Onsite Attenuation BMP Panel Update

Water Quality Goal Implementation Team

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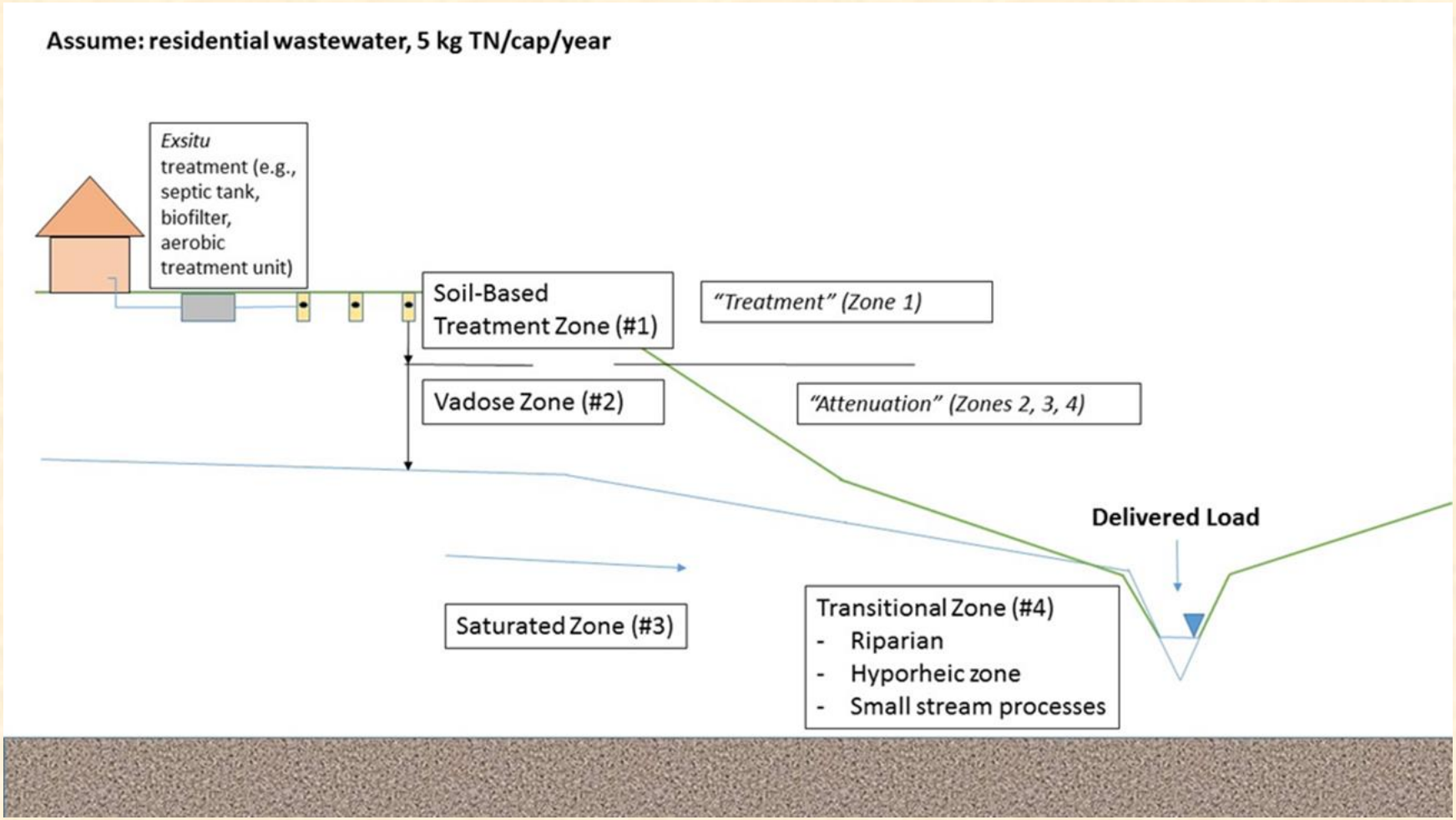
Chesapeake Bay Program

Science, Restoration, Partnership

The Phase 5 Model assumptions were of a consistent 20 percent TN reduction (from a starting septic tank effluent baseline load of 5 kg/cap/year) in the soil treatment unit and an additional 60 percent attenuation of TN load between the system and modeled stream reach.

