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**Water Quality Analysis of Fecal Coliform for the Restricted
Shellfish Harvesting Area in the Mainstem
Patuxent River Lower Basin
in Prince George's, Charles, and Calvert Counties, Maryland**

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List of Abbreviations

cfs	Cubic Feet per Second
CFR	Code of Federal Regulations
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
EPA	Environmental Protection Agency
FDA	U.S. Food and Drug Administration
km	Kilometer
LA	Load Allocation
MDE	Maryland Department of the Environment
M ₂	Lunar semi-diurnal tidal constituent
MDP	Maryland Department of Planning
m	Meter
ml	Milliliter(s)
MPN	Most Probable Number
NOAA	National Oceanic and Atmospheric Administration
NSSP	National Shellfish Sanitation Program
TMDL	Total Maximum Daily Load
WQLS	Water Quality Limited Segment

EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met.

Patuxent River Lower Basin (basin number 02131101) was identified on the State's 303(d) List submitted to U.S. Environmental Protection Agency (EPA) by the Maryland Department of the Environment (MDE) as impaired by nutrients (1996), sediments (1996), bacteria (1996/1998/2004), toxics – chlorpyrifos (water) (2002), and the non-tidal portion of the basin for impacts to biological communities (2002/2004). In addition, an impoundment within the watershed, Lake Lariat, was listed as impaired by metals – methylmercury (2002). Recent monitoring data show that the applicable water quality criteria for fecal coliform are being met in the restricted shellfish harvesting area in the mainstem of the Patuxent River Lower basin. As a result, TMDLs of fecal coliform are not necessary to achieve water quality standards in this restricted shellfish harvesting area. Barring the receipt of any contradictory data, this report will be used to support the bacteria listing change for the restricted shellfish harvesting area in the mainstem of the Patuxent River Lower Basin from Category 5 (“waterbodies impaired by one or more pollutants and requiring a TMDL”) to Category 2 (“surface waters that are meeting some standards and have insufficient information to determine attainment of other standards”) when MDE proposes the revision of Maryland's 303(d) list for public review in the future. TMDLs of fecal coliform have been completed for other tidal shellfish harvesting areas in the basin in 2004 and 2005. A TMDL for the metals listing was completed in 2002 for Lake Lariat. The listings for other impairments will be addressed separately at a future date.

Although the waters of the restricted shellfish harvesting area in the mainstem of the Patuxent River do not display signs of fecal coliform impairments, the State reserves the right to require additional pollution controls in the watershed if evidence suggests that fecal coliform from the basin is contributing to downstream water quality problems.

1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and U.S. Environmental Protection Agency (EPA)'s implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. This list of impaired waters is commonly referred to as the "303(d) List". For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met.

A segment identified as a WQLS might not require the development and implementation of a TMDL if current information contradicts the previous finding of impairment. Based on EPA's guidance for water quality-based decisions, the reasons obviating the need for a TMDL are as follows: (1) recent data indicate that the impairment no longer exists (*i.e.*, water quality standards are being met); (2) more recent and updated water quality modeling demonstrates that the waterbody attains standards; (3) refinements to water quality standards, or the interpretation of those standards, result in the attainment of the standard; and (4) corrections are made to errors in the original listing. Scenarios 1 and 2 apply to the restricted shellfish harvesting area in the mainstem Patuxent River of the Patuxent River Lower Basin.

Patuxent River Lower Basin (basin number 02131101) was identified on the State's 303(d) List submitted to U.S. Environmental Protection Agency (EPA) by the Maryland Department of the Environment (MDE) as impaired by nutrients (1996), sediments (1996), bacteria (1996/1998/2004), toxics – Chlorpyrifos (water) (2002), and the non-tidal portion of the basin for impacts to biological communities (2002/2004). In addition, an impoundment within the watershed, Lake Lariat, was listed as impaired by metals – methylmercury (2002). Shellfish waters are closed or restricted to harvesting when the fecal coliform criteria for shellfish harvesting waters are exceeded. The criteria include both a median and a 90th percentile. In specific cases under the shellfish program, waterbodies may be restricted or closed to harvesting due to the potential for harmful public health impacts even when fecal coliform criteria are being met.

