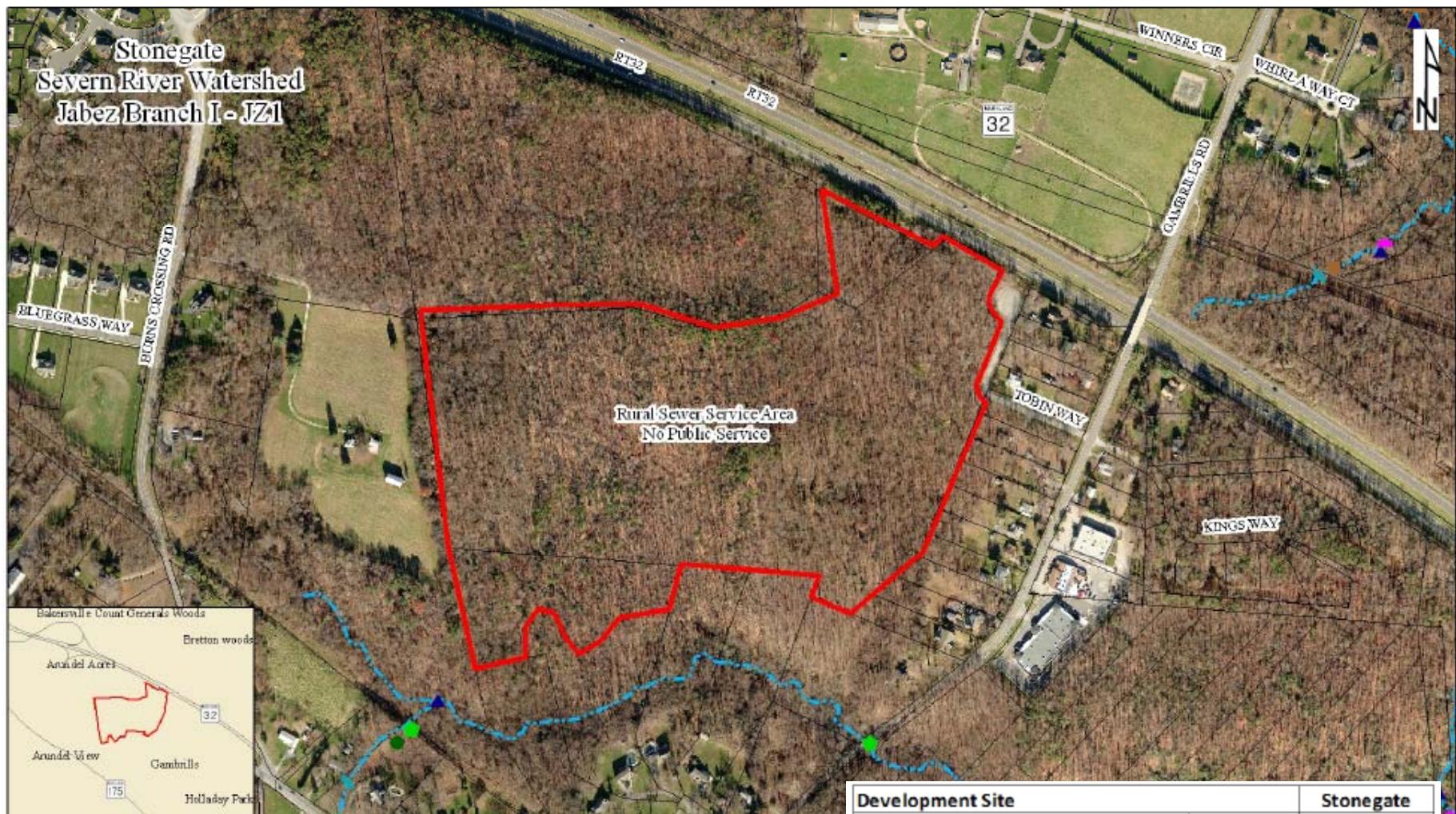


Anne Arundel County Pollution Loading Examples



Erik Michelsen
Executive Director



Development Site		Stonegate	
Site Area		Acres	55.3
Impervious Area		Acres	0.0
Landuse	Residential 1/2-acre	Acres	0.4
	Woods	Acres	54.8
Pollutant Load		TN	lb/year
		TP	lb/year
		TSS	tons/year
		0.6	



