

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOGANS CR	SR 1301	07/06/09	NF35	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	3	03010104	36.439045	-79.515205	22-50	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	65.4	550	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	122
pH (s.u.)	6.7

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	3
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	66

Site Photograph



Substrate	Sand, gravel, block bedrock boulders jutting out from the left bank
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/09	2009-80	15	42	Good-Fair

Most Abundant Species 2009	Satinfin Shiner (25%)	Exotic Species 2009	Bluegill
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected from this 2009-2010 Random Ambient Monitoring site. **Watershed** -- drains primarily eastern Rockingham County, including a portion of the Town of Reidsville; two small NPDES facilities located in the headwaters (NC0002828 and NC0077135, total Q_w = 0.027 MGD); tributary to the Dan River. **Habitats** -- snags, stick riffles, gravel bars, deadfalls, and shallow runs; high quality bank and riparian characteristics, but stream still exhibits impacts such as poor quality riffles and sandy substrate from nonpoint source erosion. **2009** -- all diversity metrics (total species diversity and diversities of darters, sunfish, and suckers) were lower than expected; intolerant species were also absent; three species (White Sucker, Notchlip Redhorse, and Largemouth Bass) were represented only by young-of-year and were excluded from the sample. Long-term nonpoint source erosion seems to be the primary stressor to this stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOGANS CR	SR 1330	07/06/09	NF15	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	3	03010104	36.49027778	-79.40416667	22-50	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	92.6	410	11	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.8
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	118
pH (s.u.)	6.7

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	4
Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph



Substrate	Sand, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/09	2009-81	18	40	Good-Fair
05/25/04	2004-56	20	52	Good

Most Abundant Species 2009	Swallowtail Shiner (28%)	Exotic Species 2009	Bluegill
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Species Change Since Last Cycle

Gains --Rosyside Dace, Crescent Shiner, Glassy Darter, Riverweed Darter. **Losses** -- White Sucker, Northern Hogsucker, Notchlip Redhorse, Margined Madtom, Channel Catfish, Green Sunfish, Chainback Darter, Roanoke Darter. All species gained or lost were represented by 1-3 fish/species, except for Crescent Shiner (n=37).

Data Analysis

Watershed -- drains eastern Rockingham and northwestern Caswell counties, including a portion of the Town of Reidsville; two small NPDES facilities located in the headwaters (NC0002828 and NC0077135, total Q_w = 0.027 MGD); tributary to the Dan River. **Habitats** -- gravelly and sandy runs; good snag pools, undercut, *Podostemum* in the riffles, but stream still exhibits substantial nonpoint source erosion. **2009** -- ~ 2 times as many fish were collected in 2009 than in 2004 (336 vs. 178), primarily Swallowtail Shiner, Crescent Shiner, and Satinfin Shiner (53% of all the fish collected); the diversities of sunfish and suckers were much lower than expected; 1 of only 2 sites where suckers were absent, although Notchlip Redhorse were collected they were represented only by young-of-year and were excluded from the sample; combined with a skewed trophic structure the NCIBI score and rating declined; despite having a large drainage area the community may still be suffering from drought impacts and from chronic nonpoint source erosion. **2004 & 2009** -- 26 species known from the site, including 6 species of darters; dominant species is the Swallowtail Shiner.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MOON CR	SR 1511	05/21/09	NF24	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.5075	-79.33555556	22-51	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	47.2	370	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	45	0	55	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	97
pH (s.u.)	6.5

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	5
Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	59

Site Photograph



Substrate	Sand, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/09	2009-42	20	52	Good
04/30/04	2004-32	16	46	Good
09/07/94	94-34	22	44	Good-Fair

Most Abundant Species 2009	Crescent Shiner (21%), Bluehead Chub (18%)	Exotic Species 2009	Green Sunfish, Bluegill, Redear Sunfish
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Species Change Since Last Cycle

Gains -- Eastern Silvery Minnow, Crescent Shiner, Redlip Shiner, Mountain Redbelly Dace, Creek Chub, White Sucker, Redear Sunfish, Glassy Darter. **Losses** -- Golden Shiner, Redfin Pickerel, Pumpkinseed, Largemouth Bass. All species gained or lost were represented by 1- 4 fish/species, except for Redlip Shiner, Eastern Silvery Minnow, and Crescent Shiner (n=17, 41, and 130, respectively).

Data Analysis

Watershed -- drains northwestern Caswell County; no municipalities with the watershed; tributary to the Dan River, site is ~ 2.2 miles above the creek's confluence with the river. **Habitats** -- sandy runs, woody debris, snags, narrow riparian zones intact along both banks, but stream still exhibits substantial nonpoint source erosion as evident from the low scoring habitat characteristics. **2009** -- 6 times more fish collected in 2009 than in 2004 (627 vs. 104), especially Crescent Shiner (130 vs. 0), Bluehead Chub (112 vs. 11), and Eastern Silvery Minnow (41 vs. 0); no lingering effects from the drought. **1994 - 2009** -- very diverse fish community, 30 species are known from the site, including 12 species of cyprinids, 5 species of sunfish, and 4 species of darters; dominant species are variable and include Eastern Silvery Minnow (1994), Satinfish Shiner and Redbreast Sunfish (2004), and Crescent Shiner and Bluehead Chub (2009); NCIBI score and rating have gradually been improving over the past 15 years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
RATTLESNAKE CR	SR 1523	05/21/09	NF26	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.50777778	-79.29333333	22-52	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.7	350	6	0.2	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.1
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	120
pH (s.u.)	6.6

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	7
Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Site Photograph



Substrate	Sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/09	2009-43	21	46	Good
05/25/04	2004-57	19	48	Good

Most Abundant Species 2009	Satinfin Shiner (46%)	Exotic Species 2009	Red Shiner, Green Sunfish, Bluegill
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Species Change Since Last Cycle

Gains -- Crescent Shiner, Mountain Redbelly Dace, Creek Chub, V-lip Redhorse, Eastern Mosquitofish, Fantail Darter. **Losses** -- Golden Shiner, Channel Catfish, Redfin Pickerel, Warmouth. All species gained or lost were represented by 1-9 fish/species, except for Eastern Mosquitofish and Fantail Darter (n=14 and 17, respectively).

Data Analysis

Watershed -- drains northwestern Caswell County with its headwaters arising in the Town of Yanceyville; tributary to the Dan River, site is ~0.2 miles above the creek's confluence with the river. **Habitats** -- very shallow and sandy runs, a couple of large boulder outcrops in the channel, riparian zones intact providing good shading to the stream; but stream is impacted by very substantial nonpoint source erosion. **2009** -- 5 times more fish collected in 2009 than in 2004 (929 vs. 184), especially Satinfin Shiner, Eastern Silvery Minnow, Swallowtail Shiner, Bluehead Chub, Speckled Killifish, and Rosefin Shiner (86% of all the fish collected); very high percentage of tolerant fish (53%). **2004 & 2009** -- 25 species known from the site, including 12 species of cyprinids and 3 species of darters; dominant species is the Satinfin Shiner; very dynamic community, the close proximity to the river may influence the community (i.e., schooling species such as Eastern Silvery Minnow and Satinfin Shiner migrating back and forth from the creek to the river).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
COUNTRY LINE CR	NC 57	NB40	08/12/09	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.537778	-79.201111	22-56-(3.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	138.0	395	10	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	30	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	23.6
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	126
pH (s.u.)	6.4

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	0
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	69

Site Photograph



Substrate	The channel substrata consisted of mostly sand and gravel.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/12/09	10808	---	28	---	4.31	Excellent
07/01/04	9400	---	24	---	4.82	Good
08/24/94	6691	---	14	---	4.55	Good-Fair
07/10/90	5337	---	26	---	4.53	Good
07/23/87	4158	---	26	---	5.15	Good

Taxonomic Analysis

Several pollution sensitive EPT taxa were collected at this site in 2009 such as the stoneflies *Paragnetina fumosa*, *Pteronarcys spp.*, and long-lived *Acroneuria abnormis*. Intolerant caddisflies collected included *Brachycentrus numerosus*, *Nyctiophylax moestus*, and *Pycnopsyche spp.* The mayfly *Plauditus cestus* and caddisfly *Ceraclea mentiea* are listed by the North Carolina Natural Heritage Program as Significantly Rare (2006) and were collected from this location in 2009.

