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21 June 2001

Bruce Michael  
Tidewater Ecosystem Assessments  
Maryland Department of Natural Resources  
Tawes State Office Building, D-2  
580 Taylor Avenue  
Annapolis, MD 21401

Dear Bruce:

Enclosed please find a hard copy and a diskette of the Ambient Toxicity Program Report for 2000. I hope you find the report to your satisfaction. If you have questions, please let me know .

Sincerely,

Roberto J. Llansó

RLL/gol

## Enclosure

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cc: L. Scott

File: 105113-5113-301

**BENTHIC COMMUNITY CONDITION AT  
AMBIENT TOXICITY PROGRAM SITES,  
2000**

Prepared for

Maryland Department of Natural Resources  
Resource Assessment Service  
Tidewater Ecosystem Assessments  
Annapolis, Maryland

Prepared by

Lisa C. Scott  
Roberto J. Llansó

Versar, Inc.  
9200 Rumsey Road  
Columbia, Maryland 21045

June 2001

## FOREWORD

This document, *Benthic Community Condition at Ambient Toxicity Program Sites, 2000*, was prepared by Versar, Inc. at the request of Mr. Bruce Michael of the Maryland Department of Natural Resources under Cooperative Agreement CA-00-02/07-4-30608-3734 between Versar, Inc., and the University of Maryland Center for Environmental and Estuarine Studies. The report assesses the status of Chesapeake Bay benthic communities at sites in four lower Maryland eastern shore tributaries.

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## 1.0 INTRODUCTION

In the summer of 2000, the Maryland Department of Natural Resources conducted a study to assess water quality, sediment quality, and the quality of biological resources at 10 sites in the tidal Chesapeake Bay. These sites were located in four tributaries on the lower eastern shore of Maryland: Fishing Bay, Wicomico River, Big Annemessex River and Pocomoke River. Water quality, sediment chemistry, sediment toxicity, and benthic data were collected at each site. This document presents the results of the benthic portion of the study.

## 2.0 METHODS

### 2.1 SAMPLE COLLECTION

Benthic samples for the Ambient Toxicity study were collected at ten sites during October 2000. The three sites in the Big Annemessex River were sampled on October 16, the Fishing Bay site was sampled on September 28, and the other six sites were sampled on October 12 and 13. Due to logistical problems, nine sites were sampled outside the proposed summer window for application of the Benthic Index of Biotic Integrity (July 27-September 30, Weisberg et al. 1997). We believe the application of the index to these samples is still valid because the samples were collected no more than 16 days outside the summer window. We expect the benthic community response to changing seasons from summer to autumn to be slow and subtle within this 16-day window. Sampling locations are provided in Table 2-1 and Figure 2-1.

| Table 2-1. Sampling locations |         |          |           |
|-------------------------------|---------|----------|-----------|
| Tributary                     | Station | Latitude | Longitude |



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|                      |      |          |          |
|----------------------|------|----------|----------|
| Big Annemessex River | BA01 | 38.0892° | 75.7456° |
|                      | BA02 | 38.0906° | 75.7428° |
|                      | BA03 | 38.0879° | 75.7364° |
| Pocomoke River       | PO04 | 38.0850° | 75.5573° |
|                      | PO05 | 38.1149° | 75.5020° |
|                      | PO06 | 38.1675° | 75.4308° |
| Wicomico River       | WI07 | 38.3406° | 75.6368° |
|                      | WI08 | 38.3406° | 75.6358° |
|                      | WI09 | 38.3423° | 75.6340° |
| Fishing Bay          | FB10 | 38.3639° | 76.0108° |

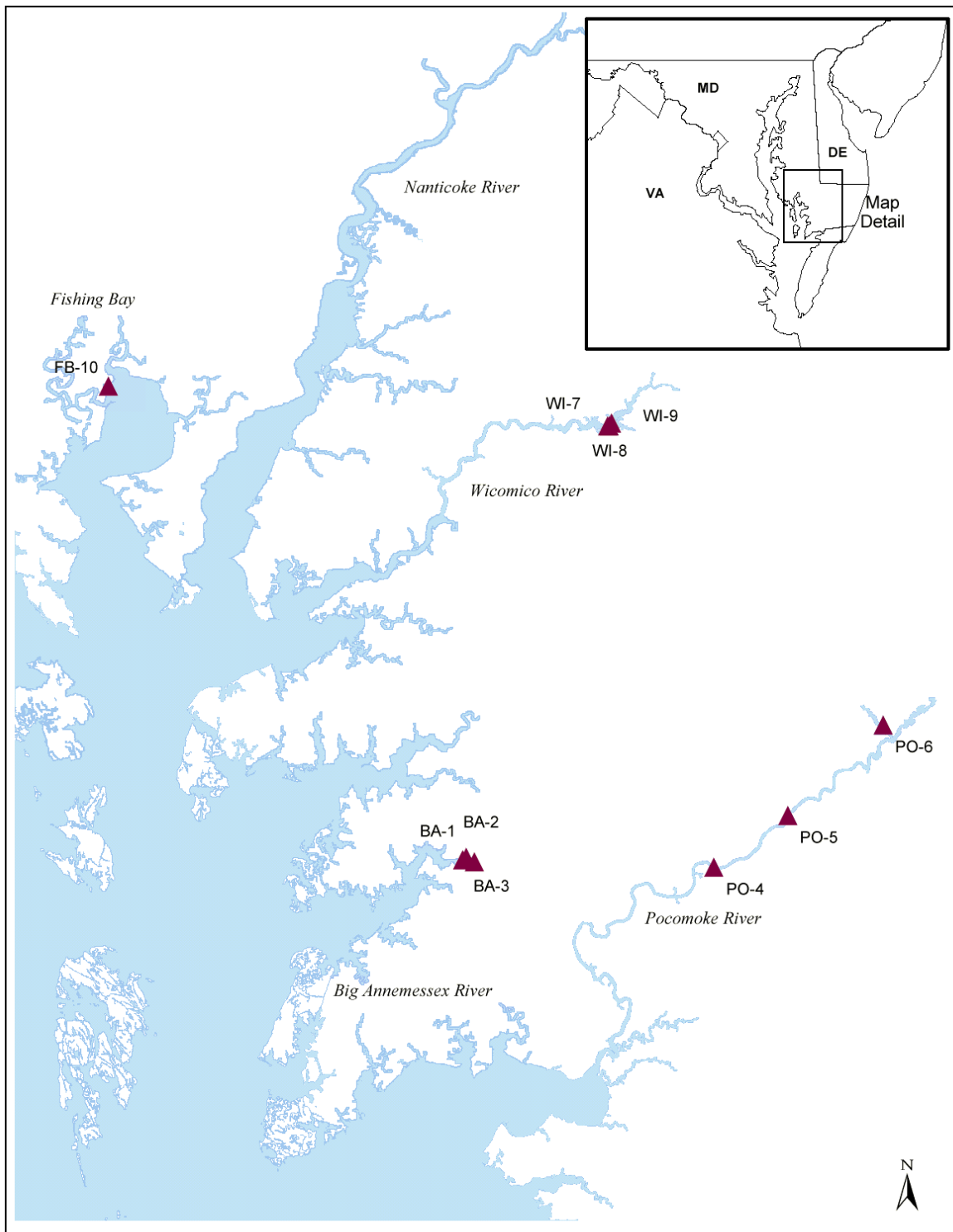


Figure 2-1. Location of the 10 ambient toxicity sites sampled in 2000.

