Water Quality Analysis of Eutrophication for the Jones Falls Watershed in Baltimore City and Baltimore County, Maryland

FINAL

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BOD	Biochemical Oxygen Demand
BSID	Biological Stressor Identification
CES	Coastal Environmental Services
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
DNR	Department of Natural Resources
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
MBSS	Maryland Biological Stream Survey
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
mg/l	Milligrams Per Liter
mi^2	Square Miles
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service
PCBs	Polychlorinated Biphenyls
SCS	Soil Conservation Service
SSURGO	Soil Survey Geography
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSI	Trophic State Index
USGS	United States Geological Survey
WQLS	Water Quality Limited Segment
µg/l	Micrograms Per Liter

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. 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 (CFR 2007).

The Jones Falls watershed (assessment unit ID: MD-02130904) was identified on the State's 303(d) List as impaired by nutrients, sediment, copper, lead, zinc (1996 listings), fecal bacteria (2002 listing), and impacts to biological communities (2002, 2004, and 2006 listings). Lake Roland was listed as impaired by chlordane (1996) and polychlorinated biphenyls (PCBs) (2002). The listings for copper, lead, and zinc have been addressed by Water Quality Analyses (WQAs) showing no impairment. The listings for fecal bacteria and chlordane have been addressed with TMDLs completed in 2006 and 2000, respectively. The 1996 nutrients listing was refined in the *2008 Integrated Report of Surface Water Quality in Maryland* (*Integrated Report*) and phosphorus was identified as the specific impairing substance. Consequently, for the purpose of this report the terms nutrients and phosphorus will be used interchangeably. A sediment TMDL is scheduled to be submitted to the EPA in 2009, and the listings for impacts to biological communities and PCBs in fish tissue will be addressed separately at a future date.

A data solicitation for information pertaining to pollutants, including nutrients, in the Jones Falls watershed was conducted by Maryland Department of the Environment (MDE) in November 2007, and all readily available data from the past five years have been considered. Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards. Nutrients typically do not have a direct impact on aquatic life; rather, they mediate impacts through excessive algal growth leading to low dissolved oxygen. Therefore, the evaluation of potentially eutrophic conditions due to nutrient over-enrichment will be based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair designated uses in the Jones Falls watershed (in this case, water contact recreation and protection of aquatic life).

Recently, MDE developed a biological stressor identification (BSID) methodology to identify the most probable cause(s) of the existing biological impairments in Maryland 8-digit watersheds based on the suite of available physical, chemical, and land use data (MDE 2009a). The BSID analysis for the Jones Falls watershed indicates inorganic pollutants and flow/sediment stressors are associated with impacts to biological communities; these findings will be addressed separately. The BSID analysis did not identify any nutrient-related stressors present and/or nutrient-related stressors showing a significant association with degraded biological conditions (MDE 2009b). The results of the BSID study, combined with the analysis of recent water quality data presented in this report, indicate that the Jones Falls watershed is not being impaired by nutrients. This WQA supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality standards in the Jones Falls.

Although the waters of the Jones Falls do not display signs of eutrophication, the State reserves the right to require future controls if evidence suggests that nutrients from the basin are contributing to downstream water quality problems. In December 2007, EPA approved TMDLs of nitrogen and phosphorus for the Baltimore Harbor. The Jones Falls watershed is located upstream of the Baltimore Harbor and drains into the Harbor's tidal waters. Although the amount of nutrients entering the Jones Falls is not causing localized impairments, it is contributing to the eutrophication of the downstream tidal waters of the Harbor. Therefore, the TMDL for the Baltimore Harbor requires nutrient reductions in the Jones Falls necessary to meet water quality standards in the Harbor. On the same principle, additional reductions may also be required by the forthcoming Chesapeake Bay TMDL, currently under development and due to be established by EPA by the end of 2010.

Barring the receipt of contradictory data, this report will be used to support a revision of the nutrients (i.e., phosphorus) listing for the Jones Falls watershed, from Category 5 ("waterbody is impaired, does not attain the water quality standard, and a TMDL is required") to Category 2 ("waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments") when MDE proposes the revision of the *Integrated Report*.

1.0 INTRODUCTION

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 listed in the *Integrated Report of Surface Water Quality in Maryland* (*Integrated Report*), 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 (CFR 2007).

A segment identified as a WQLS may not require the development and implementation of a TMDL if more recent information invalidates previous findings. The most common factual scenarios obviating the need for a TMDL are: 1) analysis of more recent data indicating that the impairment no longer exists (i.e., water quality standards are being met); 2) results of a more recent and updated water quality modeling which demonstrates that the segment is attaining standards; 3) refinements to water quality standards or to the interpretation of those standards accompanied by analysis demonstrating that the standards are being met; or 4) identification and correction of errors made in the initial listing.

The Jones Falls watershed (assessment unit ID: MD-02130904) was identified in Maryland's *Integrated Report* as impaired by nutrients, sediment, copper, lead, zinc (1996 listings), fecal bacteria (2002 listing), and impacts to biological communities (2002, 2004, and 2006 listings). Lake Roland was listed as impaired by chlordane (1996) and polychlorinated biphenyls (PCBs) (2002). The listings for copper, lead, and zinc have been addressed by Water Quality Analyses (WQAs) showing no impairment. The listings for fecal bacteria and chlordane have been addressed with TMDLs. The 1996 nutrients listing was refined in the *2008 Integrated Report of Surface Water Quality in Maryland* (*Integrated Report*) and phosphorus was identified as the specific impairing substance. Consequently, for the purpose of this report the terms nutrients and phosphorus will be used interchangeably. The listings for sediment, impacts to biological communities, and PCBs in fish tissue will be addressed separately at a future date. A sediment TMDL is scheduled to be submitted to the EPA in 2009, and the listings for impacts to biological communities and PCBs in fish tissue will be addressed separately at a future date.

This report provides an analysis of recent data that supports the removal of the nutrients (phosphorus) listing for the Jones Falls watershed when MDE proposes the revision of the State's *Integrated Report*. The remainder of this report lays out the general setting of the Jones Falls watershed area and presents a discussion of the water quality characteristics in the watershed in terms of the existing water quality standards relating to nutrients. This analysis supports the conclusion that the waters of the Jones Falls watershed do not display signs of eutrophication or nutrient over-enrichment.

2.0 GENERAL SETTING

Location

The Jones Falls watershed is located in the Patapsco River region of the Chesapeake Bay watershed within Maryland (see Figure 1). The watershed covers a portion of Baltimore County and Baltimore City, Maryland. The entire Jones Falls watershed area comprises 37,290 acres (58.3 sq. mi.).

Jones Falls is a free-flowing non-tidal stream, flowing east and south from its headwaters in Garrison, MD to its discharge into the Inner Harbor in downtown Baltimore City. An impoundment is located at Lake Roland, just north of the Baltimore County/City boundary. Several tributaries drain to the Jones Falls mainstem, including Moores Branch, Roland Run, Towson Run, Western Run, and Stony Run. Due to the density of the urban landscape in downtown Baltimore City, Jones Falls flows through roughly three miles of underground duct before discharging into the Baltimore Harbor.

Geology/Soils

The Jones Falls watershed lies within the Piedmont and Coastal Plain provinces of central Maryland. The Piedmont province is characterized by gentle to steep rolling topography, and low hills and ridges. The surficial geology is characterized by metamorphic crystalline rocks consisting primarily of schist and gneiss. These formations are resistant to short-term erosion and often determine the limits of stream bank and stream bed. These crystalline formations decrease in elevation from northwest to southeast and eventually extend beneath the younger sediments of the Coastal Plain. The fall line represents the transition between the Atlantic Coastal Plain province and the Piedmont province. The Atlantic Coastal Plain surficial geology is characterized by thick, unconsolidated marine sediments deposited over the crystalline rock of the piedmont province. The deposits include clays, silts, sands, and gravels (CES 1995).

The Jones Falls watershed drains from northwest to southeast, following the gradient of the underlying crystalline bedrock in the Piedmont province. The surface elevations range from approximately 680 feet to sea level at the discharge. Stream channels of the sub-watersheds are well incised in the Eastern Piedmont, and exhibit relatively straight reaches and sharp bends, reflecting their tendency to following zones of fractured or weathered rock. The stream channels broaden abruptly as they flow down across the fall line into the soft, flat Coastal Plain sediments (CES 1995).

Above the Baltimore City/County boundary, Jones Falls lies predominantly in the Baile soil series. Soils in this series are very deep, poorly drained, exhibit slow to moderately slow permeability, and occur on upland depressions and slopes. The secondary soil series in the Baltimore County area of the watershed is the Hatboro soil series, which has similar characteristics as the Baile soil series and is often found in flood plains.

In Baltimore City the primary soil series is the Lehigh series. This series is characterized by deep and somewhat poorly drained soil with slow permeability. The secondary soil series present in the lower Jones Falls watershed is the Beltsville soil series, which is distinguished by being moderately well drained and often found in upland regions of the coastal plain geologic region.

Land Use

The 2002 Maryland Department of Planning land use/land cover data show that the Jones Falls watershed is comprised primarily of urban land (see Figure 2). The land use distribution in the watershed is approximately 76% urban; 16% forest; 6% agricultural; and 2% pasture.