Data Analysis

This site received a bioclassification of Excellent in 2009 for the first time since sampling began in 1983. Decreases in EPTBI from 4.82 in 2004 to 4.31 in 2009 in addition to the highest EPT taxa richness (28) on record from this location continue to suggest better water quality. Pollution sensitive macroinvertebrate communities were collected at this site despite evidence of habitat degradation due to increased erosion leading to in-channel sedimentation, scouring, and increased bar development from nonpoint sources.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S HYCO CR	US 158	05/21/09	NF30	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
PERSON	5	03010104	36.38527778	-79.10777778	22-58-4-(3)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,HQW,CA	56.5	430	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	0	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.7
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.7

Water Clarity	Clear, slightly tannin stained
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	5
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	58

Site Photograph



Substrate	Gravel, sand, woody debris
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/16/10	2010-48	21	44	Good-Fair
05/21/09	2009-44	15	38	Fair
04/30/04	2004-30	21	52	Good

Most Abundant Species 2009	Swallowtail Shiner (32%)	Exotic Species 2009	Green Sunfish, Bluegill
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Species Change Since Last Cycle (2009 vs. 2004)

Gains -- Crescent Shiner, Eastern Mosquitofish, Black Crappie. **Losses** -- Mountain Redbelly Dace, White Sucker, Notchlip Redhorse, V-lip Redhorse, Margined Madtom, Yellow Bullhead, Redfin Pickerel, Speckled Killifish, Yellow Perch. All species gained or lost were represented by 1-6 fish/species, except for Crescent Shiner, V-lip Redhorse, and Eastern Mosquitofish (n=11, 13, and 36, respectively).

Data Analysis

Watershed -- drains northwest Orange, southeastern Caswell, and southwestern Person counties; no municipalities within the watershed; site is ~ 4.5 miles downstream from Roxboro Lake dam and ~ 1.5 miles above the backwaters of Hyco Reservoir, an impoundment of the Hyco River; stream is classified as High Quality Waters based upon its WS-II supplemental classification. **Habitats** -- very low flow; coarse woody debris in the channel, riparian bottomlands, snag debris dams, stream exhibits substantial nonpoint source erosion. **2009** -- 2.3 times more fish collected in 2009 than in 2004 (556 vs. 237), especially Swallowtail Shiner, Satinfish Shiner, Eastern Mosquitofish, and Bluegill (75% of all the fish collected), 1 of 2 sites where suckers were absent; very skewed trophic structure with only 3% omnivores+herbivores; lingering drought impacts. **2004 & 2009** -- despite a large drainage area, only 24 species are known from the site; including just 2 species of darters; dominant species is the Swallowtail Shiner; old weir below the bridge at the old gage may be an impediment to fish movement at low flow; recolonization avenues are limited by the upstream and downstream reservoirs. **Note:** the site was re-sampled in 2010 following a wetter winter and spring flow period and the community was rated Good-Fair.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MARLOWE CR	SR 1322	NB43	08/12/09	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
PERSON	5	03010104	36.483333	-78.979444	22-58-12-6b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	17.8	390	9	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	0	40	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Roxboro WWTP	NC0021024	5.0

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	139
pH (s.u.)	6.5

Water Clarity	turbid
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Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	10
Bank Erosion (7)	1
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	72

Substrate	This channel was dominated by mostly sand and gravel.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/12/09	10809	59	10	6.25	6.01	Fair
06/30/04	9397	56	13	6.43	5.93	Good-Fair
08/25/99	7988	53	9	6.35	5.74	Fair
08/24/94	6692	33	5	6.91	6.49	Poor

Taxonomic Analysis

This sampling location was dominated by pollution tolerant macroinvertebrates such as the mayflies *Baetis flavistriga* and *Maccaffertium modestum*; and the caddisflies *Cheumatopsyche* spp. and *Hydropsyche betteni*. The root mat-dwelling caddisflies *Oecetis persimilis* and *Trianodes ignitus* were rare at the site. The somewhat tolerant riffle beetle taxa *Macronychus glabratus* was abundant and the intolerant *Psephenus herricki* was rare at this sampling location. Eight odonate taxa were collected in addition to 26 chironomid taxa. *Polypedilum flavum* was the only abundant chironomid taxa collected. No stoneflies were collected at this site in 2009.

Data Analysis

This benthic monitoring station received a bioclassification of Fair in 2009 suggesting a transition back to degraded water quality found in 1999. EPTBI increased slightly and EPT richness decreased from the 2004 sample. In 2009, EPT taxa richness returned to the levels observed in 1999. Chironomid taxa richness (26) was the highest of all other sampling years at this site. Only one chironomid taxa was abundant at the site in 2009. The high chironomid taxa richness could be due to increased drift from the rain event that occurred the night before sampling. Conductivity was lower suggesting improvements from 2004 when levels were between 220 and 340 µS/cm. This stream drains northern portions of urban Roxboro and active row crop agriculture was noted upstream. This site may suffer from several variables including both point and nonpoint source pollution in addition to lack of substrate favorable to many rheophilic EPT taxa.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
AARONS CR	SR 1400	05/26/09	NF31	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010104	36.53166667	-78.73916667	22-59	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	27.6	370	8	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.1
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	76
pH (s.u.)	6.0

Water Clarity	Clear, easily silted
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	12
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	88

Site Photograph



Substrate	Cobble, boulder, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/26/09	2009-45	16	50	Good
04/28/04	2004-25	15	46	Good

Most Abundant Species 2009 Fantail Darter (30%), Crescent Shiner (28%)

Exotic Species 2009 Green Sunfish, Bluegill, Redear Sunfish

Species Change Since Last Cycle

Gains -- Whitemouth Shiner, Pirate Perch, Redear Sunfish, Carolina Darter, **Losses** -- Rosyside Dace, Eastern Mosquitofish. All species gained or lost were represented by 1-5 fish/species.

Data Analysis

Watershed -- drains the extreme northeast corner of Person and the extreme northwest corner of Granville counties; no municipalities in the watershed; **Habitats** -- regional reference site, a typical Carolina Slate Belt-type stream with high quality instream and riparian habitat characteristics; shallow pools and riffles, undercuts, clay banks, blow-out on upper left bank at end of reach. **2009** -- one-half the number of fish collected in 2009 than in 2004 (397 vs. 791), especially Crescent Shiner (111 vs. 321); Carolina Darter [Special Concern] collected for the first time; a slight increase in the overall diversity and diversity of darters increased the NCIBI score, but not the rating; no change in the other metrics, trophic metrics very stable. **2004 & 2009** -- only 19 species known from this site, including 5 species of sunfish and 3 species of darters, but no intolerant species; dominant species is the Crescent Shiner; very possible that the flow in this stream becomes very reduced during dry periods and this may have caused the lower than expected NCIBI score and rating for a reference site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
GRASSY CR	SR 1300	05/26/09	NF33	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010102	36.47222222	-78.66444444	23-2-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	20.9	340	8	0.5	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	4.3
Specific Conductance (µS/cm)	104
pH (s.u.)	6.4

Water Clarity	Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	10
Riffle Habitat (16)	0
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	64

Site Photograph



Substrate	Cobble, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/26/09	2009-47	16	46	Good
06/09/99	99-43	15	46	Good