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Benthic samples were collected with a Young Grab which samples an area of 440 cm<sup>2</sup> to a depth of 10 cm. One benthic grab sample was collected at each site and all samples were sieved through a 0.5-mm screen using an elutriative process. Organisms retained on the screen were transferred to labeled jars and preserved in 10% buffered formalin stained with rose bengal (a vital stain used to aid separation of organisms from sediment and detritus). An additional grab sample was collected from each site for sediment silt/clay analysis. The sediment samples were frozen until processed in the laboratory. Bottom water temperature, conductivity, salinity, dissolved oxygen concentration (DO), and pH were measured at each site with a Hydrolab Datasonde 3 unit.

## **2.2 LABORATORY PROCESSING**

Organisms were sorted from detritus under dissecting microscopes, identified to the lowest practical taxonomic level, and counted. Ash-free dry weight biomass was measured for each species identified using a dissecting scope by drying the organisms to a constant weight at 60°C followed by ashing in a muffle furnace at 500°C for four hours.

Oligochaetes and chironomid midges were mounted on microscope slides, examined under a compound microscope, and identified to genus and species following procedures based upon currently accepted practices in benthic ecology. If the number of oligochaetes or chironomids in a sample was over 20 individuals, the sample was split and 50% of the specimens were mounted. The remaining portion was saved and used for biomass determinations. The sample was split by evenly spreading the specimens in a gridded tray and selecting half of the total number of grids at random. Total taxonomic counts for each oligochaete or chironomid species were adjusted by the proportion of the total number of specimens mounted in the sample. Total oligochaete or chironomid biomass was estimated by weighing the unmounted specimens and multiplying by 2. Because most species of oligochaetes and chironomids need to be slide mounted for identification, species-specific

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biomass cannot be provided except for *Tubificoides* spp. and *Coelotanypus* spp., which do not need slide mounting for identification.

Sand and silt-clay particles were separated by wet-sieving through a 63 $\mu$  stainless steel sieve and weighed using the procedures described by Plumb (1981) and Buchanan (1984). Total organic carbon (TOC) was analyzed on an Exeter Analytical Inc., Model CE440 analyzer by the Analytical Services Department of Chesapeake Biological Laboratory.

## **2.3 DATA ANALYSIS**

Analyses were performed in the context of the Chesapeake Bay Program's Benthic Community Restoration Goals which use the Benthic Index of Biotic Integrity (B-IBI) to measure goal attainment. The newly developed Tidal Freshwater Benthic Community Restoration Goals (Alden et al. In Press) were applied to the six tidal freshwater sites sampled in the Pocomoke and Wicomico Rivers. The index developed by Weisberg et al. (1997) was applied to the four mesohaline sites in the Big Annemessex River and Fishing Bay.

### **2.3.1 The B-IBI and the Chesapeake Bay Benthic Community Restoration Goals**

The B-IBI is a multiple-attribute index developed to identify the degree to which a benthic assemblage meets the Chesapeake Bay Program's Benthic Community Restoration Goals. The restoration goals are quantitative thresholds based on reference data distributions (Weisberg et al. 1997, Alden et al. In Press). The B-IBI provides a means for comparing the relative condition of benthic invertebrate assemblages across different habitats. It also provides a validated mechanism for integrating several benthic community attributes indicative of "health" into a single number that measures overall benthic community condition.

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The B-IBI is scaled from 1 to 5, and sites with values of 3 or more are considered to meet the restoration goals. The index is calculated by scoring each of several attributes as either 5, 3, or 1 depending on whether the value of the attribute approximates, deviates slightly from, or deviates strongly from values at the best reference sites in similar habitats, and then averaging these scores across attributes. The criteria for assigning these scores are numeric and habitat-dependent.

Benthic community condition was classified into four levels based on the B-IBI. Values less than or equal to 2.0 were classified as severely degraded; values from 2.0 to 2.6 were classified as degraded; values between 2.6 and 3.0 were classified as marginal, and values of 3.0 or more were classified as meeting the goals.

### 3.0 RESULTS

For each of the 2000 Ambient Toxicity Program sites, B-IBI values and the corresponding benthic community condition are presented in Table 3-1 and Figure 3-1. Station specific water quality measurements and sediment composition are provided in Table 3-2. Details of the water quality measurements, sediment composition, species abundance and biomass, and B-IBI metric values and scores are provided in the appendix.

The sites sampled in the Big Annemessex River (BA01, BA02, and BA03) had mesohaline salinities and extremely low bottom dissolved oxygen concentrations below 1  $\mu\text{g/l}$  (Table 3-2). All of the other sites had bottom dissolved oxygen concentrations above 4.0  $\mu\text{g/l}$ . Fishing Bay Station FA10 had a bottom water salinity that placed it in the low mesohaline category for B-IBI application. The six sites in the Wicomico and Pocomoke Rivers had very low salinities placing them in the tidal freshwater category for B-IBI application (Table 3-2).

