PART 1α

First Cut Look at EPA's Numeric Nutrient Criteria & Deconstruction for Practitioners

EPA NUMERIC NUTRIENT CRITERIA – DECONSTRUCTED FOR PRACTITIONERS

- Lately there is a buzz in the drainage engineering community in Florida regarding EPA's Numeric Nutrient Criteria (promulgated Nov 15, 2010) and how it may affect design and permitting of stormwater systems.
- These few slides attempt to deconstruct the criteria and outline its potential impact to drainage engineers. Caution: this is a non-expert viewpoint.
- First recognize that these numeric criteria are intended to quantify acceptable nutrient concentrations for fresh water features and they are to be used by FDEP in preparing their list of "nutrient-impaired water bodies" and also to fix target levels for cleaning up/limiting loads to such nutrient-impaired waters (buzz words are "303-d list", "TMDL", "BMAP").
- FDEP's 1982 Stormwater Rule establishes that BMPs shall achieve at least 80% reduction of the average annual load of pollutants (95% reduction for outstanding natural resource waters). If your project was designed per these criteria, FDEP and EPA assume it meets the EPA Numeric Nutrient criteria!!...but does it?

EPA NUMERIC NUTRIENT CRITERIA – DECONSTRUCTED FOR PRACTITIONERS

Here is an anthropomorphic perspective of the EPA numeric nutrient criteria to provide a quick and incisive view for stormwater engineers in Florida.

- There are two (2) cocktail parties taking place simultaneously in the state of Florida:
  1. one party is only attended by older people (watersheds with development in place prior to 1982 with insufficient stormwater treatment which now create downstream pollution–this retrofit is being done under the FDEP's TMDL program), and
  2. the other party for younger people only (stormwater systems born after 1982 and the unborn which are presumed NOT to create this pollution and therefore don't need upgrading–but their design criteria are now being revisited via the statewide stormwater treatment rule).

- Guests at both parties are imbibing non-alcoholic cocktails of nitrogen and phosphorus.
- Since they are known to cause impairment, the attendees at the older folks party (TMDL program) are now being subject to a new standard. The federal police (EPA) has sent the local police (FDEP) a Breathalyzer (numeric nutrient criteria) to use at the older people party to ensure they are not impaired when they leave (their nitrogen and phosphorus concentrations do not pollute the receiving water body).

EPA NUMERIC NUTRIENT CRITERIA – DECONSTRUCTED FOR PRACTITIONERS

- There is no mention of this Breathalyzer being used at at the younger people party since it is presumed they are in compliance. However, the statewide stormwater treatment rule studies which are being undertaken by the FDEP now suggest that the younger systems may also be culprits.
- The question is will the federal police (EPA) (or some environmental group) ask the local police (FDEP) to also use their Breathalyzer in the younger folks party; or will some attorney explain to a judge that it just makes sense to use the same Breathalyzer at each party. If that becomes the case, then the foundation of the statewide stormwater rule will have to be reworked to ensure the Breathalyzer limits are not exceeded for "impaired“ and "non-impaired“.

My concerns lies in the last bullet and it appears that the local police (state of Florida) is now suing the federal police (EPA) to block their standards from taking effect.

EPA NUMERIC NUTRIENT CRITERIA FOR INLAND LAKES & FLOWING WATERS IN FLORIDA

1. Standards have been promulgated by EPA (via Clean Water Act) to reduce algae in fresh water systems (lakes, flowing waters, springs).

2. Establishes numerical concentrations for 4 water quality parameters:
   a. Total Nitrogen (TN mg/l) {for lakes & flowing waters}
   b. Total Phosphorus (TN mg/l) {for lakes & flowing waters}
   c. Chlorophyll-a (mg/l); a measure of algae in the water {only for lakes}
   d. Nitrate-Nitrite (mg/l) {only for springs}

IMPORTANT NOTE:
All concentrations are annual geometric means not to be surpassed more than once in a three year period.

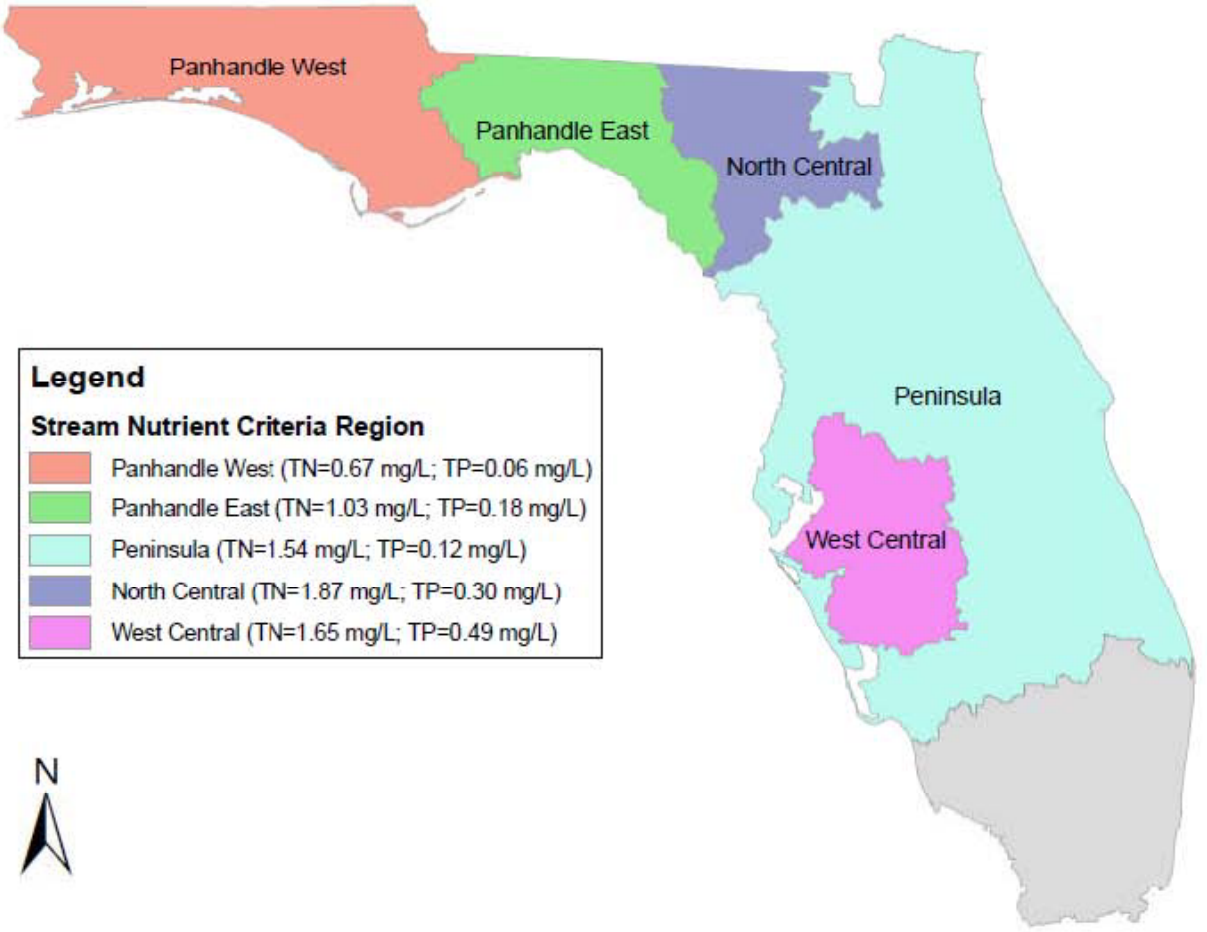
EPA NUMERIC NUTRIENT CRITERIA FOR INLAND LAKES & FLOWING WATERS IN FLORIDA

3. Water quality standards to be effective 15 months from Nov 2010, so say March 2012.

4. Applies to rivers, streams, lakes, and springs but standards not yet ready for estuaries (coming August 2012). Table below compares EPA adopted standards versus now moot standard proposed by FDEP in 2009.

