July 15, 2014

Chesapeake Bay Program
Pervious Urban Distinctions re Turf

Possible splits:

* fertilized/unfertilized
* high risk/low risk

Chesapeake Bay Program
A Watershed Partnership

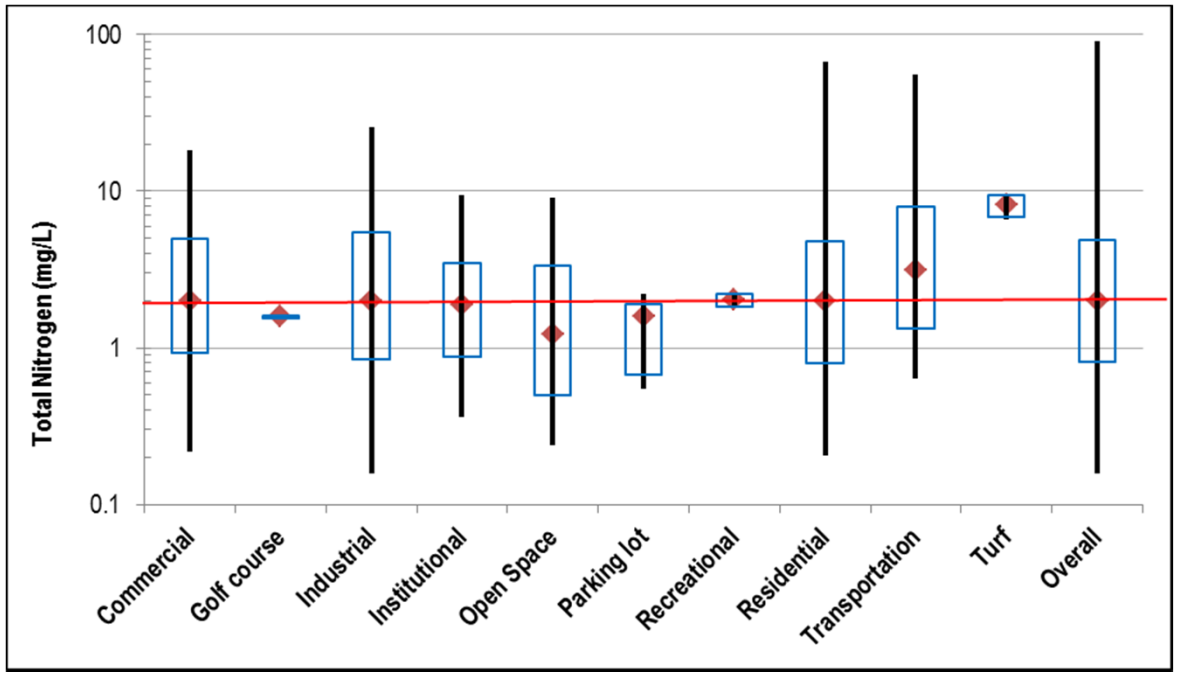
Current 5.3.2 Model Assumptions

- Nutrient inputs on pervious urban land come from atmospheric deposition and fertilizer (all pervious acres receive uniform fertilizer input)
  - For P, 1.3 lbs/acre/year (2.6 lbs for 50 % of total pervious acreage)
    - (now modified by urban nutrient management expert panel report recommendations)
  - For N, 43 pounds/acre/year (86 lbs for 50 % of total pervious acreage)
- Sensitivity of inputs to outputs
  - For P, 50 percent
  - For N, 30 percent

What is relationship between fertilizer use and nutrient export from residential land uses?

Data is variable and hard to discern a signal through the noise

TN concentration statistics from NSQD and literature review for general land uses – from Tetra Tech 3/31/14 memo



$N_{overall}$ = 4,778

N_{turf} = 2

Note: Figure shows median (red dot), 10th/90th percentile range (blue box), and minimum/maximum (black bar). Current concentration in the model is represented as red horizontal line.