| Table 3-1. B-IBI values and benthic community condition at the 2000 Ambient Toxicity sites. |         |             |                             |  |
|---|---------|-------------|-----------------------------|--|
| Tributary   | Station | B-IBI Value | Benthic Community Condition | Metrics Scoring 1  |
| Big Annemessex River  | BA01    | 3.3         | Meets Goal                  | none   |
|   | BA02    | 2.3         | Degraded                    | Biomass, Carnivore/Omnivore abundance, Pollution-indicative spp. abundance                     |
|   | BA03    | 3.3         | Meets Goal                  | Pollution-indicative spp. abundance  |
| Pocomoke River  | PO04    | 2.5         | Degraded                    | Abundance  |
|   | PO05    | 5.0         | Meets Goal                  | none   |
|   | PO06    | 1.0         | Severely Degraded           | Abundance, Deep deposit-feeder abundance, Tolerance Score, Pollution-indicative spp. abundance |
| Wicomico River  | WI07    | 3.5         | Meets Goal                  | none   |
|   | WI08    | 4.0         | Meets Goal                  | none   |
|   | WI09    | 2.5         | Degraded                    | Abundance  |
| Fishing Bay   | FB10    | 2.6         | Degraded                    | Abundance, Biomass   |

| Table 3-2. Site specific water quality measurements and sediment composition. |               |                         |                |                  |    |           |               |         |
|---|---------------|-------------------------|----------------|------------------|----|-----------|---------------|---------|
| Station   | Sampling Date | Dissolved Oxygen (µg/l) | Salinity (ppm) | Temperature (°C) | pH | Depth (m) | Silt/clay (%) | TOC (%) |
|   |               |                         |                |                  |    |           |               |         |

---

|      |          |       |       |      |     |     |      |       |
|------|----------|-------|-------|------|-----|-----|------|-------|
| BA01 | Oct. 16  | 0.37  | 14.68 | 19.6 | 7.6 | 0.5 | 30.2 | 2.76  |
| BA02 | Oct. 16  | 0.72  | 14.77 | 19.8 | 7.6 | 1.0 | 8.3  | 0.24  |
| BA03 | Oct. 16  | 0.73  | 14.07 | 20.0 | 7.5 | 2.0 | 6.2  | 0.42  |
| PO04 | Oct. 13  | 4.66  | 0.06  | 16.8 | 6.9 | 1.5 | 96.6 | 5.42  |
| PO05 | Oct. 13  | 4.97  | 0.06  | 16.7 | 6.7 | 1.0 | 75.6 | 6.24  |
| PO06 | Oct. 13  | 4.60  | 0.05  | 13.2 | 6.6 | 2.5 | 91.3 | 13.06 |
| WI07 | Oct. 12  | 9.52  | 0.08  | 16.8 | 8.7 | 3.0 | 88.6 | 6.16  |
| WI08 | Oct. 12  | 10.20 | 0.08  | 16.5 | 8.5 | 2.5 | 92.9 | 6.24  |
| WI09 | Oct. 12  | 11.62 | 0.08  | 15.7 | 8.2 | 6.0 | 82.3 | 6.40  |
| FB10 | Sept. 28 | 4.30  | 8.77  | 17.6 | 7.6 | 1.0 | 88.4 | 4.83  |

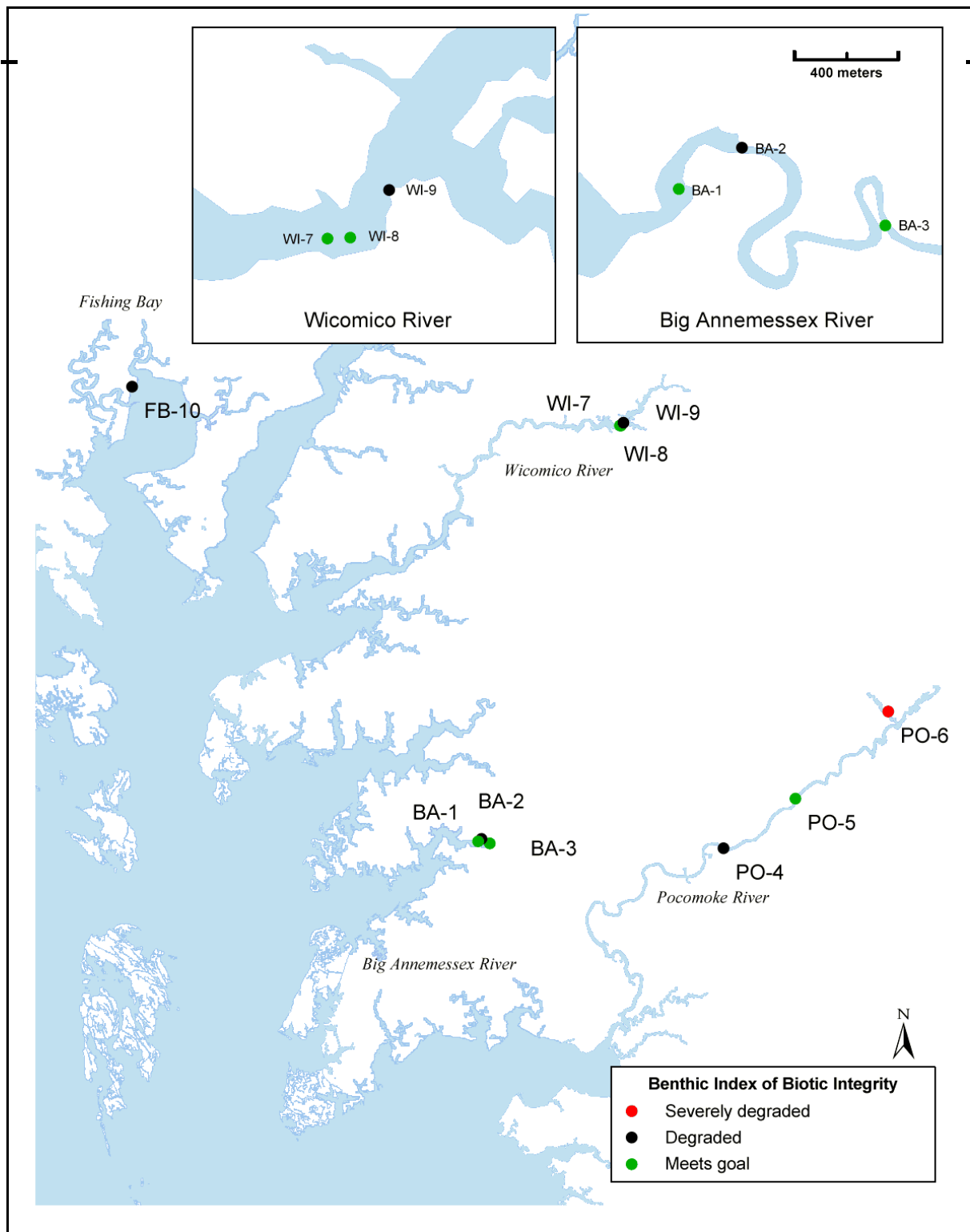


Figure 3-1. Benthic community condition at the 10 ambient toxicity sites sampled in 2000.



Of the 10 sites sampled, five sites met the Benthic Community Restoration Goals and five failed the restoration goals (Table 3-1, Figure 3-1). Of the five sites that failed, one was classified as severely degraded and four were classified as degraded (Table 3-1).