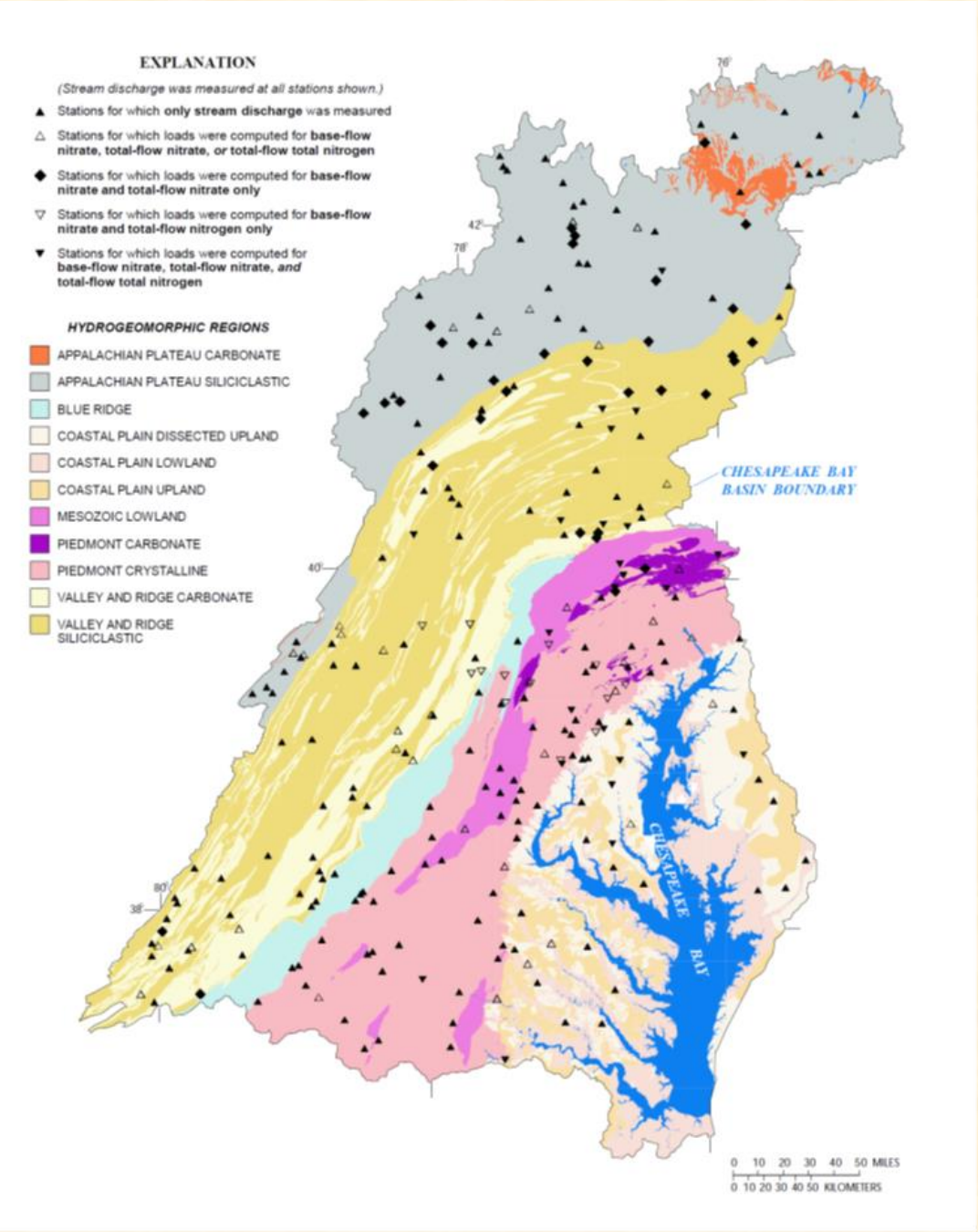


For Zone 1, the Panel reviewed existing relevant literature on TN reductions within soil-based treatment systems, and supplemented this review with targeted modeling of TN reductions using the Soil Treatment Unit Model (STUMOD) developed by the Colorado School of Mines. This weight-of-evidence approach to estimating TN reductions in Zone 1 resulted in a series of recommended variable TN reduction loads based on predominant surficial soil textural class, as summarized in Table ES-1.

