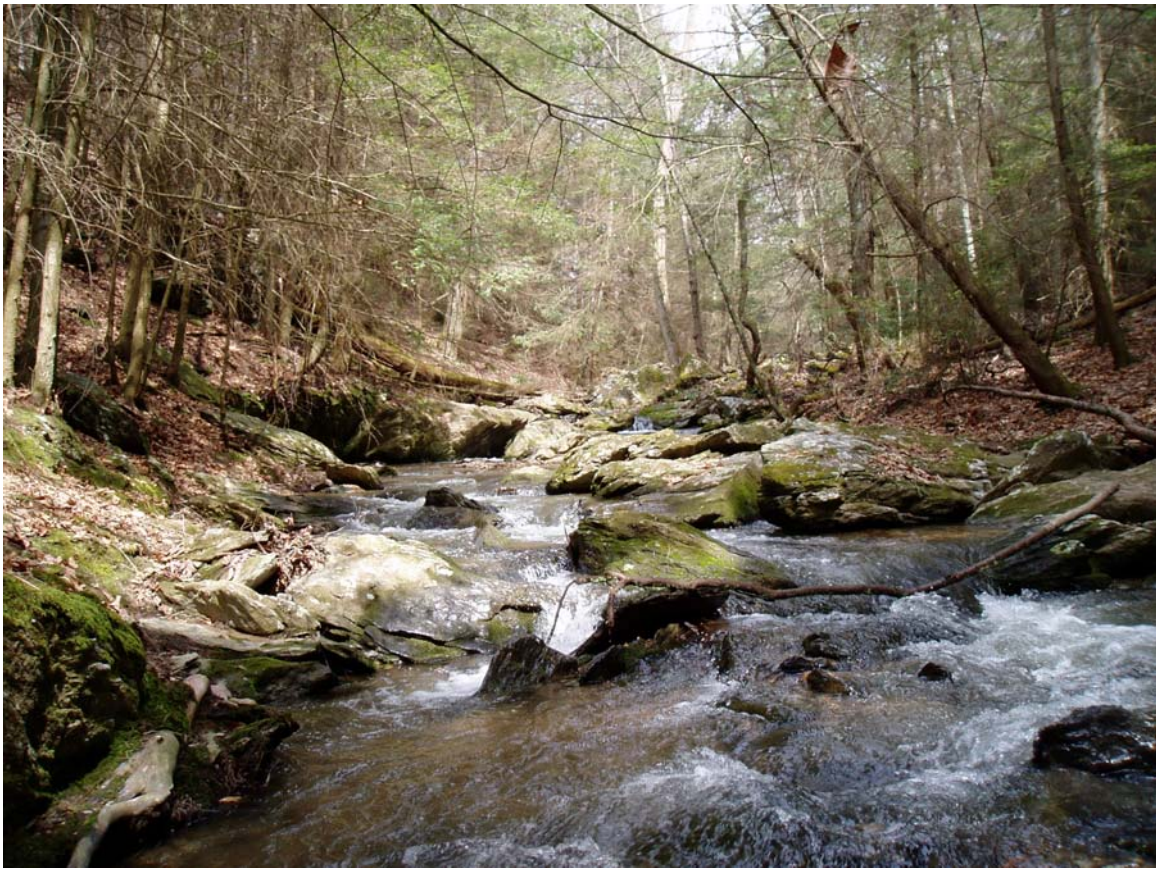
Report on Nutrient Synoptic Survey in the Prettyboy Watershed, Baltimore and Carroll Counties Maryland, April, 2005 as part of a Watershed Restoration Action Strategy.



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DEPARTMENT OF THE ENVIRONMENT

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Cover photo: Walkers Run near Gunpowder Rd. by Niles Primrose

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Executive Summary

A nutrient synoptic survey was conducted during April, 2005 in the Prettyboy watershed as part of the Prettyboy Watershed Restoration Action Strategy (WRAS). Water samples were analyzed from 68 sites throughout the watershed for dissolved nutrients. Nitrate/nitrite concentrations were found to be excessive (>5 mg/L) in twenty-three subwatersheds, high (3-5 mg/L) in thirty-seven, moderately elevated (1-3 mg/L) in seven, and baseline (<1 mg/L) in the remaining one subwatershed. Instantaneous nitrate/nitrite yields were found to be excessive (>.03 Kg/Hectare/day) in sixty-five subwatersheds, and baseline (<.01 Kg/Hectare/day) in three. Excessive concentrations (>.015 mg/L) of orthophosphate were found in two subwatersheds, high concentrations (.01- .015 mg/L) in three, moderate concentrations (.005- .01 mg/L) in thirty-two, and the remaining thirty-one were below baseline (<.005 mg/L). Orthophosphate yields were found to be baseline (<.0005 Kg/Hectare/day) in all sixty-eight subwatersheds. No significant anomalies were found in the insitu measurements of temperature, dissolved oxygen, or pH. Four subwatersheds in the Prettyboy watershed had elevated specific conductivity (>.300 mS/mm). Elevated nitrate/nitrite concentrations may be associated with row crop and animal agriculture, and communities on well and septic. Elevated ground water discharges due to a wet spring appears to be responsible for the elevated nitrate/nitrite yields. The average nutrient concentration and yield from the Prettyboy watershed was high compared to other WRAS watersheds. The elevated specific conductivity may be associated with road salt contamination of shallow ground water.

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Introduction

A nutrient synoptic survey was conducted during April, 2005 in the Prettyboy watershed as part of the Prettyboy Watershed Restoration Action Strategy (WRAS).

Nutrient synoptic sampling was scheduled for early spring to coincide with the period of maximum nitrogen concentrations in the free flowing fresh water streams. The major proportion of the nitrogen compounds are carried dissolved in the ground water rather than in surface runoff. The higher nitrogen concentrations in the late winter and early spring reflect the higher proportion of nitrogen rich shallow ground water present in the base flow at this time of year. Nitrogen concentrations are reduced in summer as the proportion of shallow ground water is reduced through plant uptake, and replaced by deeper ground water that may have lower nitrate concentrations, or has been denitrified through interaction with anoxic conditions in the soils below the streambed. Point sources can also contribute to in stream nitrate concentrations.

Orthophosphate is generally transported bound to suspended sediments in the water column. In stream orthophosphate concentrations can also be produced through mobilization of sediment bound phosphorus in anoxic water column and/or sediment conditions, sediment in surface runoff from areas having had surface applied phosphorus, ground water from phosphorus saturated soils, and point source discharges.

Ranges used for nutrient concentrations and yields (Table 1) were derived from work done by Frink (1991). The low end values are based on estimated nutrient exports from forested watersheds, and the high end values are based on estimated nutrient exports from intensively agricultural watersheds. As an additional benchmark, the Chesapeake Bay Program uses 1 mg/L total nitrogen as a threshold for indicating anthropogenic impact. The dissolved nitrogen fraction looked at in these synoptic surveys constitutes approximately 50% to 70% of the total nitrogen.