In the mesohaline habitats, BA02 failed primarily due to low biomass and low abundance of carnivores/omnivores (Appendix). The other two sites in the Big Annemessex River had higher scores for both of these metrics. The site located in Fishing Bay, FB10, failed to meet the goals due to low abundance and biomass (Table 3-1, Appendix). Even though the dissolved oxygen concentrations recorded at the three Big Annemessex River sites was low, it did not appear to affect the benthic communities at BA01 and BA03 as both sites met the goals.

The six sites sampled in the Pocomoke and Wicomico Rivers were located in tidal freshwater habitats. Three of these sites failed the goals and three met the goals. The sites that failed in these freshwater habitats did so for several reasons. PO06, was severely degraded with a B-IBI score of 1 (Table 3-1). Only one oligochaete individual was collected at this site indicating an extremely impoverished benthic community (Appendix). The other Pocomoke site that was degraded, PO04, failed due to low abundance. The one site that failed in the Wicomico River, WI09, had an over abundance of organisms causing the site to receive an abundance metric score of 1 for too much abundance. Typically, an over abundance of benthic organisms can be attributed to eutrophication.

## 4.0 REFERENCES

- Alden, R.W. III, Dauer, D.M., Ranasinghe, J. A., Scott, L. C., and Llansó, R.J., In Press. Statistical Verification of the Chesapeake Bay Benthic Index of Biotic Integrity. *Environmetrics*.
- Buchanan, J.B. 1984. Sediment analysis. Pages 41-65. *In*: N.A. Holme and A. D. McIntyre, eds. Methods for Study of Marine Benthos. IBP Handbook No. 16. 2nd Edition. Blackwell Scientific Publications. Oxford, England.

Plumb, R.H. 1981. Procedures for handling and chemical analysis of sediment and water samples. Prepared for the U. S. Environmental Protection Agency/Corps of Engineers Technical Committee of Criteria for Dredge and Fill Material. Published by Environmental Laboratory, U. S. Army Waterways Experiment Station, Vicksburg, Mississippi. Technical Report EPA/CE-81-1.

Weisberg, S.B., J.A. Ranasinghe, D.M. Dauer, L.C. Schaffner, R.J. Diaz, and J.B. Frithsen. 1997. An estuarine benthic index of biotic integrity (B-IBI) for Chesapeake Bay. *Estuaries*, 20(1): 149-158.

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**APPENDIX**

**WATER QUALITY MEASUREMENTS, SEDIMENT COMPOSITION,  
SPECIES ABUNDANCES, SPECIES BIOMASS,  
AND B-IBI METRIC VALUES AND SCORES FOR EACH SITE**

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                               |                               |                |
|-------------------------------|-------------------------------|----------------|
| Station: BA01                 |                               |                |
| Watershed: Big Annessex River | Habitat: High Mesohaline Sand | Date: 10/16/00 |
| Gear: Young Grab              | Sampled Area: 0.043 sq.m      | Time: 13:09:26 |

BOTTOM ENVIRONMENT

|                              |                               |                        |
|------------------------------|-------------------------------|------------------------|
| Depth (m): 0.5               | Salinity (ppt): 14.7          | Temperature (C): 19.6  |
| Dissolved Oxygen (mg/l): 0.4 | Sediment Silt-Clay (%): 30.18 | Total Carbon (%): 2.76 |

BENTHIC INDEX OF BIOTIC INTEGRITY

|                                   |                       |       |  |       |
|-----------------------------------|-----------------------|-------|--|-------|
| B-IBI Score: 3.3                  | Condition: Meets Goal |       | # Attributes Scored: 6                     |       |
|                                   | Value                 | Score | Value                                      | Score |
| Shannon-Weiner Index              | 3.4                   | 5     | Pollution Indicative Species Abundance (%) | 23.6  |
| Abundance (#/m2)                  | 3611                  | 3     | Pollution Indicative Species Biomass (%)   | 3.2   |
| Biomass (g/m2)                    | 1.4                   | 3     | Pollution Sensitive Species Abundance (%)  | 10.2  |
| Carnivore-Omnivore Abundance (%)  | 28.7                  | 3     | Pollution Sensitive Species Biomass (%)    | 34.6  |
| Deep Deposit Feeder Abundance (%) | 19.8                  |       |  |       |

BENTHIC DATA

| TAXA                   | Abundance (#/m2) | Biomass (g/m2) |
|------------------------|------------------|----------------|
| Almyracuma proximoculi | 23               | 0.00115        |
| Amphiporus bioculatus  | 46               | 0.00920        |
| Carinoma tremaphoros   | 184              | 0.13570        |
| Cyathura polita        | 345              | 0.31280        |
| Edotea triloba (Epi)   | 138              | 0.00115        |
| Edwardsia elegans      | 161              | 0.00460        |
| Haminoea solitaria     | 23               | 0.00115        |

|                                |  |      |  |         |  |
|--------------------------------|--|------|--|---------|--|
| Heteromastus filiformis        |  | 207  |  | 0.03450 |  |
| Hobsonia florida               |  | 437  |  | 0.01610 |  |
| Hypereteone heteropoda         |  | 23   |  | 0.00230 |  |
| Imm. Tubificid w/o Cap. Chaete |  | 92   |  |         |  |
| Laeonereis culveri             |  | 184  |  | 0.37950 |  |
| Leitoscoloplos spp.            |  | 23   |  | 0.00460 |  |
| Leptocheirus plumulosus        |  | 23   |  | 0.00115 |  |
| Macoma mitchelli               |  | 621  |  | 0.18630 |  |
| Marenzelleria viridis          |  | 23   |  | 0.15870 |  |
| Neanthes succinea              |  | 69   |  | 0.07130 |  |
| Oligochaeta                    |  |      |  | 0.00115 |  |
| Streblospio benedicti          |  | 736  |  | 0.04140 |  |
| Tubificoides spp.              |  | 391  |  | 0.00230 |  |
| -----                          |  |      |  |         |  |
| Total Abundance w/ Epi.        |  | 3749 |  |         |  |
| Total Abundance w/o Epi.       |  | 3611 |  |         |  |
| Number of Taxa w/ Epi.         |  | 19   |  |         |  |
| Number of Taxa w/o Epi.        |  | 18   |  |         |  |
| Total Biomass w/ Epi.          |  | 1.4  |  |         |  |
| Total Biomass w/o Epi.         |  | 1.4  |  |         |  |