Fecal coliform are found in the intestinal tract of humans and other warm-blooded animals. Fecal coliform may occur in surface waters from point and nonpoint sources. Few fecal coliform are pathogenic; however, the presence of elevated levels of fecal coliform in shellfish waters may indicate recent sources of pollution. Some common waterborne diseases associated with the consumption of raw clams and oysters harvested from polluted water include viral and bacterial gastroenteritis and hepatitis A.

Fecal coliform is an indicator organism used in water quality monitoring in shellfish waters to indicate fresh sources of pollution from human and other animal wastes. When the water quality standard for fecal coliform in shellfish waters is exceeded, waters are closed to shellfish harvesting to protect human health from the potential risk of consuming raw molluscan shellfish

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from contaminated waters. The U.S. Food and Drug Administration (FDA), rather than EPA, is responsible for food safety. Water quality criteria for shellfish waters are established under the National Shellfish Sanitation Program (NSSP), a cooperative program that involves States, industry, academic and federal agencies with oversight by FDA. The NSSP continues to use fecal coliform as the indicator organism to assess shellfish harvesting waters.

The remainder of this report describes the general setting of the restricted shellfish harvesting area of the mainstem Patuxent River Lower watershed, presents a discussion of the water quality characterization process, and draws conclusions regarding characterization.

2.0 GENERAL SETTING

The restricted shellfish harvesting area in the mainstem of the Patuxent River Lower Basin is addressed in this report. The Patuxent River Lower basin is located on Maryland's Western Shore in Prince George's, Charles and Calvert Counties, MD, as shown in Figure 1. The Patuxent River has a length of approximately 71 km and a width ranging from 500 m upstream to 2.4 km at the mouth, where it flows east directly into the Chesapeake Bay. The restricted shellfish harvesting area in the mainstem of the Patuxent River Lower Basin has a drainage area of 91,966.5 acres (372.2 km²). The length of the restricted area is approximately 20 km.

The soils in the Patuxent River Lower Basin are characterized as hydrology classes C and D and as having moderate to high runoff. The dominant tide in this region is the lunar semi-diurnal (M₂) tide, with a tidal range of 0.49 m at the mouth amplifying to 0.76 m upstream in the restricted portion of Patuxent River with a tidal period of 12.42 hours (National Oceanic and Atmospheric Administration (NOAA), 2004). Please refer to Table 1 for the mean volume and mean water depth of this restricted shellfish harvesting area.

Table 1: Physical Characteristics of the Restricted Shellfish Harvesting Area in the Mainstem of Patuxent River Lower Basin

Restricted Shellfish Harvesting Area	Mean Water Volume in m³	Mean Water Depth in m
Mainstem of the Patuxent River Lower	26,947,930	1.8

The 2000 Maryland Department of Planning (MDP) land use/land cover data show that the watershed can be characterized as primarily rural for Patuxent River with nearly 70% of the area being forest and cropland. The watershed land use information associated with this restricted shellfish harvesting area in the mainstem Patuxent River Lower Basin is shown in Table 2 and Figure 2. Residential urban land use identified in Table 2 includes low-density residential, medium-density residential, and high-density residential. Non-residential urban land use in this table includes commercial, industrial, institutional, extractive, and open urban land.