Table 1. Nutrient Ranges and Rating

Rating	NO2+NO3 Concentration mg/L	NO2+NO3 Yield Kg/ha/day	PO4 Concentration mg/L	PO4 Yield Kg/ha/day
Baseline	<1	<.01	<.005	<.0005
Moderate	1 to 3	.01 to .02	.005 to .01	.0005 to .001
High	3 to 5	.02 to .03	.01 to .015	.001 to .002
Excessive	>5	>.03	>.015	>.002

A Note of Caution

Estimates of annual dissolved nitrogen loads/yields from spring samples will result in inflated load estimates, but the relative contributions of subwatersheds should remain reasonably stable. More accurate nitrate/nitrite load/yield estimates need to include sampling during the growing season to account for potential lower concentrations and discharges. Storm flows can also significantly impact loads delivered to a watershed outlet.

The tendency of orthophosphate to be transported bound to sediments makes any estimates of annual orthophosphate loads/yields derived from base flow conditions very *conservative. More accurate estimates of orthophosphate loads/yields in a watershed must include samples from storm flows that carry the vast majority of the sediment load of a watershed. Residual suspended sediments from recent rains, or instream activities of livestock or construction can produce apparently elevated orthophosphate concentrations and yields at base flow.*

METHODS

Synoptic water chemistry samples were collected in early spring throughout the watershed. Sampling was halted for a minimum of 24 hours after rainfall events totaling more than .25 inches. Grab samples of whole water (500 ml) were collected just below the water surface at mid-stream and filtered using a 0.45 micron pore size (Gelman GF/C) filter. The samples were stored on ice and frozen on the day of collection. Filtered samples were analyzed by the Nutrient Analytical Services Laboratory at the University of Maryland's Chesapeake Biological Laboratory (CBL) for dissolved inorganic nitrogen (NO_3, NO_2), and dissolved inorganic phosphorus (PO_4). All analyses were conducted in accordance with U.S. Environmental Protection Agency (EPA) protocols. Stream discharge measurements were taken at the time of all water chemistry samples. Water temperature, dissolved oxygen, pH, and specific conductivity were measured in the field with a Hydrolab Surveyor II at all sites at the time of water quality collections. Watershed areas used to calculate nutrient yields per unit area were determined from a digitized watershed map using Arcview software.

Where sites are nested in a watershed the mapped concentration data for the downstream site is shown only for the area between the sites. Yield calculations for a downstream site are based on the entire area upstream of the site, but are mapped showing just the area between sites. The downstream sites therefore illustrate the cumulative impact from all upstream activities.

RESULTS

A nutrient synoptic survey was conducted during April, 2005 in the Prettyboy watershed as part of the Prettyboy WRAS. Water samples were analyzed from 68 sites throughout the watershed. Sampling site locations are noted in Table 2 and mapped with subwatersheds in Figure 1. (NOTE - The stream map layer in the MDE GIS coverages has a blank spot in part of the Carroll County portion of the Gunpowder watershed.) Dissolved nutrient concentrations and yields from all sites are noted in Table 3. Nitrate/nitrite concentrations were found to be excessive (>5 mg/L) in twenty-three subwatersheds, high (3-5 mg/L) in thirty-seven, moderately elevated (1-3 mg/L) in seven, and baseline (<1 mg/L) in the remaining one subwatershed (Figure 2). Clusters of subwatersheds with excessive nitrate/nitrite concentrations were found in the Georges Creek and Prettyboy Branch watersheds. Instantaneous nitrate/nitrite yields were found to be excessive (>.03 Kg/Hectare/day) in sixty-five subwatersheds, and baseline (<.01 Kg/Hectare/day) in three (Figure 3). Excessive concentrations (>.015 mg/L) of orthophosphate were found in two subwatersheds, high concentrations (.01- .015 mg/L) in three, moderate concentrations (.005- .01 mg/L) in thirty-two, and the remaining thirty-one were below baseline (<.005 mg/L)(Figure 4). Orthophosphate yields were found to be baseline (<.0005 Kg/Hectare/day) in all sixty-eight subwatersheds (Figure 5).

Table 2. Prettyboy WRAS Nutrient Synoptic Survey April, 2005
Sampling Site Location

Sample	LOCATION	Lat	Long
PB 0	Frog Hollow off Parsonage Rd	39.64764	-76.71718
PB 1	UT to Frog Hollow off Parsonage Rd	39.64764	-76.71718
PB 2	UT to reservoir off Spooks Hill Rd	39.65615	-76.73816
pb 3	UT to reservoir at Bulls Sawmill Rd	39.66328	-76.72739
PB 4	UT to reservoir nr Beckleysville Rd	39.66695	-76.74909
PB 5	UT to reservoir at Cotter Rd (S)	39.67536	-76.74144
PB 6	UT to reservoir at Cotter Rd (N)	39.68183	-76.75553
PB 7	UT to reservoir off Clipper Mill Rd	39.68509	-76.76991
PB 8	UT to reservoir at Slab Bridge Rd	39.69217	-76.76127
PB 9	Walker Rn at trail from Gunpowder Rd	39.68811	76.77583
PB 10	UT to Walker Rn in Timberbrook Farm	39.70155	-76.77135
PB 11	Walker Rn in Timberbrook Farm	39.70155	-76.77135
PB 12	Walker Rn at Baker School House Rd		
PB 13	Gunpowder Falls at confl w/ Walker Rn	39.68791	-76.77745
PB 14	UT to Gunpowder Falls at trail from Gunpowder Rd	39.69226	-76.78701
PB 15	Muddy Cr at Shaffer Mill Rd	39.70182	-76.80628
PB 16	Muddy Cr at Lineboro Rd	39.71386	-76.79547
PB 18	Gunpowder Falls at Schalk Rd # 1	39.70630	-76.82528
PB 19	Gunpowder Falls at Brodbeck Rd	39.72013	-76.82335
PB 20	UT to Gunpowder Falls at Carroll Warehime Rd	39.71998	-76.82186
PB 21	Gunpowder Falls off York Rd # 1 at RR	39.71477	-76.82958
PB 22	South Br at York Rd # 1	39.71477	-76.82958
PB 23	UT to South Br at Baughman Rd	39.71555	-76.83730
PB 24	South Br at Church St S	39.71020	-76.84698
PB 25	UT to South Br at Alesia-Lineboro Rd	39.70560	-76.84396
PB 26	Gunpowder Falls South Br at Tracey's Mill Rd	39.71160	-76.86110
PB 27	UT to South Br at Black Rock/Willow Lane (PA)	39.72442	-76.87416
PB 28	South Br (S) at Lineboro Rd	39.70358	-76.86383
PB 29	S Br Gunpowder Falls at Stoney La	39.70636	-76.87655
PB 30	UT to S Br Gunpowder Falls at Wentz Rd	39.70877	-76.89021
PB 31	S Br Gunpowder Falls at Wentz Rd	39.69866	-76.90415
PB 32	UT to S Br Gunpowder Falls at Hanover Pike/Traceys Mill	39.68982	-76.89637
PB 33	UT to Gunpowder Falls at Falls Rd	39.69358	-76.82401
PB 34	UT to Gunpowder Falls at Alesia-Lineboro Rd	39.68462	-76.82983
PB 35	UT to Gunpowder Falls at Alesia Rd	39.67726	-76.84183
PB 36	UT to Gunpowder Falls at Graves Rn Rd		
PB 37	UT to reservoir at Clipper Mill Rd	39.67945	-76.77151
PB 38	UT to reservoir at trail south of Clipper Mill Rd	39.67593	-76.77854
PB 39	Poplar Rn at Gunpowder Rd	39.66169	-76.78107
PB 40	Poplar Rn at Church Rd	39.66877	-76.79659