=====  
 \* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                                 |                               |                |
|---------------------------------|-------------------------------|----------------|
| Station: BA02                   |                               |                |
| Watershed: Big Annemessex River | Habitat: High Mesohaline Sand | Date: 10/16/00 |
| Gear: Young Grab                | Sampled Area: 0.043 sq.m      | Time: 13:48:40 |

|                              |                              |                        |
|------------------------------|------------------------------|------------------------|
| BOTTOM ENVIRONMENT           |                              |                        |
| Depth (m): 1.0               | Salinity (ppt): 14.8         | Temperature (C): 19.8  |
| Dissolved Oxygen (mg/l): 0.7 | Sediment Silt-Clay (%): 8.32 | Total Carbon (%): 0.24 |

|                                   |                     |       |  |       |   |
|-----------------------------------|---------------------|-------|--|-------|---|
| BENTHIC INDEX OF BIOTIC INTEGRITY |                     |       |  |       |   |
| B-IBI Score: 2.3                  | Condition: Degraded |       | # Attributes Scored: 6                     |       |   |
|                                   | Value               | Score | Value                                      | Score |   |
| Shannon-Weiner Index              | 3.2                 | 5     | Pollution Indicative Species Abundance (%) | 30.7  | 1 |
| Abundance (#/m2)                  | 3151                | 3     | Pollution Indicative Species Biomass (%)   | 6.5   |   |
| Biomass (g/m2)                    | 0.9                 | 1     | Pollution Sensitive Species Abundance (%)  | 11.0  | 3 |
| Carnivore-Omnivore Abundance (%)  | 10.2                | 1     | Pollution Sensitive Species Biomass (%)    | 15.1  |   |
| Deep Deposit Feeder Abundance (%) | 19.7                |       |  |       |   |

|                        |                  |                |
|------------------------|------------------|----------------|
| BENTHIC DATA           |                  |                |
| TAXA                   | Abundance (#/m2) | Biomass (g/m2) |
| Almyracuma proximoculi | 23               | 0.14490        |
| Amphiporus bioculatus  | 23               | 0.00115        |
| Cyathura polita        | 115              | 0.02300        |
| Edotea triloba (Epi)   | 69               | 0.00115        |
| Edwardsia elegans      | 92               | 0.00115        |
| Glycinde solitaria     | 23               | 0.00115        |

|                                |  |      |  |         |  |
|--------------------------------|--|------|--|---------|--|
| Heteromastus filiformis        |  | 414  |  | 0.25530 |  |
| Hobsonia florida               |  | 115  |  | 0.00460 |  |
| Hypereteone heteropoda         |  | 46   |  | 0.00115 |  |
| Imm. Tubificid w/o Cap. Chaete |  | 69   |  |         |  |
| Laeonereis culveri             |  | 23   |  | 0.03910 |  |
| Leptocheirus plumulosus        |  | 276  |  | 0.02760 |  |
| Littoridinops tenuipes (Epi)   |  | 1012 |  | 0.05290 |  |
| Macoma mitchelli               |  | 713  |  | 0.20010 |  |
| Manayunkia speciosa            |  | 23   |  | 0.00115 |  |
| Mya arenaria                   |  | 138  |  | 0.03680 |  |
| Oligochaeta                    |  |      |  | 0.00115 |  |
| Rangia cuneata                 |  | 69   |  | 0.06900 |  |
| Streblospio benedicti          |  | 851  |  | 0.05520 |  |
| Tubificoides spp.              |  | 138  |  | 0.00115 |  |
| -----                          |  |      |  |         |  |
| Total Abundance w/ Epi.        |  | 4232 |  |         |  |
| Total Abundance w/o Epi.       |  | 3151 |  |         |  |
| Number of Taxa w/ Epi.         |  | 19   |  |         |  |
| Number of Taxa w/o Epi.        |  | 17   |  |         |  |
| Total Biomass w/ Epi.          |  | 0.9  |  |         |  |
| Total Biomass w/o Epi.         |  | 0.9  |  |         |  |

=====

\* Indicates taxa is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000 AMBIENT TOXICITY STATIONS

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=====
|                               Station: BA03                               |
| Watershed: Big Annemessex River   Habitat: High Mesohaline Sand   Date: 10/16/00   |
| Gear: Young Grab                  Sampled Area: 0.043 sq.m         Time: 14:34:12   |
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|                               BOTTOM ENVIRONMENT                               |
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```

| Depth (m): 2.0                   Salinity (ppt): 14.1           Temperature (C): 20.0   |
| Dissolved Oxygen (mg/l): 0.7     Sediment Silt-Clay (%): 6.18       Total Carbon (%): 0.42   |
=====
  
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=====
|                               BENTHIC INDEX OF BIOTIC INTEGRITY                               |
=====
  
```

```

| B-IBI Score: 3.3                 Condition: Meets Goal                 # Attributes Scored: 6   |
|                               Value  Score                               Value  Score |
| Shannon-Weiner Index            3.3    5    Pollution Indicative Species Abundance (%) 25.6    1 |
| Abundance (#/m2)                4761   3    Pollution Indicative Species Biomass (%)   2.3     |
| Biomass (g/m2)                  5.0    5    Pollution Sensitive Species Abundance (%) 12.1    3 |
| Carnivore-Omnivore Abundance (%) 23.2   3    Pollution Sensitive Species Biomass (%)   4.1     |
| Deep Deposit Feeder Abundance (%) 30.0   |
=====
  
```