Development Site			Stonegate
Site Area	Acres	55.3	
Impervious Area	Acres	0.0	
Landuse	Residential 1/2-acre	Acres	0.4
	Woods	Acres	54.8
Pollutant Load	TN	lb/year	28.1
	TP	lb/year	3.7
	TSS	tons/year	0.6

Development Site			Stonegate
Site Area	Acres	55.3	
Impervious Area	Acres	2.7	
Landuse	Residential 1-acre	Acres	19.1
	Woods	Acres	36.2
Pollutant Load (No BMPs)	TN	lb/year	99.6
	TP	lb/year	11.9
	TSS	tons/year	1.1
Forest Conservation	Areas within development site set aside for forest conservation credits.	Acres	34.3
% woods in good condition	Percentage of development site used for forest conservation.		62.1
ESD treatment	Areas within development site set aside for ESD treatment credits.	Acres	18.6
% ESD treatment	Percentage of development site used for ESD treatment.		33.7
Structural BMP treatment	Areas within development site set aside for BMP treatment.	Acres	2.4
% structural	Percentage of development site used for BMP treatment.		4.4
Pollutant Load (With BMPs)	TN	lb/year	32.1
	TP	lb/year	4.1
	TSS	tons/year	0.6
Septic Load	Number septic systems per site.	Units	11
	Amount of nitrogen from septic systems entering waterway dependant on system distance to waterway.	Delivery Ratio	50
	TN	lb/year	167.2
WWTP Load	TN	lb/year	0.0
	TP	lb/year	0.0
Pollutant Export	TN	lb/year	171.2
	TP	lb/year	0.4
	TSS	tons/year	0.0

Single family, large lots, rural example (55.3 acres woods)

Pre development TN load = 28.1 lbs/yr

Post development TN load = 32.1 lbs/yr

(stormwater/ESD) + 167.2 lbs/yr (septic) =
199.3 lbs/yr

Net post development TN load = 199.3 –
28.1 = 171.2 lbs/yr

Per unit load = 171.2/11 = 15.6 lbs



Development Site		Parksides
	Site Area	Acres
	Impervious Area	Acres
	Commercial	Acres
	Industrial	Acres
	Open Space	Acres
	Pasture/Hay	Acres
	Residential 1/2-acre	Acres
	Row Crops	Acres
	Transportation	Acres
	Woods	Acres
Landuse	TN	lb/year
	TP	lb/year
	TSS	tons/year
Pollutant Load	47.2	
	24.6	
	3.2	
	0.5	



Development Site		Parkside	
Site Area	Acres	48.7	
Impervious Area		Acres	0.0
Landuse	Commercial	Acres	0.0
	Industrial	Acres	0.0
	Open Space	Acres	1.2
	Pasture/Hay	Acres	0.0
	Residential 1/2-acre	Acres	0.0
	Row Crops	Acres	0.0
	Transportation	Acres	0.2
	Woods	Acres	47.2
Pollutant Load	TN	lb/year	24.6
	TP	lb/year	3.2
	TSS	tons/year	0.5

Development Site		Parkside	
Site Area	Acres	48.7	
Impervious Area		Acres	12.2
Landuse	Residential 1/8-acre	Acres	35.9
	Transportation	Acres	0.1
	Woods	Acres	12.6
Pollutant Load (No BMPs)	TN	lb/year	313.9
	TP	lb/year	36.8
	TSS	tons/year	2.0
Forest Conservation	Areas within development site set aside for forest conservation credits.	Acres	-
% woods in good condition	Percentage of development site used for forest conservation.		-
ESD treatment	Areas within development site set aside for ESD treatment credits.	Acres	27.8
% ESD treatment	Percentage of development site used for ESD treatment.		57.1
Structural BMP treatment	Areas within development site set aside for BMP treatment.	Acres	9.3
% structural	Percentage of development site used for BMP treatment.		19.0
Pollutant Load (With BMPs)	TN	lb/year	126.4
	TP	lb/year	13.6
	TSS	tons/year	0.9
Septic Load	Number septic systems per site.	Units	-
	Amount of nitrogen from septic systems entering waterway dependant on system distance to waterway.	Delivery Ratio	50
	TN	lb/year	0.0
WWTP Load	TN	lb/year	1469.5
	TP	lb/year	146.9
Pollutant Export	TN	lb/year	1571.2
	TP	lb/year	157.3
	TSS	tons/year	0.3