Table ES-1. Recommended Zone 1 TN reduction factors based on surficial soil texture

Soil Textural Grouping	USDA Soil Textures	Zone 1 TN Reduction	TN Load at Edge of Zone 1
Sandy	Sand, Loamy Sand, Sandy Loam, Loam	16%	4.2 kg/cap/yr
Loamy	Silt loam, Clay Loam, Sandy Clay Loam, Silty Clay Loam, Silt	34%	3.3 kg/cap/yr
Clayey	Sandy Clay, Silty Clay, Clay	54%	2.3 kg/cap/yr

Hydrogeomorphic regions of the Zone 3 characterization.



For Zone 3, the Panel reviewed existing literature on groundwater TN plume and load delivery case studies, and nitrogen attenuation by Chesapeake Bay hydrogeomorphic region to establish a series of TN transmission classifications with associated Zone 3 attenuation factors for 15 distinct hydrogeomorphic regions (HGMRs) that span the entire watershed. Recommended Zone 3 attenuation factors are summarized in Table ES-2.

Table ES-2. Recommended Zone 3 attenuation factors for Chesapeake Bay HGMRs

Hydrogeomorphic Region[1]	Relative TN Transmission Classification	Recommended Zone 3 Attenuation Factor (Transmission Factor)
Fine Coastal Plain - Coastal Lowlands	Low	75% (25%)
Fine Coastal Plain - Alluvial and Estuarine Valleys	Low	75% (25%)
Fine Coastal Plain - Inner Coastal Plain - Upland Sands and Gravels	Medium	60% (40%)
Fine Coastal Plain - Middle Coastal Plain – mixed sediment texture	Medium	60% (40%)
Fine Coastal Plain - Middle Coastal Plain – fine sediment texture	Low	75% (25%)
Coarse Coastal Plain - Middle Coastal Plain – Sands with Overlying Gravels (also dissected)	High	45% (55%)
Coarse Coastal Plain - Inner Coastal Plain - Dissected Outcrop Belt	High	45% (55%)
Crystalline Piedmont	High	45% (55%)
Crystalline Blue Ridge	High	45% (55%)
Carbonate Piedmont	Very High	35% (65%)
Carbonate Valley and Ridge	Very High	35% (65%)
Carbonate Appalachian Plateau	Very High	35% (65%)
Siliciclastic Mesozoic Lowland	High	45% (55%)
Siliciclastic Valley and Ridge	Medium	60% (40%)
Siliciclastic Appalachian Plateau	Low	75% (25%)

[1] Generalized Geology from Greene et al., 2005; Subdivisions from Bachman et al., 1998, and Ator et al., 2005 for coastal plain