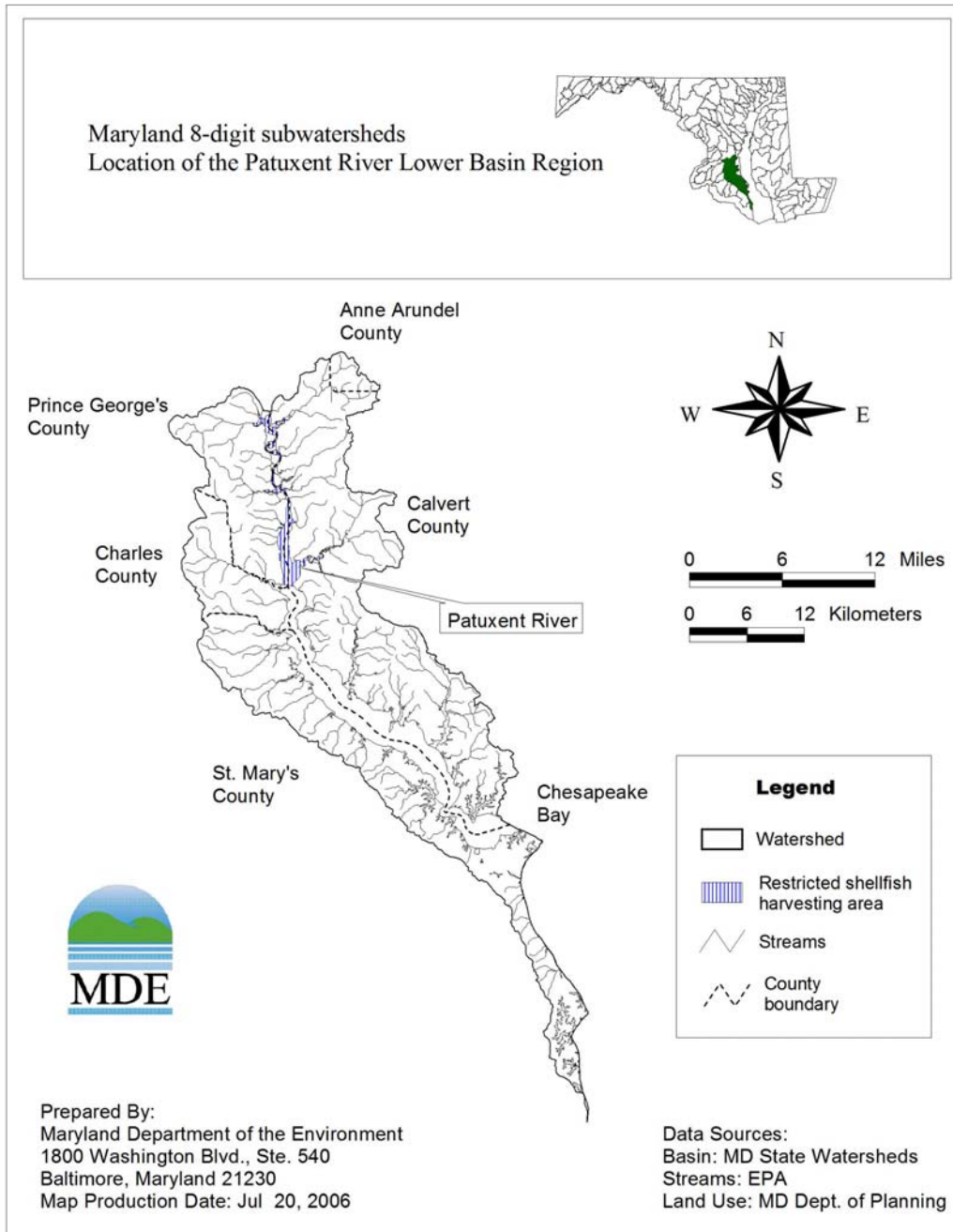


Figure 1: Location Map of the Patuxent River Lower Basin

Table 2: Land Use Percentage Distribution for Patuxent River Lower

Land Type	Acreage	Percentage
Residential urban	17,948.6	18.6
Non-Residential urban	2,421.3	2.5
Cropland	22,588.3	23.5
Pasture	1,497.5	1.5
Feedlot	54.3	0.1
Forest	44,529.4	46.3
Water	4,245.0	4.4
Wetlands	2,759.5	2.9
Barren	167.6	0.2
Totals	96,211.5	100.0