Development Site		Hackerman-Patz	
Site Area		Acres	1.9
Impervious Area		Acres	0.0
Landuse	Woods	Acres	1.9
	TN	lb/year	1.0
Pollutant Load	TP	lb/year	0.1
	TSS	tons/year	0.0



Development Site		Hackerman-Patz	
Site Area	Acres	1.9	
Impervious Area	Acres	0.0	
Landuse	Woods	Acres	1.9
Pollutant Load	TN	lb/year	1.0
	TP	lb/year	0.1
	TSS	tons/year	0.0

Development Site		Hackerman-Patz	
Site Area	Acres	1.9	
Impervious Area	Acres	0.6	
Landuse	Commercial	Acres	1.2
	Open Space	Acres	0.2
	Woods	Acres	0.8
Pollutant Load (No BMPs)	TN	lb/year	12.8
	TP	lb/year	1.7
	TSS	tons/year	0.1
Forest Conservation	Areas within development site set aside for forest conservation credits.	Acres	-
% woods in good condition	Percentage of development site used for forest conservation.		-
ESD treatment	Areas within development site set aside for ESD treatment credits.	Acres	0.5
% ESD treatment	Percentage of development site used for ESD treatment.		28.2
Structural BMP treatment	Areas within development site set aside for BMP treatment.	Acres	0.4
% structural	Percentage of development site used for BMP treatment.		23.3
Pollutant Load (With BMPs)	TN	lb/year	8.3
	TP	lb/year	1.0
	TSS	tons/year	0.1
Septic Load	Number septic systems per site.	Units	-
	Amount of nitrogen from septic systems entering waterway dependant on system distance to waterway.	Delivery Ratio	50
	TN	lb/year	0.0
WWTP Load	TN	lb/year	13.8
	TP	lb/year	1.4
Pollutant Export	TN	lb/year	21.1
	TP	lb/year	2.3
	TSS	tons/year	0.1

Commercial development, greenfield (1.9 acres woods)