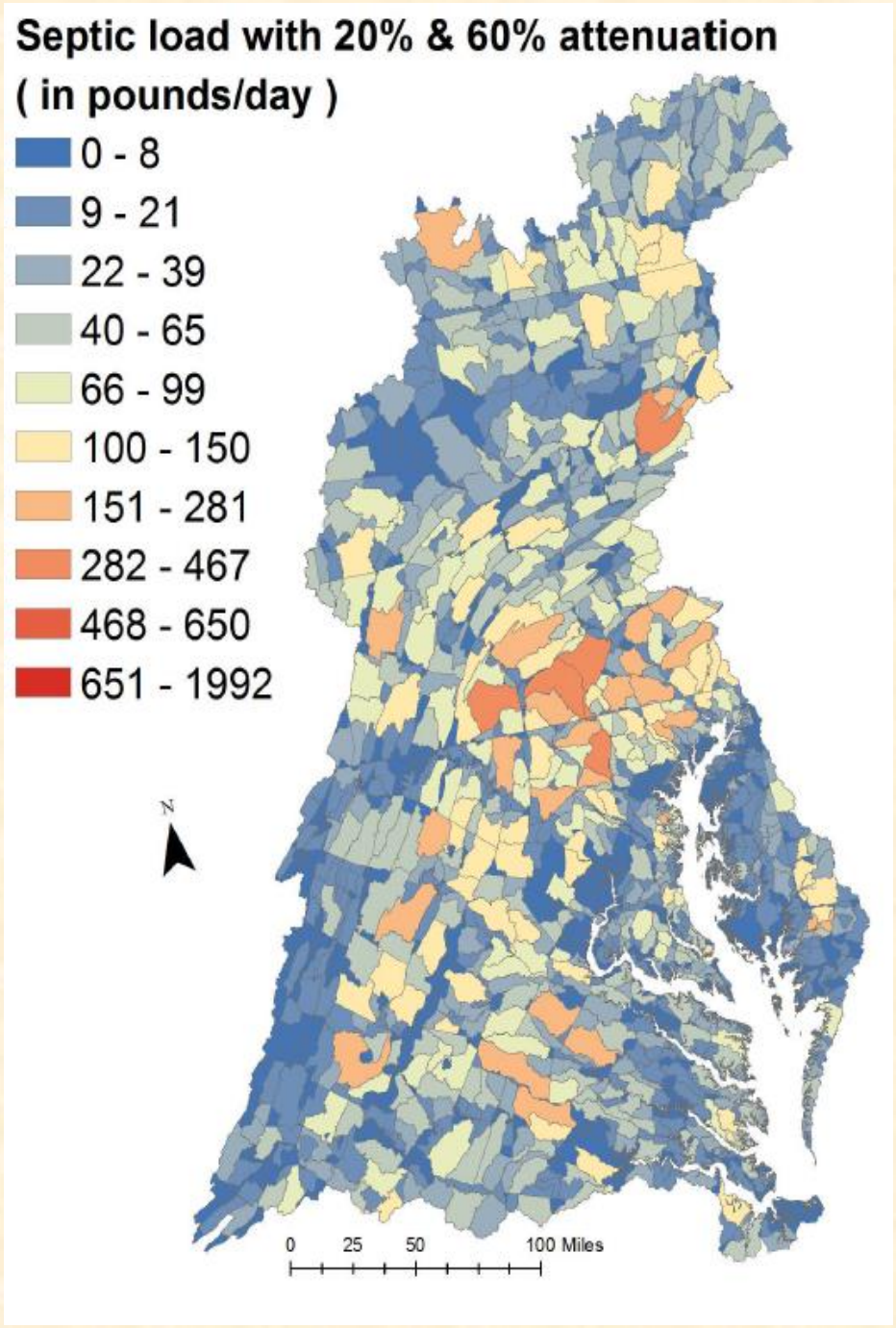
A summary of the Panel's combined Zone 1 and Zone 3 recommendations is provided in Table ES-3, which shows the total recommended TN load for all possible combinations of soil textural classification (Zone 1) and TN transmission classification (Zone 3).