PB 41	Graves Rn at Gunpowder Rd	39.65481	-76.78001
PB 43	Indian Rn at Graves Rn Rd	39.65460	-76.80821
PB 44	Graves Rn at Falls Rd	39.65370	-76.80673
PB 45	Graves Rn at Brick Stone Rd	39.65021	-76.81628
PB 46	UT to Graves Rn at Warehime Rd	39.66371	-76.84930
PB 47	Graves Rn at Warehime Rd	39.66371	-76.84930
PB 49	Georges Cr at Gunpowder Rd	39.61610	-76.79258
PB 50	Peggy's Br at Gunpowder Rd	39.61610	-76.79258
PB 51	Georges Rn at Beckleysville Rd	39.63567	-76.81558
PB 52	Murphy's Rn at Marshall Mill Rd	39.61991	-76.81403
PB 53	Georges Rn at Fairmont Rd	39.63900	-76.83391
PB 54	Georges Rn at Hanover Pike	39.65162	-76.87909
PB55	Murphy Rn at Gross Mill Rd	39.62640	-76.83086
PB56	UT to Murphy Rn off Gross Mill Rd	39.62640	-76.83086
PB 57	Murphys Rn at Fairmont Rd	39.62694	-76.84479
PB 58	Murphys Rn at Greenmount Church Rd	39.63054	-76.85647
PB 59	UT to Peggys Rn at Mt Carmel Rd	39.60959	-76.79795
PB 60	Peggys Rn at Mt Carmel Rd	39.60850	-76.79721
PB 61	Prettyboy Br at Traceys Store Rd	39.61607	-76.73422
PB 62	UT to Prettyboy Br at Bruehl Rd	39.61607	-76.73422
PB 63	Prettyboy Br at Foreston Rd	39.60713	-76.75397
PB 64	UT to South Br at Intersection Rd (PA)	39.72472	-76.84855
PB 65	UT to Muddy Br at Lineboro Rd	39.71458	-76.79593
PB 66	Compass Rn at Gunpowder Rd	39.63781	-76.78063
PB 68	UT to Georges Cr at Gunpowder Rd	39.62405	-76.78375
PB 69	UT to Peggy's Br at Grace Rd	39.60533	-76.81425
PB 70	UT to reservoir (N) at trail from Clipper Mill Rd	39.67694	-76.76645
PB 71	UT to reservoir at Hoffmanville Rd	39.68434	-76.77941
PB 72	UT to South Br at York Rd #1	39.70198	-76.84827
PB 73	UT to UT #7 &8 at Slab Bridge Rd	39.69062	-76.76424

Figure 1. Prettyboy Reservoir WRAS Nutrient Synoptic Survey April, 2005
Sample Locations and Subsheds

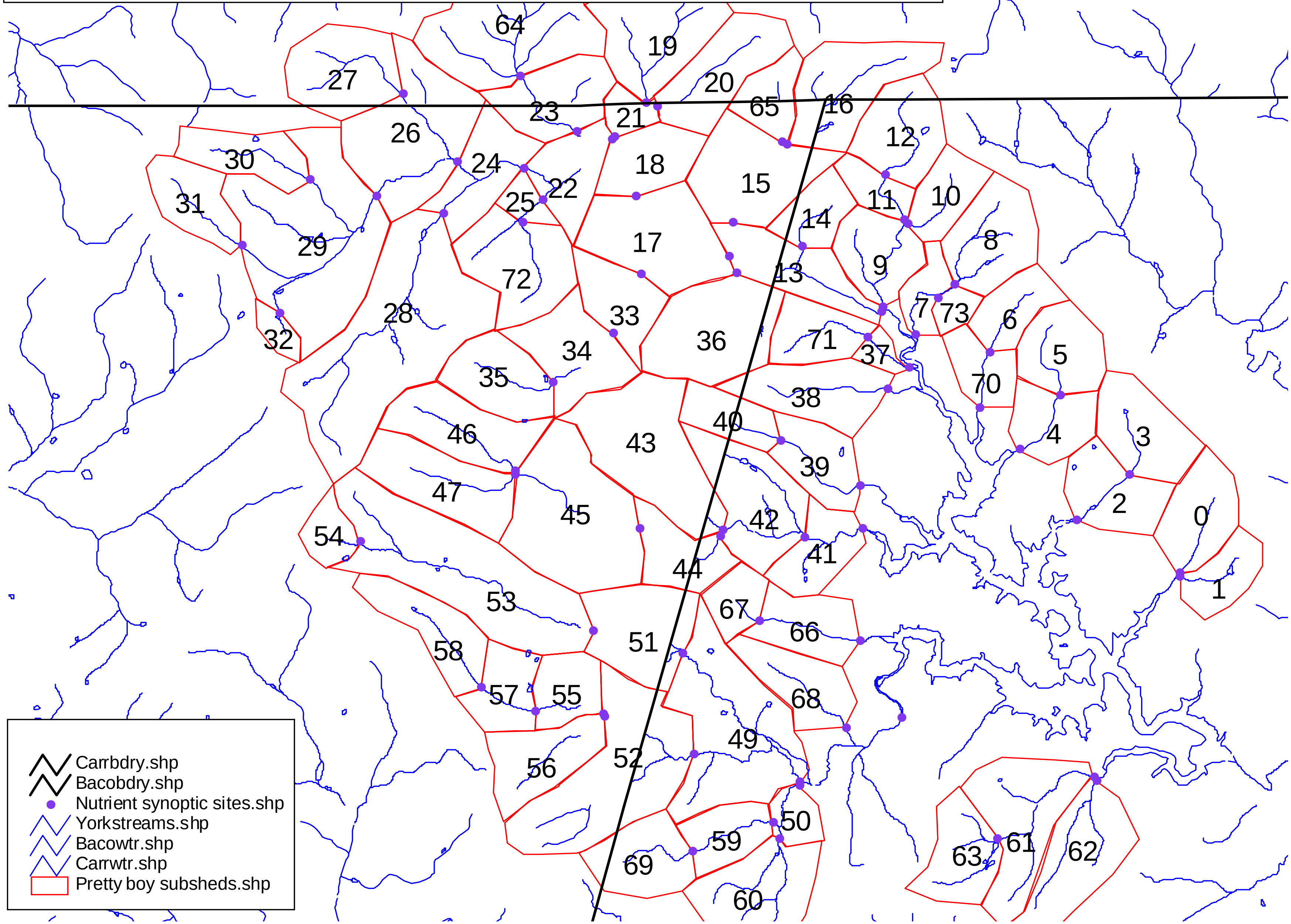


Table 3. Prettyboy WRAS Nutrient Synoptic Survey April, 2005
Dissolved Nutrient Concentrations and Yields