```

=====
|                               BENTHIC DATA                               |
=====
  
```

| TAXA                   | Abundance (#/m2) | Biomass (g/m2) |
|------------------------|------------------|----------------|
| Ablabesmyia spp.       | 46               |                |
| Almyracuma proximoculi | 138              | 0.00920        |
| Carinoma tremaphoros   | 92               | 0.02760        |
| Chironomidae larvae    |                  | 0.00115        |
| Coelotanypus spp.      | 23               | 0.00115        |
| Cyathura polita        | 552              | 0.19550        |
| Edotea triloba (Epi)   | 92               | 0.00690        |
| Edwardsia elegans      | 138              | 0.00920        |
| Epoicocladus spp.      | 23               |                |



|                                |  |      |         |  |
|--------------------------------|--|------|---------|--|
| Gammarus spp.(Epi)             |  |      | 0.00460 |  |
| Gammarus daiberi (Epi)         |  | 69   |         |  |
| Heteromastus filiformis        |  | 1081 | 4.22395 |  |
| Hirudinea spp.(Epi)            |  | 46   | 0.00920 |  |
| Hobsonia florida               |  | 92   | 0.00115 |  |
| Hypereteone heteropoda         |  | 138  | 0.01150 |  |
| Imm. Tubificid w/o Cap. Chaete |  | 46   |         |  |
| Laeonereis culveri             |  | 69   | 0.16790 |  |
| Leptocheirus plumulosus        |  | 460  | 0.05520 |  |
| Macoma mitchelli               |  | 437  | 0.13110 |  |
| Marenzelleria viridis          |  | 23   | 0.00690 |  |
| Oligochaeta                    |  |      | 0.00115 |  |
| Polypedilum simulans/digitifer |  | 46   |         |  |
| Stenochironomus spp.           |  | 46   |         |  |
| Streblospio benedicti          |  | 1012 | 0.09890 |  |
| Stylochus ellipticus (Epi)     |  | 23   | 0.00115 |  |
| Tubificoides spp.              |  | 299  | 0.00460 |  |
| -----                          |  |      |         |  |
| Total Abundance w/ Epi.        |  | 4991 |         |  |
| Total Abundance w/o Epi.       |  | 4761 |         |  |
| Number of Taxa w/ Epi.         |  | 23   |         |  |
| Number of Taxa w/o Epi.        |  | 19   |         |  |
| Total Biomass w/ Epi.          |  | 5.0  |         |  |
| Total Biomass w/o Epi.         |  | 4.9  |         |  |

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\* Indicates taxa is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                           |                           |                |
|---------------------------|---------------------------|----------------|
| Station: PO04             |                           |                |
| Watershed: Pocomoke River | Habitat: Tidal Freshwater | Date: 10/13/00 |
| Gear: Young Grab          | Sampled Area: 0.043 sq.m  | Time: 07:46:50 |

|                              |                              |                        |
|------------------------------|------------------------------|------------------------|
| BOTTOM ENVIRONMENT           |                              |                        |
| Depth (m): 1.5               | Salinity (ppt): 0.06         | Temperature (C): 16.8  |
| Dissolved Oxygen (mg/l): 4.7 | Sediment Silt-Clay (%): 96.6 | Total Carbon (%): 5.42 |

|                                   |                     |       |   |       |   |
|-----------------------------------|---------------------|-------|---|-------|---|
| BENTHIC INDEX OF BIOTIC INTEGRITY |                     |       |   |       |   |
| B-IBI Score: 2.5                  | Condition: Degraded |       | # Attributes Scored: 4                    |       |   |
|                                   | Value               | Score | Value                                     | Score |   |
| Shannon-Weiner Index              | 2.2                 |       | T.F. Pollution Indicative Spp. Abund. (%) | 39.1  | 3 |
| Abundance (#/m2)                  | 529                 | 1     | Tolerance Score                           | 9.3   | 3 |
| Deep Deposit Feeder Abundance (%) | 82.6                | 3     | Carnivore-Omnivore Abundance (%)          | 13.0  |   |

BENTHIC DATA

| TAXA                             | Abundance (#/m2) | Biomass (g/m2) |
|----------------------------------|------------------|----------------|
| Coelotanypus spp.                | 69               | 0.00115        |
| Imm. Tubificid w/ Cap. Chaete    | 23               |                |
| Imm. Tubificid w/o Cap. Chaete * | 138              |                |
| Limnodrilus hoffmeisteri         | 69               |                |
| Limnodrilus udekemianus          | 207              |                |
| Oligochaeta                      |                  | 0.03105        |
| Thienemanniella spp.             | 23               |                |

|                          |  |       |  |  |
|--------------------------|--|-------|--|--|
| Total Abundance w/ Epi.  |  | 529   |  |  |
| Total Abundance w/o Epi. |  | 529   |  |  |
| Number of Taxa w/ Epi.   |  | 5     |  |  |
| Number of Taxa w/o Epi.  |  | 5     |  |  |
| Total Biomass w/ Epi.    |  | < 0.1 |  |  |
| Total Biomass w/o Epi.   |  | < 0.1 |  |  |

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\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                           |                           |                  |
|---------------------------|---------------------------|------------------|
| Station: PO05             |                           |                  |
| Watershed: Pocomoke River | Habitat: Tidal Freshwater | Date: 10/13/2000 |
| Gear: Young Grab          | Sampled Area: 0.043 sq.m  | Time: 8:16:48    |

|                              |                              |                        |
|------------------------------|------------------------------|------------------------|
| BOTTOM ENVIRONMENT           |                              |                        |
| Depth (m): 1.0               | Salinity (ppt): 0.06         | Temperature (C): 16.7  |
| Dissolved Oxygen (mg/l): 5.0 | Sediment Silt-Clay (%): 75.6 | Total Carbon (%): 6.24 |

|                                   |                       |       |   |       |       |
|-----------------------------------|-----------------------|-------|---|-------|-------|
| BENTHIC INDEX OF BIOTIC INTEGRITY |                       |       |   |       |       |
| B-IBI Score: 5.0                  | Condition: Meets Goal |       | # Attributes Scored: 4                    |       |       |
|                                   | Value                 | Score |   | Value | Score |
| Shannon-Weiner Index              | 2.2                   |       | T.F. Pollution Indicative Spp. Abund. (%) | 0.0   | 5     |
| Abundance (#/m2)                  | 1127                  | 5     | Tolerance Score                           | 5.3   | 5     |
| Deep Deposit Feeder Abundance (%) | 0.0                   | 5     | Carnivore-Omnivore Abundance (%)          | 65.3  |       |

BENTHIC DATA

| TAXA                       | Abundance (#/m2) | Biomass (g/m2) |
|----------------------------|------------------|----------------|
| Ablabesmyia spp.           | 230              |                |
| Acellus spp. (Epi)         | 23               | 0.00460        |
