Nansemond River Preservation Alliance

Baseline Levels of Pollution in the Nansemond River as of 2010

Prepared by the NRPA Water Quality Committee

Introduction

This Report serves as the supporting document for the *2010 State of the Nansemond Report*. Specifically, the statistics in this Report served as the basis for the letter grades (A – F) assigned by the Water Quality Committee to each pollution parameter in the *2010 State of the Nansemond Report*. Also, establishing a baseline will allow NRPA to track pollution remediation progress.

The tables on the following pages compare measured pollution levels and measured dissolved oxygen levels with Virginia Department of Environmental Quality (DEQ) water quality standards or stress threshold levels. Measured levels are also compared with levels from minimally impaired streams where applicable. Parameters reported include 1) fecal bacteria, 2) total nitrogen, 3) total phosphorus and 4) dissolved oxygen. The statistics in the tables were derived from the DEQ's data base of measured levels in the Nansemond River from 1985 through 2010; which database James Beckley of DEQ was kind enough to share with NRPA.

The x-y charts, appended as j.peg files, show how actual pollution levels varied over time. The fecal coliform charts have linear (best fit) trend lines.

Water clarity (using a Secchi Disk) will be measured extensively in 2011. Secchi Disk readings from minimally impaired streams are listed below for reference purposes.

Water Quality Standards and Levels for Minimally Impaired Streams

1. Bacteria

In 2003, DEQ began measuring Enterococci bacteria in addition to fecal coliform bacteria. The standard for Enterococci bacteria (stated as a geometric mean) is 35 colonies per 100 mL.

However, the Virginia Department of Health/Division of Shellfish Sanitation continues to monitor for fecal coliform bacteria. DEQ impairment threshold levels for fecal coliform bacteria (stated as geometric means) are listed below for the following designated uses:

Shellfish harvesting: 14 cfu/100mL[1] Recreation (swimming): 200 cfu/100mL

Waters with fecal coliform levels above these thresholds are deemed impaired. In addition, VDH considers the 90th percentile of data samples when deciding whether to open waters for shellfish harvesting.

Statistics for both fecal coliform and Enterococci bacteria are tabulated on the following pages.

[1] Cfu stands for colony forming units.

It is important to note that salinity levels in the upper half of the Nansemond are typically too low to support an oyster population. The appropriate designated use for the upper half of the Nansemond is therefore recreation (swimming, etc.).

2. Total nitrogen, phosphorus

Nutrient related problems such as algae blooms may start when total nitrogen levels exceed 1 mg/L. Minimally impaired streams have typical nitrogen levels of < 0.07 mg/L. Nutrient related problems such as algae blooms may start when total phosphorus levels exceed 0.1 mg/L. Minimally impaired streams have typical phosphorus levels of <0.003 mg/L.

3. Dissolved oxygen

The minimum dissolved oxygen level (threshold) necessary to support marine life is 5 mg/L. Minimally impaired streams have significantly higher levels of dissolved oxygen.

4. Water clarity

Water clarity (Secchi Disk) readings for minimally impaired streams typically exceed 1.0 meters.

Comments on the Results

Bacteria in the Nansemond – A Tale of Two Rivers

Shown in Table 1 are fecal coliform bacteria levels taken from eight test sites in the Nansemond River over the period from 1980 to 2005. For purposes of discussion, we have divided the Nansemond River into two zones; **upper**, from downtown to Station SDH 16 and **lower,** from the Rt. 125 Bridge north to the mouth. Table 1 clearly shows a gradient from the mouth of the Nansemond to downtown Suffolk. Geometric mean levels at the Rt. 460 Bridge site and the Shingle Creek site in the **upper** Nansemond greatly exceed the impairment threshold for recreation. The 90th percentile of data samples at SDH 16 and BASF in the **upper** Nansemond also exceed the threshold for recreation.