SAMPLE	DATE	PO4 Conc mg/L	NO2+NO3 Conc mg/L	DISCHARGE L/sec	AREA Hectares	PO4 YIELD Kg/H/day	NO2+NO3 YIELD Kg/H/day
PB 0	04/06/05	0.003	3.17	41	196	0.000055	0.057887
PB 1	04/06/05	0.005	2.74	100	124	0.000349	0.191023
PB 2	04/06/05	0.004	2.46	129	318	0.000141	0.086494
PB 3	04/06/05	0.004	3.40	70	224	0.000108	0.091555
PB 4	04/06/05	0.009	4.31	92	344	0.000209	0.099970
PB 5	04/06/05	0.009	5.42	53	186	0.000220	0.132630
PB 6	04/06/05	0.006	5.46	32	131	0.000126	0.114492
PB 8	04/06/05	0.006	4.14	107	232	0.000238	0.164520
PB 8A	04/06/05	0.003	4.00	7	46	0.000038	0.050643
PB 9	04/07/05	0.005	3.01	247	612	0.000174	0.104880
PB 10	04/06/05	0.010	3.70	31	134	0.000199	0.073551
PB 11	04/06/05	0.004	3.21	108	298	0.000126	0.100800
PB 12	04/07/05	0.004	4.14	67	215	0.000108	0.111440
PB 13	04/07/05	0.007	3.54	2904	4286	0.000410	0.207222
PB 14	04/10/05	0.003	0.36	8	118	0.000017	0.002049
PB 15	04/07/05	0.007	4.25	195	696	0.000169	0.102620
PB 16	04/07/05	0.007	4.45	121	283	0.000259	0.164738
PB 18	04/07/05	0.007	3.82	1470	3401	0.000261	0.142631
PB 19	04/15/04	0.004	5.84	66	314	0.000076	0.106113
PB 20	04/07/05	0.018	5.55	75	243	0.000477	0.147030
PB 21	04/15/04	0.004	3.79	139	613	0.000487	0.074511
PB 22	04/15/04	0.005	5.51	804	3851	0.000017	0.099380
PB 23	04/14/05	0.007	3.91	164	737	0.000127	0.075372
PB 24	04/14/05	0.004	3.61	649	2206	0.000109	0.091739
PB 25	04/14/05	0.008	4.73	86	330	0.000187	0.106615
PB 26	04/14/05	0.008	3.63	349	1661	0.000136	0.065835
PB 27	04/14/05	0.004	3.57	70	249	0.000085	0.086822
PB 28	04/14/05	0.003	3.41	179	754	0.000063	0.069778
PB 29	04/14/05	0.004	3.93	324	1000	0.000118	0.110184
PB 30	04/15/04	0.003	2.95	65	157	0.000108	0.105744
PB 31	04/15/04	0.004	5.24	40	162	0.000079	0.112333
PB 32	04/14/05	0.003	4.18	9	44	0.000050	0.077681
PB 33	04/07/05	0.005	3.62	203	607	0.000145	0.104794
PB 34	04/07/05	0.006	3.86	126	568	0.000115	0.074127
PB 35	04/12/05	0.005	5.22	56	204	0.000119	0.124512
PB 36	04/07/05	0.006	4.42	102	333	0.000158	0.116592
PB 37	04/06/05	0.005	3.08	52	191	0.000118	0.072524
PB 38	04/07/05	0.004	3.36	66	231	0.000099	0.083045
PB 39	04/12/05	0.004	2.28	84	293	0.000099	0.056303
PB 40	04/12/05	0.003	3.09	47	123	0.000098	0.101371
PB 41	04/12/05	0.003	3.95	546	1990	0.000071	0.093672

PB 43	04/11/05	0.004	3.79	99	409	0.000084	0.079286
PB 44	04/11/05	0.004	4.77	297	1137	0.000090	0.107691
PB 45	04/12/05	0.003	4.71	284	979	0.000075	0.117919
PB 46	04/12/05	0.006	4.68	71	238	0.000155	0.120608
PB 47	04/12/05	0.005	5.06	137	265	0.000224	0.226230
PB 49	04/11/05	0.005	5.52	591	2632	0.000097	0.107159
PB 50	04/11/05	0.008	5.99	199	693	0.000199	0.148972
PB 51	04/11/05	0.005	6.28	219	955	0.000099	0.124288
PB 52	04/11/05	0.004	4.92	252	1183	0.000074	0.090652
PB 53	04/12/05	0.003	6.75	209	691	0.000079	0.176769
PB 54	04/12/05	0.003	7.47	29	307	0.000024	0.060330
PB 55	04/12/05	0.003	5.49	143	470	0.000079	0.144793
PB 56	04/12/05	0.004	5.58	40	206	0.000068	0.094482
PB 57	04/12/05	0.003	5.12	57	343	0.000043	0.073382
PB 58	04/12/05	0.004	4.61	18	197	0.000031	0.035681
PB 59	04/11/05	0.006	5.23	63	329	0.000099	0.086197
PB 60	04/11/05	0.010	7.09	49	291	0.000146	0.103574
PB 61	04/11/05	0.008	5.71	62	510	0.000085	0.060388
PB 62	04/11/05	0.006	5.32	63	283	0.000116	0.103009
PB 63	04/11/05	0.015	9.39	14	189	0.000097	0.060414
PR 64	04/14/05	0.004	1.84	21	524	0.000013	0.006478
PB 65	04/07/05	0.008	4.78	29	114	0.000175	0.104817
PB 66	04/12/05	0.005	2.99	54	266	0.000088	0.052676
PB 68	04/11/05	0.014	4.92	35	183	0.000231	0.081195
PB 69	04/11/05	0.007	6.86	18	195	0.000055	0.053965
PB 70	04/10/05	0.006	1.50	10	247	0.000021	0.005182
PB 72	04/14/05	0.007	5.29	42	279	0.000094	0.069079

Figure 2. Pretty Boy WRAS Nutrient Synoptic Survey April, 2005
Nitrate/Nitrite (NO2+NO3) Concentration (mg/L)