Edge of Stream Runoff Concentrations

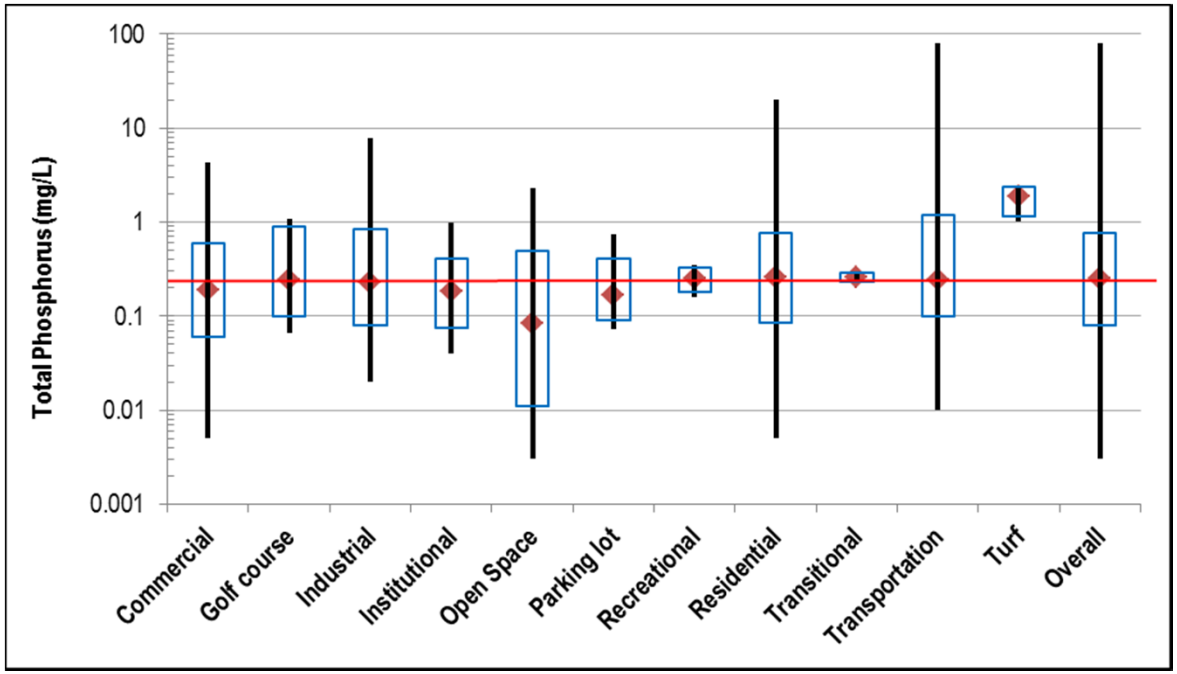
Data presented by Shirley Clark at April 2014 STAC workshop

Nutrient Runoff Concentrations as a Function of Fertilizer Use

USGS, Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin. USGS Water-Resources Investigation Report 02-4130, July 2002)

	Regular Fertilizer Application	Non-P Fertilizer Application	Unfertilized Lawns	Unfertilized Wooded Sites
Ammonia (mg/L)				
Geometric Mean	1.11	1	0.76	2.95
Median	1.07	0.93	0.63	4.38
Mean	2.18	3.95	1.12	5.33
TKN (mg/L)				
Geometric Mean	5.9	6.5	4.08	12.7
Median	5.9	5.2	5.1	9.8
Mean	8.6	12.2	5.85	29.3
NO_2+NO_3 (mg/L)				
Geometric Mean	0.09	0.14	0.12	0.16
Median	0.12	0.14	0.14	0.24
Mean	0.17	0.57	0.17	0.9

TP concentration statistics from NSQD and literature review for residential land uses – from Tetra Tech 3/31/14 memo



$N_{overall}$ = 6,823

N_{turf} = 4

Note: Figure shows median (red dot), 10th/90th percentile range (blue box), and minimum/maximum (black bar). Current concentration in the model is represented as red horizontal line.