Point Sources

There are a total of 3 municipal and industrial point source facilities with permits to discharge in the Jones Falls watershed. Of these 3 facilities, only 1 municipal wastewater treatment plant is regulated by a National Pollution Discharge Elimination System (NPDES) permit for the discharge of nutrients (see Table 1 below).

Table 1: Point Source Facilities Discharging Nutrients in the Jones Falls Watershed

Facility	NPDES Permit Number	Maximum Permitted Flow (mgd)
Stevenson University WWTP	MD0066001	0.025

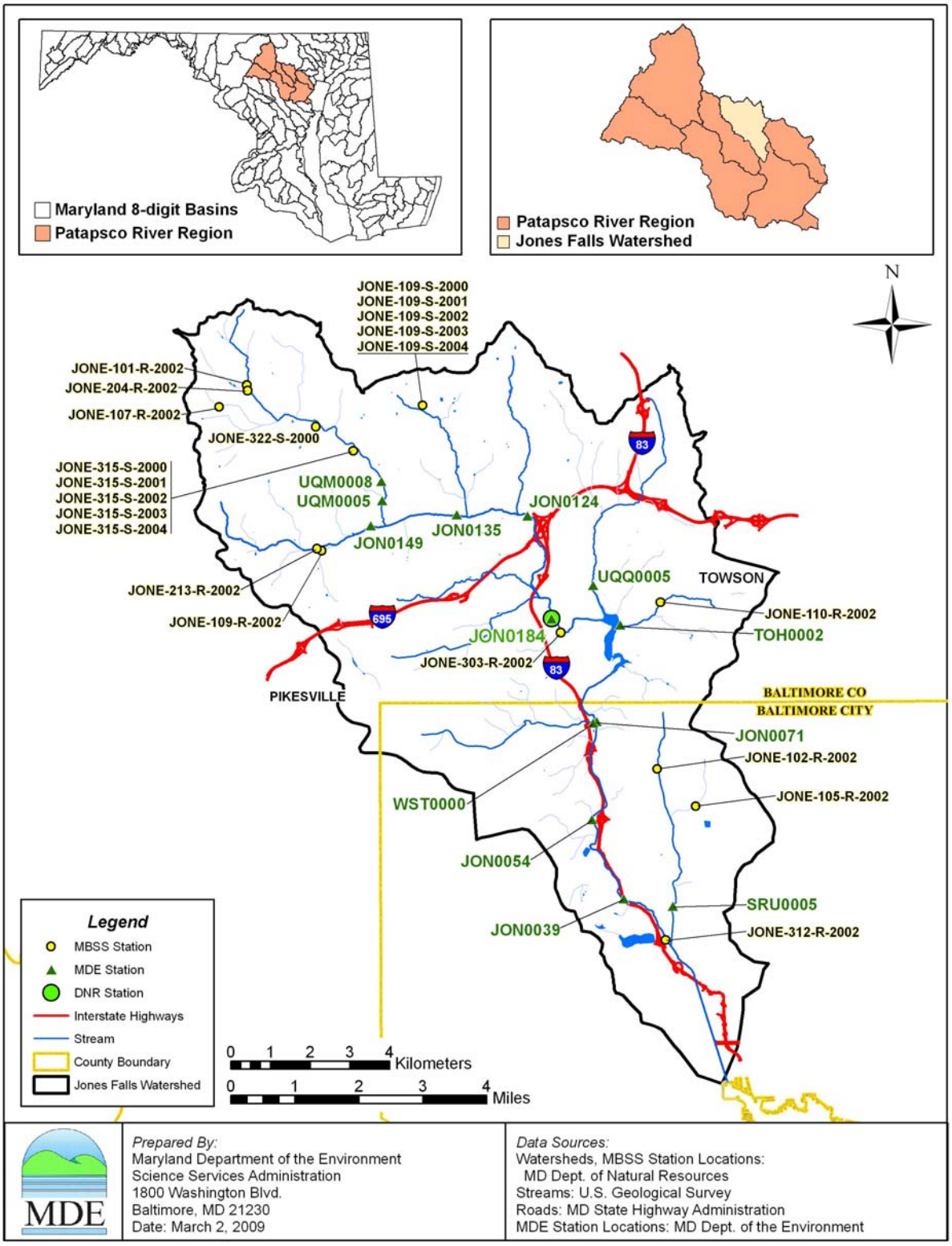

Figure 1: Location Map and Monitoring Stations of the Jones Falls Watershed

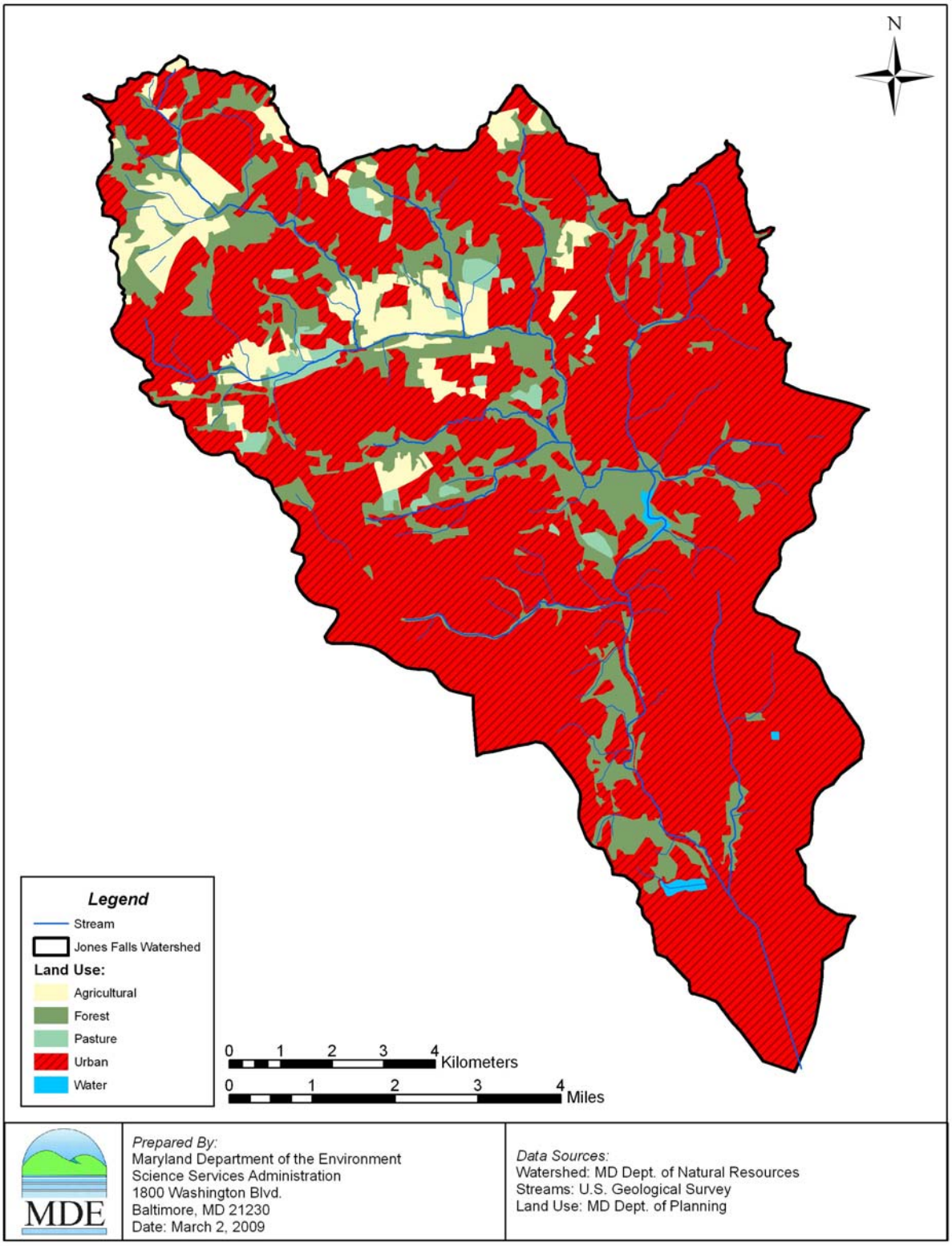

Figure 2: Land Use of the Jones Falls Watershed

3.0 WATER QUALITY CHARACTERIZATION

The Maryland Surface Water Use Designation for the Jones Falls and all tributaries above Lake Roland is Use III (nontidal cold water). Jones Falls, between North Ave. and Lake Roland, is designated as Use IV (recreational trout waters). Stony Run and all its tributaries are also designated as Use IV. All other waters of the watershed are designated as Use I (water contact recreation, fishing, and protection of aquatic life and wildlife). See Code of Maryland Regulations (COMAR) 26.08.02.08K(3)(c), 26.08.02.08K(5)(b), 26.08.02.08K(5)(d), and 26.08.02.07F(5).

A water quality standard is the combination of a designated use for a particular body of water and the water quality criteria designed to protect that use. Designated uses include support of aquatic life, primary or secondary contact recreation, drinking water supply, and shellfish propagation and harvest. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. The criteria developed to protect the designated use may differ and are dependent on the specific designated use(s) of a waterbody.

Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards. Therefore, the evaluation of potentially eutrophic conditions due to nutrient over-enrichment will be based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair designated uses in the Jones Falls watershed. The dissolved oxygen (DO) concentration to protect Use I waters "may not be less than 5 milligrams per liter (mg/l) at any time" (COMAR 26.08.02.03-3A(2)). The same criteria applies for Use IV waters (COMAR 26.08.02.03-3F(2)). The DO concentration to protect Use III waters "may not be less than 5 milligrams/liter at any time, with a minimum daily average of not less than 6 milligrams/liter" (COMAR 26.08.02.03-3D(2)). The water quality data presented in this section will show that DO concentrations in the Jones Falls and its tributaries meet these criteria.

In addition to the DO and chlorophyll *a* data analysis, the results of a new biological stressor identification (BSID) analysis demonstrate that any biological impairment in the watershed is not caused by nutrient enrichment. Instead, the analysis suggests that the degradation to biological communities in the Jones Falls watershed is strongly associated with the extensive urban nature of the watershed, which results in altered hydrology and elevated levels of sulfate, chlorides, and conductivity MDE 2009b).

A data solicitation was conducted in 2007. All readily available water quality data from the past five years have been considered for this analysis. Water quality data from MDE surveys conducted from October 1999 through August 2000, October 2002 through December 2005, and January 2007 through December 2007, were used. Maryland Department of Natural Resources (DNR) data used in the analysis were from January 1998 through June 2007. Data from Maryland Biological Stream Survey (MBSS) sampling conducted in 2000, 2001, 2002, 2003, and 2004 were also used. Table 2 lists the water quality monitoring stations in the Jones Falls watershed with their geographical coordinates. Figures 3 through 6 provide graphical representation of the collected data for the parameters discussed below.

Table 2: Water Quality Stations in the Jones Falls Watershed Monitored During 1998-2007

Station ID	Agency/Program	Latitude (Decimal-Degrees)	Longitude (Decimal-Degrees)
JON0039	MDE	39.3275	-76.6403
JON0054	MDE	39.3455	-76.6494
JON0071	MDE	39.3678	-76.6480
JON0124	MDE	39.4144	-76.6679
JON0135	MDE	39.4148	-76.6886
JON0149	MDE	39.4123	-76.7137
JON0184	MDE	39.3911	-76.6610
SRU0005	MDE	39.3258	-76.6260
TOH0002	MDE	39.3896	-76.6410
UQM0005	MDE	39.4180	-76.7104
UQM0008	MDE	39.4224	-76.7106
UQQ0005	MDE	39.3986	-76.6488
WST0000	MDE	39.3674	-76.6490
JON0184	DNR/CORE	39.3934	-76.6619
JONE-101-R-2002	DNR/MBSS	39.4442	-76.7498
JONE-102-R-2002	DNR/MBSS	39.3569	-76.6303
JONE-105-R-2002	DNR/MBSS	39.3483	-76.6192
JONE-107-R-2002	DNR/MBSS	39.4393	-76.7579
JONE-109-R-2002	DNR/MBSS	39.4067	-76.7280
JONE-109-S-2000	DNR/MBSS	39.4395	-76.6984
JONE-109-S-2001	DNR/MBSS	39.4395	-76.6984
JONE-109-S-2002	DNR/MBSS	39.4395	-76.6984
JONE-109-S-2003	DNR/MBSS	39.4395	-76.6984
JONE-109-S-2004	DNR/MBSS	39.4395	-76.6984
JONE-110-R-2002	DNR/MBSS	39.3947	-76.6292
JONE-204-R-2002	DNR/MBSS	39.4431	-76.7496
JONE-213-R-2002	DNR/MBSS	39.4071	-76.7294
JONE-303-R-2002	DNR/MBSS	39.3879	-76.6584
JONE-312-R-2002	DNR/MBSS	39.3180	-76.6282
JONE-315-S-2000	DNR/MBSS	39.4293	-76.7187
JONE-315-S-2001	DNR/MBSS	39.4293	-76.7187
JONE-315-S-2002	DNR/MBSS	39.4293	-76.7187
JONE-315-S-2003	DNR/MBSS	39.4293	-76.7187
JONE-315-S-2004	DNR/MBSS	39.4293	-76.7187
JONE-322-S-2000	DNR/MBSS	39.4348	-76.7296

3.1 Dissolved Oxygen

DNR , MDE and MBSS samples taken during the growing season (May through October) show DO concentrations ranging from 0.7 to 17.9 mg/l, with only one value (out of 270) below either criterion of 5 mg/l and 6 mg/l (the second lowest sample value being 6.6 mg/l). The DO data are presented graphically in Figure 3 and in tabular form in Appendix A. Although the criterion concentration is 5 mg/l DO "at all times," MDE does not consider that the one value below the criterion, representing 0.4% of monitoring samples, is indicative of a pattern of use impairment. That one sample was measured by MBSS on Stony Run. The lowest DO value of samples taken by MDE on Stony Run is 7.3 mg/l (out of 26 samples). Given the overwhelming percentage of attainment indicated by the total data used in the analysis, MDE considers that the water quality standard for DO is being met in the Jones Falls watershed.

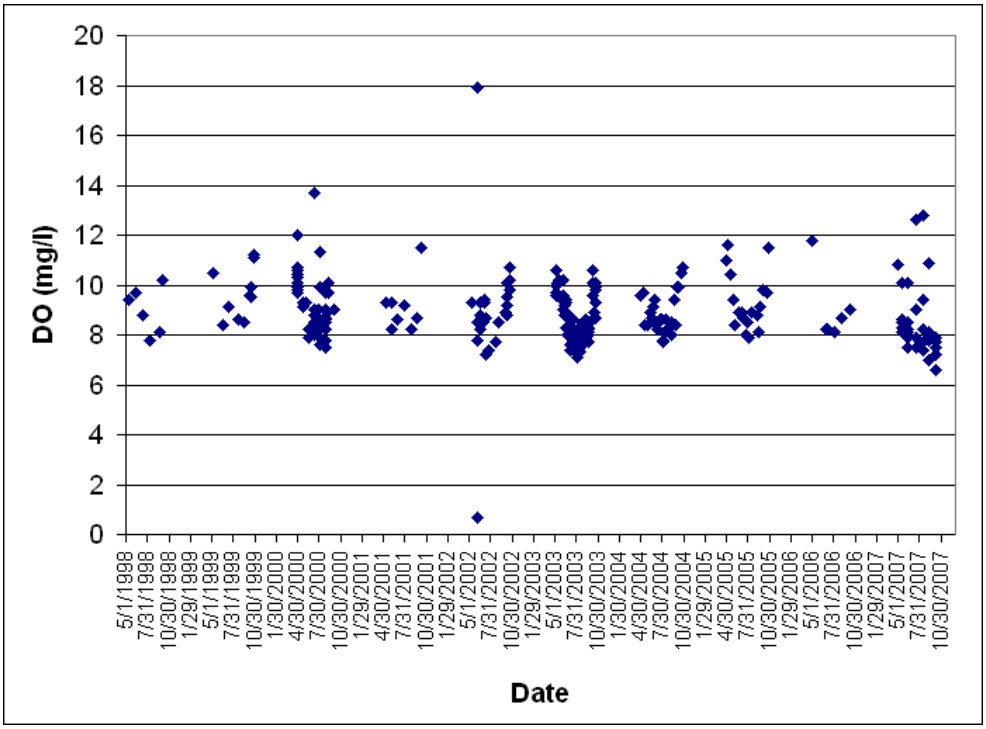

Figure 3: Jones Falls Watershed Dissolved Oxygen Data for Growing Season Periods May 1998 through October 2007

3.2 Chlorophyll *a*

Currently, Maryland water quality standards do not specify numeric criteria for chlorophyll *a*. However pollution of waters of the State by any material in amounts sufficient to create a nuisance or interfere with designated uses is prohibited (COMAR 26.08.02.03B(2)). Elevated chlorophyll *a* concentrations, a measure of algal growth, may indicate poor water quality that cannot support a waterbody's designated uses and may constitute a nuisance condition. Nuisance levels of algae can interfere with uses related to recreational activities such as fishing,

boating, and aesthetic appreciation. High chlorophyll *a* levels can also present taste, odor, and treatment problems in water supply systems.