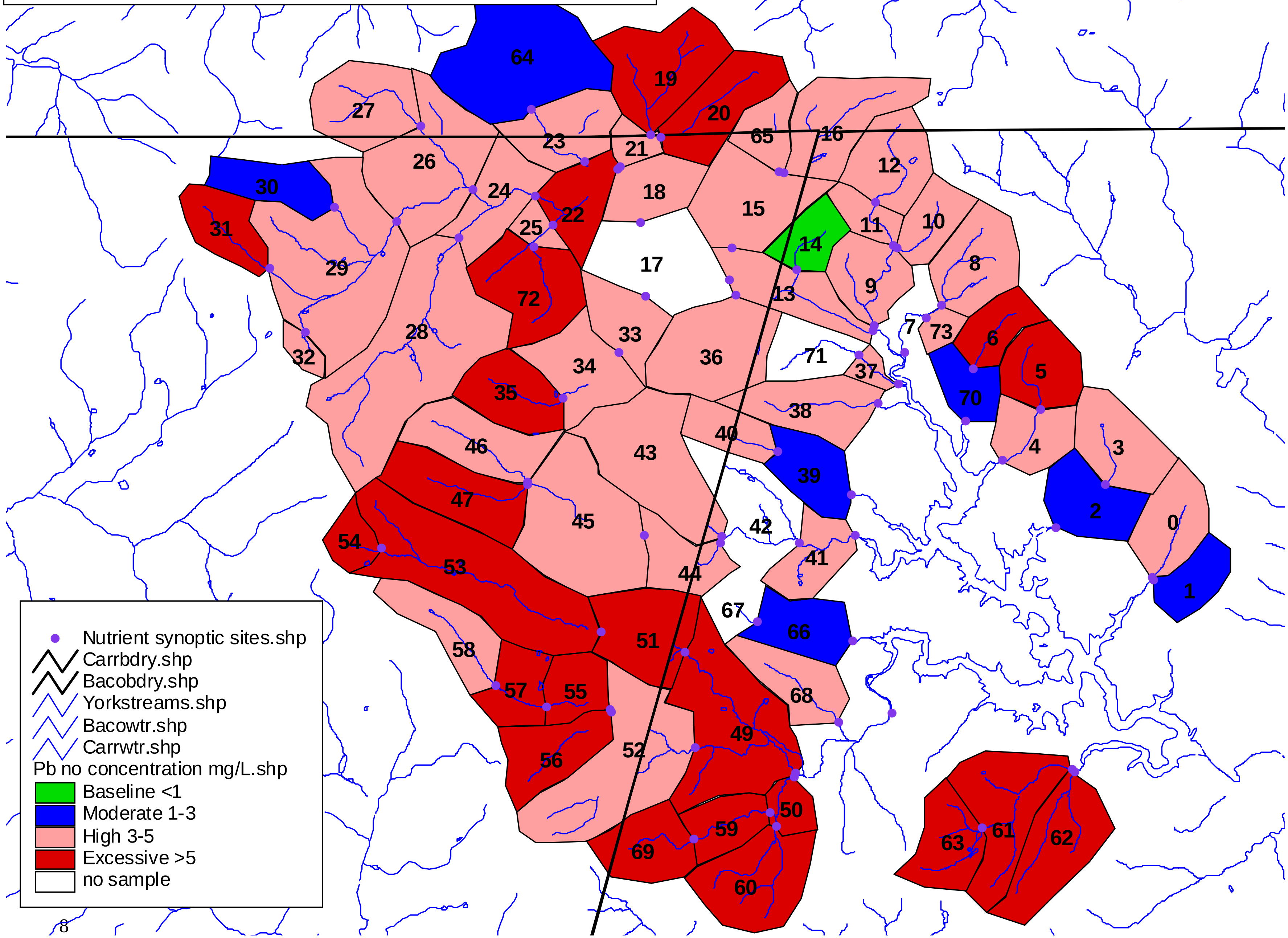
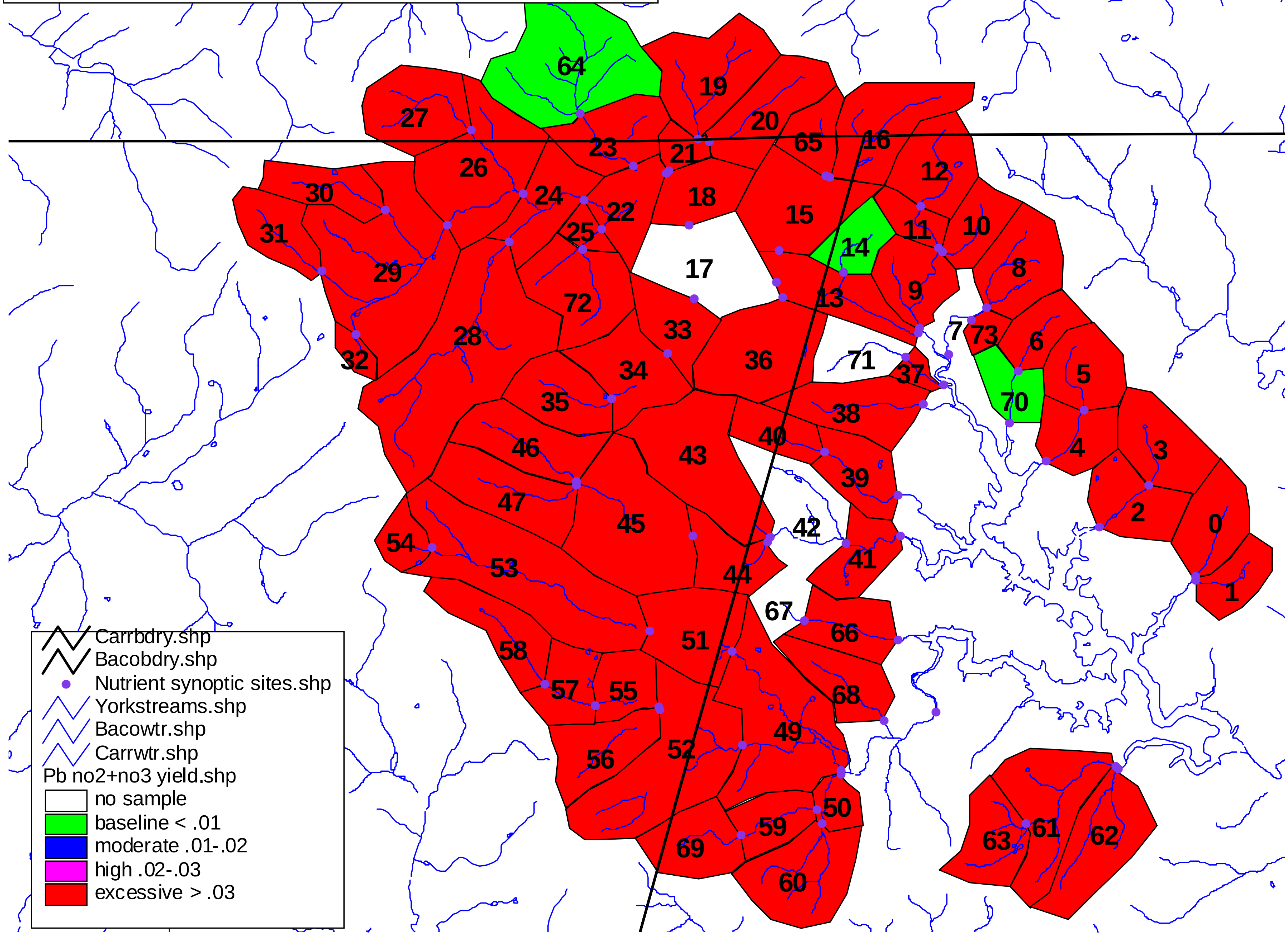


Figure 3. Pretty Boy WRAS Nutrient Synoptic Survey April, 2005
Nitrate/Nitrite (NO2+NO3) Yield (Kg/H/day)