Region	Chlorophyll-a (mg/l)		Total Nitrogen (mg/l)		Total Phosphorus (mg/l)		Nitrate + Nitrite (mg/l)	
	EPA	FDEP	EPA	FDEP	EPA	FDEP	EPA	FDEP
LAKES								
Colored lakes	0.020		1.27	1.23	0.050	0.050		
Clear lakes (alkaline)	0.020		1.05	1.00	0.031	0.030		
Clear lakes (acidic)	0.006		0.50	0.85	0.011	0.015		
FLOWING WATERS								
Panhandle East			1.03	0.82	0.180	0.069		
Panhandle West			0.67	0.82	0.060	0.069		
North Central			1.87	1.72	0.300	0.359		
West Central			1.65	1.62	0.490	0.750		
Peninsula			1.54	1.72	0.120	0.119		
SPRINGS								
Springs							0.35	0.35

Exhibit 3-4: Numeric Nutrient Criteria Regions for Streams in Florida



Note that South Florida ‘s flowing water bodies are excluded from these criteria
No geographic adjustment for lakes, unlike flowing water bodies which are in geological regions

Exhibit 2-9: Map of Baseline Impairments in Florida

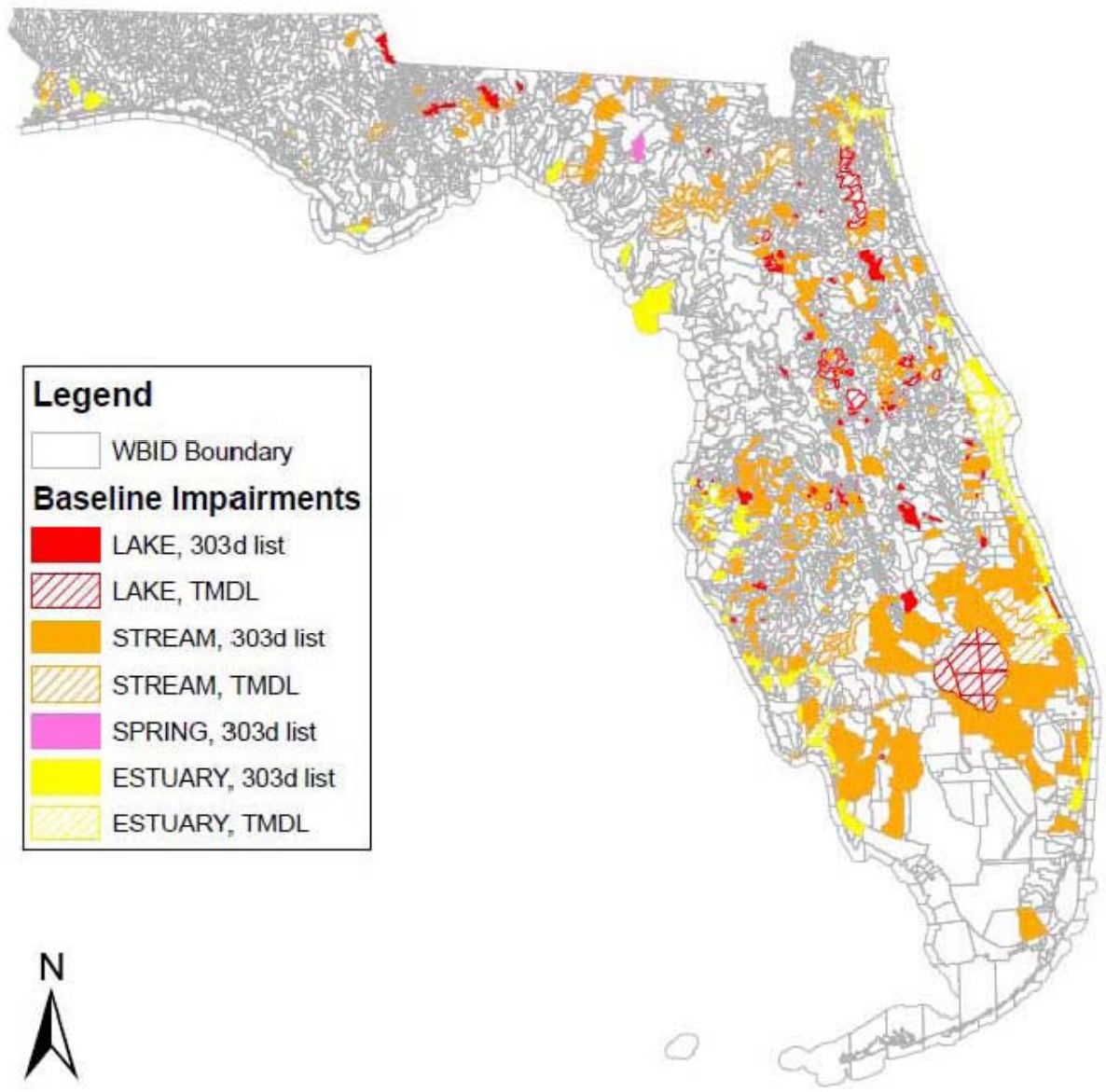
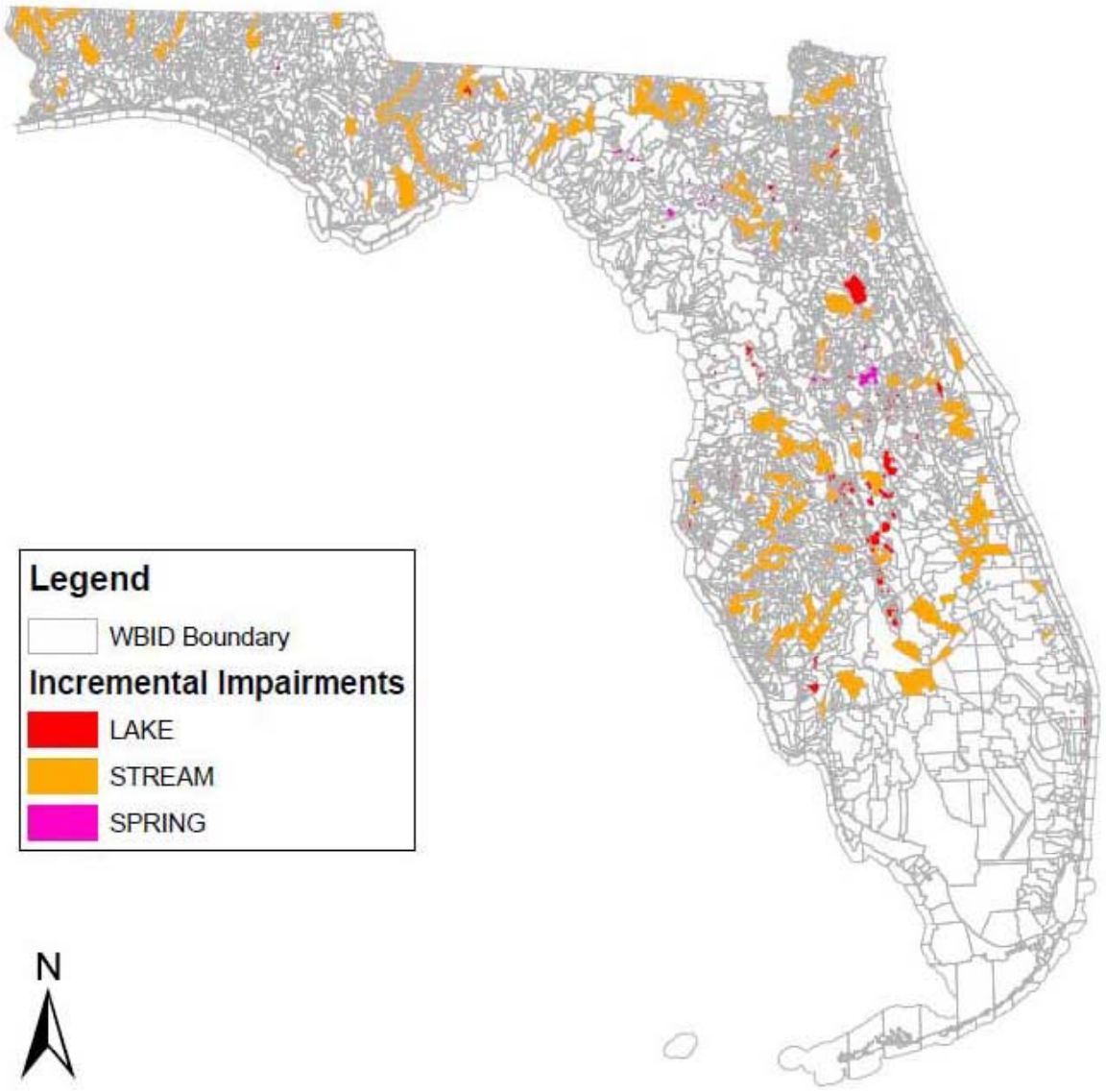