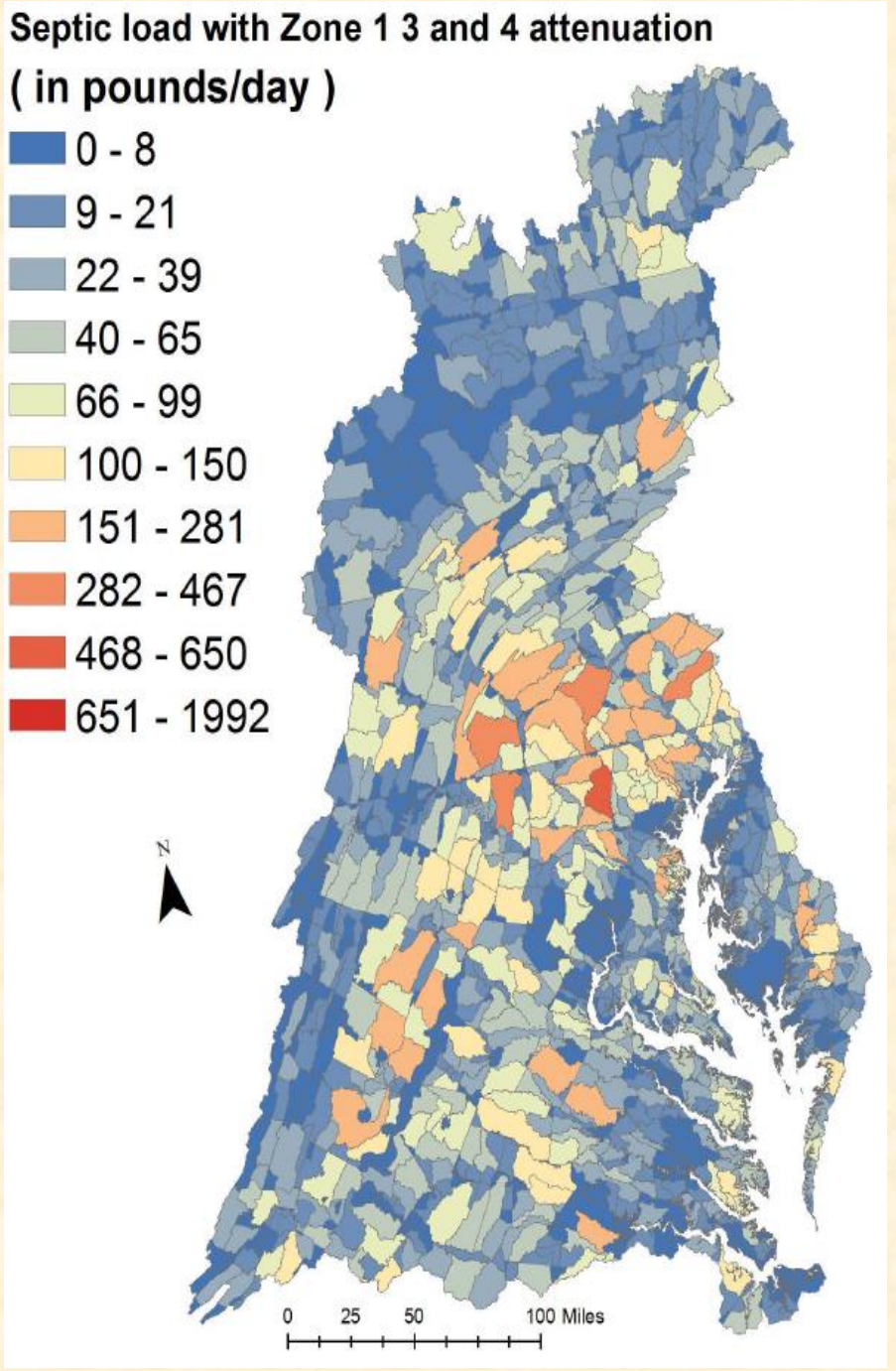
Table ES-3. Recommended TN load delivery rates at outer edge of Zone 3 (i.e., to Zone 4) as a function of dominant soil texture and relative TN transmission rating for conventional onsite wastewater systems