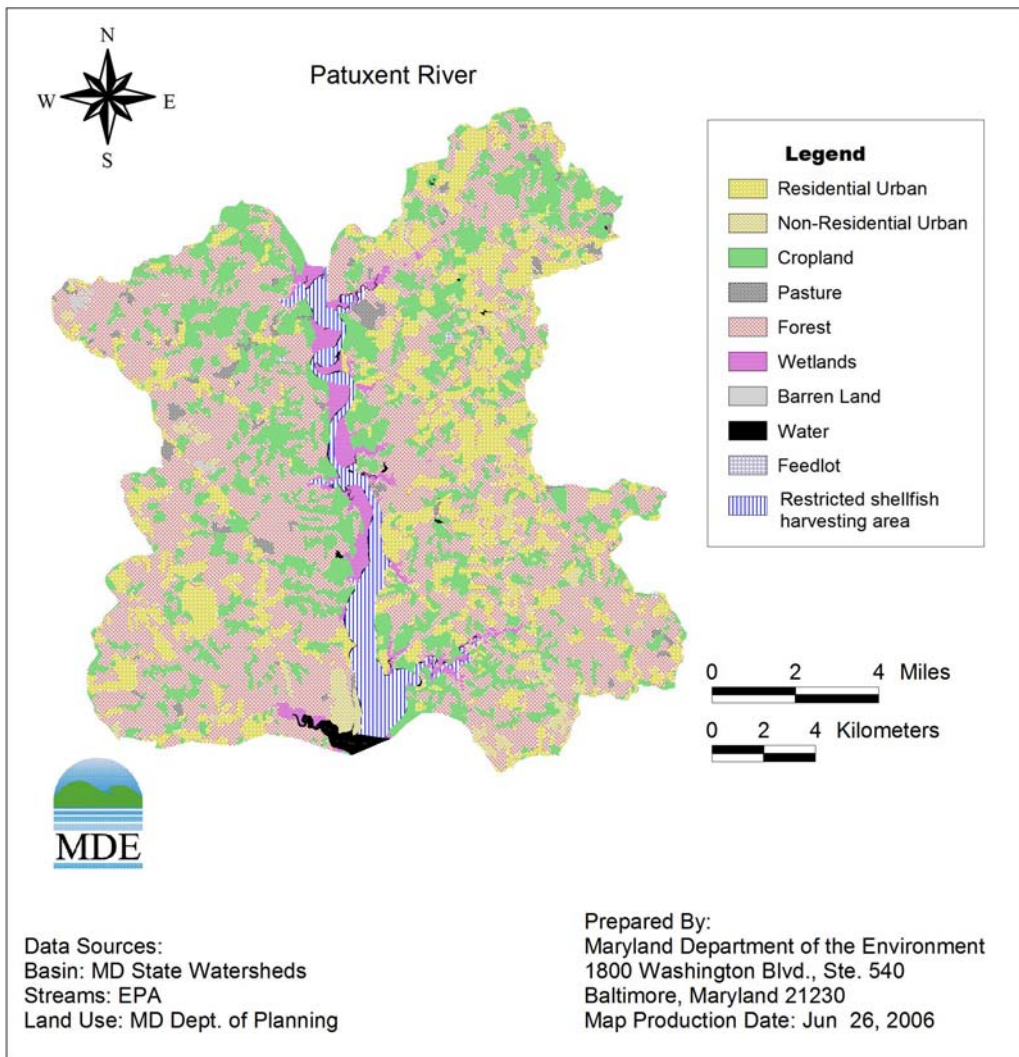


Figure 2: Land Use in the Patuxent River Lower Basin

3.0 WATER QUALITY CHARACTERIZATION

MDE's Shellfish Certification Program is responsible for classifying shellfish harvesting waters to ensure oysters and clams are safe for human consumption. MDE adheres to the requirements of the National Shellfish Sanitation Program (NSSP), with oversight by the U.S. Food and Drug Administration (FDA). MDE conducts shoreline surveys and collects routine bacteria water quality samples in the shellfish waters of Maryland. These data are used to determine if the shellfish water classification is being met.

MDE's Shellfish Certification Program has monitored shellfish waters throughout Maryland for the past several decades. There is one shellfish monitoring station in the restricted shellfish harvesting area addressed in this report. The station identification and observations recorded during the period of June 2000 – June 2005 are provided in Table 3 and in Figures 3 and 4. A tabulation of observed fecal coliform values at the single monitoring station included in this report is provided in Appendix A.