Exhibit 6-2: Map of Potential Incrementally Impaired Waters Affected by the Rule



EPA NUMERIC NUTRIENT CRITERIA FOR INLAND LAKES & FLOWING WATERS IN FLORIDA

5. If your lake is “happy-trophic” (my term) which means that its chlorophyll a (annual geometric mean) is less than 20 mg/m^3 for alkaline lakes [or 6 mg/m^3 for acidic lakes] for 3 consecutive preceding years, entity can collect data and apply for an adjustment in TN and TP numeric criteria within the limits shown on the next slide.

6. “Sufficient” data to justify this request includes at least four measurements per year, with at least one measurement between May and September and one measurement between October and April each year. 3 consecutive preceding years.

7. Modified criteria = geometric mean of all annual geometric mean concentrations from at least the immediately preceding three years in a particular lake. When the TN and/or TP criteria are modified, the chlorophyll a criterion must also be modified to reflect the same period. Modified TP and TN criteria may not exceed criteria applicable to streams to which a lake discharges.

CRITERIA ADJUSTMENT RANGE FOR LAKES

Lake Color and Alkalinity	Chl-a (mg/L)	TN (mg/L)	TP (mg/L)
Colored Lakes > 40 PCU	0.020	1.27 [1.27-2.23]	0.05 [0.05-0.16]
Clear Lakes, High Alkalinity ≤ 40 PCU and Alkalinity > 20 mg/L CaCO3	0.020	1.05 [1.05-1.91]	0.03 [0.03-0.09]
Clear Lakes, Low Alkalinity ≤ 40 PCU and Alkalinity ≤ 20 mg/L CaCO3	0.006	0.51 [0.51-0.93]	0.01 [0.01-0.03]

* All concentrations are annual geometric means not to be surpassed more than once in a three year period. Bracketed numbers reflect the range in which Florida can adjust the TN and TP criteria when data shows the lake is meeting the relevant Chl a criterion.

EPA'S ESTIMATED COST TO COMPLY

For this analysis, EPA estimated unit costs from data on existing stormwater projects in Florida obtained from FDEP.

The cost of these projects ranges from $62 per acre to $60,300 per acre, with a median cost of $6,800 per acre. Using the median cost per acre and the estimated number of acres needing additional controls, EPA estimated that costs for additional nutrient controls for stormwater could range from $60.5 million per year to $108.0 million per year.

IMPORTANT NOTE: these are PER YEAR cost estimates. Not one time.

ESTIMATED ANNUAL COST OF EPA NUMERIC NUTRIENT CRITERIA (Prepared by EPA)

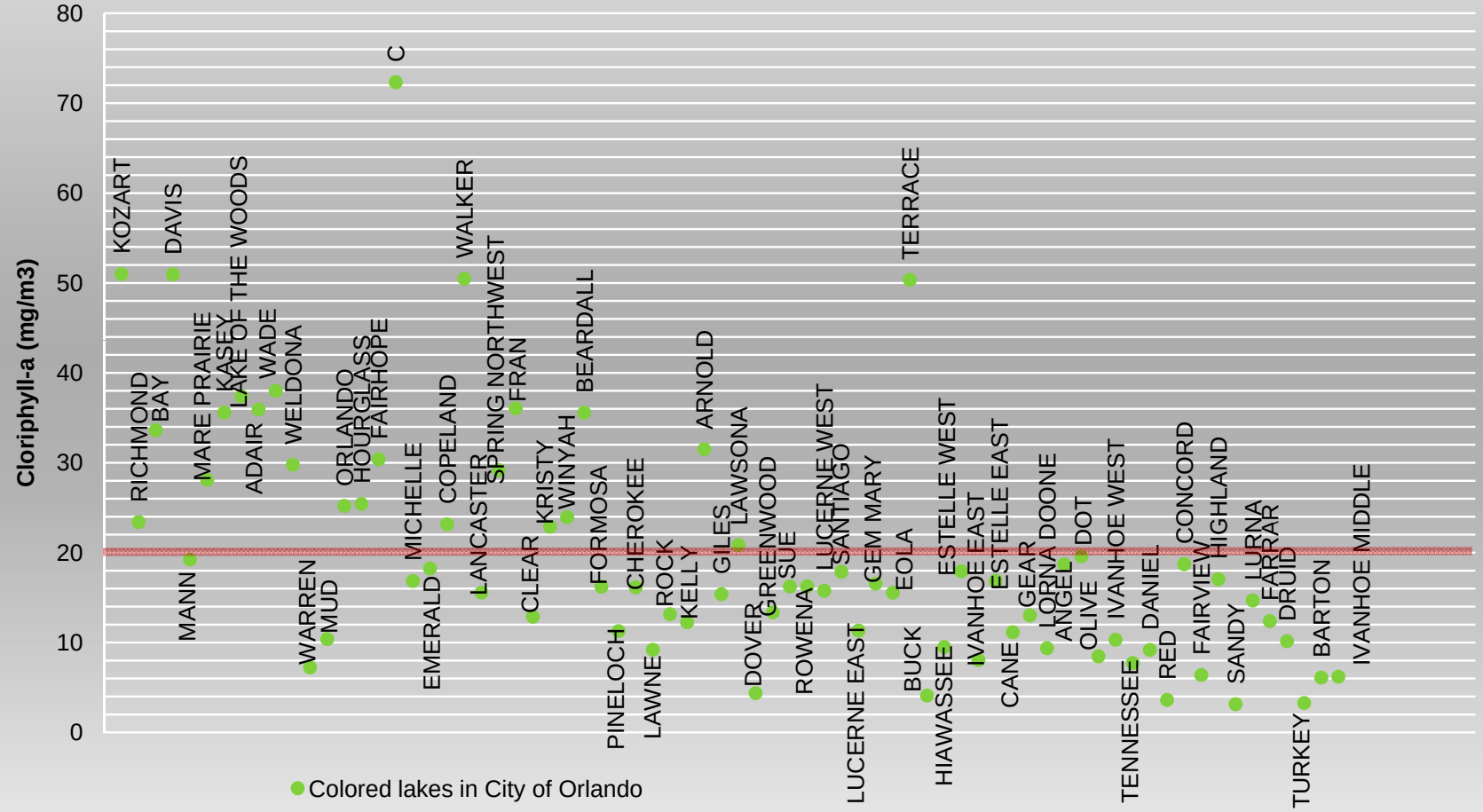
Item Affected	Cost Estimated by EPA (Million Dollars Per Year)
Municipal wastewater	$22 to $38
Industrial Wastewater	$25.4
Urban Stormwater	$60.5 to $108.0
Agriculture	$19.9 to $23.0
Septic	$6.6 to $10.7
Govt cost to implement	$0.9
TOTAL	$135.5 ➟ $206.1 million/year

P.S.: these are U.S. government estimates – not trying to be facetious, but can the actual amount be double or treble these estimates?

