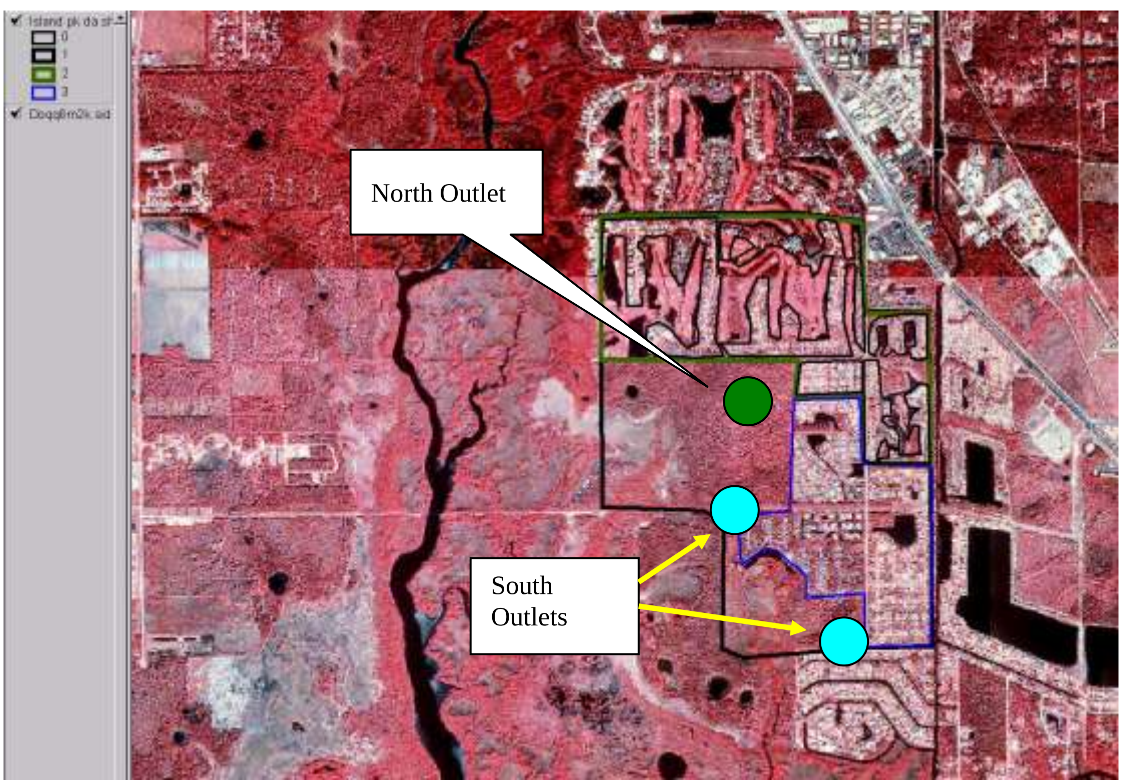

Figure 1 - Map of Study Area
Legend – Green and Blue dots – locations of proposed wetland treatment areas

The north sub-watershed (green outline) drains to the west through a channelized ditch to the proposed wetland treatment system. Removal of the southern levee of the ditch would restore flow to a wetland (see the green dot for location) that is not isolated from the channelized flows.

The runoff from approximately one-half of the south sub-watershed will be routed directed to both new and existing wetlands (see the blue dot for location). The remainder of the runoff will be directed toward existing ponds on site. These ponds will provide primary treatment and will discharge to the new and existing wetlands.

The drainage area for the north and south sub-watersheds, imperviousness percentages, runoff rates, and Total Phosphorus and Nitrogen loads are presented in the following tables. The runoff and nutrient loads were calculated using the Harper Concentration Method (Harper, 2003).

Table 1 – Sub-watershed Calculated Runoff; Existing Conditions

	Drainage Area (acres)	Rainfall (inches)	Pj	Runoff Coefficient	Runoff (acre-feet)
South Watershed					
High Density Residential	95.35	52	0.9	0.41	152.46
High Density Residential (drain to ponds)	95.35	52	0.9	0.41	152.46
Open Area	10.5	52	0.9	0.095	3.89
North Watershed					
High Density Residential	185.7	52	0.9	0.41	296.93
Golf Course	192.8	52	0.9	0.095	71.43

Runoff was calculated using the following equation:

$$R = ((P)(Pj)(Rv)/12)(A)$$

Where

R	=	Runoff (acre-feet)
P	=	Rainfall depth (inches) over the desired time period.
Pj	=	A factor that corrects P for storms that produce no runoff (value assigned is 0.9)
Rv	=	Runoff coefficient that expresses the fraction of rainfall that is converted into runoff. Calculated as 0.05 + 0.009(PI), where PI is the Percent Impervious for specific land uses
A	=	Total area of concern (acres)
12	=	Conversion factor to convert inches of rain to feet of rain

The Percent Impervious factors for each land use were taken from the DHI Tidal Caloosahatchee report (2002) and are presented below:

Land Use	Percent Impervious
Public	30
Medium Density Residential	16
Open/Vacant	5
Low Density Residential	5
Agriculture	5
High Density Residential	40
Recreational	5
Commercial	40
Wetlands	10
Industrial	70

The runoff concentrations for nitrogen and phosphorus are taken from Table 26 of the Harper Methodology (2003) and the NPDES calculations completed for Lee County (DHI, 2003). Existing conditions load concentration calculations are presented in the following tables.