Table 3: Location of the Shellfish Monitoring Station in the Restricted Shellfish Harvesting Area in the Mainstem of the Patuxent River Lower Basin

Station Location	Shellfish Monitoring Station	Obs. Period	Total Obs.	LATITUDE Deg-min-sec	LONGITUDE Deg-min-sec
Mainstem Patuxent River Lower	09-01-001	2000-2005	50	38 32 27.0	76 40 25.0

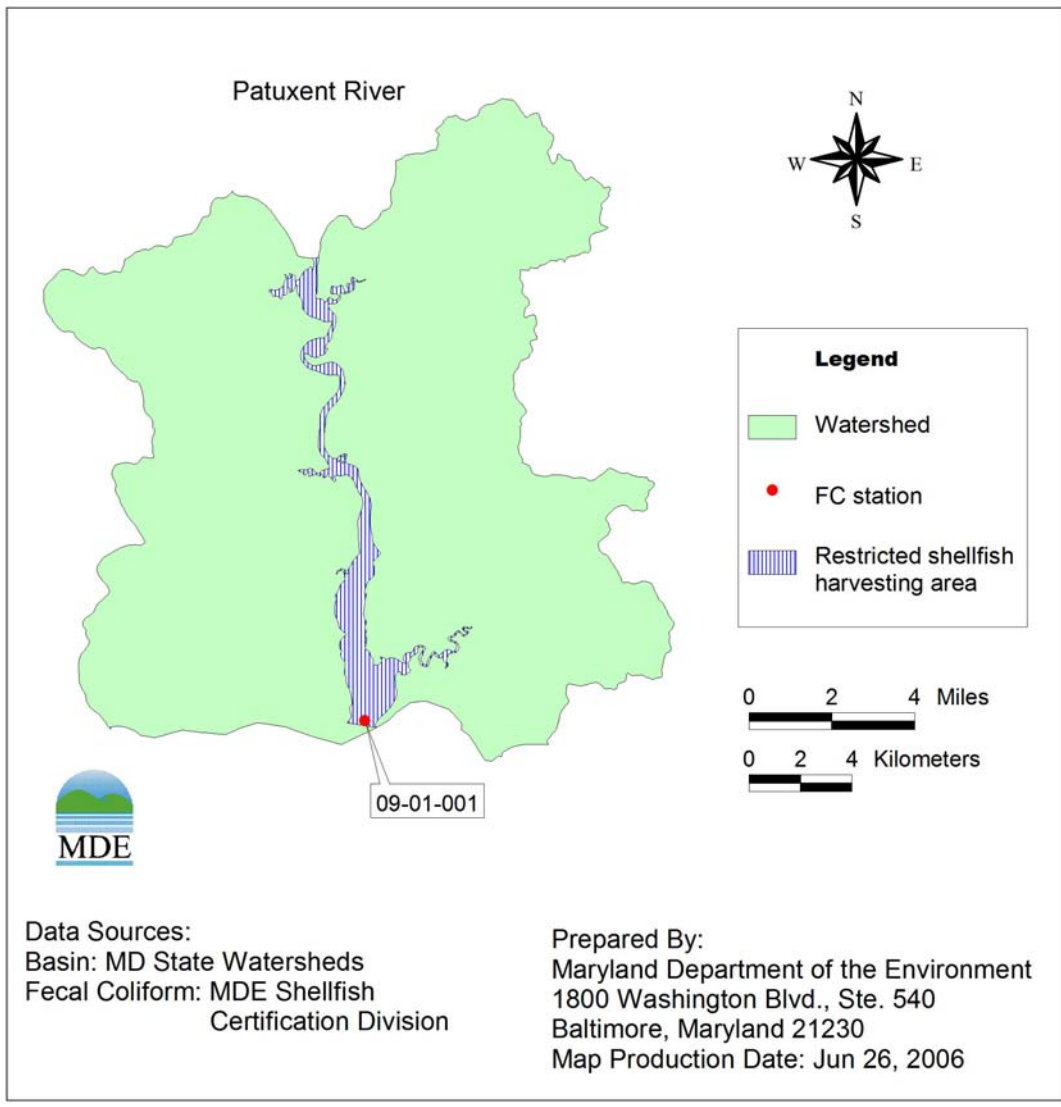


Figure 3: Shellfish Monitoring Station in the Restricted Shellfish Harvesting area in the mainstem of Patuxent River Lower