EPA's Numeric Nutrient Criteria

APPLIED TO CITY OF ORLANDO'S LAKES (95 lakes, 2009 data) How do they compare?

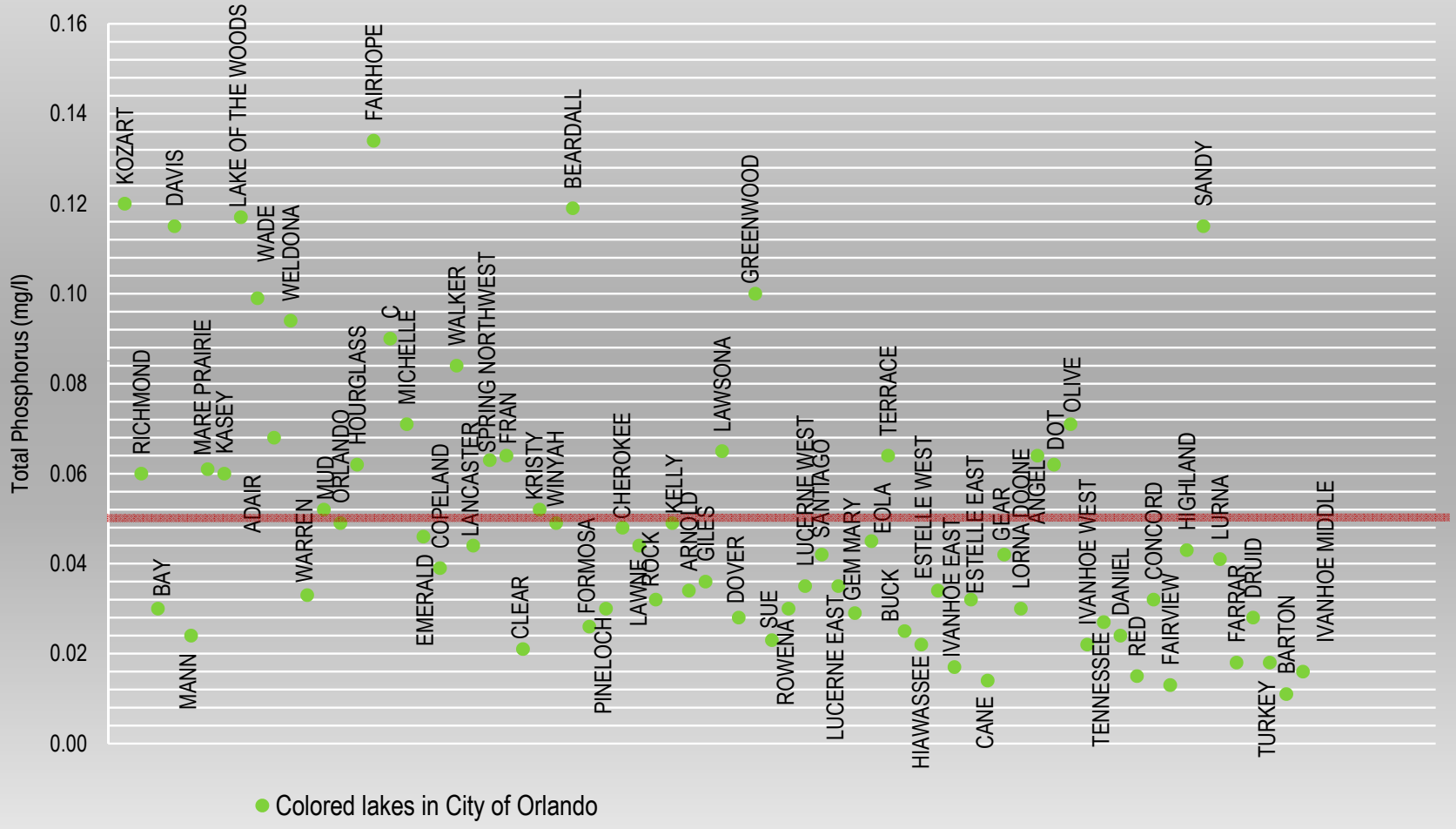
Chlorophyll-a Measurements for Colored Lakes in Orlando



Total # of Lakes in this category = 72 (76% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 24 (33% not meeting)

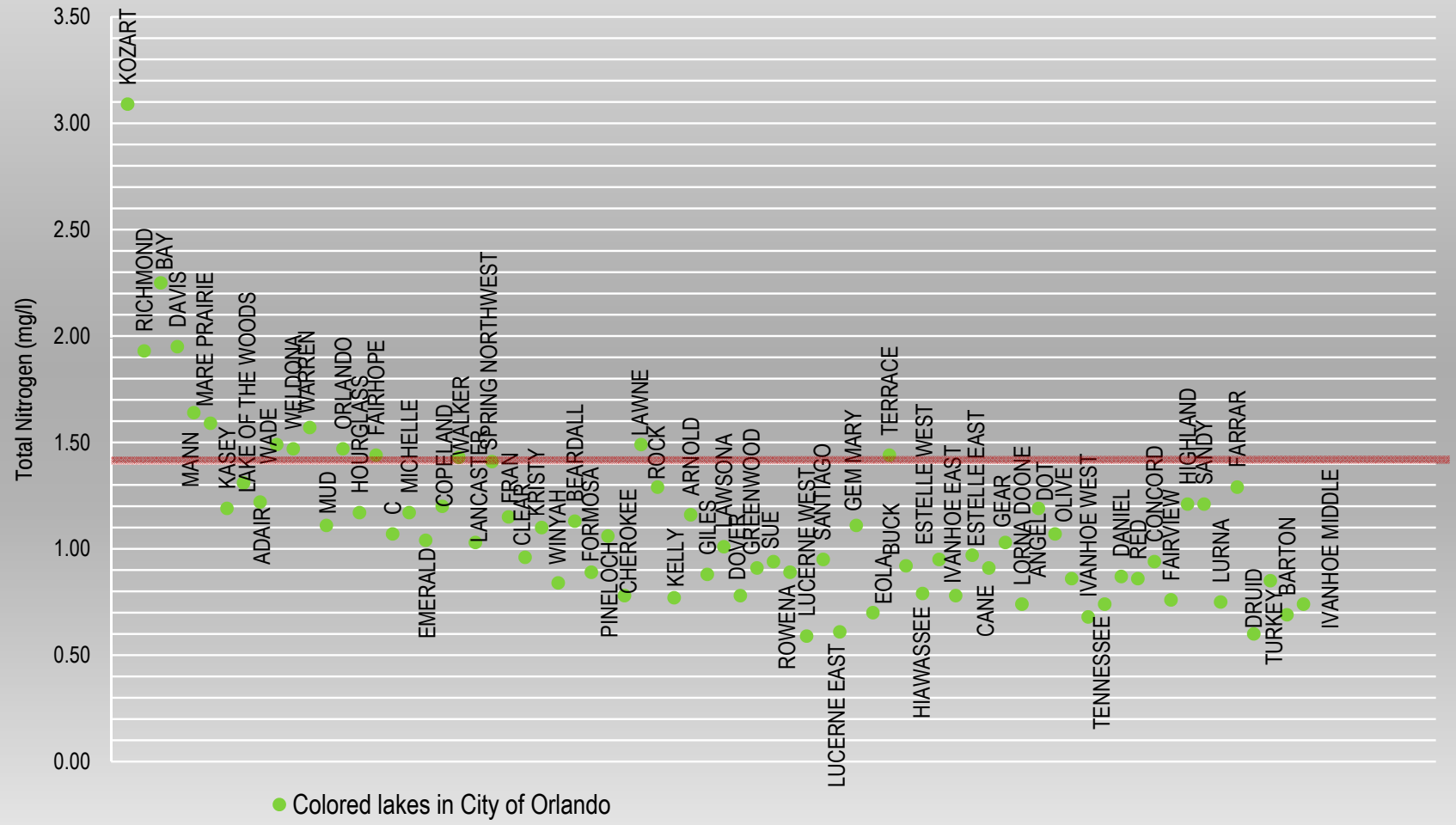
Total phosphorus Measurements for Colored Lakes in Orlando