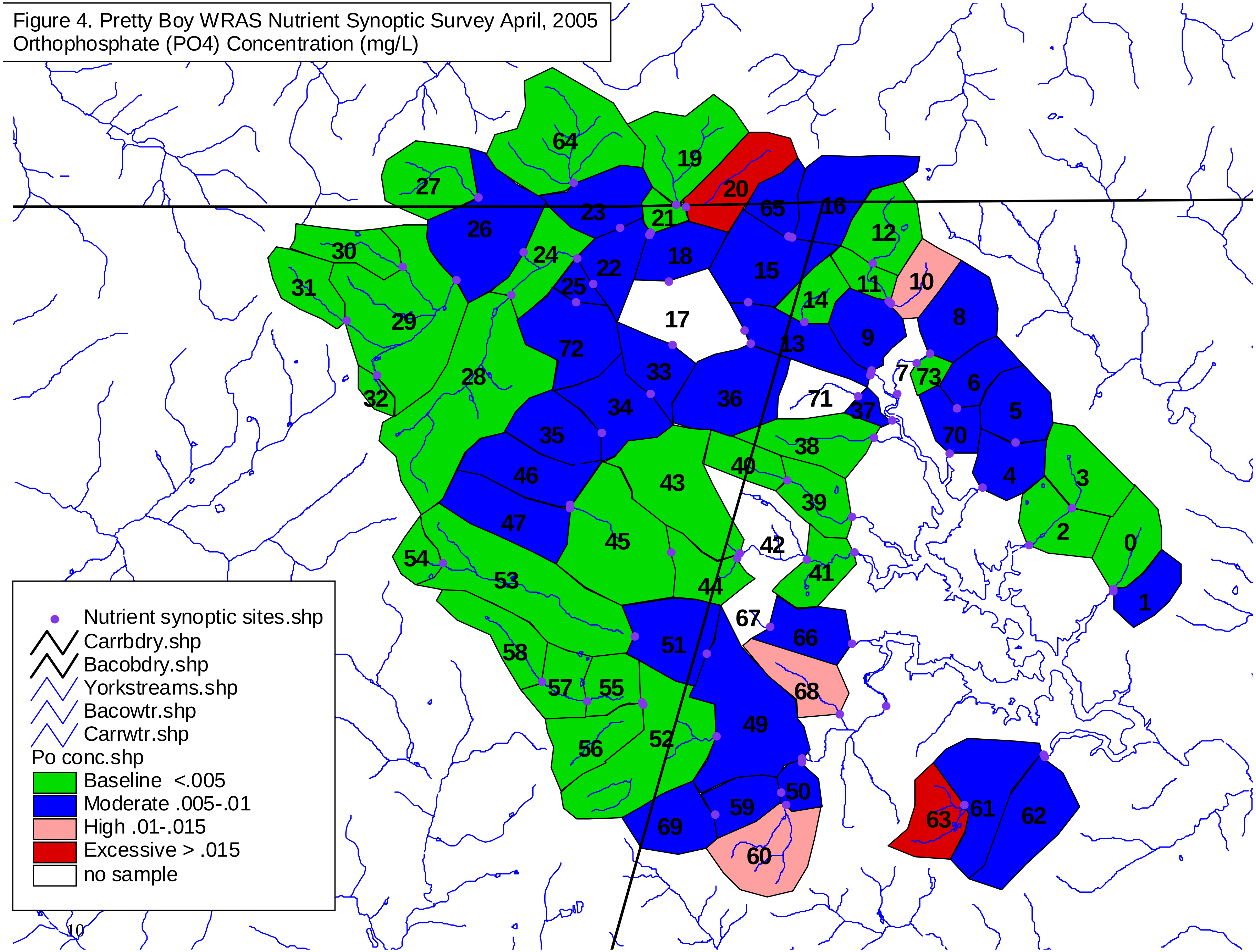
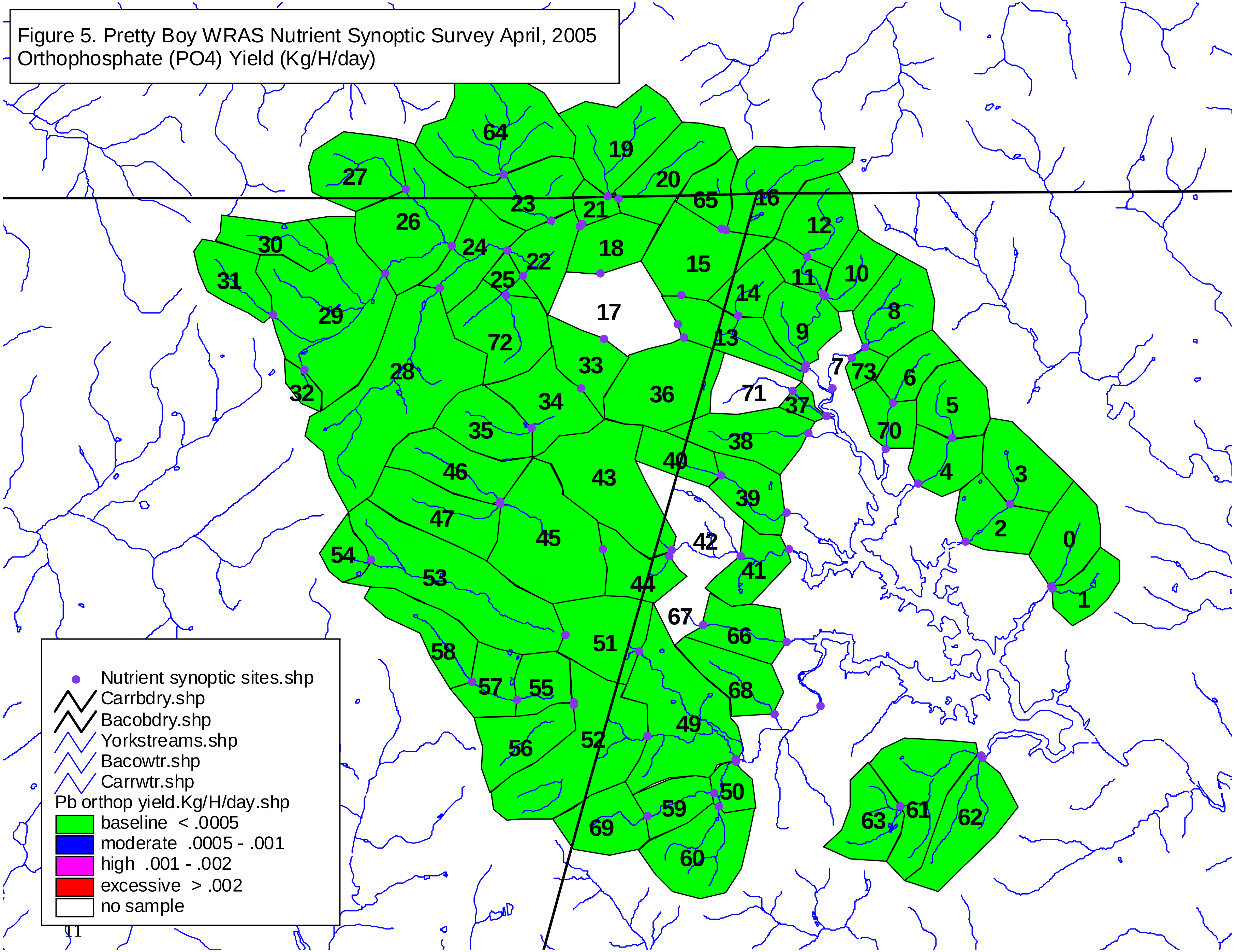


Figure 4. Pretty Boy WRAS Nutrient Synoptic Survey April, 2005
Orthophosphate (PO4) Concentration (mg/L)