Pre development TN load = 1 lb/yr

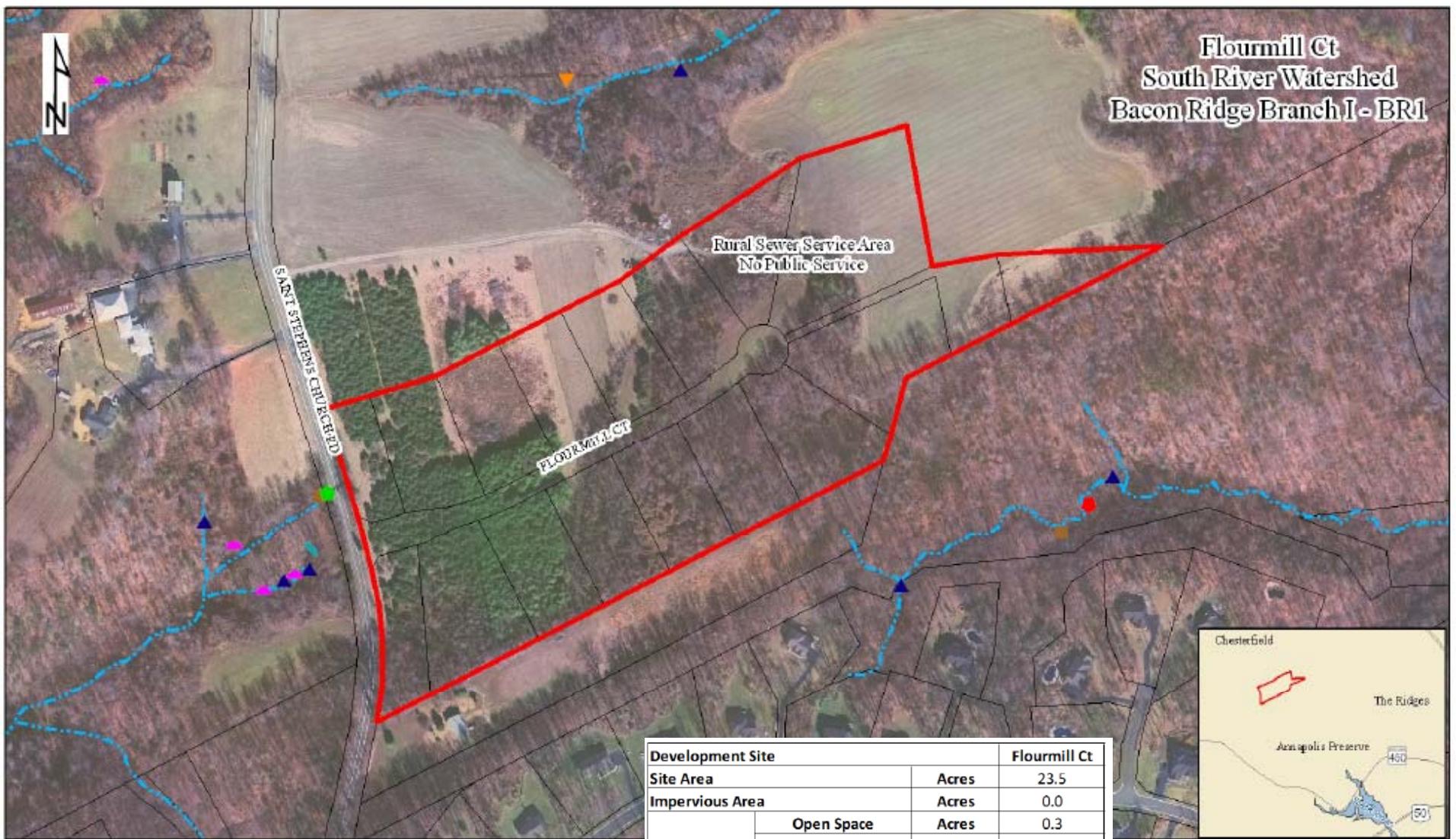
Post development TN load = 8.3 lbs/yr

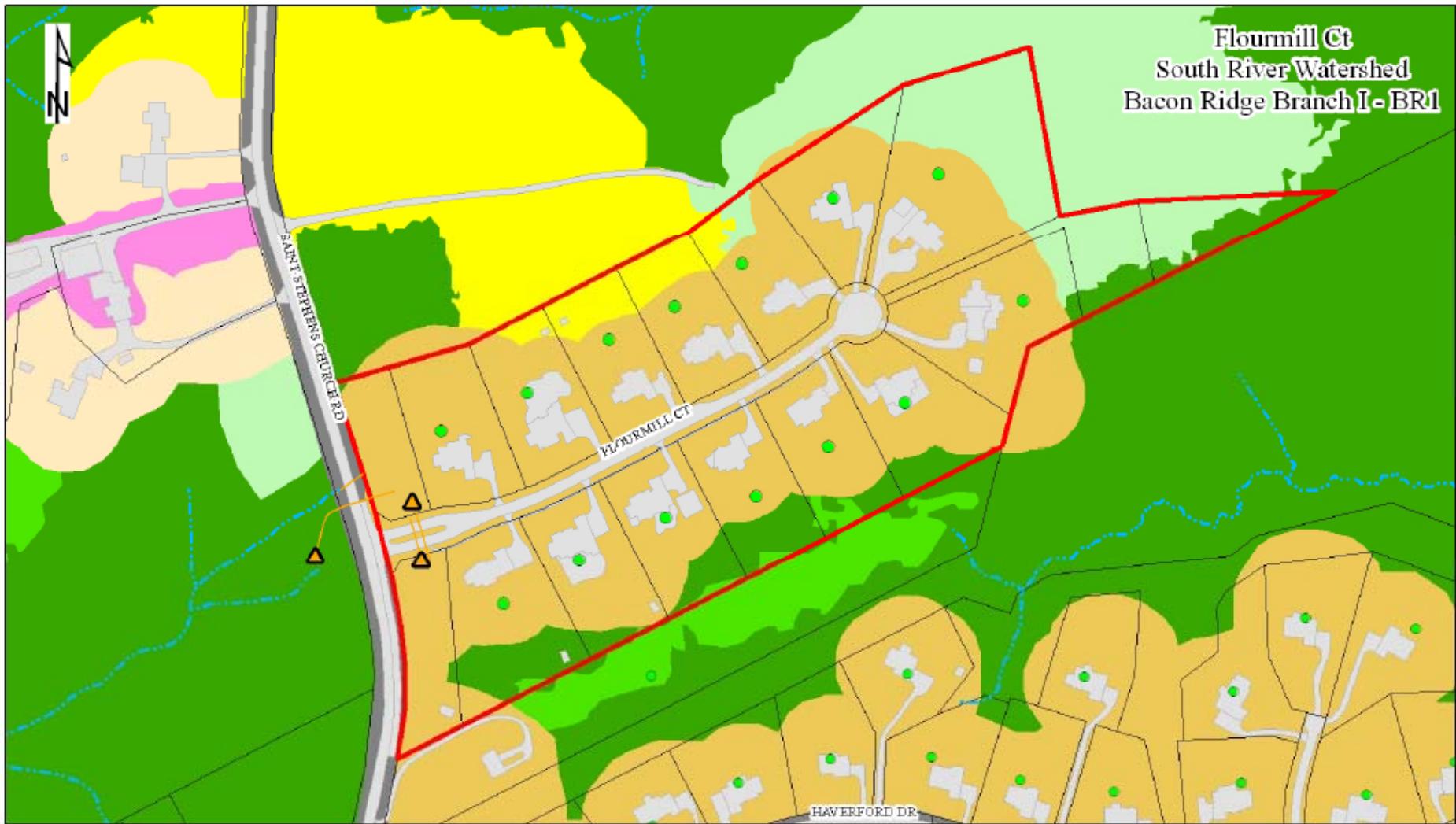
(stormwater/ESD) + 0 lbs/yr (sewer) = 8.3
lbs/yr