Total # of Lakes in this category = 72 (76% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 26 (36% not meeting)

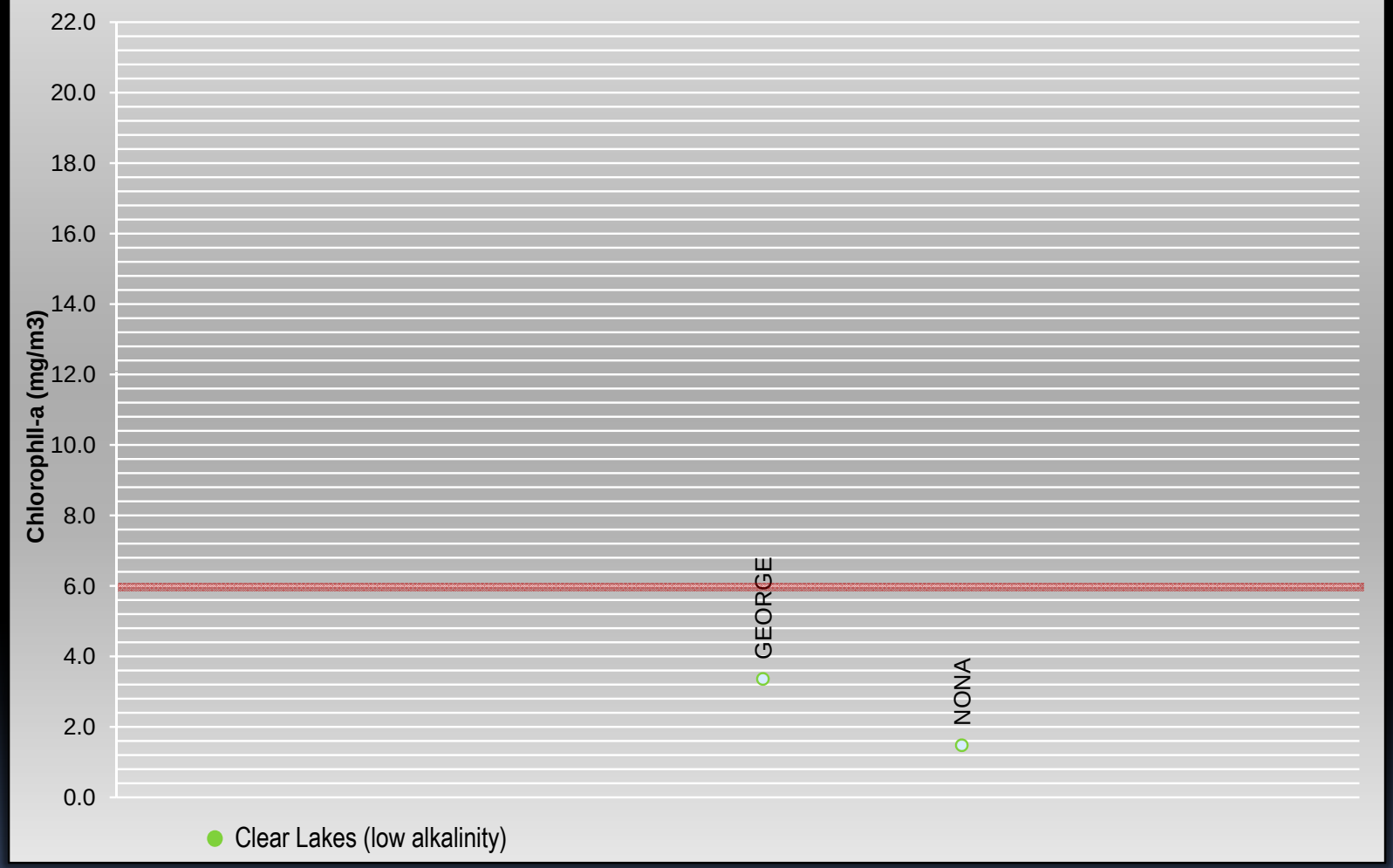
Total Nitrogen Measurements for Colored Lakes in Orlando



Total # of Lakes in this category = 72 (76% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 14 (19% not meeting)

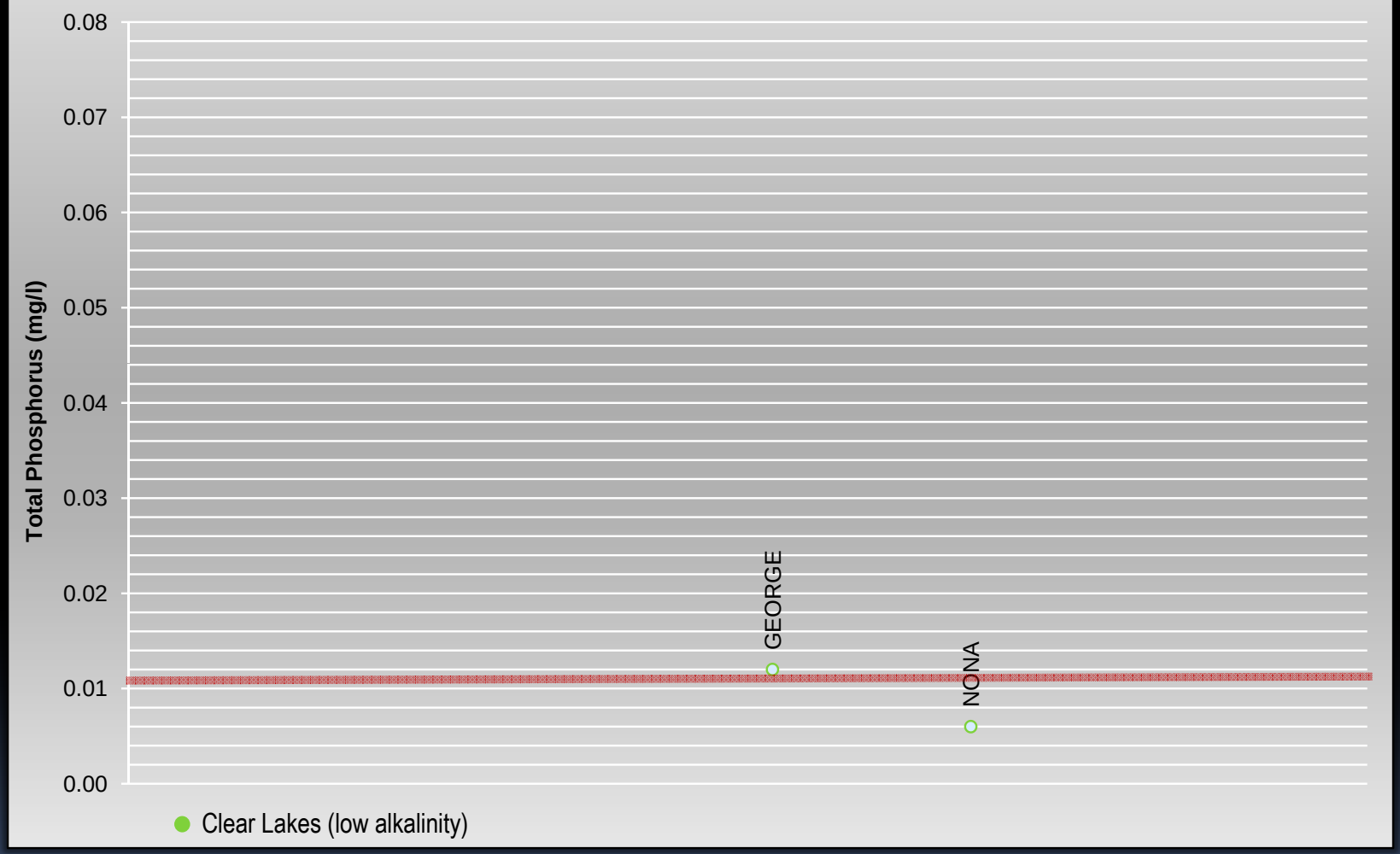
Chlorophyll-a measurement for Clear Lakes (low alkalinity) in Orlando