Most Abundant Species 2009	Highfin Shiner	Exotic Species 2009	Green Sunfish, Bluegill
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Species Change Since Last Cycle	Gains -- Golden Shiner (n=11), Green Sunfish (n=6), Pumpkinseed (n=7), Warmouth (n=3), Carolina Darter (n=1). Losses -- Crescent Shiner (n=31), Margined Madtom (n=3), Fantail Darter (n=54).
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Data Analysis

Watershed -- drains central Granville County, no municipalities in the watershed; tributary to Kerr Reservoir. **Habitats** -- primarily a run and slow moving pool upstream from the bridge, riffles absent, not much habitat in mid-channel, no coarse woody debris snags, some *Justicia* at the bridge, good riparian zones. **Water Quality** -- due to the low flow and pool conditions, the dissolved oxygen concentration was low, only at 48% of saturation. **2009** -- fewest fish collected at any site in 2009 (n=81), more than 650 fish were collected in 1999; metric scores and ratings for 2009 may be biased by this small sample size; Carolina Darter [Special Concern] collected for the first time. **1999 & 2009** -- only 19 species known from the site, including 3 species of darters, but no intolerant species; because it is a regional reference site, this site should be re-evaluated in 2014 or during a more normal flow year to determine if reference site status is still warranted.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
JOHNSON CR	SR 1440	05/26/09	NF36	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010102	36.53222222	-78.65861111	23-2-7-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	7.6	325	7	0.3	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	95	0	5	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	19.7
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	127
pH (s.u.)	6.3

Water Clarity	Clear, easily silted
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	5
Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph



Substrate	Cobble, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/26/09	2009-46	13	44	Good-Fair
04/28/04	2004-26	13	44	Good-Fair

Most Abundant Species 2009	Fantail Darter (46%)	Exotic Species 2009	Green Sunfish, Bluegill
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Species Change Since Last Cycle	Gains -- Golden Shiner, Chain Pickerel, Warmouth, Carolina Darter, Johnny Darter. Losses -- Satinfin Shiner, Margined Madtom, Snail Bullhead, Redbreast Sunfish. All species gained or lost were represented by 1-3 fish/species, except for Golden Shiner and Margined Madtom (n=8 and 53, respectively).
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Data Analysis

Watershed -- drains the extreme north-central part of Granville County and a small portion of southeast Mecklenburg County, VA; no municipalities in the watershed; tributary to Grassy Creek and Kerr Reservoir, site is ~ 3.8 miles above the creek's confluence with the reservoir. **Habitats** -- a regional reference site, a typical Carolina Slate Belt-type stream with very shallow pools and many riffles out of water; very low flow. **Water Quality** -- specific conductance has always been slightly elevated (129 µS/cm in 2004), the highest of any site in the basin in 2009. **2009** -- one-third fewer fish in 2009 than in 2004 (232 vs. 339), noticeably absent were Margined Madtom, and the number of Fantail Darters decreased from 190 to 107; fewest species of any site in 2009 (n=13); Carolina Darter [Special Concern] was collected for the first time; greater darter diversity and a higher percentage of omnivores+herbivores were offset by lower percentages of piscivores and species with multiple ages classes; lingering effects from drought may still be evident. **2004 & 2009** -- 18 species known from this site, including 3 species of darters; dominant species is the Fantail Darter; lower than expected metric scores for this small drainage area reference site are attributable to the very low flows during droughts and limited downstream re-colonization sources.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
ISLAND CR	SR 1445	NB45	08/13/09	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010102	36.495240	-78.504200	23-4	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	32.5	330	9	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	80	0	0	20 (Fallow Fields)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	22.7
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	103
pH (s.u.)	6.7

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	2
Bank Vegetation (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	72

Site Photograph



Substrate	Mostly sand and silt with one long cobble riffle.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/13/09	10811	---	21	---	5.05	Good
06/29/04	9421	---	17	---	5.48	Good-Fair
08/24/94	6693	---	17	---	5.12	Good-Fair

Taxonomic Analysis

Four additional EPT taxa were collected since sampling began in 1994. The pollution sensitive edge-dwelling caddisfly *Mystacides sepulchralis* was common at this site in 2009. Additionally, the intolerant mayfly taxa *Acerpenna macdunnoughi* and *Leucrocota spp.* were collected at this location. Other taxa not previously collected from this site include the Slate Belt Ecoregion endemic *Stenonema femoratum*; the stonefly *Leuctra spp.*; and the caddisflies *Pycnopsyche spp.* and *Hydroptila spp.*

Data Analysis

An improvement in water quality from Good-Fair in both 1994 and 2004 to Good in 2009 was observed at this sampling location. The EPTBI was the lowest and EPT taxa richness was the highest on BAU record at this sampling location suggesting a more intolerant benthic community and overall improved water quality. Upstream portions of this catchment are mostly rural with some agricultural land use. The site was not sampled in 1999 due to low flow conditions.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ISLAND CR	SR 1445	05/27/09	NF22	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010102	36.495	-78.50444444	23-4	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33.1	290	10	0.5	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	10	15	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

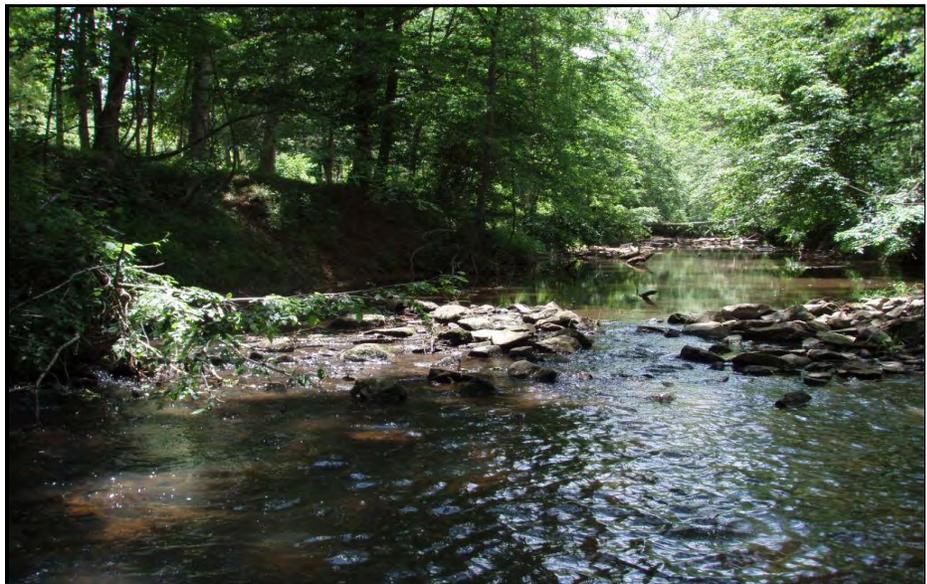
Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	5.5
Specific Conductance (µS/cm)	102
pH (s.u.)	6.4

Water Clarity: Slightly turbid, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	3
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	75

Site Photograph



Substrate: Cobble, gravel, sand, clay, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/16/10	2010-49	19	46	Good
05/27/09	2009-49	21	44	Good-Fair
06/09/99	99-44	24	54	Excellent
06/02/94	94-25	24	50	Good

Most Abundant Species 2009: Johnny Darter (20%) Exotic Species 2009: Green Sunfish, Bluegill, Redear Sunfish

Species Change Since Last Cycle (2009 vs. 2004)

Gains -- Comely Shiner, Pirate Perch, Eastern Mosquitofish, Pumpkinseed, Redear Sunfish. **Losses** -- Rosyside Dace, Rosefin Shiner, Mountain Redbelly Dace, Golden Redhorse, Creek Chubsucker, Margined Madtom, Brown Bullhead, Flat Bullhead, Chain Pickerel. All species gained or lost were represented by 1-6 fish/species, except for Pirate Perch, Rosefin Shiner, and Golden Redhorse (n=13, 59, and 91, respectively).