Net post development TN load = $8.3 - 1 = 7.3$ lbs/yr

Per unit load = $7.3/1 = 7.3$ lbs

Per unit load with sewer offset = $(7.3 + 13.8)/1 = 21.1$ lbs





Development Site			Flourmill Ct
Site Area		Acres	23.5
Impervious Area		Acres	0.0
Landuse	Open Space	Acres	0.3
	Pasture/Hay	Acres	4.5
	Row Crops	Acres	2.4
	Woods	Acres	16.2
Pollutant Load	TN	lb/year	83.2
	TP	lb/year	17.9
	TSS	tons/year	2.2

Development Site			Flourmill Ct
Site Area		Acres	23.5
Impervious Area		Acres	3.5
Landuse	Open Space	Acres	0.2
	Pasture/Hay	Acres	2.7
	Residential 1-acre	Acres	17.8
	Row Crops	Acres	0.8
	Woods	Acres	2.0
Pollutant Load (No BMPs)	TN	lb/year	133.9
	TP	lb/year	20.1
	TSS	tons/year	1.8
Forest Conservation	Areas within development site set aside for forest conservation credits.	Acres	-
% woods in good condition	Percentage of development site used for forest conservation.	Acres	-
ESD treatment	Areas within development site set aside for ESD treatment credits.	Acres	-
% ESD treatment	Percentage of development site used for ESD treatment.	Acres	-
Structural BMP treatment	Areas within development site set aside for BMP treatment.	Acres	2.0
% structural	Percentage of development site used for BMP treatment.	Acres	8.5
Pollutant Load (With BMPs)	TN	lb/year	129.3
	TP	lb/year	19.0
	TSS	tons/year	1.7
Septic Load	Number septic systems per site.	Units	14
	Amount of nitrogen from septic systems entering waterway dependant on system distance to waterway.	Delivery Ratio	50
	TN	lb/year	212.8
	TP	lb/year	0.0
WWTP Load	TN	lb/year	0.0
	TP	lb/year	0.0
	TSS	tons/year	-0.5
Pollutant Export	TN	lb/year	258.9
	TP	lb/year	1.1
	TSS	tons/year	-0.5

Single family, large lots, rural example (7 acres ag, 16 acres woods)