Total # of Lakes in this category = 2 (2% of all lakes in Orlando)

Total # of Lakes not meeting criteria = Zero (0% not meeting)

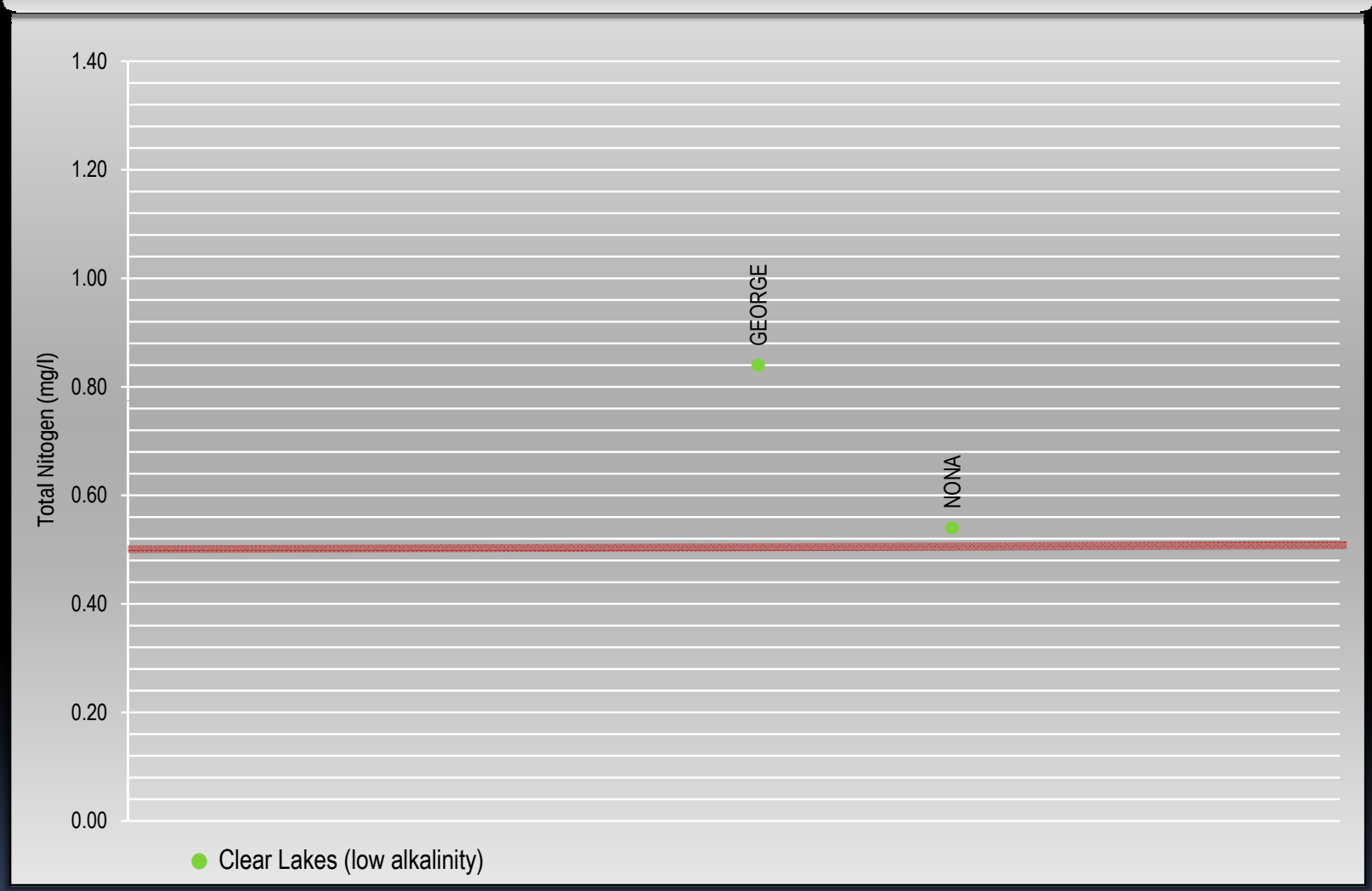
Total Phosphorus measurement for Clear Lakes (low alkalinity) in Orlando



Total # of Lakes in this category = 2 (2% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 1 (50% not meeting)

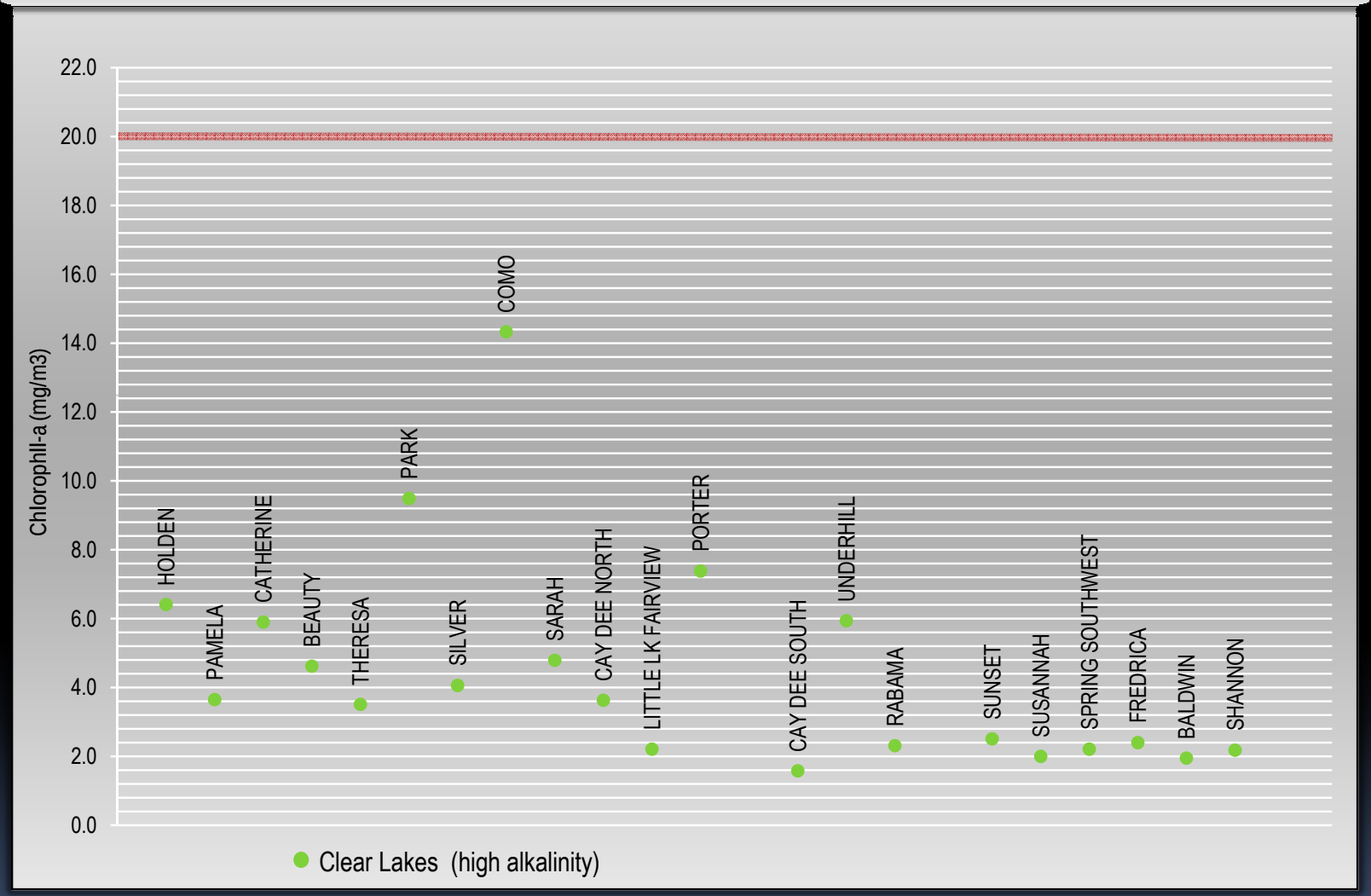
Total Nitrogen measurement for Clear Lakes (low alkalinity) in Orlando