Table 1 - Fecal Coliform Bacteria Levels in the Nansemond River, 1985 – 2005

Station ID	Description	Samples	Geometric mean	90th Percentile	Impair. Threshold
Lower Nansemond					
2NAN000.20	Mouth	108	6.0 cfu/100mL	23.2 cfu/100mL	14 cfu/100mL
2NAN002.77	Rt. 17 Bridge	116	8.2 cfu/100mL	70.0 cfu/100mL	14 cfu/100mL
2NAN005.82	Ferry Point	99	12.4 cfu/100mL	49.0 cfu/100mL	14 cfu/100mL
2NAN007.89	Rt. 125 Bridge	98	21.9 cfu/100mL	99.5 cfu/100mL	14 cfu/100mL
Upper Nansemond					
2NAN010.69	SDH 16	98	86.1 cfu/100mL	460.0 cfu/100mL	200 cfu/100mL

2NAN013.50	BASF	33	140.6 cfu/100mL	540.0 cfu/100mL	200 cfu/100mL
2NAN019.14	Rt. 460 Bridge	205	679.7 cfu/100mL	2520 cfu/100mL	200 cfu/100mL
2SGL001.00	Shingle Creek	209	679.1 cfu/100mL	1640 cfu/100mL	200 cfu/100mL

As can be seen from Table 1 above, geometric means at three of the four test sites in the **lower** Nansemond are below the impairment thresholds for shellfish harvesting. The Virginia Department of Health has opened these areas for shellfish harvesting.

Shown on Chart 1a are monthly bacteria levels for the period from 1980 - 2010 at the Route 460 Bridge crossing in the **upper** Nansemond. Shown on Chart 1b are monthly bacteria levels for the same period at the Wilroy Road crossing of Shingle Creek in the **upper** Nansemond. The results from these sites are dominated by a series of catastrophic (rainfall?) events which mask the remainder of the data.

Shown in Table 2 are fecal coliform bacteria levels at the Rt. 460 Bridge crossing and the Wilroy Road crossing over Shingle Creek in the **upper** Nansemond, taken over the period from 2000 to 2010. Levels exceed the DEQ water quality standard for recreation of 200 cfu per 100mL.

Table 2 - Fecal Coliform Bacteria Levels in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Geometric mean	90th Percentile	Impair. Threshold
2NAN019.14	Rt. 460 Bridge	72	309.3 cfu/100mL	1840 cfu/100mL	200 cfu/100mL
2SGL001.00	Shingle Creek	73	393.5 cfu/100mL	1600 cfu/100mL	200 cfu/100mL

Shown on Chart 2 are fecal coliform bacteria levels at the Rt. 460 Bridge crossing, taken over the period from 2005 to 2010. The majority of the samples exceed 200 cfu/100mL and the trend line is up!

Shown in Table 3 are Enterococci bacteria levels at the Rt. 460 Bridge crossing and the Wilroy Road crossing over Shingle Creek in the **upper** Nansemond, taken over the period from 2000 to 2010. Levels greatly exceed the DEQ water quality standard of 35 colonies per 100mL.

Table 3 - Enterococci Bacteria Levels in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Geometric mean	Impair. Threshold
2NAN019.14	Rt. 460 Bridge	69	166.4 colonies/100mL	35 colonies/100mL
2SGL001.00	Shingle Creek	48	270.0 colonies/100mL	35 colonies/100mL

Shown on Chart 3 are monthly Enterococci bacteria levels for the period from March 2000 to October 2010 taken at the Rt. 460 Bridge in the **upper** Nansemond. The majority of the samples exceed 35 cfu/100mL.

Nitrogen and Phosphorus

Shown in Table 4 are total nitrogen levels taken at the Rt. 460 Bridge crossing and the Wilroy Road crossing over Shingle Creek, from 2000 to 2010. Levels at these **upper** Nansemond sites exceeded the threshold for algae bloom formation. No nitrogen data exists for the **lower** Nansemond.

Table 4 – Total Nitrogen Levels in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Average	Median	Algae Bloom Thresh.
Lower Nansemond					
2NAN000.20	Mouth	0			>1.00 mg/L
2NAN002.77	Rt. 17 Bridge	0			>1.00 mg/L
2NAN005.82	Ferry Point	0			>1.00 mg/L
2NAN007.89	Rt. 125 Bridge	0			>1.00 mg/L
Upper Nansemond					
2NAN010.69	SDH 16	0			>1.00 mg/L
2NAN013.50	BASF	0			>1.00 mg/L
2NAN019.14	Rt. 460 Bridge	44	1.108 mg/L	1.055 mg/L	>1.00 mg/L
2SGL001.00	Shingle Creek	44	1.654 mg/L	1.525 mg/L	>1.00 mg/L

Note: nitrogen in minimally impaired streams measured < 0.07 mg/L.