Data Analysis

Watershed -- drains northeastern Granville and and northwestern Vance counties; no municipalities in the watershed; tributary to Kerr Reservoir. **Habitats** -- root mats, snags, pools, short, shallow riffles. **Water Quality** -- specific conductance has ranged from 90 to 106 µS/cm. **2009** -- the number of fish collected in 2009 was one-fourth the number in 1999 (208 vs. 895); the Crescent Shiner, the dominant species in 1999, was essentially absent in 2009 (435 vs. 1); greatest diversity of sunfish than at any other site (n=6); very skewed trophic structure along with decreases in the total number of fish and diversity of suckers were responsible for the decline in the NCIBI score and rating; lingering drought impacts. **1994 - 2009** -- diverse community with 30 species known from the site, including 6 species of sunfish, 3 species of suckers, and 3 species of darters including the Carolina Darter [Special Concern]; but no intolerant species; in 1994 and 1999 the dominant species was the Crescent Shiner. **Note:** the site was re-sampled in 2010 following a wetter winter and spring flow period and the community was rated Good.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NUTBUSH CR	SR 1317	NB49	08/12/09	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
VANCE	6	03010102	36.368770	-78.408520	23-8-(1)b	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	7.0	330	8	0.2

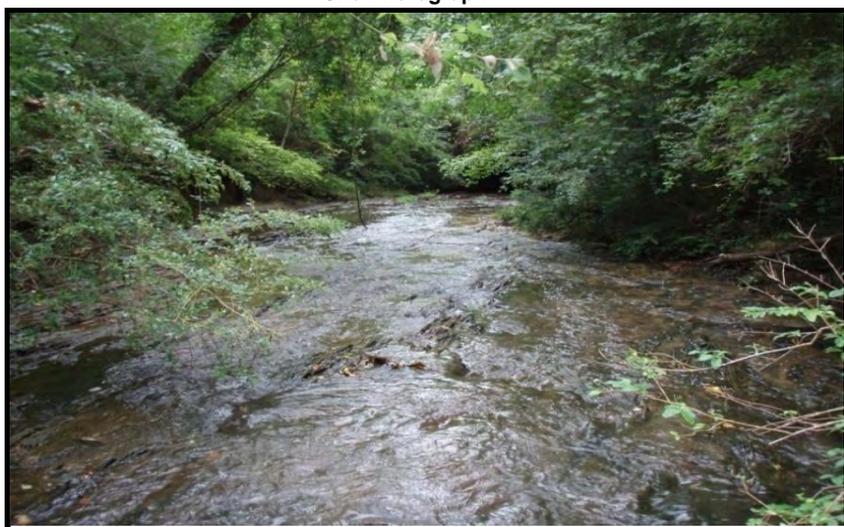
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	80	20	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Henderson Water Reclamation Facility	NC0020559	6.0

Water Quality Parameters

Temperature (°C)	25.9
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	416
pH (s.u.)	7.4
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	12
Bank Erosion (7)	3
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Substrate	Good mix of bedrock, boulder, rubble, and sand.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/12/09	10810	57	12	6.54	6.03	Fair
06/29/04	9420	64	9	7.00	6.70	Fair
08/25/99	7989	41	8	6.73	6.75	Fair
10/28/94	6738	50	8	6.74	6.31	Fair
08/24/94	6694	44	8	6.84	6.89	Fair

Taxonomic Analysis

A tolerant macroinvertebrate community was observed at this Basinwide sampling location in 2009. No stoneflies were collected at the site. *Maccaffertium modestum* and *Baetis flavistriga* were the abundant tolerant mayflies collected at the site. These mayfly species commonly occur in NC piedmont streams. The tolerant filter-feeding caddisfly taxa *Cheumatopsyche* spp. and *Hydropsyche betteni* were also abundant. A rarely collected mayfly *Paracloeodes fleeki* was common at this location. This taxa is generally collected in degraded streams. The organic pollution tolerant *Dicrotendipes neomodestus* was abundant along with other tolerant chironomids such as *Phaenopsectra punctipes* gr., *Polypedilum illinoense* gr., and *P. scalaenum* gr. Only two intolerant taxa were collected including the caddisfly *Chimarra* spp. and the beetle *Psephenus herricki*.

Data Analysis

This stream received a bioclassification of Fair in 2009 despite the highest EPT taxa richness and lowest EPTBI and NCBI on record at this station. A generally tolerant benthic community was found at this location. A more diverse macroinvertebrate community would be expected due to adequate habitat found at the site. Conductivity was the highest compared to all other Roanoke Basinwide sites at 416 µS/cm. This is most likely due to the WWTP located approximately 1 mile upstream. In 2009, the elevated conductivity was lower than in 1999 (633 µS/cm) and in 2004 (501µS/cm) and dissolved oxygen was higher in 2009 potentially paralleling decreases in biotic indices. This site has been issued permit violations in the past and continues to suffer degraded conditions most likely from point source inputs.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SIXPOUND CR	SR 1306	NB51	08/13/09	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WARREN	7	03010106	36.510000	-78.079444	23-13	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	9.6	220	7	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	-	-

Water Quality Parameters

Temperature (°C)	23.8
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	62
pH (s.u.)	6.6
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	5
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Substrate	Sand and silt was the dominant substrata.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/13/09	10812	58	13	5.75	4.69	Good-Fair
06/29/04	9418	62	15	6.43	5.44	Good-Fair
07/16/99	7923	54	14	5.50	5.03	Good-Fair
08/22/94	6643	12	12	5.51	5.51	Fair

Taxonomic Analysis

Only one stonefly larvae was collected at the sampling location. EPT taxa richness was low (13) and most are tolerant and common taxa found in North Carolina Piedmont streams. The intolerant caddisfly *Pycnopsyche* spp. was abundant at the site. Chironomid richness (12) and biomass was low with tolerant and slightly intolerant taxa present. No chironomid taxa were abundant at the site. Odonate richness (11) was high and several taxa were common or abundant at the site including *Argia* spp., *Boyeria vinosa*, *Calopteryx* spp., *Gomphus* spp., and *Macromia* spp.

Data Analysis

No NPDES dischargers are located upstream from this location and land use is mostly rural with some agricultural portions. This site received a bioclassification of Good-Fair for the third year in a row. The NCBI and EPTBI dropped since 2004 potentially due to half as many chironomid taxa present in 2009. Also *Pycnopsyche* spp. were found rare at the site in 2004 and abundant in 2009. It was noted that water in the channel in certain sections did not reach the bottom of both banks, flows were low, and detritus was abundant similar to that found in swamp-like conditions. These observations and the presence of so many odonates suggests the site suffers from low flow conditions. Physical parameters such as infrequent embedded riffles and low flows may limit habitat necessary for colonization of some rheophilic macroinvertebrates such as long-lived stonefly taxa.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
DEEP CR	US 158	NB54	02/03/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010106	36.451389	-77.781944	23-24-(1)	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	23.3	145	7	0.5

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (US 158)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	6.5
Dissolved Oxygen (mg/L)	11.4
Specific Conductance (µS/cm)	69
pH (s.u.)	5.9
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Substrate	Rubble, gravel, sand, silt, and detritus.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/03/09	10527	67	21	6.11	5.06	Natural
02/23/04	9339	63	23	5.54	4.42	Natural

Taxonomic Analysis

The primary reason for the jump in EPTBI in 2009 relative to previous samples was the first time collection of the pollution tolerant mayflies *Caenis spp.* and *Stenacron interpunctatum*. In addition, several intolerant stoneflies collected in 2004 were absent in 2009 (*Shipsa rotunda* and *Eccoptura xanthenes*) as was the intolerant caddisfly *Neophylax oligius*. The 2009 assessment produced a substantial increase in the diversity and abundance of pollution-tolerant chironmids relative to the the 2004 sample. Indeed the 2009 sample produced 23 chironomid taxa while the 2004 sample had 12. This shift in community composition was largely responsible for the increase in the BI from 2004 to 2009.