Total # of Lakes in this category = 2 (2% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 2 (100% not meeting)

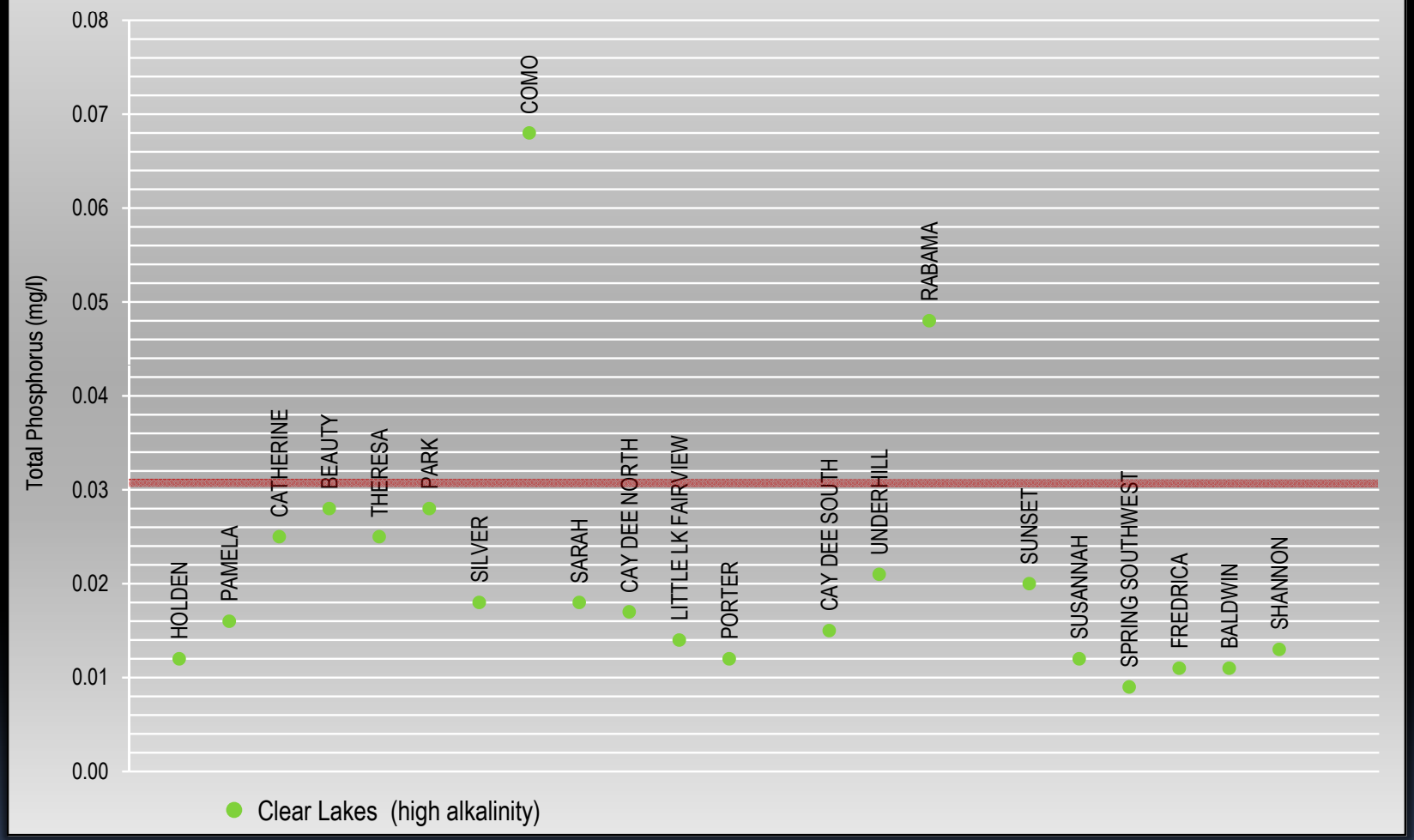
Chlorophyll-a measurement for Clear Lakes (high alkalinity) in Orlando



Total # of Lakes in this category = 21 (22% of all lakes in Orlando)

Total # of Lakes not meeting criteria = Zero (0% not meeting)

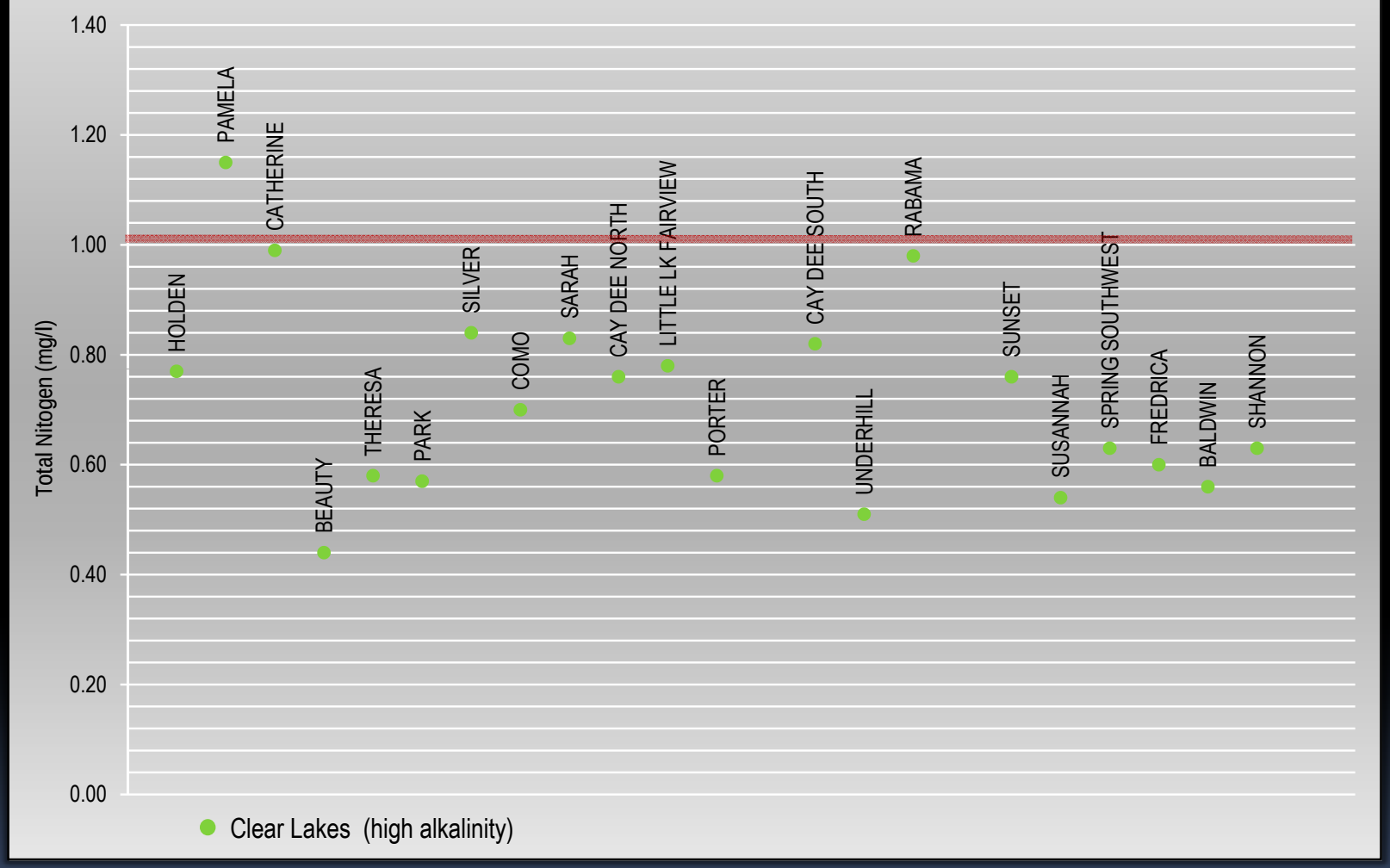
Total Phosphorus measurement for Clear Lakes in Orlando