Narrative water quality criteria are an important component of the State's water quality standards, but are difficult to incorporate into quantitative water quality or TMDL analyses. In the case of free-flowing non-tidal waters, there is an insufficient understanding of the relationship between chlorophyll *a* concentrations and the waterbody's designated use impairment. However, the Code of Maryland Regulations (COMAR) includes narrative criteria for acceptable chlorophyll *a* levels in tidal waters. Maryland's numeric interpretation of these criteria for application in estuarine waters is as follows:

> The chlorophyll *a* concentration goal used by the State in estuarine TMDL analyses is based on guidelines set forth by Thomann and Mueller (1987) and by the EPA Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1 (1997). The chlorophyll *a* narrative criterion (COMAR 26.08.02.03-3C(10)) states: "Chlorophyll *a* - Concentrations of chlorophyll *a* in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in ecologically undesirable consequences that would render tidal waters unsuitable for designated uses." The Thomann and Mueller guidelines acknowledge that "'Undesirable levels of phytoplankton [chlorophyll *a*] vary considerably depending on water body." MDE has determined, per Thomann and Mueller, that it is acceptable to maintain chlorophyll *a* concentrations below a maximum of 100 µg/L, and to target, with some flexibility depending on waterbody characteristics, a 30-day rolling average of approximately 50 µg/L (with some flexibility depending on waterbody characteristics). (MDE 2006)

Maryland has also developed guidelines for application of the narrative criteria in drinking water reservoirs. The guidelines, adapted from previously approved TMDLs, are as follows:

> The chlorophyll *a* endpoints selected for public water supply reservoirs are (a) a ninetieth-percentile instantaneous concentration not to exceed 30 µg/l in the surface layers, and (b) a 30-day moving average concentration not to exceed 10 µg/l in the surface layers. The concentration of 10 µg/l corresponds to a score of approximately 53 on the Carlson's Trophic State Index (TSI). This is at the boundary of mesotrophic and eutrophic conditions, which is an appropriate trophic state at which to manage these reservoirs. Mean chlorophyll *a* concentrations exceeding 10 µg/l are associated with peaks exceeding 30 µg/l, which in turn are associated with a shift to blue-green assemblages, which present taste, odor and treatment problems (Walker 1984). Achieving these chlorophyll *a* endpoints should thus safeguard such reservoirs from nuisance algal blooms. (MDE 2008b)

Using the chlorophyll *a* targets for tidal waters and public water supply reservoirs described above as screening values for non-tidal waters, the following data analysis reflects an absence of excessive algal growth in the Jones Falls watershed, as indicated by low chlorophyll *a* concentrations in comparison with those values.

DNR and MDE monitoring data in the Jones Falls watershed show growing season (May through October) averages, by station, between 0.6 and 5.5 µg/l. These samples show observed chlorophyll *a* concentrations ranging from 0.1 to 20.5 µg/l, with only four out of 180 samples greater than 10 µg/l. These monitoring data values suggest that chlorophyll *a* concentrations are not causing any nuisance in the Jones Falls watershed or interfering with its designated uses.

The chlorophyll *a* data are presented graphically in Figure 4 and in tabular form in Appendix A.

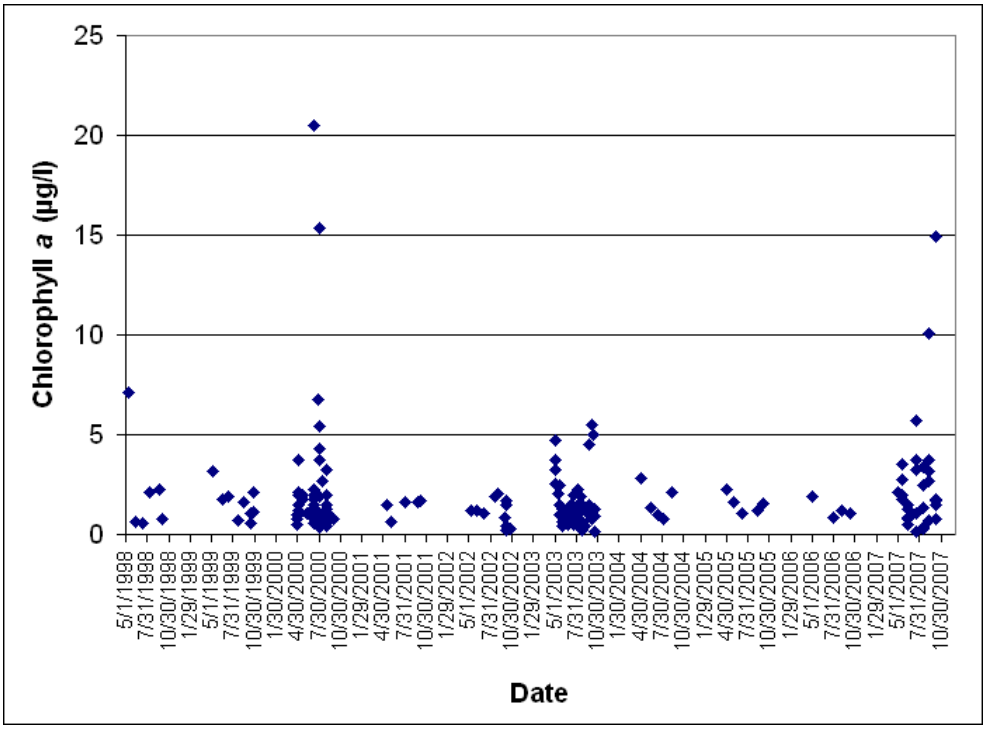

Figure 4: Jones Falls Watershed Chlorophyll *a* Data for Growing Season Periods May 1998 through October 2007

3.3 Nutrients

In the absence of State water quality standards with specific numeric limits for nutrients, evaluation of potentially eutrophic conditions is based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair the designated uses in the Jones Falls watershed (in this case protection of aquatic life and wildlife, fishing, and swimming). Consequently, the nutrients data presented in this section are for informational purposes only.

Total nitrogen (TN) and total phosphorus (TP) data for the Jones Falls watershed have been collected as part of this study and the results are presented here for informational purposes, graphically in Figures 5 and 6, and in tabular form in Appendix A. In general, DNR, MDE, and

MBSS data show TN concentrations during the growing season (May through October) ranging from 0.71 to 3.81 mg/l and TP concentrations ranging from 0.01 to 0.39 mg/l.

In the absence of specific numeric criteria to evaluate the TP and TN monitoring data results, MDE evaluated these results using its BSID methodology, which compared Jones Falls watershed parameters to the results from similar control sites (i.e., watersheds with no biological impairments) and concluded that nutrients are not likely stressors associated with the degraded biological conditions (MDE 2009b). Current DO conditions in the Jones Falls watershed further support this conclusion.

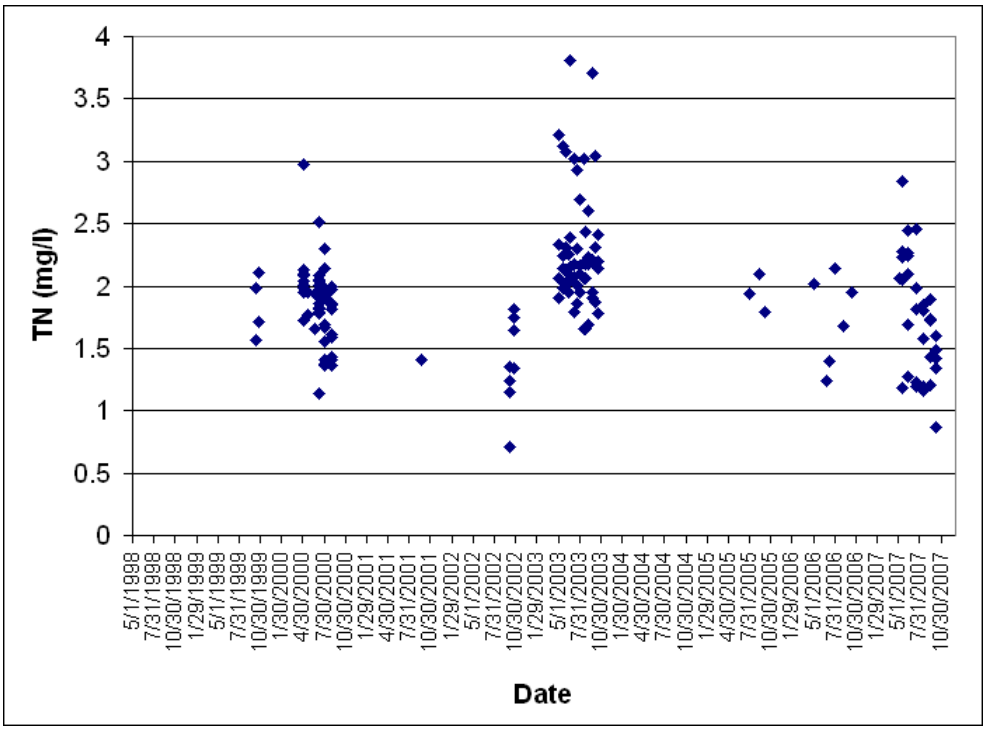

Figure 5: Jones Falls Watershed Total Nitrogen Data for Growing Season Periods May 1998 through October 2007