Figure 5. Pretty Boy WRAS Nutrient Synoptic Survey April, 2005
Orthophosphate (PO4) Yield (Kg/H/day)



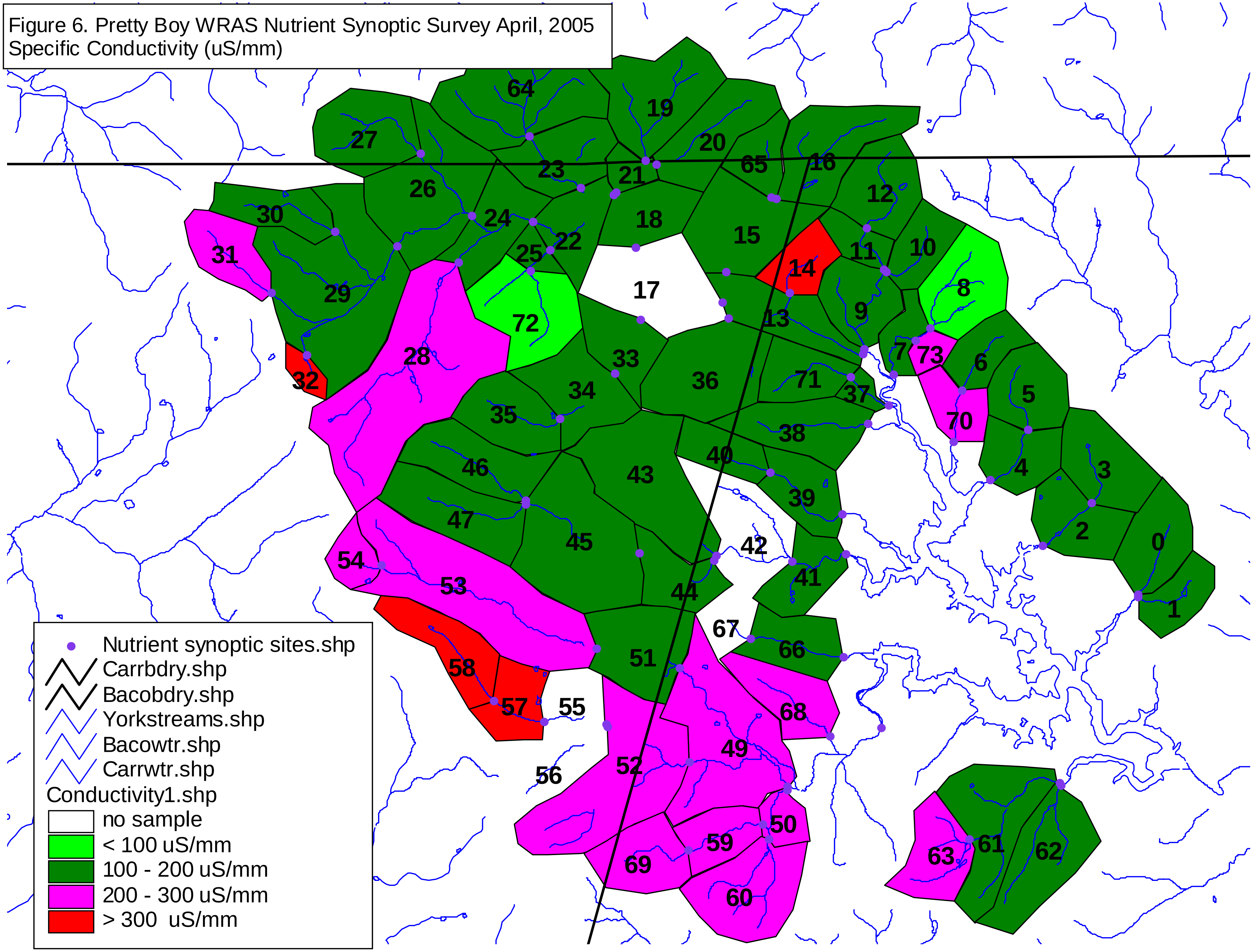
No significant anomalies were found in the insitu measurements of temperature, dissolved oxygen, or pH. Four subwatersheds in the Prettyboy watershed had elevated specific conductivity (>.300 mS/mm) (Table 4, Figure 6).

Table 4. Prettyboy Wras Nutrient Synoptic Survey April, 2005
Insitu Water Quality Parameters

Sample	Date	Time	Temp oC	pH	Dissolved O2 mg/L	Specific Cond uS/mm	Lat	Long
PB 0	4/6/05	915	10.30	6.97	No Reading	0.119	39.64764	-76.71718
PB 1	4/6/05	930	8.51	7.06	No Reading	0.157	39.64764	-76.71718
PB 2	4/6/05	1015	6.61	7.21	No Reading	0.129	39.65615	-76.73816
pb 3	4/6/05	950	9.52	7.18	No Reading	0.196	39.66328	-76.72739
PB 4	4/6/05	1045	15.00	7.35	No Reading	0.158	39.66695	-76.74909
PB 5	4/6/05	1200	12.62	7.37	No Reading	0.178	39.67536	-76.74144
PB 6	4/6/05	1230	12.70	7.24	No Reading	0.167	39.68183	-76.75553
PB 7	4/7/05	1330	13.86	6.88	9.12	0.129	39.68509	-76.76991
PB 8	4/6/05	1350	13.50	7.19	No Reading	0.089	39.69217	-76.76127
PB 9	4/7/05	1145	12.42	6.97	9.47	0.115	39.68811	76.77583
PB 10	4/6/05	1430	15.19	7.32	No Reading	0.111	39.70155	-76.77135
PB 11	4/6/05	1450	15.48	7.32	No Reading	0.131	39.70155	-76.77135
PB 12	4/7/05	950	11.56	6.79	9.42	0.145	No Reading	No Reading
PB 13	4/7/05	1215	12.26	7.33	9.77	0.153	39.68791	-76.77745
PB 14	4/10/05	1100	8.23	6.46	9.80	0.536	39.69226	-76.78701
PB 15	4/7/05	1045	12.11	7.07	9.93	0.150	39.70182	-76.80628
PB 16	4/7/05	1015	11.98	6.65	9.27	0.151	39.71386	-76.79547
PB 18	4/7/05	1445	14.27	7.33	9.41	0.148	39.70630	-76.82528
PB 19	4/15/05	1045	9.84	7.49	13.04	0.171	39.72013	-76.82335
PB 20	4/7/05	1500	14.86	7.05	8.87	0.167	39.71998	-76.82186
PB 21	4/15/05	1015	9.18	7.65	13.52	0.185	39.71477	-76.82958
PB 22	4/15/05	1000	9.24	7.62	12.70	0.120	39.71477	-76.82958
PB 23	4/15/05	1315	13.61	7.93	12.89	0.119	39.71555	-76.83730
PB 24	4/15/05	1330	13.24	7.54	13.76	0.182	39.71020	-76.84698
PB 25	4/14/05	1350	14.82	7.56	12.28	0.168	39.70560	-76.84396
PB 26	4/14/05	1120	10.85	7.16	14.01	0.166	39.71160	-76.86110
PB 27	4/14/05	1240	13.55	7.29	12.82	0.125	39.72442	-76.87416
PB 28	4/14/05	1100	9.55	7.06	14.10	0.210	39.70358	-76.86383
PB 29	4/14/05	1140	11.50	7.33	13.92	0.174	39.70636	-76.87655