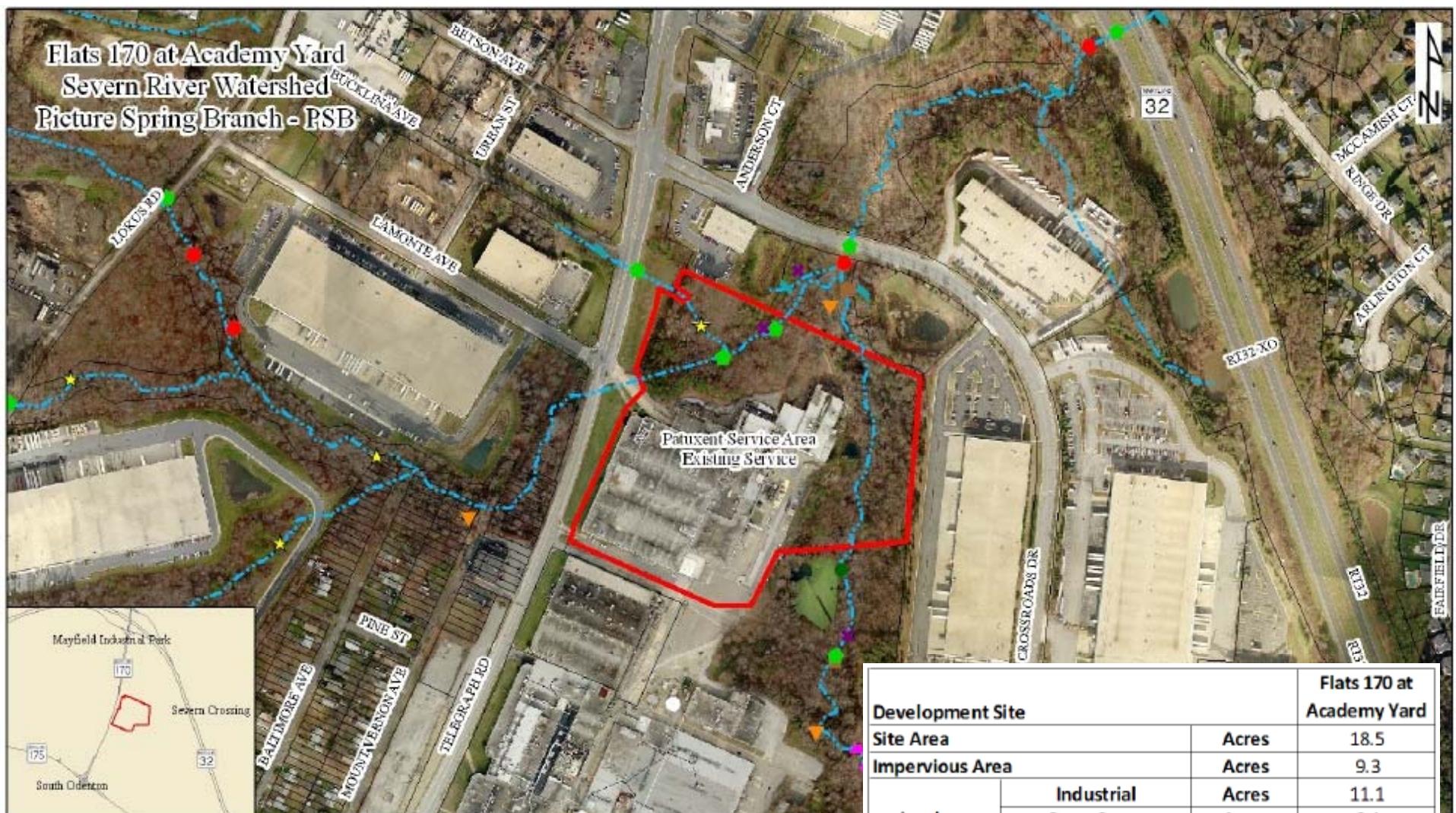
Pre development TN load = 83.2 lbs/yr

Post development TN load = 129.3 lbs/yr
(stormwater) + 212.8 lbs/yr (septic) =

342.1 lbs/yr

Net post development TN load = 342.1 –
83.2 = 258.9 lbs/yr

Per unit load = 258.9/14 = 18.5 lbs



Development Site		Flats 170 at Academy Yard	
Site Area		Acres	18.5
Impervious Area		Acres	9.3
Landuse	Industrial	Acres	11.1
	Open Space	Acres	0.1
	Woods	Acres	7.4
Pollutant Load	TN	lb/year	177.1
	TP	lb/year	15.3
	TSS	tons/year	3.1



Development Site		Flats 170 at Academy Yard	
Site Area	Acres	18.5	
Impervious Area	Acres	9.3	
Landuse	Industrial	Acres	11.1
	Open Space	Acres	0.1
	Woods	Acres	7.4
Pollutant Load (No BMPs)	TN	lb/year	177.1
	TP	lb/year	15.3
	TSS	tons/year	3.1