Total # of Lakes in this category = 21 (22% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 2 (10% not meeting)

Total Nitrogen measurement for Clear Lakes (high alkalinity) in Orlando



Total # of Lakes in this category = 21 (22% of all lakes in Orlando)

Total # of Lakes not meeting criteria = 1 (5% not meeting)

EPA's Numeric Nutrient Criteria

WHAT IF THE DISCHARGE FROM A WET DETENTION POND HAS TO MEET THESE CRITERIA LIKE THE EFFLUENT DISCHARGE FROM A WASTEWATER TREATMENT PLANT?

LEVEL OF NUTRIENT REDUCTION REQUIRED?

WET DETENTION POND DISCHARGING TO AN ACIDIC, CLEAR LAKE

	EMC (mg/l)		TARGET REDUCTIONS	
Land Use	TN	TP	TN	TP
Agricultural - Citrus	2.31	0.16	78%	93%
Agricultural - General Agriculture	2.42	0.46	79%	98%
Agricultural - Pasture	2.48	0.7	80%	98%
Agricultural - Row Crops	2.47	0.51	80%	98%
High-Intensity Commercial	2.48	0.23	80%	95%
Highway	1.37	0.17	64%	94%
Light Industrial	1.14	0.23	56%	95%
Low-Density Residential	1.5	0.18	67%	94%
Low-Intensity Commercial	0.93	0.16	46%	93%
Mining / Extractive	1.18	0.15	58%	93%
Multi-Family	1.91	0.48	74%	98%
Single-Family	1.85	0.31	73%	96%
Undeveloped / Rangeland / Forest	1.15	0.055	57%	80%
Undeveloped - Dry Prairie	1.95	0.107	74%	90%
Undeveloped - Hydric Hammock	1.072	0.026	53%	58%
Undeveloped - Marl Prairie	0.603	0.01	17%	0%
Undeveloped - Mesic Flatwoods	1	0.034	50%	68%
Undeveloped - Mixed Hardwood	0.288	0.501	0%	98%
Undeveloped - Ruderal/Upland Pine	1.318	0.347	62%	97%
Undeveloped - Scrubby Flatwoods	1.023	0.027	51%	59%
Undeveloped - Upland Hardwood	0.891	0.269	44%	96%
Undeveloped - Upland Mixed Forest	0.676	2.291	26%	100%
Undeveloped - Wet Flatwoods	1.175	0.015	57%	27%
Undeveloped - Wet Prairie	0.776	0.009	36%	0%
Undeveloped - Xeric Hammock	1.318	2.816	62%	100%
Undeveloped - Xeric Scrub	1.158	0.096	57%	89%

Target Nitrogen Concentration (mg/l) = 0.500

Target Phosphorus Concentration (mg/l) = 0.011

WET DETENTION POND DISCHARGING TO AN ALKALINE, CLEAR LAKE

	EMC (mg/l)		TARGET REDUCTIONS	
Land Use	TN	TP	TN	TP
Agricultural - Citrus	2.31	0.16	55%	81%
Agricultural - General Agriculture	2.42	0.46	57%	93%
Agricultural - Pasture	2.48	0.7	58%	96%
Agricultural - Row Crops	2.47	0.51	57%	94%
High-Intensity Commercial	2.48	0.23	58%	87%
Highway	1.37	0.17	23%	82%
Light Industrial	1.14	0.23	8%	87%
Low-Density Residential	1.5	0.18	30%	83%
Low-Intensity Commercial	0.93	0.16	0%	81%
Mining / Extractive	1.18	0.15	11%	79%
Multi-Family	1.91	0.48	45%	94%
Single-Family	1.85	0.31	43%	90%
Undeveloped / Rangeland / Forest	1.15	0.055	9%	44%
Undeveloped - Dry Prairie	1.95	0.107	46%	71%
Undeveloped - Hydric Hammock	1.072	0.026	2%	0%
Undeveloped - Marl Prairie	0.603	0.01	0%	0%
Undeveloped - Mesic Flatwoods	1	0.034	0%	9%
Undeveloped - Mixed Hardwood	0.288	0.501	0%	94%
Undeveloped - Ruderal/Upland Pine	1.318	0.347	20%	91%
Undeveloped - Scrubby Flatwoods	1.023	0.027	0%	0%
Undeveloped - Upland Hardwood	0.891	0.269	0%	88%
Undeveloped - Upland Mixed Forest	0.676	2.291	0%	99%
Undeveloped - Wet Flatwoods	1.175	0.015	11%	0%
Undeveloped - Wet Prairie	0.776	0.009	0%	0%
Undeveloped - Xeric Hammock	1.318	2.816	20%	99%
Undeveloped - Xeric Scrub	1.158	0.096	9%	68%

Target Nitrogen Concentration (mg/l) = 1.050 Target Phosphorus Concentration (mg/l) 0.031

WET DETENTION POND DISCHARGING TO A COLORED LAKE

	EMC (mg/l)		TARGET REDUCTIONS	
Land Use	TN	TP	TN	TP
Agricultural - Citrus	2.31	0.16	45%	69%
Agricultural - General Agriculture	2.42	0.46	48%	89%
Agricultural - Pasture	2.48	0.70	49%	93%
Agricultural - Row Crops	2.47	0.51	49%	90%
High-Intensity Commercial	2.48	0.23	49%	78%
Highway	1.37	0.17	7%	71%
Light Industrial	1.14	0.23	0%	78%
Low-Density Residential	1.5	0.18	15%	72%
Low-Intensity Commercial	0.93	0.16	0%	69%
Mining / Extractive	1.18	0.15	0%	67%
Multi-Family	1.91	0.48	34%	90%
Single-Family	1.85	0.31	31%	84%
Undeveloped / Rangeland / Forest	1.15	0.055	0%	9%
Undeveloped - Dry Prairie	1.95	0.107	35%	53%
Undeveloped - Hydric Hammock	1.072	0.026	0%	0%
Undeveloped - Marl Prairie	0.603	0.01	0%	0%
Undeveloped - Mesic Flatwoods	1	0.034	0%	0%
Undeveloped - Mixed Hardwood	0.288	0.501	0%	90%
Undeveloped - Ruderal/Upland Pine	1.318	0.347	4%	86%
Undeveloped - Scrubby Flatwoods	1.023	0.027	0%	0%
Undeveloped - Upland Hardwood	0.891	0.269	0%	81%
Undeveloped - Upland Mixed Forest	0.676	2.291	0%	98%
Undeveloped - Wet Flatwoods	1.175	0.015	0%	0%
Undeveloped - Wet Prairie	0.776	0.009	0%	0%
Undeveloped - Xeric Hammock	1.318	2.816	4%	98%
Undeveloped - Xeric Scrub	1.158	0.096	0%	48%

Target Nitrogen Concentration (mg/l) = 1.270 Target Phosphorus Concentration (mg/l) 0.050