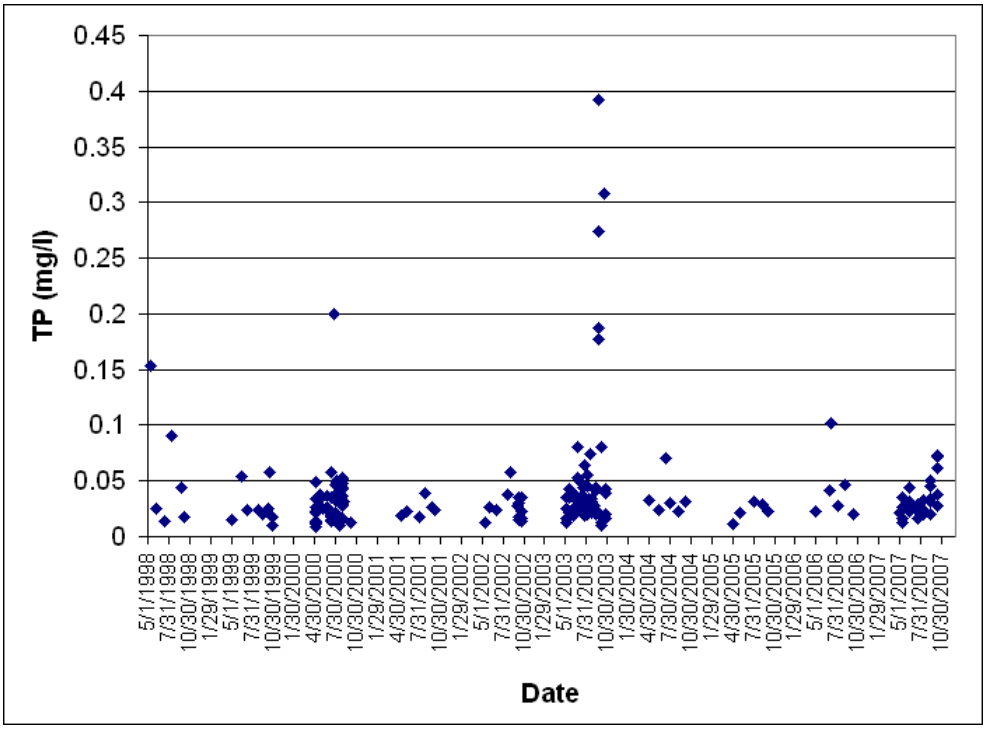

Figure 6: Jones Falls Watershed Total Phosphorus Data for Growing Season Periods May 1998 through October 2007

3.4 Biological Stressor Identification Analysis

In the process of evaluating the existing biological impairments, MDE developed a BSID methodology (MDE 2009a). The BSID methodology uses data available from the statewide DNR MBSS. These data are presented in Appendix A. The current MDE biological assessment methodology is a three-step process: (1) a data quality review, (2) a systematic vetting of the dataset, and (3) a watershed assessment that presents the results of this assignment in terms of currently used *Integrated Report* listing categories.

The BSID analysis for the Jones Falls watershed did not identify nutrients as potential stressors or indicate any significant association between current nutrient levels and the degraded biological conditions (MDE 2009b). According to this report, nutrients are not causing any impairment to aquatic life or biological communities in the Jones Falls watershed. The BSID analysis results suggest that biological degradation in the Jones Falls watershed is strongly associated with the extensive urban nature of the watershed, which has resulted in altered hydrology and elevated levels of sulfate, chlorides, and (electrical) conductivity. As explained in the BSID report, urbanization of landscapes generates broad and inter-related forms of degradation (i.e., hydrological, morphological, and water chemistry) that can affect stream ecology and biological composition. Scientific literature has established a link between highly urbanized landscapes and degradation in the aquatic health of non-tidal stream ecosystems.

4.0 CONCLUSION

Based on the analysis of data presented in the preceding section of this report, indicating that DO and chlorophyll *a* concentrations are meeting water quality criteria, and the results of the Jones Falls watershed BSID analysis, MDE concludes that currently the Jones Falls watershed is not being impaired by nutrients. (The BSID analysis indicates inorganic pollutants and flow/sediment stressors are associated with impacts to biological communities; these findings will be addressed separately.) Barring the receipt of contradictory data, this report will be used to support a revision of the phosphorus listing for the Jones Falls watershed, from Category 5 ("waterbody is impaired, does not attain the water quality standard, and a TMDL is required") to Category 2 ("waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments"), when MDE proposes the revision of Maryland's *Integrated Report*.

Although the waters of the Jones Falls watershed do not display signs of eutrophication, the State reserves the right to require future controls if evidence suggests that nutrients from the basin are contributing to downstream water quality problems. In December 2007, EPA approved TMDLs of nitrogen and phosphorus for the Baltimore Harbor. The Jones Falls watershed is located upstream of the Baltimore Harbor and drains into the Harbor's tidal waters. Although the amount of nutrients entering the Jones Falls is not causing localized impairments, it is contributing to the eutrophication of the downstream tidal waters of the Harbor. Therefore, the TMDL for the Baltimore Harbor requires nutrient reductions in the Jones Falls necessary to meet water quality standards in the Harbor. On the same principle, additional reductions may also be required by the forthcoming Chesapeake Bay TMDL, currently under development and due to be established by EPA by the end of 2010.

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Appendix A – Tabular Water Quality Data

Table A-1: MDE Water Quality Data

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0039	10/13/1999	9.5	1.05	1.57	0.057
JON0039	10/26/1999	11.2	2.09	1.71	0.018
JON0039	11/16/1999	12.0	6.62	1.61	0.018
JON0039	11/30/1999	12.3	1.00	1.35	0.029
JON0039	12/14/1999	11.4	17.44	2.08	0.188
JON0039	1/11/2000	12.1	3.99	1.97	0.018
JON0039	1/24/2000	14.5	1.99	2.22	0.010
JON0039	2/23/2000	13.6	13.21	2.00	0.025
JON0039	2/29/2000	11.2	4.49	1.78	0.068
JON0039	3/8/2000	11.8	5.34	1.99	0.017
JON0039	3/8/2000	11.8	5.34	2.00	0.017
JON0039	4/4/2000	9.3	5.23	1.92	0.039
JON0039	4/4/2000	9.3	4.98	1.90	0.038
JON0039	5/3/2000	9.7	1.50	1.95	0.023
JON0039	5/3/2000	9.7	1.99	1.94	0.022
JON0039	5/24/2000	9.1	1.99	1.77	0.037
JON0039	6/20/2000	7.9		1.66	0.036
JON0039	7/12/2000	8.8	1.74	1.78	0.021
JON0039	7/12/2000	8.8	1.99	1.80	0.023
JON0039	8/2/2000	7.9	4.30	1.36	0.036
JON0039	8/2/2000	7.9	3.74	1.37	0.037
JON0039	8/31/2000	8.6	1.50	1.41	0.044
JON0039	8/31/2000	8.6	1.99	1.41	0.043
JON0039	10/8/2002	10.1	1.50	0.71	0.030
JON0039	10/22/2002	10.7	0.25	1.34	0.036
JON0039	11/13/2002	9.9	1.25	1.27	0.050
JON0039	11/25/2002	12.3	0.43	1.66	0.026
JON0039	12/3/2002			1.73	0.018
JON0039	12/17/2002	12.4		1.97	0.050
JON0039	1/7/2003	13.3		2.00	0.036
JON0039	1/22/2003	13.8	1.50	2.56	0.026
JON0039	2/4/2003	11.2	116.63	4.65	0.656
JON0039	3/4/2003	13.4	0.75	2.13	0.040
JON0039	3/18/2003	12.9	5.98	2.01	0.030
JON0039	4/22/2003	11.2	10.25	1.97	0.019
JON0039	5/6/2003	9.7	4.73	1.90	0.026
JON0039	5/20/2003	9.5	1.50	1.98	0.043
JON0039	6/3/2003	9.6	1.28	2.02	0.039
JON0039	6/17/2003	8.9	1.00	1.95	0.035
JON0039	6/24/2003	8.3	1.00	2.04	0.053
JON0039	7/8/2003	7.4	1.50	1.79	0.035
JON0039	7/22/2003	7.9	1.99	1.86	0.035
JON0039	8/5/2003	7.1	2.24	1.94	0.055
JON0039	8/19/2003	8.2	1.92	1.65	0.033
JON0039	8/26/2003	7.9	1.28	1.65	0.032
JON0039	9/9/2003	8.4	0.43	1.68	0.044
JON0039	9/23/2003	8.0	1.50	1.95	0.274

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0039	10/7/2003	10.6	5.48	1.87	0.018
JON0039	10/21/2003	10.1	1.28	1.78	0.043
JON0039	1/18/2007	13.1	1.99	2.20	0.012
JON0039	2/26/2007	13.2	3.99	2.71	0.033
JON0039	3/14/2007	13.3	5.73	2.12	0.013
JON0039	4/25/2007	10.5	4.98	1.77	0.015
JON0039	5/16/2007	8.1	3.49	2.05	0.023
JON0039	6/13/2007	7.9	1.50	1.69	0.026
JON0039	7/18/2007	7.5	5.71	1.20	0.029
JON0039	8/15/2007	9.4	3.36	1.19	0.033
JON0039	9/12/2007	8.0	10.07	1.21	0.050
JON0039	10/11/2007	7.7	14.95	0.87	0.073
JON0039	11/15/2007	9.3	16.95	1.77	0.169
JON0039	11/15/2007	9.3	16.95	1.77	0.169
JON0039	12/12/2007	11.3	1.64	1.53	0.019
JON0039	12/12/2007	11.3	1.64	1.53	0.019
JON0054	3/8/2000	12.4	3.99	1.98	0.019
JON0054	4/4/2000	9.2	5.23	1.94	0.034
JON0054	5/3/2000	10.3	1.99	1.99	0.026
JON0054	7/12/2000	9.0	1.37	1.86	0.023
JON0054	8/2/2000	9.9	5.42	1.40	0.039
JON0054	8/31/2000	9.7	3.24	1.37	0.048
JON0071	3/8/2000	12.3	2.99	2.11	0.020
JON0071	4/4/2000	9.4	2.74	2.05	0.030
JON0071	5/3/2000	9.9	3.74	2.13	0.026
JON0071	7/12/2000	8.0	1.50	2.01	0.035
JON0071	8/2/2000	8.2	15.33	1.56	0.049
JON0071	8/31/2000	7.5	1.50	1.59	0.048
JON0124	3/7/2000	13.4	3.53	2.28	0.009
JON0124	4/5/2000	11.5	1.92	2.05	0.013
JON0124	5/2/2000	10.6	0.75	2.01	0.011
JON0124	7/11/2000	8.4	1.50	2.08	0.018
JON0124	8/1/2000	8.5	0.75	1.91	0.033
JON0124	8/30/2000	8.2	1.12	1.85	0.027
JON0135	3/7/2000	12.7	2.31	2.27	0.010
JON0135	4/5/2000	11.2	2.43	1.99	0.019
JON0135	5/2/2000	10.4	0.75	2.01	0.014
JON0135	7/11/2000	8.2	0.75	2.05	0.019
JON0135	8/1/2000	8.4	0.93	1.98	0.034
JON0135	8/30/2000	8.2	1.12	1.97	0.031
JON0149	3/7/2000	11.8	1.50	2.30	0.021
JON0149	4/5/2000	11.0	1.71	2.12	0.018
JON0149	5/2/2000	10.4	1.00	2.04	0.021
JON0149	7/11/2000	8.3	1.74	2.04	0.020
JON0149	8/1/2000	9.0	0.93	2.14	0.047
JON0149	8/30/2000	8.7	0.56	1.99	0.037
JON0184	10/13/1999	9.9		1.98	0.020
JON0184	10/26/1999	11.1	1.12	2.10	0.010
JON0184	11/16/1999	11.9	2.35	1.89	0.012
JON0184	11/30/1999	12.3	0.93	2.00	0.010
JON0184	12/14/1999	11.1	14.95	1.89	0.222
JON0184	1/11/2000	11.7	1.74	1.92	0.027