Data Analysis

Bioclassification and macroinvertebrate metrics have generally been stable at this location since sampling commenced in 2004 with both winter samples producing Natural bioclassifications. However, the slight increase in both the BI and EPTBI in 2009 relative to the 2004 sample correlates to the increasing trend in conductivity observed at this site as previous measurements in 1999 (21 µS/cm) and 2004 (47 µS/cm) were much lower than the 2009 measurement (69 µS/cm). These data combined may suggest a slight decrease in overall physical conditions at this site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
DEEP CR	US 158	05/27/09	NF45	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010106	36.45138889	-77.7825	23-24-(1)	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	23.5	145	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	89
pH (s.u.)	6.6

Water Clarity Clear, slightly tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	10
Riffle Habitat (16)	5
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Site Photograph



Substrate Gravel, cobble, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/16/10	2010-50	22	48	Good
05/27/09	2009-48	18	38	Fair
05/26/04	2004-59	28	46	Good
09/21/94	94-39	21	50	Good

Most Abundant Species 2009 Spottail Shiner (37%) Exotic Species 2009 Green Sunfish, Bluegill

Species Change Since Last Cycle (2009 vs. 2004)

Gains -- Eastern Silvery Minnow, Notchlip Redhorse, Flier. **Losses** -- Crescent Shiner, Rosefin Shiner, Satfin Shiner, Creek Chubsucker, V-lip Redhorse, Flat Bullhead, Redfin Pickerel, Eastern Mudminnow, Eastern Mosquitofish, Pumpkinseed, Warmouth, Redear Sunfish, Largemouth Bass. All species gained or lost were represented by 1-9 fish/species, except for Eastern Mosquitofish, Flat Bullhead, and Satfin Shiner (n= 11, 14, and 21, respectively).

Data Analysis

Watershed -- drains north-central Halifax County; no municipalities in the watershed; tributary to Roanoke Rapids Lake, site is ~ 1.4 miles upstream from the reservoir. **Habitats** -- straddles the Northern Outer Piedmont and the Rolling Coastal Plain Level IV ecoregions; good root mats, snags, undercuts, deadfalls, short and shallow riffles, high quality riparian zones. **2009** -- number of fish collected was not much lower than in 2004 (289 vs 316), but 10 fewer species were present; very low percentage of the species with multiple age classes (28%); high percentage of tolerant fish (primarily Redbreast Sunfish and Green Sunfish); skewed trophic structure due to the abundance of the omnivorous Spottail Shiner. **1994 - 2009** -- very diverse community, 31 species known from the site, including 8 species of sunfish, 5 species of catfish, but no intolerant species; in 1994 and 2004 the dominant species was the Redbreast Sunfish. **Note:** the site was re-sampled in 2010 following a wetter winter and spring flow period and the community was rated Good.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
DEEP CR	US 158	NB54	02/03/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010106	36.451389	-77.781944	23-24-(1)	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	23.3	145	7	0.5

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (US 158)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	6.5
Dissolved Oxygen (mg/L)	11.4
Specific Conductance (µS/cm)	69
pH (s.u.)	5.9
Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Site Photograph



Substrate	Rubble, gravel, sand, silt, and detritus.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/03/09	10527	67	21	6.11	5.06	Natural
02/23/04	9339	63	23	5.54	4.42	Natural

Taxonomic Analysis

The primary reason for the jump in EPTBI in 2009 relative to previous samples was the first time collection of the pollution tolerant mayflies *Caenis* spp. and *Stenacron interpunctatum*. In addition, several intolerant stoneflies collected in 2004 were absent in 2009 (*Shipsa rotunda* and *Eccoptura xanthenes*) as was the intolerant caddisfly *Neophylax oligius*. The 2009 assessment produced a substantial increase in the diversity and abundance of pollution-tolerant chironmids relative to the the 2004 sample. Indeed the 2009 sample produced 23 chironomid taxa while the 2004 sample had 12. This shift in community composition was largely responsible for the increase in the BI from 2004 to 2009.

Data Analysis

Bioclassification and macroinvertebrate metrics have generally been stable at this location since sampling commenced in 2004 with both winter samples producing Natural bioclassifications. However, the slight increase in both the BI and EPTBI in 2009 relative to the 2004 sample correlates to the increasing trend in conductivity observed at this site as previous measurements in 1999 (21 µS/cm) and 2004 (47 µS/cm) were much lower than the 2009 measurement (69 µS/cm). These data combined may suggest a slight decrease in overall physical conditions at this site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
DEEP CR	US 158	05/27/09	NF45	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010106	36.45138889	-77.7825	23-24-(1)	Northern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	23.5	145	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	89
pH (s.u.)	6.6

Water Clarity Clear, slightly tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	10
Riffle Habitat (16)	5
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Site Photograph



Substrate Gravel, cobble, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/16/10	2010-50	22	48	Good
05/27/09	2009-48	18	38	Fair
05/26/04	2004-59	28	46	Good
09/21/94	94-39	21	50	Good

Most Abundant Species 2009 Spottail Shiner (37%) Exotic Species 2009 Green Sunfish, Bluegill

Species Change Since Last Cycle (2009 vs. 2004)

Gains -- Eastern Silvery Minnow, Notchlip Redhorse, Flier. **Losses** -- Crescent Shiner, Rosefin Shiner, Satinfin Shiner, Creek Chubsucker, V-lip Redhorse, Flat Bullhead, Redfin Pickerel, Eastern Mudminnow, Eastern Mosquitofish, Pumpkinseed, Warmouth, Redear Sunfish, Largemouth Bass. All species gained or lost were represented by 1-9 fish/species, except for Eastern Mosquitofish, Flat Bullhead, and Satinfin Shiner (n= 11, 14, and 21, respectively).

Data Analysis

Watershed -- drains north-central Halifax County; no municipalities in the watershed; tributary to Roanoke Rapids Lake, site is ~ 1.4 miles upstream from the reservoir. **Habitats** -- straddles the Northern Outer Piedmont and the Rolling Coastal Plain Level IV ecoregions; good root mats, snags, undercuts, deadfalls, short and shallow riffles, high quality riparian zones. **2009** -- number of fish collected was not much lower than in 2004 (289 vs 316), but 10 fewer species were present; very low percentage of the species with multiple age classes (28%); high percentage of tolerant fish (primarily Redbreast Sunfish and Green Sunfish); skewed trophic structure due to the abundance of the omnivorous Spottail Shiner. **1994 - 2009** -- very diverse community, 31 species known from the site, including 8 species of sunfish, 5 species of catfish, but no intolerant species; in 1994 and 2004 the dominant species was the Redbreast Sunfish. **Note:** the site was re-sampled in 2010 following a wetter winter and spring flow period and the community was rated Good.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
QUANKEY CR	NC 903	NB59	02/03/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010107	36.353333	-77.643889	23-30a	Rolling Coastal Plain

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	33.6	113	5	0.5

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (NC 903)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	6.6
Dissolved Oxygen (mg/L)	10.6
Specific Conductance (µS/cm)	74
pH (s.u.)	5.4

Water Clarity	Tannic
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Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	0
Bank Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Site Photograph



Substrate	Gravel, sand, silt, and detritus.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/03/09	10528	51	15	5.80	4.77	Natural
02/23/04	9351	52	17	5.81	4.05	Natural
02/16/99	7823	40	9	6.66	5.93	Natural

Taxonomic Analysis

Pollution tolerant taxa present in 1999 but absent from 2004 and 2009 include the oligochaete *Limnodrilus spp.*, the gastropod *Physa spp.*, the beetle *Tropisternus spp.*, and the chironomids *Dicrotendipes neomodestus*, and *D. nervosus*. Conversely, many pollution intolerant taxa were present in 2004 and 2009 but absent in 1999 and included the mayfly *Ephemerella doris*, the caddisfly *Ceraclea transversa* and *Polycentropus spp.* Most notably, the 1999 sample lacked nine stonefly taxa collected from the subsequent samples that included *Allocapnia spp.*, *Suwallia basalis*, *Leuctra spp.*, *Shipsa rotunda*, *Perlesta spp.*, *Perlinella drymo*, *Clioerla clio*, *Isoperla namata*, and *I. transmarina*.