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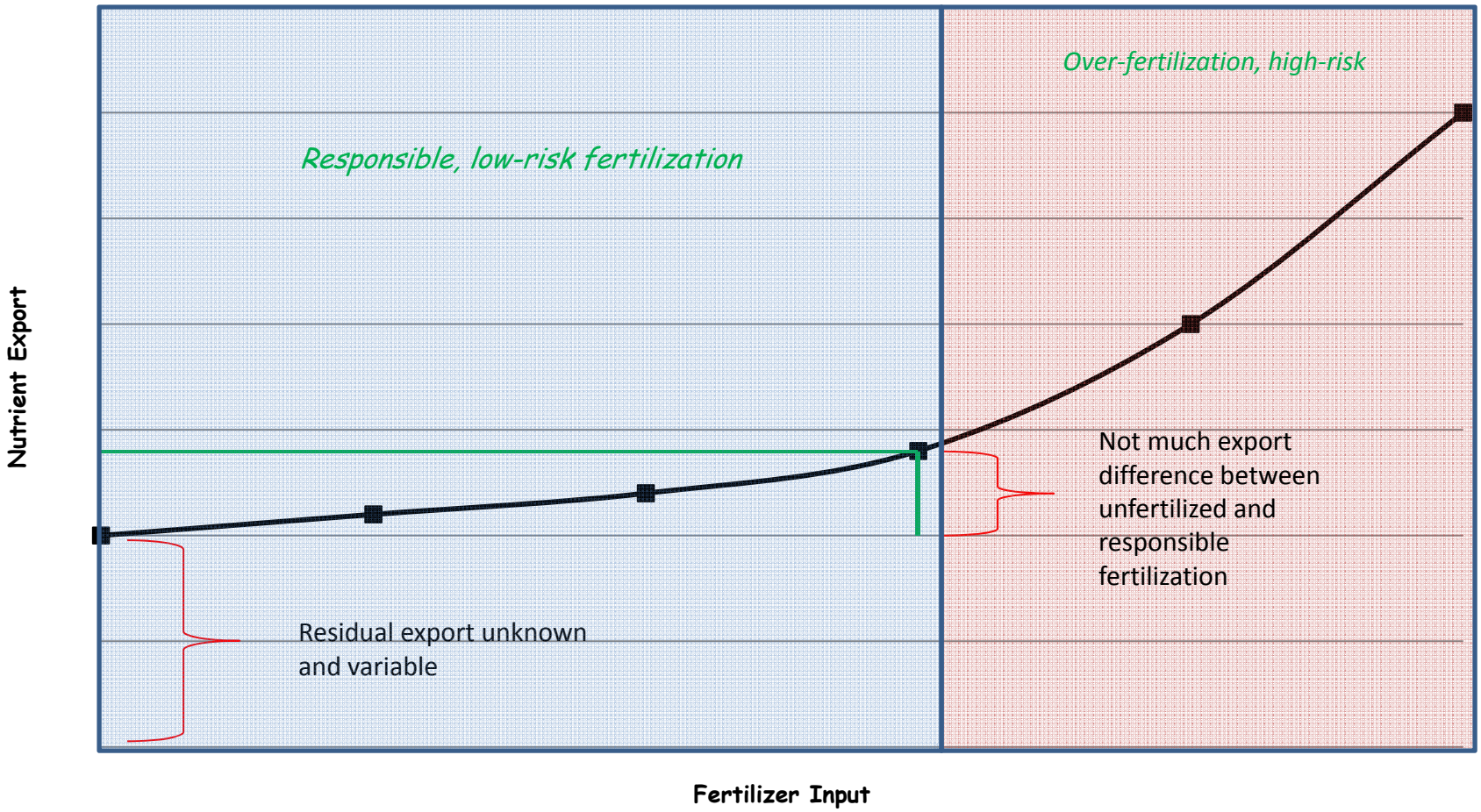
	Regular Fertilizer Application	Non-P Fertilizer Application	Unfertilized Lawns	Unfertilized Wooded Sites
TP (mg/L)				
Geometric Mean	2.57	1.89	1.73	3.52
Median	2.85	1.58	1.81	3.98
Mean	4.02	3.3	2.33	6.78
Dissolved P (mg/L)				
Geometric Mean	0.7	0.34	0.4	1.04
Median	0.77	0.33	0.38	1.99
Mean	0.93	0.46	0.43	1.4

Theoretical fertilizer/export relationship



Risk Considerations

UNM Panel identified risk factors that can lead to greater nutrient export, but didn't attempt to quantify impact of these factors