Table 5 – Nitrogen Existing Conditions Annual Load

	runoff ac.ft	Conversion Factors				Conc. (mg/L)	TN/yr (Kg)
		(ft2/ac)	(gal/cfs)	(lit/gal)	(kg/mg)		
South Watershed							
High Density Residential	152.46	43560	7.48	3.785	1.00E-06	1.7	320
High Density Residential (drain to ponds)	152.46	43560	7.48	3.785	1.00E-06	1.7	320
Open Area	3.89	43560	7.48	3.785	1.00E-06	1.25	6
North Watershed							
High Density Residential	296.93	43560	7.48	3.785	1.00E-06	1.7	623
Golf Course	71.43	43560	7.48	3.785	1.00E-06	2.32	204

Table 6 – Phosphorus Existing Conditions Annual Load

	runoff ac.ft	Conversion Factors				Conc. (mg/L)	TP/yr (Kg)
		(ft2/ac)	(gal/cfs)	(lit/gal)	(kg/mg)		
South Watershed							
High Density Residential	152.46	43560	7.48	3.785	1.00E-06	0.49	92
High Density Residential (drain to ponds)	152.46	43560	7.48	3.785	1.00E-06	0.49	92
Open Area	3.89	43560	7.48	3.785	1.00E-06	0.046	0
North Watershed							
High Density Residential	296.93	43560	7.48	3.785	1.00E-06	0.49	179
Golf Course	71.43	43560	7.48	3.785	1.00E-06	0.34	30

All calculations used the concentration method where the average annual concentration is multiplied by the runoff and then converted to a mass of kilograms.

The load flowing into the south wetland was reduced to the primary treatment effect of the stormwater ponds in the development. The pond efficiency was calculated using the method described in the Harper report (2003).

Table 7 – Nitrogen Load to the Proposed Wetland Treatment System

Watershed	Existing Conditions Load	Load after Pond Removal (58%)	Total Net Load
South Watershed			
High Density Residential	320		
High Density Residential (drain to ponds)	320	134	
Open Area	6		460
North Watershed			
High Density Residential	623		
Golf Course	204		827

Table 8 – Phosphorus Load to the Proposed Wetland Treatment System

Watershed	Existing Conditions Load	Load after Pond Removal (74%)	Total Net Load
South Watershed			
High Density Residential	92		
High Density Residential (draining to ponds)	92	24	
Open Area	0		116
North Watershed			
High Density Residential	179		
Golf Course	30		209

The wetland areas proposed to treat the north and south sub-watersheds and projected nutrient removal efficiencies are presented in Table 9.

Table 9 – Summary of Proposed Wetland Treatment Performance

Sub Watershed	Wetland Treatment Area, Acres	TP Load, Kg/yr	Removal Efficiency %	TP Load Removed Kg/yr	TN Load, Kg/yr	Removal Efficiency %	TN Load Removed Kg/yr
South	22.9	116	83	96	460	81	374
North	17.2	209	81	169	827	73	601

The TP removal efficiency was determined using an empirical formula for TP removal in south Florida wetlands determined by William Walker, a wetland scientist with extensive experience in nutrient assimilation in south Florida wetlands (Walker, 1995). This formulation was used for the determination of wetland performance for proposed wetland detention/retention areas north of Lake Okeechobee (Stanley Consultants, 2000).

If you have any questions or comments regarding these calculations. please contact me or Peter deGolian at (813) 254-9427.

Best regards,
DHI Inc.

Roger Copp
Vice President

References

DHI; July 2002; Tidal Caloosahatchee Basin Model; Model Calibration and Validation, Final Report. Prepared for South Florida Water Management District

DHI; February 2003; Water Year 2001 Annual NPDES Loading Calculations Letter Report. Prepared for Lee County.

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Scheuler, Thomas R., and Matthew R. Bley; 1987; A Framework for Evaluating Compliance with the 10% Rule in the Chesapeake Bay Critical Areas. Metropolitan Washington Council of Governments, Washington, D.C.

Stanley Consultants, Inc. 2000. Lake Okeechobee Water Retention Areas Project, Contract DAW17-98-D-0014. Prepared for the US Army Corps of Engineers Jacksonville District, Stanley Consultants, West Palm Beach, FL.

Walker, W.W. 1995. Design Basis for Everglades Stormwater Treatment Areas. Water Resources Bulletin, 31(4):671-685.