Shown in Table 5 are total phosphorus levels taken from eight test sites in the Nansemond River over the period from 2000 to 2010. Phosphorus levels increase from the mouth of the Nansemond to downtown Suffolk. Levels in the **upper** Nansemond exceed the threshold for algae bloom formation. Only 16 samples were taken in the **lower** Nansemond during this period.

Table 5 – Total Phosphorus Levels in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Average	Median	Algae Bloom Thresh.
Lower Nansemond					
2NAN000.20	Mouth	16	0.080 mg/L	0.070 mg/L	>0.10 mg/L
2NAN002.77	Rt. 17 Bridge	16	0.092 mg/L	0.095 mg/L	>0.10 mg/L
2NAN005.82	Ferry Point	16	0.109 mg/L	0.100 mg/L	>0.10 mg/L
2NAN007.89	Rt. 125 Bridge	16	0.121 mg/L	0.115 mg/L	>0.10 mg/L

Upper Nansemond

2NAN010.69	SDH 16	16	0.118 mg/L	0.125 mg/L	>0.10 mg/L
2NAN013.50	BASF	17	0.108 mg/L	0.110 mg/L	>0.10 mg/L
2NAN019.14	Rt. 460 Bridge	73	0.124 mg/L	0.100 mg/L	>0.10 mg/L
2SGL001.00	Shingle Creek	74	0.183 mg/L	0.155 mg/L	>0.10 mg/L

Note: phosphorus in minimally impaired streams measured < 0.003 mg/L.

Shown on Chart 5 are monthly total phosphorus readings taken at the Rt. 460 Bridge in the **upper** Nansemond over the period from 2000 to 2010.

Dissolved Oxygen

Shown in Table 6 are dissolved oxygen levels taken from eight test sites in the Nansemond River over the period from 2000 to 2010. Dissolved oxygen levels decrease with distance from the River's mouth. However, all statistics exceed the 5.0 mg/L stress threshold.

Table 6 – Dissolved Oxygen Levels in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Average	Median	Stress Threshold
Lower Nansemond					
2NAN000.20	Mouth	16	8.9 mg/L	8.8 mg/L	5.0 mg/L
2NAN002.77	Rt. 17 Bridge	16	8.5 mg/L	8.3 mg/L	5.0 mg/L
2NAN005.82	Ferry Point	16	8.2 mg/L	7.9 mg/L	5.0 mg/L
2NAN007.89	Rt. 125 Bridge	16	8.0 mg/L	7.8 mg/L	5.0 mg/L
Upper Nansemond					
2NAN010.69	SDH 16	16	7.7 mg/L	7.6 mg/L	5.0 mg/L
2NAN013.50	BASF	16	7.3 mg/L	6.9 mg/L	5.0 mg/L
2NAN019.14	Rt. 460 Bridge	72	7.8 mg/L	7.6 mg/L	5.0 mg/L
2SGL001.00	Shingle Creek	72	6.8 mg/L	6.5 mg/L	5.0 mg/L

Shown on Chart 6 are monthly dissolved oxygen readings taken at the Rt. 460 Bridge in the **upper** Nansemond over the period from 2000 to 2010.

Water Clarity

The handful of samples taken in the Nansemond show Secchi Disk readings of < 0.5 meters.

Table 7 – Water Clarity, Salinity in the Nansemond River, 2000 - 2010

Station ID	Description	Samples	Average	Conductivity @ 25 deg. C	Salinity
2NAN000.20	Mouth	1	0.5 meters	24,815 umhos	15.1 ppt
2NAN002.77	Rt. 17 Bridge	1	0.3 meters	23,584 umhos	14.3 ppt
2NAN005.82	Ferry Point	1	0.3 meters	22,582 umhos	13.6 ppt
2NAN007.89	Rt. 125 Bridge	1	0.2 meters	21,313 umhos	12.8 ppt
2NAN010.69	SDH 16			17,650 umhos	10.4 ppt
2NAN013.50	BASF			11,847 umhos	6.8 ppt