| Caecidotea communis (Epi.) | 23               | 0.00115        |
| Ceratopogonidae            | 23               | 0.00115        |
| Chironomidae larvae        |                  | 0.00115        |
| Coelotanypus spp.          | 184              | 0.00115        |
| Cyrnellus spp.(Epi)        | 46               | 0.00115        |

|                          |  |      |  |         |  |
|--------------------------|--|------|--|---------|--|
| Epicocladius spp.        |  | 46   |  |         |  |
| Gammarus fasciatus (Epi) |  | 115  |  | 0.00115 |  |
| Heptageniidae (Epi)      |  | 46   |  | 0.00460 |  |
| Hexagenia spp.           |  | 299  |  | 0.16330 |  |
| Pisidium spp.            |  | 345  |  | 0.00115 |  |
| Stenelmis spp.(Epi)      |  | 23   |  | 0.01150 |  |
| -----                    |  |      |  |         |  |
| Total Abundance w/ Epi.  |  | 1403 |  |         |  |
| Total Abundance w/o Epi. |  | 1127 |  |         |  |
| Number of Taxa w/ Epi.   |  | 11   |  |         |  |
| Number of Taxa w/o Epi.  |  | 6    |  |         |  |
| Total Biomass w/ Epi.    |  | 0.2  |  |         |  |
| Total Biomass w/o Epi.   |  | 0.2  |  |         |  |

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\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                           |                           |                  |
|---------------------------|---------------------------|------------------|
| Station: PO06             |                           |                  |
| Watershed: Pocomoke River | Habitat: Tidal Freshwater | Date: 10/13/2000 |
| Gear: Young Grab          | Sampled Area: 0.043 sq.m  | Time: 9:21:02    |

|                              |                              |                         |
|------------------------------|------------------------------|-------------------------|
| BOTTOM ENVIRONMENT           |                              |                         |
| Depth (m): 2.58              | Salinity (ppt):0.05          | Temperature (C): 13.2   |
| Dissolved Oxygen (mg/l): 4.6 | Sediment Silt-Clay (%): 91.3 | Total Carbon (%): 13.06 |

|                                   |                              |       |   |       |   |
|-----------------------------------|------------------------------|-------|---|-------|---|
| BENTHIC INDEX OF BIOTIC INTEGRITY |                              |       |   |       |   |
| B-IBI Score: 1.0                  | Condition: Severely Degraded |       | # Attributes Scored: 4                    |       |   |
|                                   | Value                        | Score | Value                                     | Score |   |
| Shannon-Weiner Index              | 0.0                          |       | T.F. Pollution Indicative Spp. Abund. (%) | 100.0 | 1 |
| Abundance (#/m2)                  | 23                           | 1     | Tolerance Score                           | 9.8   | 1 |
| Deep Deposit Feeder Abundance (%) | 100.0                        |       | Carnivore-Omnivore Abundance (%)          | 0.0   |   |

|                                |                  |                |
|--------------------------------|------------------|----------------|
| BENTHIC DATA                   |                  |                |
| TAXA                           | Abundance (#/m2) | Biomass (g/m2) |
| Imm. Tubificid w/o Cap. Chaete | 23               |                |
| Oligochaeta                    |                  | 0.00115        |
| Total Abundance w/ Epi.        | 23               |                |
| Total Abundance w/o Epi.       | 23               |                |
| Number of Taxa w/ Epi.         | 1                |                |
| Number of Taxa w/o Epi.        | 1                |                |

|                        |  |       |  |  |
|------------------------|--|-------|--|--|
| Total Biomass w/ Epi.  |  | < 0.1 |  |  |
| Total Biomass w/o Epi. |  | < 0.1 |  |  |

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\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                           |                           |                  |
|---------------------------|---------------------------|------------------|
| Station: WI07             |                           |                  |
| Watershed: Wicomico River | Habitat: Tidal Freshwater | Date: 10/12/2000 |
| Gear: Young Grab          | Sampled Area: 0.043 sq.m  | Time: 16:08:19   |

|                              |                              |                        |
|------------------------------|------------------------------|------------------------|
| BOTTOM ENVIRONMENT           |                              |                        |
| Depth (m): 3.0               | Salinity (ppt): 0.08         | Temperature (C): 16.8  |
| Dissolved Oxygen (mg/l): 9.5 | Sediment Silt-Clay (%): 88.6 | Total Carbon (%): 6.16 |

|                                   |                       |       |   |       |   |
|-----------------------------------|-----------------------|-------|---|-------|---|
| BENTHIC INDEX OF BIOTIC INTEGRITY |                       |       |   |       |   |
| B-IBI Score: 3.5                  | Condition: Meets Goal |       | # Attributes Scored: 4                    |       |   |
|                                   | Value                 | Score | Value                                     | Score |   |
| Shannon-Weiner Index              | 1.0                   |       | T.F. Pollution Indicative Spp. Abund. (%) | 78.5  | 3 |
| Abundance (#/m2)                  | 3749                  | 5     | Tolerance Score                           | 9.2   | 3 |
| Deep Deposit Feeder Abundance (%) | 82.2                  | 3     | Carnivore-Omnivore Abundance (%)          | 17.8  |   |

BENTHIC DATA

| TAXA                             | Abundance (#/m2) | Biomass (g/m2) |
|----------------------------------|------------------|----------------|
| Chironomidae pupae               |                  | 0.00230        |
| Chironomidae pupae *             | 23               |                |
| Coelotanypus spp.                | 644              | 0.10350        |
| Imm. Tubificid w/ Cap. Chaete    | 138              |                |
| Imm. Tubificid w/o Cap. Chaete * | 2898             |                |
| Limnodrilus hoffmeisteri         | 46               |                |
| Oligochaeta                      |                  | 0.42320        |



|                          |  |      |  |  |
|--------------------------|--|------|--|--|
| Total Abundance w/ Epi.  |  | 3749 |  |  |
| Total Abundance w/o Epi. |  | 3749 |  |  |
| Number of Taxa w/ Epi.   |  | 3    |  |  |
| Number of Taxa w/o Epi.  |  | 3    |  |  |
| Total Biomass w/ Epi.    |  | 0.5  |  |  |
| Total Biomass w/o Epi.   |  | 0.5  |  |  |

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\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

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=====
|                               Station: WI08                               |
| Watershed: Wicomico River      Habitat: Tidal Freshwater      Date: 10/12/2000      |
| Gear: Young Grab              Sampled Area: 0.043 sq.m        Time: 15:53:13       |
=====
  