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	1/24/2000	13.5	1.00	2.37	0.008
JON0184	2/23/2000	12.8	2.09	2.19	0.009
JON0184	2/29/2000	12.0	3.63	2.00	0.017
JON0184	3/7/2000	13.2	2.72	2.24	0.009
JON0184	3/7/2000	13.2	2.58	2.24	0.007
JON0184	4/5/2000	11.3	3.36	2.01	0.013
JON0184	4/5/2000	11.3	3.36	2.02	0.014
JON0184	5/2/2000	10.1	0.75	2.09	0.012
JON0184	5/2/2000	10.1	0.75	2.09	0.013
JON0184	5/24/2000	9.3	1.74	1.95	0.034
JON0184	6/20/2000	8.2		1.94	0.026
JON0184	7/11/2000	8.1	2.24	1.92	0.018
JON0184	7/11/2000	8.1	2.24	1.93	0.017
JON0184	8/1/2000	8.3	1.00	1.91	0.034
JON0184	8/1/2000	8.3	1.00	1.92	0.035
JON0184	8/30/2000	8.5	1.00	1.81	0.029
JON0184	8/30/2000	8.5	1.25	1.81	0.029
JON0184	10/8/2002	9.5	1.71	1.24	0.017
JON0184	10/22/2002	10.7		1.75	0.017
JON0184	11/13/2002	10.1	0.75	1.31	0.044
JON0184	11/25/2002	12.3		1.86	0.013
JON0184	12/3/2002			2.09	0.007
JON0184	12/17/2002	11.7	0.50	2.11	0.015
JON0184	1/7/2003	13.2			
JON0184	1/7/2003	12.9	0.30	2.19	0.015
JON0184	1/22/2003	14.7		2.54	0.010
JON0184	1/22/2003	14.7			
JON0184	2/4/2003	12.1	7.73	2.41	0.025
JON0184	2/4/2003	11.9			
JON0184	3/4/2003	13.1	1.20	2.13	0.021
JON0184	3/4/2003	13.1			
JON0184	3/18/2003	12.8	3.99	1.96	0.011
JON0184	3/18/2003	12.1			
JON0184	4/22/2003	10.9	3.92	2.00	0.007
JON0184	4/22/2003	10.8			
JON0184	5/6/2003	10.6	2.54	2.07	0.013
JON0184	5/6/2003	10.6			
JON0184	5/20/2003	10.2	2.49	2.14	0.022
JON0184	5/20/2003	10.2			
JON0184	6/3/2003	10.2	0.64	2.12	0.019
JON0184	6/3/2003	10.2			
JON0184	6/17/2003	9.3	0.75	2.10	0.022
JON0184	6/17/2003	9.3			
JON0184	6/24/2003	8.8	0.50	2.16	0.032
JON0184	7/8/2003	8.2			
JON0184	7/8/2003	8.1	0.75	2.07	0.028
JON0184	7/22/2003	8.2	1.00	2.01	0.022
JON0184	7/22/2003	8.0			
JON0184	8/5/2003	8.0			
JON0184	8/5/2003	7.8	1.50	2.09	0.020
JON0184	8/19/2003	8.3	0.64	2.06	0.028
JON0184	8/19/2003	8.3			

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	8/26/2003	8.5	0.64	2.07	0.024
JON0184	9/9/2003	8.6	0.43	2.17	0.024
JON0184	9/9/2003	8.6			
JON0184	9/23/2003	8.1			
JON0184	9/23/2003	7.7	4.49	2.21	0.393
JON0184	10/7/2003	10.1	0.75	2.17	0.010
JON0184	10/7/2003	10.1			
JON0184	10/21/2003	9.9			
JON0184	10/21/2003	9.8	0.90	2.14	0.017
JON0184	11/6/2003	9.1			
JON0184	11/13/2003	10.0			
JON0184	11/20/2003	10.2			
JON0184	12/4/2003	13.2			
JON0184	12/11/2003	11.6			
JON0184	12/11/2003	11.6			
JON0184	12/18/2003	12.7			
JON0184	1/8/2004	13.7			
JON0184	1/23/2004	14.4			
JON0184	1/29/2004	14.6			
JON0184	2/10/2004	12.6			
JON0184	2/20/2004	13.4			
JON0184	2/25/2004	13.4			
JON0184	3/4/2004	11.9			
JON0184	3/8/2004	11.7			
JON0184	3/18/2004	13.4			
JON0184	4/8/2004	11.6			
JON0184	4/13/2004	11.1			
JON0184	4/22/2004	9.3			
JON0184	5/13/2004	9.7			
JON0184	5/19/2004	8.4			
JON0184	5/27/2004	8.4			
JON0184	6/10/2004	8.9			
JON0184	6/24/2004	9.1			
JON0184	6/28/2004	9.4			
JON0184	7/9/2004	8.2			
JON0184	7/22/2004	8.6			
JON0184	7/27/2004	8.6			
JON0184	8/12/2004	8.1			
JON0184	8/17/2004	8.6			
JON0184	8/26/2004	8.2			
JON0184	9/10/2004	8.5			
JON0184	9/23/2004	9.4			
JON0184	9/29/2004	8.4			
JON0184	10/7/2004	9.9			
JON0184	10/21/2004	10.5			
JON0184	10/26/2004	10.7			
JON0184	11/10/2004	11.5			
JON0184	11/22/2004	11.4			
JON0184	12/8/2004	11.1			
JON0184	12/15/2004	13.5			
JON0184	12/20/2004	13.3			
JON0184	1/5/2005	10.4			

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	1/13/2005	11.8			
JON0184	1/20/2005	13.0			
JON0184	2/2/2005	14.5			
JON0184	2/14/2005	12.7			
JON0184	2/22/2005	12.7			
JON0184	3/16/2005	13.3			
JON0184	4/14/2005	12.1			
JON0184	5/5/2005	11.6			
JON0184	5/19/2005	10.4			
JON0184	6/8/2005	8.4			
JON0184	6/23/2005	8.9			
JON0184	7/13/2005	8.7			
JON0184	7/26/2005	8.0			
JON0184	8/4/2005	7.9			
JON0184	8/18/2005	8.9			
JON0184	9/15/2005	8.1			
JON0184	9/22/2005	9.1			
JON0184	10/18/2005	9.7			
JON0184	10/28/2005	11.5			
JON0184	11/2/2005	10.2			
JON0184	11/18/2005	12.0			
JON0184	12/1/2005	11.5			
JON0184	12/15/2005	13.7			
JON0184	1/18/2007	13.6	1.25	2.59	0.010
JON0184	2/26/2007	13.0	1.50	2.38	0.018
JON0184	3/14/2007	11.9	1.50	2.33	0.007
JON0184	4/25/2007	11.2	2.49	1.92	0.006
JON0184	5/16/2007	8.6	1.74	2.27	0.016
JON0184	6/13/2007	8.2	0.50	2.24	0.028
JON0184	7/18/2007	9.0	3.26	1.82	0.017
JON0184	8/15/2007	8.2	1.37	1.58	0.020
JON0184	9/12/2007	8.1	2.69	1.73	0.020
JON0184	10/11/2007	7.2	1.50	1.34	0.028
JON0184	11/15/2007	9.3	5.48		
JON0184	11/15/2007	9.3	5.48		
JON0184	12/12/2007	11.0	6.43	1.70	0.008
JON0184	12/12/2007	11.0	6.43	1.70	0.008
SRU0005	3/8/2000	11.0	0.85	2.85	0.019
SRU0005	4/4/2000	9.1	3.24	2.57	0.092
SRU0005	5/3/2000	9.8	1.20	2.98	0.034
SRU0005	7/12/2000	8.4	0.56	2.51	0.058
SRU0005	8/2/2000	7.6	0.37	2.30	0.051
SRU0005	8/31/2000	7.8	0.43	1.86	0.053
SRU0005	10/8/2002	8.8	0.21	1.15	0.036
SRU0005	10/22/2002	9.8		1.64	0.022
SRU0005	11/13/2002	9.8	0.25	1.96	0.038
SRU0005	11/25/2002	10.7		1.71	0.024
SRU0005	12/3/2002			1.59	0.022
SRU0005	12/17/2002	10.9		2.69	0.022
SRU0005	1/7/2003	12.6		4.77	0.028
SRU0005	1/22/2003	13.1		3.25	0.090
SRU0005	2/4/2003	11.8	13.46	5.99	0.368