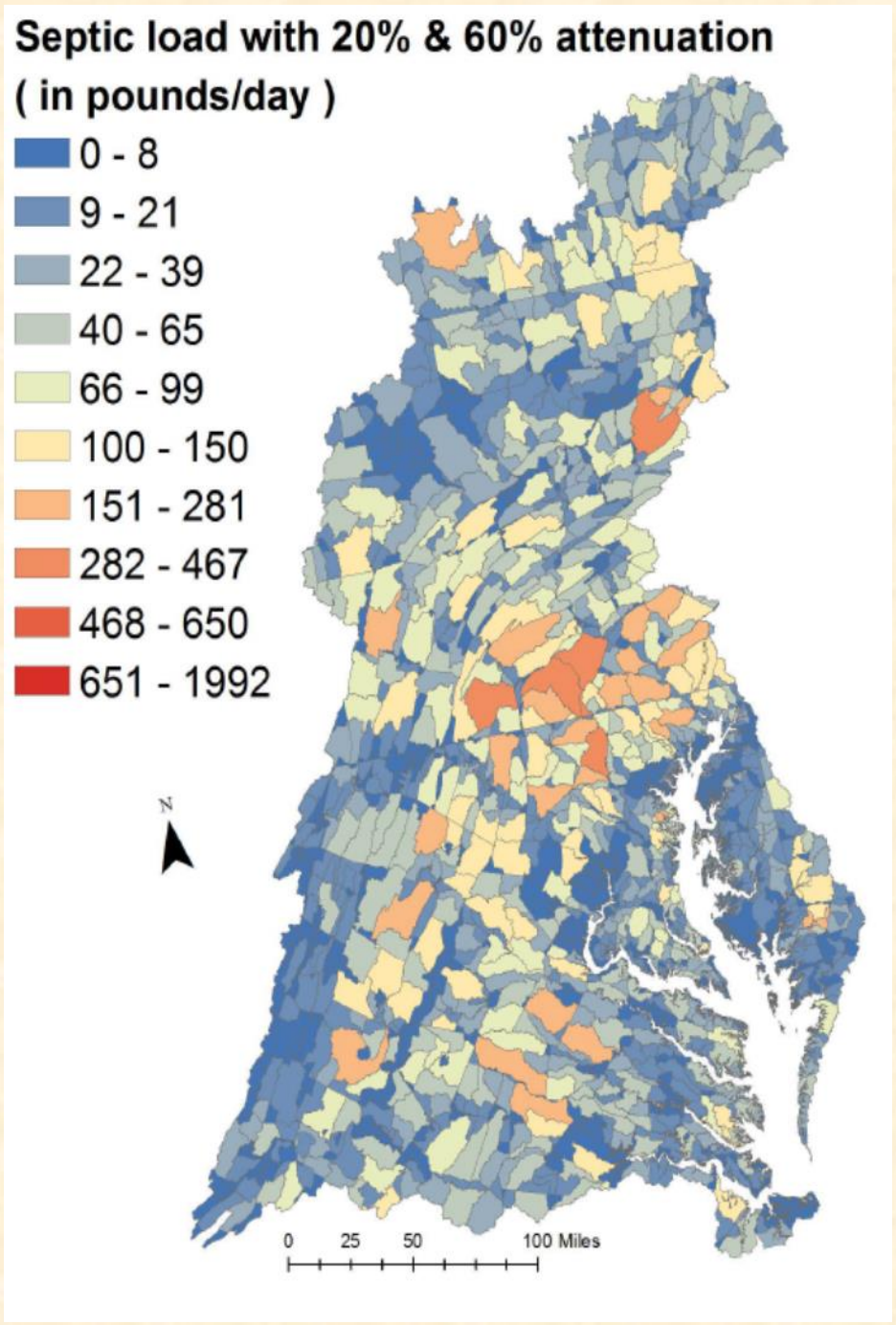
Soil Textural Classification	USDA Soil Textures	Low TN Transmission Area	Medium TN Transmission Area	High TN Transmission Area	Very High TN Transmission Area
Sandy	Sand, Loamy Sand, Sandy Loam, Loam	1.1 kg/cap/yr	1.7 kg/cap/yr	2.3 kg/cap/yr	2.7 kg/cap/yr
Loamy	Silt loam, Clay Loam, Sandy Clay Loam, Silty Clay Loam, Silt	0.8 kg/cap/yr	1.3 kg/cap/yr	1.8 kg/cap/yr	2.1 kg/cap/yr
Clayey	Sandy Clay, Silty Clay, Clay	0.6 kg/cap/yr	0.9 kg/cap/yr	1.3 kg/cap/yr	1.5 kg/cap/yr