Data Analysis

The 2009 sample continues the trend of improving benthic macroinvertebrate community metrics from the first sample here in 1999. The S, EPTS, BI and EPTBI have all improved in 2004 and 2009 from the initial assessment. Although specific conductance has been fairly stable here with the 1999 sample resulting in a measurement of 70 µS/cm, 61 µS/cm in 2004, and 74 µS/cm in 2009, the benthic macroinvertebrate data suggest improving physical conditions at this site since 1999.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
KEHUKEE SWP	SR 1804	NB55	02/03/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010107	36.129167	-77.363333	23-42	Southeastern Floodplains and Low Terraces

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	19.2	44	6	0.6

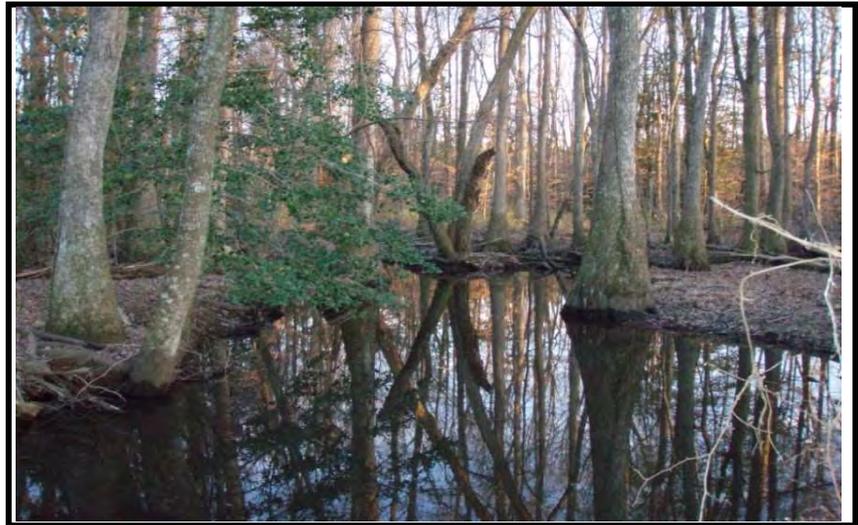
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	6.6
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	93
pH (s.u.)	5.4
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	18
Bottom Substrate (15)	6
Pool Variety (10)	10
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Substrate	Sand, silt, and detritus,
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/03/09	10598	66	12	6.79	6.06	Natural
02/24/04	9343	46	7	7.08	5.89	Moderate
02/11/99	7811	59	8	7.11	6.64	Moderate

Taxonomic Analysis

The 2009 sampled produced the highest EPT taxa richness and the lowest BI since sampling commenced here in 1999. EPT taxa present in 2009 but absent previously included the intolerant caddisflies *Triadenodes ignitus*, *Ptilostomis spp.*, and *Chimarra spp.*. Additionally, several tolerant taxa that were either abundant or common in previous collections were absent or rare in 2009 including the molluscs *Physa spp.*, *Micromenetus dilatatus*, and *Sphaerium spp.*

Data Analysis

The 2009 collection established the highest EPT, ST and the lowest BI since sampling first started here in 1999 and resulted in a subsequent improvement in the bioclassification to Natural. Although the specific conductance was somewhat higher in 2009 (92 µS/cm) relative to 2004 (78 µS/cm) and 1999 (74 µS/cm), the evidence based on the shift from a facultative benthic macroinvertebrate community to a slightly more pollution intolerant community suggest an overall improvement in conditions at this site from previous samples. This improvement may be related to a decrease in non-point pollution as a result of the drought.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CONOHO CR	NC 11-42	NB93	02/03/09	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Martin	9	03010107	35.971667	-77.295278	23-49a	Mid-Atlantic Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	38.5	42	6	0.6

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	---	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	3.9
Dissolved Oxygen (mg/L)	11.6
Specific Conductance (µS/cm)	143
pH (s.u.)	5.2
Water Clarity	clear/tannic

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	15
Bottom Substrate (15)	5
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	10
Bank Vegetation (7)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Substrate	Mostly silt with detrital pools, some sand.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/03/09	10599	29	3	7.20	6.78	Moderate
02/25/04	9345	31	4	7.70	7.10	Moderate

Taxonomic Analysis

Only the second time sampled, there was a 25% reduction in EPT taxa richness from 4 species obtained in 2004 to 3 species in 2009. The winter stonefly *Taeniopteryx* and the silt-loving mayfly *Caenis* were absent in 2009 while the caddisfly *Polycentropus* was collected for the first time. Additionally, fewer tolerant crustaceans, oligochaetes, and midges were also collected in 2009 leading to a decrease in the overall benthic biotic index.

Data Analysis

Located just northeast of Oak City, this headwater segment of Conoho Creek is mostly forested in the immediate vicinity of the sampling site although the catchment is overwhelmingly dominated by agricultural farms. A total absence of NPDES permitted dischargers indicates the high specific conductance measured is a result of nonpoint source runoff. Despite the presence of good macroinvertebrate habitat and decent flows, Conoho Creek received a Moderate bioclassification, driven in part by the paucity of EPT taxa. However, this Moderate rating is on the cusp of a Natural rating, as it was in 2004, leading to the conclusion that the water quality in this stream has not changed since that time.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CONOHO CR	SR 1417	NB67	02/04/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Martin	9	03010107	35.885556	-77.124444	23-49b	Mid-Atlantic Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	98.2	12	8	0.6

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	---	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	4.5
Dissolved Oxygen (mg/L)	10.7
Specific Conductance (µS/cm)	177
pH (s.u.)	5.3
Water Clarity	clear/tannic

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	16
Bottom Substrate (15)	5
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	10
Bank Vegetation (7)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	85

Substrate	Detritus with silt, some sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/04/09	10600	32	6	6.43	5.23	Natural
02/24/04	9344	38	6	6.80	5.40	Natural
02/24/99	7834	39	5	6.27	4.80	Natural

Taxonomic Analysis

This sampling site maintained its EPT richness of 6 taxa from the previous sampling event. Two species of mayflies collected in 2004, *Caenis* and *Eurylophella doris* were absent in 2009 as was the caddisfly *Platycentropus*. *Ironoquia punctatissima*, a caddisfly often found in swamp-like conditions, was collected for the first time in 10 years. Additionally, total taxa richness decreased from 2004 levels reflected in fewer tolerant midges, oligochaetes and crustacea collected. Although still higher than that measured in 1999, the biotic index was lower than in 2004 due in part to the more intolerant EPT community observed.