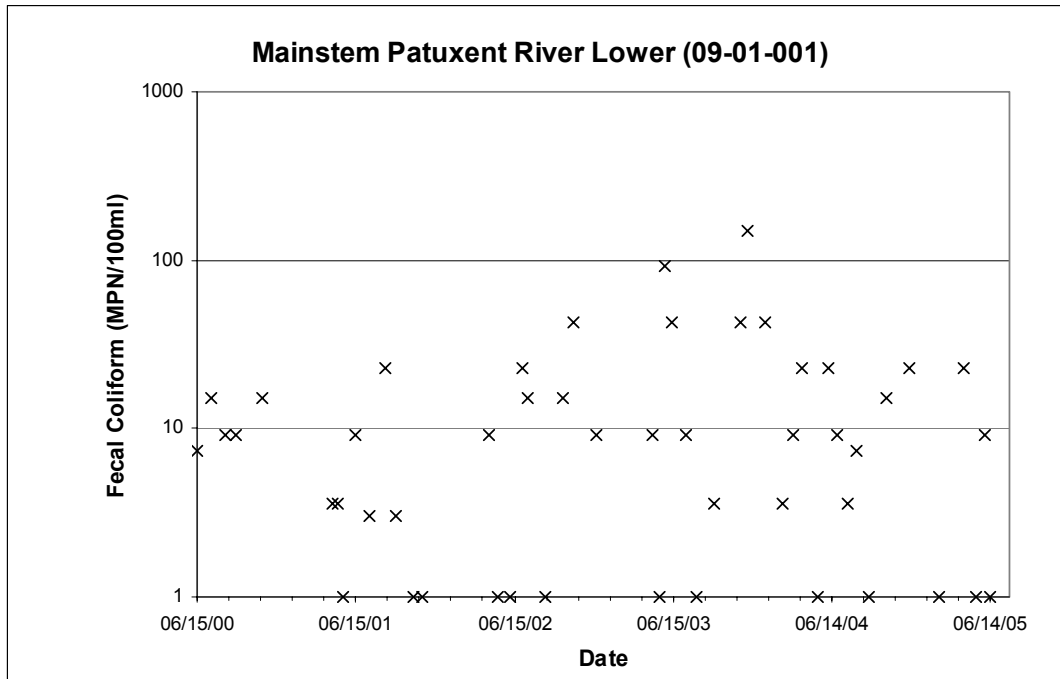


Figure 4: Observed Fecal Coliform Concentrations at Station 09-01-001

3.1 Water Quality Standard

The fecal coliform listing addressed in this analysis was determined with reference to Maryland’s Classification of Use II Waters-Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting in the Code of Maryland Regulations (COMAR), Surface Water Quality Criteria 26.08.02.03-3C, which states:

2) Classification of Use II Waters for Harvesting.

(a) Approved classification means that the median fecal coliform MPN of at least 30 water sample results taken over a 3-year period to incorporate inter-annual variability does not exceed 14 per 100 milliliters; and:

(i) In areas affected by point source discharges, not more than 10 percent of the samples exceed an MPN of 43 per 100 milliliters for a five tube decimal dilution test or 49 MPN per 100 milliliters for a three tube decimal dilution test; or

(ii) In other areas, the 90th percentile of water sample results does not exceed an MPN of 43 per 100 milliliters for a five tube decimal dilution test or 49 MPN per 100 milliliters for a three tube decimal dilution test.

MDE updated and promulgated shellfish water quality criteria for shellfish waters in June 2004. Although bacteriological criteria for shellfish harvesting waters were unchanged, the intent of the

update was to include classification criteria required under the NSSP that were not previously included in COMAR. In 2005, MDE revised the use designations in COMAR as part of the Chesapeake Bay Program revision to reflect living resources-based habitat needs, but did not change the fecal coliform criteria for shellfish harvesting waters or shellfish harvesting use designations.

For this analysis MDE is using routine monitoring data collected over a five-year period between June 2000 and June 2005. The assimilative capacity will be based on the approved classification requirements of a median of 14 MPN/100 ml and a 90th percentile of less than 49 MPN/100ml.