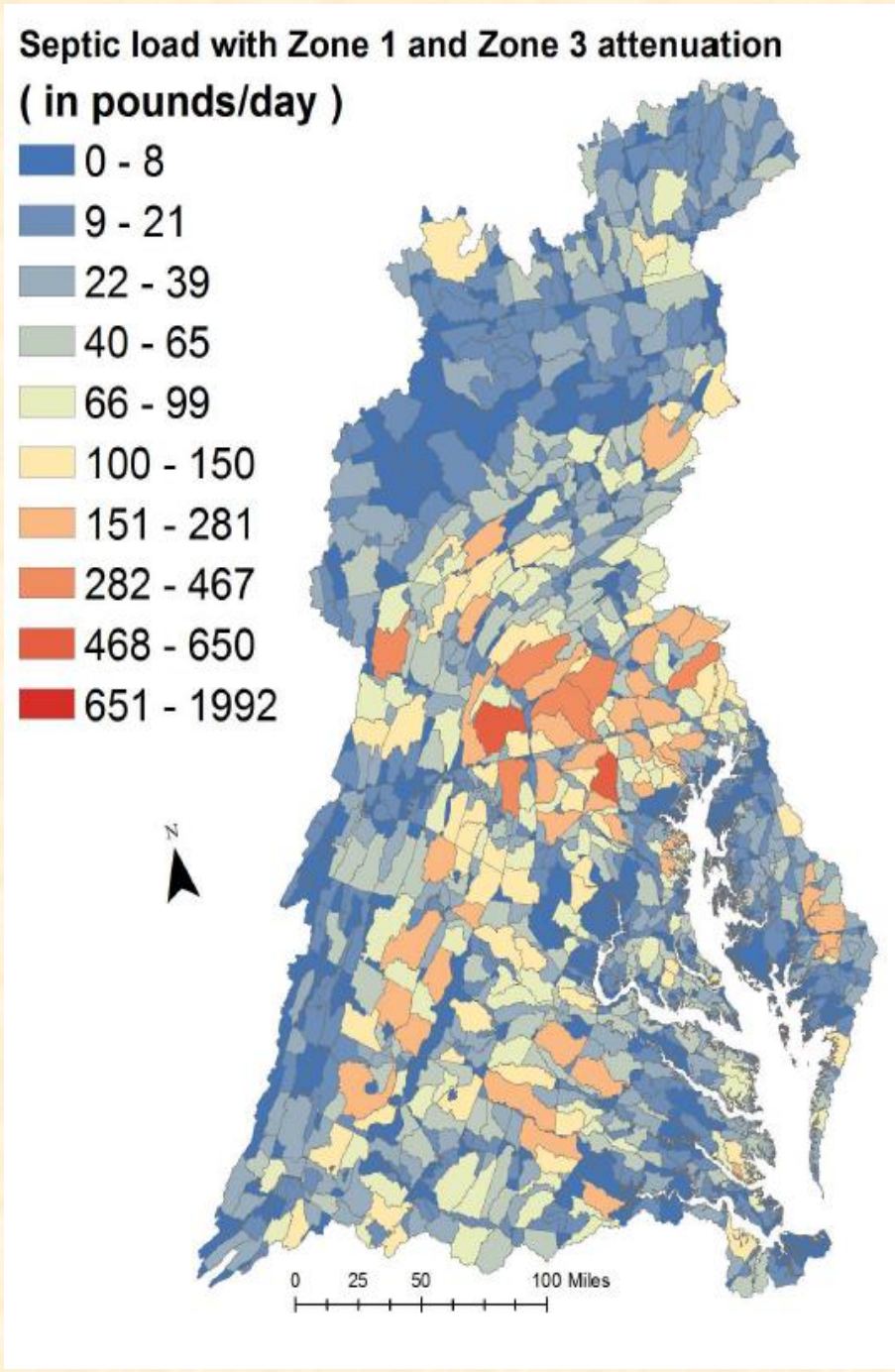
Loads shown are for the 1991-2000 period for the Chesapeake Bay Watershed.

Septic Loads	Nitrogen loads (Mlb/year)	Attenuation (Mlb/year)	Attenuation (%)
Load without attenuation	50.7	0.0	0%
Load with 60% attenuation	16.2	34.5	68%
Load with Zone 1 attenuation	31.7	19.0	37%
Load with Zone 3 attenuation	27.4	23.2	46%
Load with Zone 1 and Zone 3 attenuation	17.3	33.4	66%
Load with Zone 1, Zone 3, and Zone 4 attenuation	15.5	35.2	69%


Septic load with 20% & 60% attenuation
(in pounds/day)
0 - 8
9 - 21
22 - 39
40 - 65
66 - 99
100 - 150
151 - 281
282 - 467
468 - 650
651 - 1992
N
0 25 50 100 Miles


Septic load with Zone 1 3 and 4 attenuation
(in pounds/day)
0 - 8
9 - 21
22 - 39
40 - 65
66 - 99
100 - 150
151 - 281
282 - 467
468 - 650
651 - 1992
N
0 25 50 100 Miles


Septic load with 20% & 60% attenuation
(in pounds/day)
0 - 8
9 - 21
22 - 39
40 - 65
66 - 99
100 - 150
151 - 281
282 - 467
468 - 650
651 - 1992
N
0 25 50 100 Miles


Septic load with Zone 1 and Zone 3 attenuation
(in pounds/day)
0 - 8
9 - 21
22 - 39
40 - 65
66 - 99
100 - 150
151 - 281
282 - 467
468 - 650
651 - 1992
N
0 25 50 100 Miles