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
SRU0005	3/4/2003	12.6		4.39	0.024
SRU0005	3/18/2003	10.8		3.33	0.026
SRU0005	4/22/2003	11.1	5.77	4.40	0.123
SRU0005	5/6/2003	10.0	3.74	3.21	0.036
SRU0005	5/20/2003	9.5		3.12	0.035
SRU0005	6/3/2003	9.0	0.43	3.07	0.039
SRU0005	6/17/2003	8.3			
SRU0005	6/24/2003	8.0		3.81	0.080
SRU0005	7/8/2003	7.6		3.02	0.049
SRU0005	7/22/2003	7.4	0.50	2.93	0.064
SRU0005	8/5/2003	7.3		2.69	0.046
SRU0005	8/19/2003	7.3	0.27	3.02	0.074
SRU0005	8/26/2003	7.6		2.43	0.034
SRU0005	9/9/2003	8.1		2.61	0.042
SRU0005	9/23/2003	8.3	1.00	3.71	0.188
SRU0005	10/7/2003	8.6		3.04	0.081
SRU0005	10/21/2003	8.7		2.41	0.039
SRU0005	1/18/2007	12.3		2.44	0.019
SRU0005	2/26/2007	11.9	0.75	2.54	0.055
SRU0005	3/14/2007	11.2	1.25	2.98	0.023
SRU0005	4/25/2007	9.6	1.25	2.80	0.025
SRU0005	5/16/2007	8.5		2.84	0.035
SRU0005	6/13/2007	8.1		2.45	0.031
SRU0005	7/18/2007	7.5	0.14	2.46	0.026
SRU0005	8/15/2007	7.7	0.25	1.85	0.024
SRU0005	9/12/2007	7.8	0.70	1.74	0.031
SRU0005	10/11/2007	7.9	0.75	1.49	0.038
SRU0005	11/15/2007	9.5	3.99	1.52	0.110
SRU0005	11/15/2007	9.5	3.99	1.52	0.110
SRU0005	12/12/2007	10.8		1.51	0.020
SRU0005	12/12/2007	10.8		1.51	0.020
TOH0002	3/7/2000	13.5	1.90	3.00	0.010
TOH0002	4/5/2000	11.0	3.20	2.83	0.018
UQM0005	7/11/2000	8.3		1.81	0.014
UQM0005	8/1/2000	8.4	0.56	1.67	0.017
UQM0005	8/30/2000				
UQM0008	3/7/2000	12.1	0.95	1.84	0.004
UQM0008	4/5/2000	11.1	1.00	1.63	0.012
UQM0008	5/2/2000	10.3	0.50	1.72	0.009
UQM0008	7/11/2000	8.5	0.75	1.83	0.015
UQM0008	8/1/2000	8.6	0.93	1.69	0.021
UQM0008	8/30/2000	9.7	0.56	1.61	0.016
UQQ0005	3/7/2000	13.2	1.50	2.25	0.005
UQQ0005	4/5/2000	11.0	3.99	2.21	0.016
UQQ0005	10/8/2002	9.2	0.43	1.36	0.016
UQQ0005	10/22/2002	10.2		1.82	0.014
UQQ0005	11/13/2002	9.9	0.50	1.61	0.025
UQQ0005	11/25/2002	12.3		2.03	0.011
UQQ0005	12/3/2002	13.7		2.00	0.007
UQQ0005	12/17/2002	12.1		2.36	0.014
UQQ0005	1/7/2003	12.1		2.38	0.014
UQQ0005	1/22/2003	14.0		2.50	0.004

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
UQQ0005	2/4/2003	11.7	15.70	2.85	0.140
UQQ0005	3/4/2003	13.3		2.50	0.026
UQQ0005	3/18/2003	14.4	3.49	2.10	0.014
UQQ0005	4/22/2003	10.9	4.06	2.08	0.008
UQQ0005	5/6/2003	9.6	3.24	2.33	0.016
UQQ0005	5/20/2003	10.1	1.00	2.24	0.018
UQQ0005	6/3/2003	9.5	0.43	2.31	0.020
UQQ0005	6/17/2003	9.4		2.26	0.021
UQQ0005	6/24/2003	8.7		2.39	0.024
UQQ0005	7/8/2003	8.0		2.17	0.028
UQQ0005	7/22/2003	8.1	0.75	2.30	0.019
UQQ0005	8/5/2003	8.0	0.56	2.16	0.026
UQQ0005	8/19/2003	8.1	0.45	2.19	0.023
UQQ0005	8/26/2003	7.7	0.21	2.17	0.021
UQQ0005	9/9/2003	8.3		2.23	0.021
UQQ0005	9/23/2003	8.2	1.50	1.91	0.177
UQQ0005	10/7/2003	9.6		2.31	0.012
UQQ0005	10/21/2003	9.3	0.15	2.19	0.020
UQQ0005	1/18/2007	13.6	1.00	2.45	0.008
UQQ0005	2/26/2007	12.6	2.49	2.12	0.037
UQQ0005	3/14/2007	12.7	2.74	2.22	0.007
UQQ0005	4/25/2007	10.5	3.24	2.12	0.007
UQQ0005	5/16/2007	8.3	1.99	2.23	0.013
UQQ0005	6/13/2007	7.5	0.75	2.26	0.024
UQQ0005	7/18/2007	7.9	1.09	1.99	0.023
UQQ0005	8/15/2007	7.4	0.37	1.80	0.023
UQQ0005	9/12/2007	7.0	3.74	1.89	0.034
UQQ0005	10/11/2007	6.6	1.74	1.60	0.061
UQQ0005	11/15/2007	8.4	7.23	1.67	0.096
UQQ0005	11/15/2007	8.4	7.23	1.67	0.096
UQQ0005	12/12/2007	10.1		1.85	0.009
UQQ0005	12/12/2007	10.1		1.85	0.009
WST0000	3/8/2000	13.5	2.69	1.63	0.012
WST0000	4/4/2000	9.4	8.72	1.48	0.054
WST0000	5/3/2000	12.0	2.09	2.04	0.012
WST0000	7/12/2000	13.7	20.51	1.13	0.035
WST0000	8/2/2000	11.3	1.87	1.36	0.039
WST0000	8/31/2000	9.0	1.07	1.44	0.052
WST0000	1/18/2007	14.2	0.25	2.03	0.019
WST0000	2/26/2007	12.9	2.99	2.06	0.077
WST0000	3/14/2007	14.2	7.48	3.29	0.226
WST0000	4/25/2007	10.1	3.49	0.96	0.010
WST0000	5/16/2007	10.1	2.74	1.19	0.026
WST0000	6/13/2007	10.1	1.25	1.27	0.044
WST0000	7/18/2007	12.6	3.74	1.22	0.017
WST0000	8/15/2007	12.8	2.49	1.16	0.022
WST0000	9/12/2007	10.9	3.19	1.43	0.045
WST0000	10/11/2007	7.5	1.71	1.42	0.072
WST0000	11/15/2007	9.6		1.39	0.148
WST0000	11/15/2007	9.6		1.39	0.148
WST0000	12/12/2007	11.2	1.20	1.26	0.031
WST0000	12/12/2007	11.2	1.20	1.26	0.031