```

```

=====
|                               BOTTOM ENVIRONMENT                               |
=====
| Depth (m):2.5                 Salinity (ppt): 0.08      Temperature (C): 16.5  |
| Dissolved Oxygen (mg/l): 10.2  Sediment Silt-Clay (%): 92.9  Total Carbon (%): 6.24  |
=====
  
```

```

=====
|                               BENTHIC INDEX OF BIOTIC INTEGRITY                               |
=====
| B-IBI Score: 4.0              Condition: Meets Goal              # Attributes Scored: 4  |
|                               Value   Score                               Value   Score |
| Shannon-Weiner Index         1.6           T.F. Pollution Indicative Spp. Abund. (%)  61.2   3  |
| Abundance (#/m2)             1955          5           Tolerance Score                8.8   3  |
| Deep Deposit Feeder Abundance (%) 65.9          5           Carnivore-Omnivore Abundance (%)  31.8   |
=====
  
```

```

=====
|                               BENTHIC DATA                               |
=====
  
```

| TAXA                           | Abundance (#/m2) | Biomass (g/m2) |
|--------------------------------|------------------|----------------|
| Chironomidae larvae            |                  | 0.00115        |
| Coelotanypus spp.              | 529              | 0.10120        |
| Einfeldia spp.                 | 92               |                |
| Imm. Tubificid w/ Cap. Chaete  | 46               |                |
| Imm. Tubificid w/o Cap. Chaete | 1196             |                |
| Littoridinops tenuipes (Epi)   | 23               | 0.00230        |
| Musculium spp.                 | 23               | 0.00115        |

|                           |  |      |         |  |
|---------------------------|--|------|---------|--|
| Oligochaeta               |  |      | 0.29670 |  |
| Pisidium spp.             |  | 23   | 0.00690 |  |
| Quistadrilus multisetosus |  | 46   |         |  |
| -----                     |  |      |         |  |
| Total Abundance w/ Epi.   |  | 1978 |         |  |
| Total Abundance w/o Epi.  |  | 1955 |         |  |
| Number of Taxa w/ Epi.    |  | 8    |         |  |
| Number of Taxa w/o Epi.   |  | 7    |         |  |
| Total Biomass w/ Epi.     |  | 0.4  |         |  |
| Total Biomass w/o Epi.    |  | 0.4  |         |  |
| =====                     |  |      |         |  |

\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000  
 AMBIENT TOXICITY STATIONS

```

=====
|                               Station: WI09                               |
| Watershed: Wicomico River      Habitat: Tidal Freshwater      Date: 10/12/2000      |
| Gear: Young Grab              Sampled Area: 0.043 sq.m        Time: 15:35:33       |
=====
  
```

```

=====
|                               BOTTOM ENVIRONMENT                               |
=====
| Depth (m): 6.0                Salinity (ppt): 0.08                Temperature (C): 15.7  |
| Dissolved Oxygen (mg/l):11.6  Sediment Silt-Clay (%):82.3        Total Carbon (%): 6.40  |
=====
  
```

```

=====
|                               BENTHIC INDEX OF BIOTIC INTEGRITY                               |
=====
| B-IBI Score: 2.5              Condition: Degraded              # Attributes Scored: 4  |
|                               Value   Score                               Value   Score |
| Shannon-Weiner Index         1.3           T.F. Pollution Indicative Spp. Abund. (%) 70.9   3  |
| Abundance (#/m2)             6095         1           Tolerance Score                       9.1   3  |
| Deep Deposit Feeder Abundance (%) 80.0         3           Carnivore-Omnivore Abundance (%)      19.6   |
=====
  
```

```

=====
|                               BENTHIC DATA                               |
=====
  
```

| TAXA                           | Abundance (#/m2) | Biomass (g/m2) |
|--------------------------------|------------------|----------------|
| Aulodrilus pigueti             | 46               |                |
| Chironomidae larvae            |                  | 0.00115        |
| Chironomus spp.                | 23               |                |
| Coelotanypus spp.              | 1081             | 0.18860        |
| Cryptochironomus spp.          | 23               |                |
| Imm. Tubificid w/ Cap. Chaete  | 506              |                |
| Imm. Tubificid w/o Cap. Chaete | 4324             |                |

|                          |  |      |  |         |  |
|--------------------------|--|------|--|---------|--|
| Musculium spp.           |  | 23   |  | 0.00230 |  |
| Oligochaeta              |  |      |  | 0.46920 |  |
| Procladius spp.          |  | 69   |  |         |  |
| -----                    |  |      |  |         |  |
| Total Abundance w/ Epi.  |  | 6095 |  |         |  |
| Total Abundance w/o Epi. |  | 6095 |  |         |  |
| Number of Taxa w/ Epi.   |  | 8    |  |         |  |
| Number of Taxa w/o Epi.  |  | 8    |  |         |  |
| Total Biomass w/ Epi.    |  | 0.7  |  |         |  |
| Total Biomass w/o Epi.   |  | 0.7  |  |         |  |
| =====                    |  |      |  |         |  |

\* Indicates taxon is skipped in taxa counts

BOTTOM ENVIRONMENT AND BENTHOS, SUMMER 2000

AMBIENT TOXICITY STATIONS

|                        |                          |                |
|------------------------|--------------------------|----------------|
| Station: FB10          |                          |                |
| Watershed: Fishing Bay | Habitat: Low Mesohaline  | Date: 09/28/00 |
| Gear: Young Grab       | Sampled Area: 0.043 sq.m | Time: 10:49:30 |

BOTTOM ENVIRONMENT

|                              |                               |                        |
|------------------------------|-------------------------------|------------------------|
| Depth (m): 1.0               | Salinity (ppt): 8.8           | Temperature (C): 17.6  |
| Dissolved Oxygen (mg/l): 4.3 | Sediment Silt-Clay (%): 88.41 | Total Carbon (%): 4.83 |

BENTHIC INDEX OF BIOTIC INTEGRITY

|                                   |                     |       |  |        |
|-----------------------------------|---------------------|-------|--|--------|
| B-IBI Score: 2.6                  | Condition: Degraded |       | # Attributes Scored: 5                     |        |
|                                   | Value               | Score | Value                                      | Score  |
| Shannon-Weiner Index              | 2.0                 | 3     | Pollution Indicative Species Abundance (%) | 0.0 5  |
| Abundance (#/m2)                  | 368                 | 1     | Pollution Indicative Species Biomass (%)   | 0.0    |
| Biomass (g/m2)                    | 0.6                 | 1     | Pollution Sensitive Species Abundance (%)  | 50.0   |
| Carnivore-Omnivore Abundance (%)  | 31.3                |       | Pollution Sensitive Species Biomass (%)    | 95.0 3 |
| Deep Deposit Feeder Abundance (%) | 18.8                |       |  |        |

BENTHIC DATA

| TAXA                    | Abundance (#/m2) | Biomass (g/m2) |
|-------------------------|------------------|----------------|
| Carinoma tremaphoros    | 92               | 0.00230        |
| Cyathura polita         | 23               | 0.06900        |
| Heteromastus filiformis | 69               | 0.01840        |
| Macoma mitchelli        | 23               | 0.01150        |
| Marenzelleria viridis   | 161              | 0.54280        |
| Total Abundance w/ Epi. | 368              |                |

|                          |  |     |  |  |
|--------------------------|--|-----|--|--|
| Total Abundance w/o Epi. |  | 368 |  |  |
| Number of Taxa w/ Epi.   |  | 5   |  |  |
| Number of Taxa w/o Epi.  |  | 5   |  |  |
| Total Biomass w/ Epi.    |  | 0.6 |  |  |
| Total Biomass w/o Epi.   |  | 0.6 |  |  |

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