PB 30	4/15/05	1220	13.87	7.49	12.94	0.101	39.70877	-76.89021
PB 31	4/15/05	1210	12.30	8.01	13.25	0.244	39.69866	-76.90415
PB 32	4/14/05	1200	12.97	7.60	13.09	0.325	39.68982	-76.89637
PB 33	4/7/05	1420	14.61	7.43	9.32	0.172	39.69358	-76.82401
PB 34	4/7/05	1400	14.35	7.34	9.56	0.163	39.68462	-76.82983
PB 35	4/12/05	1240	13.36	7.18	8.88	0.170	39.67726	-76.84183
PB 36	4/7/05	1100	12.12	6.83	9.41	0.113	No Reading	No Reading
PB 37	4/6/05	1240	13.27	7.46	No Reading	0.172	39.67945	-76.77151
PB 38	4/7/05	1240	14.07	6.88	8.99	0.102	39.67593	-76.77854
PB 39	4/12/05	1030	8.68	7.03	9.73	0.114	39.66169	-76.78107
PB 40	4/12/05	1050	10.59	6.65	9.01	0.138	39.66877	-76.79659
PB 41	4/12/05	1010	8.18	6.84	9.92	0.138	39.65481	-76.78001
PB 43	4/11/05	1545	15.08	6.81	8.63	0.115	39.65460	-76.80821
PB 44	4/11/05	1530	14.84	7.18	8.54	0.153	39.65370	-76.80673
PB 45	4/12/05	1205	10.48	6.75	9.58	0.145	39.65021	-76.81628
PB 46	4/12/05	1255	13.32	7.05	8.79	0.154	39.66371	-76.84930
PB 47	4/12/05	1305	13.01	6.95	8.95	0.165	39.66371	-76.84930
PB 49	4/11/05	1330	14.14	7.58	9.25	0.204	39.61610	-76.79258
PB 50	4/11/05	1345	14.78	7.76	9.27	0.226	39.61610	-76.79258
PB 51	4/11/05	1440	15.61	7.38	8.96	0.189	39.63567	-76.81558
PB 52	4/11/05	1415	15.43	7.34	8.98	0.233	39.61991	-76.81403
PB 53	4/12/05	1140	10.08	7.05	9.80	0.211	39.63900	-76.83391
PB 54	4/12/05	1330	14.60	6.86	9.32	0.246	39.65162	-76.87909
PB 57	4/12/05	1425	14.31	7.44	9.91	0.317	39.62694	-76.84479
PB 58	4/12/05	1405	14.35	8.31	11.37	0.451	39.63054	-76.85647
PB 59	4/11/05	1300	13.16	7.07	8.77	0.222	39.60959	-76.79795
PB 60	4/11/05	1305	14.62	6.85	8.97	0.256	39.60850	-76.79721
PB 61	4/11/05	1200	15.25	6.91	8.49	0.193	39.61607	-76.73422
PB 62	4/11/05	1205	12.45	6.91	8.52	0.173	39.61607	-76.73422
PB 63	4/11/05	1030	11.69	6.68	8.99	0.203	39.60713	-76.75397
PB 64	4/14/05	1255	12.60	7.19	13.18	0.157	39.72472	-76.84855
PB 65	4/7/05	1030	12.44	7.30	9.11	0.135	39.71458	-76.79593
PB 66	4/12/05	940	8.60	6.45	9.53	0.176	39.63781	-76.78063
PB 68	4/11/05	1400	15.56	6.97	8.74	0.218	39.62405	-76.78375
PB 69	4/11/05	1500	15.92	6.95	9.12	0.226	39.60533	-76.81425
PB 70	4/10/05	900	7.84	7.13	9.80	0.246	39.67694	-76.76645
PB 71	4/6/05	1300	13.66	7.34	No Reading	0.128	39.68434	-76.77941
PB 72	4/14/05	1400	15.02	7.46	11.84	0.062	39.70198	-76.84827
PB 73	4/6/05	1345	13.66	7.38	No Reading	0.216	39.69062	-76.76424

Figure 6. Pretty Boy WRAS Nutrient Synoptic Survey April, 2005
Specific Conductivity (uS/mm)



Discussion

Almost two thirds of the subwatersheds exhibiting excessive nitrate/nitrite concentrations were in the Georges Run and Prettyboy Branch watersheds. Judging from site photos and housing densities in these subwatersheds, the elevated nitrate/nitrite concentrations may be associated with row crop and animal agriculture, and communities on well and septic. Elevated ground water discharges due to a wet spring appears to be responsible for the elevated nitrate/nitrite yields. The large number of subwatersheds with excessive nitrate/nitrite yields compared to the number of subwatersheds with excessive concentrations has been found in all other rural piedmont WRAS watersheds. The topography and soils in these piedmont watersheds appear to produce more groundwater than more urban or coastal plain watersheds, especially during wet periods such as the early spring of 2005. Streams with low concentrations can have excessive yields if discharge volumes are high. Orthophosphate tends to travel in association with suspended sediment, thus streams with excessive orthophosphate concentrations (> .015 mg/L) usually had an active sediment source. This source could range from crayfish burrowing activity to domestic animals in the stream or land clearing in the watershed. Because this survey is done during dry weather, sediment associated phosphorus should be at a minimum. The lack of subwatersheds with orthophosphate yields over baseline reinforce this assumption. Implementation activities that address either nitrogen or phosphorus will help moderate both due to the tendency of elevated nitrate/nitrite and orthophosphate concentrations to be in the same subwatershed. The average nitrite/nitrate and orthophosphate concentration from the Prettyboy watershed was high compared to other WRAS watersheds (Table 5). The elevated specific conductivity noted in four subwatersheds may be associated with road salt contamination of shallow ground water or possibly limestone outcrops. Three of the four subwatersheds drain portions of Rt 30 and other roads in Hampstead and Manchester. These road networks would have aggressive snow removal and deicing due to heavy use. The absence of nearby roads at the fourth site (#14) points more towards the possibility of limestone.

Table 5. Annual & Spring Nutrient Concentration Averages from Other Nutrient Synoptic Surveys

Mg/L	Piney	German Br.	Pocomoke	Lower Monocacy	Liberty	Deer Creek	Prettyboy	Port Tobacco
NO2+NO3 Spring	3.742	3.832	3.734	3.11	3.41	3.7	**4.41**	.751
NO2+NO3 Annual	4.823	4.704	2.384					
PO4 Spring	0.800	0.043	0.028	0.013	0.004	.007	**.006**	0.008
PO4 Annual	1.177	0.067	0.022					

Summary

The results of this nutrient synoptic survey indicate that nutrients, especially nitrate/nitrite, could be considered a water quality problem in the Prettyboy watershed. The source of these nutrients appears to be a combination of agriculture and residential septic. The minor anomalies found in the insitu measurements of specific conductivity are not current threats to water quality, but should be considered when formulating a watershed management plan.

Literature Cited

Frink, Charles R.. 1991. *Estimating Nutrient Exports to Estuaries*. Journal of Environmental Quality. 20:717-724.