Data Analysis

This sampling site is low in the watershed of Conoho Creek and is very large. Much like the upstream site, agriculture dominates the landuse of Conoho Creek's watershed. Non-point source pollutants are likely diluted by the time they reach this segment and thereby have less impact on the macroinvertebrate community. Although this site did receive a Natural rating compared to the upstream rating (Moderate), the upstream site very nearly obtained a Natural rating suggesting water quality differences between these two sites are not so great. The macroinvertebrate community here appears to be relatively stable.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HARDISON MILL CR	SR 1528	NB69	02/04/09	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MARTIN	9	03010107	35.764722	-77.006111	23-50-3	Mid-Atlantic Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	49.7	18	11	0.7

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	5.8
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	179
pH (s.u.)	4.3
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	11
Instream Habitat (20)	15
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Substrate	Detritus and silt.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/04/09	10601	15	1	7.61	6.40	Moderate
02/24/04	9331	36	2	7.54	5.20	Moderate
02/12/99	7817	27	3	7.32	7.67	Moderate

Taxonomic Analysis

The 2009 sample produced a drastic decline in chironomid taxa relative to previous collections. Given the increase in specific conductance, it would have been expected that the diversity of the generally pollution tolerant chironomids would have increased or at least maintained levels previously recorded from this station. It is unclear as to why this reduction was observed in 2009 but it might be related to the very low pH (4.3) which was lower than previous collections (4.6 in 2004, 5.5 in 1999). However, the most significant change in this community was the total absence of the flow-dependent blackflies *Simulium spp.* and *Stegopterna spp.* which were both abundant or common from all previous collections. Their absence in 2009 strongly suggests that poor flows have been persistent at this location and may have had a role in the lowered ST and higher BI although the extremely low pH likely exacerbated this condition.

Data Analysis

Although the ST and EPT metrics reached all time lows for 2009, the BI, although higher, was generally comparable to previous collections. Moreover, the EPTBI in 2009 was intermediate between the two previous records. The primary difference in the benthic macroinvertebrate community observed at this location in 2009 relative to previous assessments was the drastic decrease in the diversity of chironomid larvae. Indeed, only two chironomid taxa were collected in 2009 versus 20 in 2004 and seven in 1999. The absence of the flow-dependent blackflies suggest that there have been persistent low flow conditions at this site. Indeed, flow conditions were marginal at the time of sampling. This likely explains, at least in part, the increased BI and lowered ST. However, specific conductance at this site was drastically higher in 2009 (179.1 µS/cm) versus levels measured in 2004 (58 µS/cm) and 1999 (65µS/cm). Consequently, deleterious anthropogenic influence at this station cannot be ruled out. In addition to the low flows and elevated conductivity, the very low pH likely played a role in the decline in the invertebrate community. Indeed, benthic macroinvertebrate communities are known to degrade with very low pH.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CASHIE R	SR 1219	NB75	02/05/09	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BERTIE	10	03010107	36.123611	-77.121667	24-2-(1)a	Mid-Atlantic Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Sw	35.4	45	6	0.6

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Lewiston-Woodville WWTP (~2.5 miles upstream)	NC0023116	0.15

Water Quality Parameters

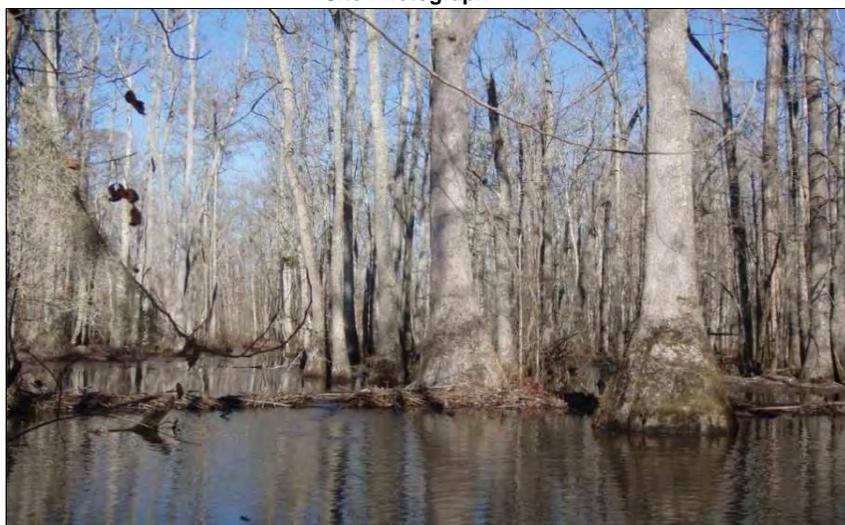
Temperature (°C)	2.2
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	190
pH (s.u.)	4.7

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	9
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate Detritus and fine particulate organic matter was dominant.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/05/09	10602	26	2	8.15	7.10	Moderate
02/23/04	9328	29	3	7.49	7.03	Moderate
02/11/99	7812	41	6	7.51	7.24	Natural
06/26/84	3242	41	2	8.20	7.00	Not Rated
07/14/83	3057	34	2	8.55	7.00	Not Rated

Taxonomic Analysis

A mostly tolerant benthic community was observed at this sampling location in 2009. No stoneflies or mayflies were collected at this monitoring station. Caddisflies present in the sample included *Isonychia punctatissima* and *Ptilostomis* spp. These are common somewhat tolerant caddisflies found in North Carolina swamp benthic communities. Chironomid taxa richness was also low (8) with only two taxa that were common and abundant including *Orthocladius obumbratus* and the recently described *Tvetenia* sp. NC (Epler 2001) respectively.

Data Analysis

A Moderate bioclassification was retained at this site in 2009. Total taxa richness (26) and EPT taxa richness (2) dropped slightly compared to 2004. The NCBI was elevated from the 2004 sample. Despite the Moderate bioclassification, water quality parameters suggests some degradation. Conductivity was twice as high (190 µS/cm) and acidic conditions (pH=4.7) were observed in 2009 compared to 1999 (82 µS/cm, pH=6.2). Physico-chemical data was not collected at this site in 2004. The elevated conductivity suggest the possibility of upstream point source pollution inputs from the Lewiston-Woodville WWTP. Additionally, naturally acidic waters occur in North Carolina swamp ecosystems and can lead to reductions in benthic taxa richness. A small beaverdam was observed within the sampling area in 2004 and 2009 and low flow conditions with nearly homogenous detrital substrate were noted in 2009 compared to other Roanoke Basinwide swamp sites. This lack of flow and lack of mixed substrate could lead to the absence of some mayflies and stoneflies adapted to those conditions.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CASHIE R	SR 1257	NB76	02/09/09	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BERTIE	10	03010107	36.047778	-76.985556	24-2-(1)b	Mid-Atlantic Floodplains and Low Terraces

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C ₁ Sw	108.6	10	8	0.7

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Lewiston-Woodville WWTP (>4 miles upstream)	NC0023116	0.15

Water Quality Parameters

Temperature (°C)	4.4
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	133
pH (s.u.)	5.1

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	17
Bottom Substrate (15)	5
Pool Variety (10)	9
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph



Substrate	Fine particulate organic matter and detritus was dominant.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/09/09	10603	34	3	7.40	6.59	Moderate
02/24/04	9330	35	7	6.59	4.90	Natural
02/15/99	7827	34	7	6.80	6.09	Natural

Taxonomic Analysis

EPT taxa collected at this station were similar to that upstream including the caddisflies *Isonychia punctatissima* and *Ptilostomis spp.*. Additionally, the winter stonefly *Taeniopteryx spp.* was collected in abundance at this monitoring station. A low chironomid taxa richness (11) was present at this location similar to upstream, however, intolerant chironomid taxa were present in the sample including *Eukiefferiella devonica gr.* and *Lopescladius spp.*. Rarely collected chironomid taxa in the sample included *Parakiefferiella sp. D* and *Tvetenia sp. NC*. The swamp endemic megalopteran *Chauliodes rasticornis* was found rare at the site.