3.2 Water Quality Evaluation

The observed fecal coliform median and 90th percentile are 9.10 MPN/100ml and 38.46 MPN/100ml, respectively (Table 4). Since the bacteria water quality criteria applicable to the designated use are being met in the restricted shellfish harvesting area in the mainstem Patuxent River of the Patuxent River Lower Basin, a TMDL for fecal coliform is not necessary to achieve water quality standards in the related watershed.

Table 4: Mainstem Patuxent River Lower Fecal Coliform Statistics (data from 2002-2005)

Restricted Area Name	Station	Median		90 th Percentile	
		Monitoring Data	Criterion	Monitoring Data	Criterion
		MPN/100ml	MPN/100ml	MPN/100ml	MPN/100ml
Mainstem Patuxent River Lower	09-01-001	9.10	14	38.46	49

4.0 CONCLUSION

The data presented in this report indicate that fecal coliform concentrations in the restricted shellfish harvesting area in the mainstem Patuxent River Lower Basin fall within the State's standards. Barring the receipt of any contradictory data, this report will be used to support the bacteria listing change for the Patuxent River from Category 5 ("waterbodies impaired by one or more pollutants and requiring a TMDL") to Category 2 ("surface waters that are meeting some standards and have insufficient information to determine attainment of other standards") when MDE proposes the revision of Maryland's 303(d) List for public review in the future.

Restricted shellfish waters in the mainstem of the Lower Patuxent River are limited to the waters between Chalk Point and Ferry Landing. The water quality use designation for shellfish waters does not extend above Ferry Landing. Historically, there has been no shellfish resource above Chalk Point. MDE currently does not have monitoring stations upstream of Chalk Point. The NSSP requires additional routine monitoring stations to reclassify this small segment of the mainstem Patuxent River Lower Basin. Therefore, even though data collected for this WQA

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indicate that the water quality criteria are being met, the restricted classification will remain in effect. MDE continues to routinely monitor the current station within the restricted shellfish harvesting area under the NSSP requirements.

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REFERENCES

Code of Maryland Regulations, 26.08.02.03-3C(2). Bacteriological Criteria for Use II Waters - Shellfish harvesting. Website <http://www.dsd.state.md.us/comar/26/26.08.02.03-3.htm>.

Maryland Department of the Environment (2004). Maryland's 2004 Section 303(d) List. Website http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/final_2004_303dlist.asp.

Maryland Department of Planning. 2000 Reference for Land Use.

National Oceanic and Atmospheric Administration (NOAA) (2004). Tides Online. National Ocean Survey. Website: <http://co-ops.nos.noaa.gov/>

Appendix A. Tabulation of Fecal Coliform Data

This appendix provides a tabulation of fecal coliform values for the one monitoring station in the Patuxent River Lower Basin used in this report in Table A-1. These data are plotted in report Figure 4.

Table A-1: Observed Fecal Coliform data at Patuxent River Station 09-01-001

DATE	Fecal Coliform MPN/100 ml	DATE	Fecal Coliform MPN/100 ml
6/1/2000	9.1	5/14/2003	1
6/15/2000	7.3	5/27/2003	93
7/17/2000	15	6/10/2003	43
8/17/2000	9.1	7/14/2003	9.1
9/13/2000	9.1	8/7/2003	1
11/13/2000	15	9/17/2003	3.6
4/23/2001	3.6	11/17/2003	43
5/3/2001	3.6	12/1/2003	150
5/17/2001	1	1/12/2004	43
6/13/2001	9.1	2/23/2004	3.6
7/16/2001	3	3/15/2004	9.1
8/23/2001	23	4/7/2004	23
9/13/2001	3	5/11/2004	1
10/24/2001	1	6/7/2004	23
11/14/2001	1	6/24/2004	9.1
4/16/2002	9.1	7/20/2004	3.6
5/6/2002	1	8/9/2004	7.3
6/4/2002	1	9/7/2004	1
7/1/2002	23	10/18/2004	15
7/16/2002	15	12/8/2004	23
8/26/2002	1	2/16/2005	1
10/3/2002	15	4/13/2005	23
10/28/2002	43	5/11/2005	1
12/19/2002	9.1	5/31/2005	9.1
4/29/2003	9.1	6/14/2005	1