Development Site		Flats 170 at Academy Yard	
Site Area	Acres	18.5	
Impervious Area	Acres	7.7	
Landuse	Commercial	Acres	10.8
	Open Space	Acres	0.7
	Woods	Acres	7.0
Pollutant Load (No BMPs)	TN	lb/year	150.5
	TP	lb/year	20.1
	TSS	tons/year	1.5
Forest Conservation	Areas within development site set aside for forest conservation credits.	Acres	-
% woods in good condition	Percentage of development site used for forest conservation.		-
ESD treatment	Areas within development site set aside for ESD treatment credits.	Acres	6.1
% ESD treatment	Percentage of development site used for ESD treatment.		33.2
Structural BMP treatment	Areas within development site set aside for BMP treatment.	Acres	-
% structural	Percentage of development site used for BMP treatment.		-
Pollutant Load (With BMPs)	TN	lb/year	104.0
	TP	lb/year	13.9
	TSS	tons/year	1.1
Septic Load	Number septic systems per site.	Units	-
	Amount of nitrogen from septic systems entering waterway dependant on system distance to waterway.	Delivery Ratio	50
	TN	lb/year	0.0
WWTP Load	TN	lb/year	136.5
	TP	lb/year	13.6
Pollutant Export	TN	lb/year	63.5
	TP	lb/year	12.2
	TSS	tons/year	-2.0

Commercial re-development (11.1 acres industrial)

Pre development TN load = 177.1 lb/yr

Post development TN load = 104 lbs/yr

(stormwater/ESD) + 0 lbs/yr (sewer) = 104
lbs/yr

Net post development TN load = 104 –

177.1 = -73.1 lbs/yr

Per unit load = -73.1/1 = -73.1 lbs

Per unit load with sewer offset = (-73.1 + 136.5)/1 = 63.4 lbs

Pre Development Conditions



Post Development Conditions



Urban, commercial re- development with restoration

Bausum Property:	Parcel Area including Driveway	Impervious Area Including Driveway	% Impervious	ESD Rainfall Target PE (inches)	ESD RCN Reduction
	Acres				
Existing Condition	29	1.1	4	1.6	57
Proposed Condition	29	12.0	42		

Required Volume of Treatment (Assuming New Development) = 71,163 Cubic Feet
 Required Volume of Treatment (Assuming Redevelopment) = 35,582 Cubic Feet

Proposed Volumes of Treatment:

Micro Bioretention # 1:	2,607	Cubic Feet
Micro Bioretention # 2:	2,637	Cubic Feet
Micro Bioretention # 3:	2,662	Cubic Feet
Micro Bioretention # 4:	1,735	Cubic Feet
Micro Bioretention # 5:	2,426	Cubic Feet
Micro Bioretention # 6:	14,501	Cubic Feet
Subtotal Non-structural Practices	26,568	Cubic Feet
Bioretention Area A:	3,973	Cubic Feet
Proposed R-SPSC # 1 - West of Development:	42,084	Cubic Feet
Proposed R-SPSC # 2 - West Branch North of Site:	7,014	Cubic Feet
Proposed R-SPSC # 3 - East Branch North of Site:	17,535	Cubic Feet
Proposed R-SPSC # 4 - At discharge of BOE pond:	29,459	Cubic Feet
Subtotal Structural Practices	100,065	Cubic Feet
Total Provided Treatment	126,633	Cubic Feet

TMDL Pollutants of Concern	TN	TP	TSS
Filtering System Pollutant Efficiency (% Reduction)	40	60	85
Required Treatment ratio for 100% efficiency/no net increase in pollutant	2.5	1.7	1.2
Proposed Treatment Ratio "New Development"		1.8	
Proposed Treatment Ratio "Redevelopment"		3.6	
Potential Water Quality Volume Trading "New Development"	-51,275	8,028	42,912
Potential Water Quality Volume Credit "Redevelopment"	37,679	67,331	84,772
Impervious Acre Credit "New Development"	-17.3	0.9	11.5
Impervious Acre Credit "Redevelopment"	9.9	19.0	24.4
Predominant Site is Commercial, EMC factors are:	2.24	0.3	43
Summary Potential Nutrient Trading Credit	lbs/year	lbs/year	Tons/Year
Pollutant Reduction Credit "New Development"	-277	6	2
Pollutant Reduction Credit "Redevelopment"	203	49	4
Wastewater Load Treated to ENR	142.7	14.3	0.0