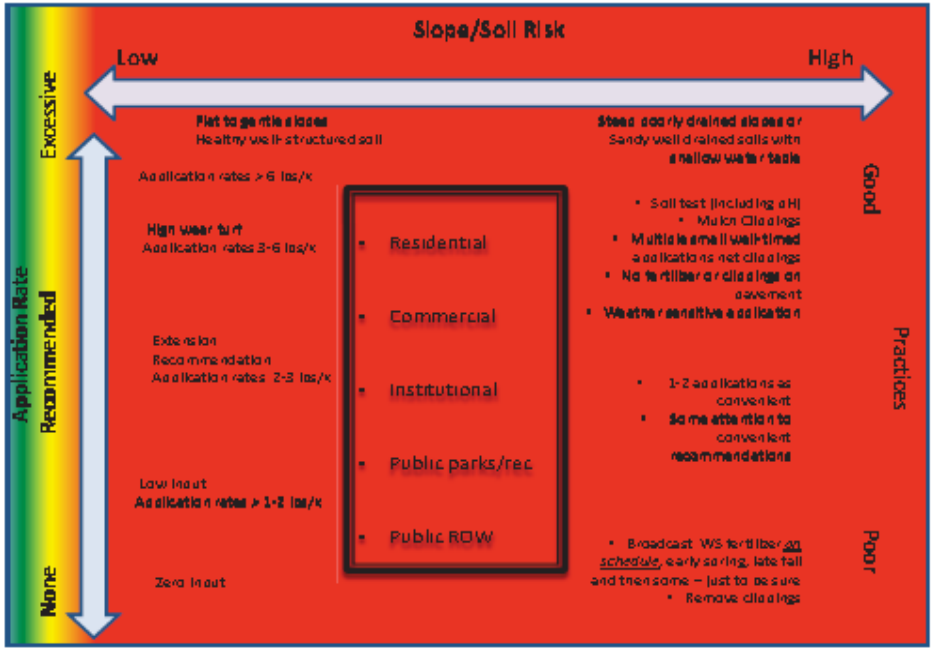


Figure 5 Conceptual Model for Defining N Export Risk in the Urban Landscape (developed by Stuart Schwartz)

- Owners are currently over-fertilizing beyond state or extension recommendations
- P-saturated soils as determined by a soil P test
- Newly established turf (Easton and Petrovic, 2004)
- Steep slopes (more than 15%)
- Exposed soil (more than 5 % for managed turf and 15% for unmanaged turf)
- High water table (within three feet of surface)
- Over-irrigated lawns (Barton and Colmer, 2005, Guillard, 2008)
- Soils that are shallow, compacted or low water holding capacity (Easton and Petrovic 2008a and b)
- High use areas (e.g., athletic fields, golf courses)
- Sandy soils (infiltration rate more than 2 inches per hour)
- Adjacent to stream, river or Bay (within 300 feet)
- Karst terrain

Recommendations re Possible Splits

Fertilizer vs. Unfertilized -- really Irresponsible Fertilization vs. Responsible Fertilization

- Does it matter for loadings – yes, but hard to quantify
- Can we map it – NO

Risk Factors (high vs. low)

- Does it matter for loadings – yes, but hard to quantify
- Can we map it – Not at Bay-wide scale, maybe locally

Extra Slides

Median Phosphorus EMCs for different urban land uses

From Schueler's STAC presentation

Urban Land Use	Total P (mg/l)
Residential	0.30
Commercial	0.22
Industrial	0.26
Freeway	0.25
Source: Pitt et al 2004, N = 3800 Storms	

Soluble P about 40% of Total P
Coefficient of Variation: 1.1 to 1.5

Median Nitrogen EMCs for different urban land uses

From Schueler's STAC presentation

Urban Land Use	Total N (mg/l)
Residential	2.0
Commercial	2.2
Industrial	2.2
Freeway	2.5
Source: Pitt et al 2004, N= ~4000	

TKN: about 70% of TN
Coefficient of Variation: Ranges from 0.9 to 1.2
Log-Normally Distributed

Current Nutrient Management Credits

Management Action	Nitrogen Reduction	Phosphorus Reduction
Statewide Credits		
State-wide Fertilizer Legislation	Commercial: 9%* DIY-ers: 4.5%*	23.3 to 26.7%***
No Statewide Fertilizer Legislation**	3% EOS reduction for every 10% reduction in N fertilizer inputs to pervious land	19 to 21.1%***
Urban Nutrient Management Plans**		
Low Risk	6%	3%
High Risk	20%	10%
Blended	9%	4.5%
Urban Nutrient Management Pledges		
Only eligible for low-risk rate	6%	3%

*Maryland is the only state that currently has state-wide legislation for nitrogen.
**States without legislation benefit from industry phase-out of phosphorus in fertilizer products.
*** Numbers vary slightly based on variable delivery rates in the model
**** Plans must be renewed every three years.

Rationale for Setting the UNM Rates

Panel assumptions:

• 80% of the pervious land in the Bay watershed is in a low-risk category for potential nutrient loss; 20% is in a high-risk category

• 5% of applied N fertilizer is exported in high risk category; 1% is exported in low risk category.

• No P fertilizer applied for either high or low risk

•Current CBWM pervious fertilizer application rates and export sensitivities used as the baseline for estimating reductions.

•A portion of the total N/P load from pervious land is not subject to any reduction by UNM practices—defined as twice the average load from forest land in CBWM. Correspondingly UNM practices can reduce export from pervious land to which no fertilizer is applied.

•A lower maximum removal rate is assigned for P since reductions in P fertilizer application are already addressed by the state-wide P reduction credit for pervious land.

Two independent mass balance checks were conducted to determine if the rates were reasonable and consistent w/ current watershed model – see Appendix A of Urban Nutrient Management Expert Panel report