Data Analysis

Total taxa richness remained similar to samples in the past, however, EPT taxa richness dropped from seven taxa in 1999 and 2004 to only three in 2009. This drop in EPT richness in addition to the highest NCBI and EPTBI recorded from this site lowered the bioclassification from Natural in 2004 to Moderate in 2009. Habitat parameters in 2009 (86) were higher than that observed in 2004 (70), yet similar to that observed in 1999 (85) suggesting no reduction in the bioclassification due to physical parameters. More acidic conditions were found in 2009 (pH=5.1) compared to 2004 (pH=5.6) and 1999 (pH=6.4) which could lead to the recent depletion of EPT taxa. Additionally, conductivity was elevated in 2009 (133 µS/cm) compared to in 2004 (64 µS/cm) and 1999 (72 µS/cm) similar to the upstream site at SR 1219 suggesting inputs from an upstream discharger or another unknown source.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HOGGARD MILL CR	SR 1301	NB78	02/05/09	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BERTIE	10	03010107	36.025000	-76.951389	24-2-6	Mid-Atlantic Floodplains and Low Terraces

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Sw	48.2	5	4	0.5

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	10	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	3.4
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	89
pH (s.u.)	5.1
Water Clarity	Tannic

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	12
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	77

Substrate	Sand, silt, and detritus.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/05/09	10604	24	3	7.40	7.57	Moderate
02/23/04	9327	30	3	7.18	5.65	Moderate
02/15/99	7826	46	7	6.81	6.38	Natural

Taxonomic Analysis

The 2009 sample continues the trend observed here since the 1999 collection in that there has been a decline in intolerant taxa and an increase in tolerant taxa. For 2009, this trend in reduced presence (or total absence) of intolerant taxa is exemplified by the lack of the stonefly *Amphinemura spp.*, a substantial decrease in the abundance of the stonefly *Taeniopteryx spp.* (abundant in 1999 and 2004, rare in 2009), the absence of the caddisfly *Platycentropus spp.*, and the first time appearance of the the tolerant beetle *Coptotomus spp.*, the hemipteran *Pelocoris spp.*, as well as the tolerant chironomids *Cricotopus annulator* and *Cricotopus bicinctus*.

Data Analysis

As can be seen from the BI (and to a lesser extent the EPTBI data), as well as the ST and (to a lesser extent) the EPTS, the benthic macroinvertebrate community metrics continue to decline at this site since its first assessment in 1999. The data show a continuing shift from pollution intolerant taxa to more pollution tolerant taxa. It is possible that the prolonged drought may have resulted in very low flow conditions at this site for much of the year before the February sample and that may have caused natural stress due to lowered dissolved oxygen levels. Although dissolved oxygen data is extremely variable, it does not support this conclusion as the dissolved oxygen levels in 2009 (10.2 mg/l) was higher than in either 2004 (8.9 mg/l) or 1999 (8.6 mg/l). Conversely, the much higher specific conductance at this location (89.4 µS/cm) in 2009 relative to levels measured from previous observations in 2004 (60 µS/cm) and 1999 (70 µS/cm) may suggest a possible anthropogenic component to the increasing biotic indices observed at this location since 1999.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
ROQUIST SWP	US 17	NB80	02/06/09	Natural

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BERTIE	10	03010107	35.941667	-76.962222	24-2-7	Mid-Atlantic Floodplains and Low Terraces

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Sw	45.7	10	6	0.6

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (US 13/17)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

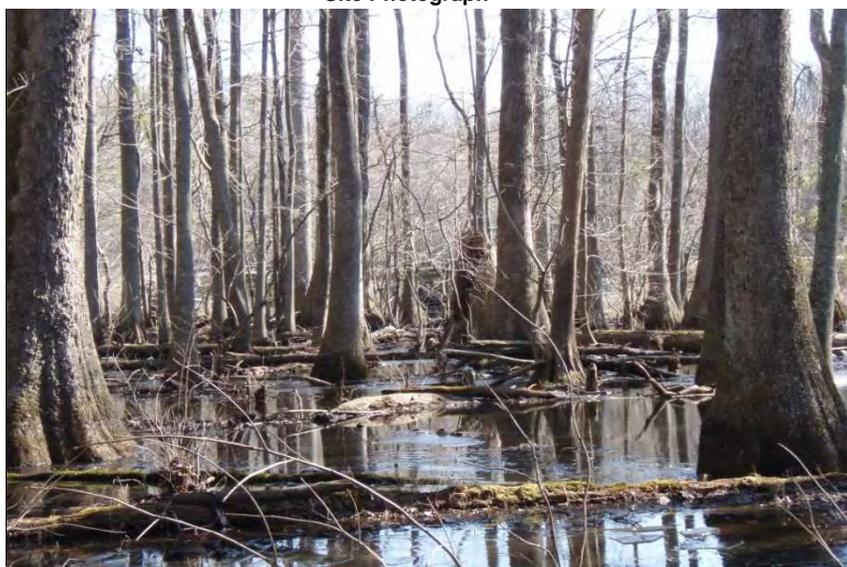
Temperature (°C)	0.8
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	83
pH (s.u.)	5.0

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	13
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph



Substrate	Sand, silt, and detritus.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/06/09	10605	30	3	6.73	2.28	Natural
02/24/04	9329	38	4	7.14	6.46	Natural
02/11/99	7813	31	4	6.99	5.50	Natural

Taxonomic Analysis

The 2009 collection produced the first record at this location for the facultative caddisfly *Ptilostomis* spp. and the intolerant caddisfly *Lepidostoma* spp. In addition, the previous two collections included the collection of the pollution tolerant mayfly *Caenis* spp. but was absent in 2009. Other pollution tolerant taxa collected from 1999 and 2004 but absent from 2009 sample included the chironomids *Kiefferulus* spp, *Procladius* spp, as well as the gastropods *Micromenetus dilatatus* and *Ferrissia* spp.

Data Analysis

Although the ST and EPT have been relatively stable at this site since sampling commenced in 1999 the EPTBI and BI both dropped in 2009 with the EPTBI dropping substantially. The decline in both the EPTBI and BI were due to the presence of several intolerant taxa collected for the first time in 2009 and the lack of several pollutant tolerant taxa absent from the 2009 collection but present in the previous samples. The shift in the benthic macroinvertebrate community represented by these taxa from 2009 relative to the 2004 and 1999 collections may reflect the drought and the reduced presence of non-point runoff at this site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
QUANKEY CR	US 301/NC 903/NC 125	06/18/09	NF46	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HALIFAX	8	03010107	36.318589	-77.594832	23-30b	Rolling Coastal Plain

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33.6	65	6	0.4	No

Visible Landuse (%)	Forested/Wetland	Residential	Agriculture	Other (describe)
	95	5	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	22.0
Dissolved Oxygen (mg/L)	5.4
Specific Conductance (µS/cm)	120
pH (s.u.)	5.6

Water Clarity	Clear, tannin stained
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph



Substrate	Gravel, cobble, boulder, clay, silt
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/18/09	2009-66	24	50	Good

Most Abundant Species 2009

Eastern Silvery Minnow (16%),
 Redbreast Sunfish (15%), Bluehead
 Chub (14%)

Exotic Species 2009

Bluegill

Species Change Since Last Cycle

N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains east-central Halifax County including the southern portion of the Town of Halifax; tributary to the Roanoke River; site is ~ 2 miles upstream of the creek's confluence with the river. **Habitat** -- upstream from the bridge Coastal Plain-like, downstream from the bridge Piedmont-like gorge with very high quality instream and riparian habitats -- riffles, runs, pools, *Podostemum*, and bluffs along both banks. **Water Quality** -- dissolved oxygen saturation only 62%; pH less than 6 s.u., but upstream watershed is swamp-like where low pH values are to be expected. **2009** -- a very diverse fish community with Coastal Plain and Piedmont species present, but only one species of sucker, one intolerant species, and only two species of darters; some evidence of nutrient enrichment based upon the high percentage of omnivores+herbivores collected such as Eastern Silvery Minnow, Bluehead Chub, and Spottail Shiner.