Table A-2: DNR Water Quality Data

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	1/13/1998	12.8	1.00		0.012
JON0184	2/23/1998	11.3	2.24		0.010
JON0184	3/16/1998	12.3	1.05		0.021
JON0184	4/14/1998	11.7	3.24		0.010
JON0184	5/12/1998	9.4	7.10		0.153
JON0184	6/9/1998	9.7	0.65		0.025
JON0184	7/14/1998	8.8	0.53		0.014
JON0184	8/11/1998	7.8	2.14		0.091
JON0184	9/22/1998	8.1	2.24		0.044
JON0184	10/6/1998	10.2	0.80		0.017
JON0184	11/4/1998	11.1	0.64		0.011
JON0184	12/1/1998	11.8	0.80		0.019
JON0184	1/5/1999	13.3	0.85		0.042
JON0184	3/9/1999	14.2	2.21		0.014
JON0184	4/6/1999	11.5	2.32		0.010
JON0184	5/5/1999	10.5	3.16		0.015
JON0184	6/16/1999	8.4	1.79		0.054
JON0184	7/12/1999	9.1	1.87		0.024
JON0184	8/25/1999	8.6	0.70		0.024
JON0184	9/15/1999	8.5	1.60		0.020
JON0184	10/12/1999	9.6	0.60		0.025
JON0184	11/16/1999	12.1	2.69		0.017
JON0184	12/14/1999	10.8	23.18		0.293
JON0184	1/11/2000	11.7	7.78		0.083
JON0184	2/8/2000	14.3	4.29		0.010
JON0184	3/6/2000	12.4	2.99	2.08	0.010
JON0184	4/5/2000	11.7	3.19		0.018
JON0184	5/3/2000	10.7	0.98		0.049
JON0184	6/7/2000	9.3	1.07		0.025
JON0184	7/26/2000	8.4	6.73		0.200
JON0184	8/14/2000	8.6	2.69		0.010
JON0184	9/6/2000	8.9	0.75		0.032
JON0184	10/4/2000	9.0	0.75		0.012
JON0184	11/1/2000	11.4	1.40		0.011
JON0184	12/5/2000	12.6	0.55		0.010
JON0184	2/20/2001	14.1	6.73		0.020
JON0184	3/26/2001	12.6	1.16		0.015
JON0184	4/30/2001	11.1	1.87		0.011
JON0184	5/15/2001	9.3	1.50		0.019
JON0184	6/6/2001	9.3	0.60		0.023
JON0184	7/31/2001	9.2	1.64		0.018
JON0184	8/28/2001	8.2			0.039
JON0184	9/24/2001	8.7	1.64	1.41	0.027
JON0184	10/9/2001	11.5	1.68		0.024
JON0184	11/6/2001	11.9	4.19		0.010
JON0184	12/4/2001	12.4	0.90		0.010
JON0184	1/14/2002	13.0	1.50		0.010
JON0184	2/5/2002	14.2	2.46		
JON0184	3/5/2002	13.3	1.69		0.011
JON0184	4/2/2002	12.4	2.09	1.46	0.010

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	5/13/2002	9.3	1.20		0.012
JON0184	6/5/2002	8.5	1.20		0.027
JON0184	7/1/2002	8.5	1.05		0.024
JON0184	8/21/2002	7.7	1.89		0.038
JON0184	9/3/2002	8.5	2.06		0.058
JON0184	10/1/2002	8.9	0.87		0.028
JON0184	11/6/2002	10.2	2.09		0.058
JON0184	12/2/2002	13.3			0.028
JON0184	1/7/2003	12.7		2.02	0.010
JON0184	2/3/2003	14.0	2.12	2.27	0.010
JON0184	3/3/2003	13.4	2.09		0.037
JON0184	4/1/2003	12.5	4.49		0.017
JON0184	5/13/2003	10.1	2.05		0.018
JON0184	6/10/2003	9.2	0.75		0.027
JON0184	7/15/2003	8.6	0.90		0.044
JON0184	8/11/2003	8.3	1.20		0.034
JON0184	9/3/2003	8.4	1.42		0.028
JON0184	10/15/2003	8.9	4.98		0.308
JON0184	11/3/2003	10.1	2.82		0.046
JON0184	12/8/2003	13.6	1.00		0.020
JON0184	1/6/2004	12.1	2.24		0.015
JON0184	2/10/2004	12.4	1.50		0.022
JON0184	3/9/2004	12.3	3.79		0.010
JON0184	4/6/2004	12.5			0.013
JON0184	5/3/2004	9.6	2.84		0.033
JON0184	6/14/2004	8.7	1.33		0.024
JON0184	7/12/2004	8.2	1.00		0.071
JON0184	8/3/2004	7.7	0.80		0.030
JON0184	9/8/2004	8.0	2.09		0.022
JON0184	10/5/2004	9.9			0.031
JON0184	11/4/2004	10.1	1.50		0.013
JON0184	12/2/2004	12.0	1.31		0.047
JON0184	1/19/2005	13.1			0.053
JON0184	2/7/2005	13.1	1.40		0.016
JON0184	3/7/2005	13.1	6.62		0.017
JON0184	4/4/2005	11.5			0.030
JON0184	5/2/2005	11.0	2.24		0.011
JON0184	6/1/2005	9.4	1.59		0.021
JON0184	7/5/2005	8.9	1.05		
JON0184	8/1/2005	8.5		1.93	0.032
JON0184	9/8/2005	8.8	1.20	2.10	0.029
JON0184	10/3/2005	9.8	1.57	1.79	0.023
JON0184	11/1/2005	11.1	0.45	2.08	0.018
JON0184	12/6/2005	13.8	2.39	2.17	0.020
JON0184	1/3/2006	11.3	7.26	1.57	0.061
JON0184	2/2/2006	13.4	2.99	2.20	0.018
JON0184	3/1/2006	13.8	3.39	2.48	0.013
JON0184	4/11/2006	11.9	1.35	2.02	0.014
JON0184	5/1/2006	11.8	1.87	2.02	0.022
JON0184	6/29/2006	8.2		1.24	0.041
JON0184	7/6/2006	8.2		1.40	0.102
JON0184	8/2/2006	8.1	0.82	2.14	0.028

Station	Sampling Date	DO (mg/l)	Chlorophyll *a* (µg/l)	TN (mg/l)	TP (mg/l)
JON0184	9/6/2006	8.7	1.20	1.68	0.047
JON0184	10/11/2006	9.0	1.07	1.95	0.020
JON0184	11/2/2006	9.7	0.75	2.20	0.036
JON0184	12/5/2006	13.2		2.14	0.014
JON0184	1/4/2007	12.7	1.71	2.19	0.012
JON0184	2/6/2007	14.7	1.99	2.81	0.007
JON0184	3/5/2007	12.6	1.79	2.31	0.015
JON0184	4/3/2007	11.5	2.09	2.09	0.011
JON0184	5/3/2007	10.8	2.09	2.06	0.021
JON0184	6/12/2007	8.5	0.85	2.09	0.022

Table A-3: MBSS Water Quality Data

Station	Stream	Date	DO (mg/l)	TN (mg/l)	TP (mg/l)
JONE-315-S-2000	North Branch Jones Falls	3/23/2000		1.34	0.009
JONE-322-S-2000	North Branch Jones Falls	3/23/2000		1.19	0.010
JONE-109-S-2000	Dipping Pond Run UT1	3/24/2000		2.61	0.006
JONE-109-S-2001	Dipping Pond Run UT1	3/20/2001		3.02	0.009
JONE-315-S-2001	North Branch Jones Falls	3/20/2001		1.56	0.009
JONE-312-R-2002	Jones Falls	3/4/2002		1.27	0.034
JONE-105-R-2002	Stony Run UT1	3/4/2002		1.71	0.044
JONE-110-R-2002	Towson Run	3/4/2002		2.13	0.021
JONE-303-R-2002	Jones Falls	3/26/2002		1.78	0.012
JONE-102-R-2002	Stony Run	3/26/2002		4.33	0.026
JONE-109-S-2002	Dipping Pond Run UT1	4/1/2002		3.14	0.010
JONE-213-R-2002	Jones Falls	4/1/2002		2.09	0.028
JONE-109-R-2002	Jones Falls UT1	4/1/2002		1.53	0.022
JONE-107-R-2002	North Branch Jones Falls	4/1/2002		0.74	0.029
JONE-315-S-2002	North Branch Jones Falls	4/1/2002		1.06	0.015
JONE-204-R-2002	North Branch Jones Falls UT1	4/1/2002		2.10	0.022
JONE-101-R-2002	North Branch Jones Falls UT1 UT1	4/1/2002		2.11	0.009
JONE-109-S-2003	Dipping Pond Run UT1	3/10/2003		2.69	0.007
JONE-315-S-2003	North Branch Jones Falls	3/10/2003		1.33	0.025
JONE-109-S-2004	Dipping Pond Run UT1	3/18/2004		2.95	0.012
JONE-315-S-2004	North Branch Jones Falls	3/18/2004		1.79	0.014
JONE-109-S-2000	Dipping Pond Run UT1	7/19/2000	8.1		
JONE-315-S-2000	North Branch Jones Falls	9/7/2000	10.1		
JONE-322-S-2000	North Branch Jones Falls	9/7/2000	9.7		
JONE-109-S-2001	Dipping Pond Run UT1	6/8/2001	8.2		
JONE-315-S-2001	North Branch Jones Falls	6/28/2001	8.6		
JONE-102-R-2002	Stony Run	6/4/2002	0.7		
JONE-105-R-2002	Stony Run UT1	6/4/2002	17.9		
JONE-109-S-2002	Dipping Pond Run UT1	6/6/2002	7.8		
JONE-110-R-2002	Towson Run	6/18/2002	8.2		
JONE-213-R-2002	Jones Falls	6/19/2002	8.8		
JONE-109-R-2002	Jones Falls UT1	6/19/2002	9.3		
JONE-107-R-2002	North Branch Jones Falls	7/8/2002			
JONE-204-R-2002	North Branch Jones Falls UT1	7/8/2002	9.3		
JONE-101-R-2002	North Branch Jones Falls UT1 UT1	7/8/2002	9.4		
JONE-303-R-2002	Jones Falls	7/11/2002	7.2		
JONE-315-S-2002	North Branch Jones Falls	7/11/2002	8.7		
JONE-312-R-2002	Jones Falls	7/25/2002	7.4		
JONE-315-S-2003	North Branch Jones Falls	6/12/2003	8.8		
JONE-109-S-2003	Dipping Pond Run UT1	6/25/2003	8.3		
JONE-109-S-2004	Dipping Pond Run UT1	6/24/2004	8.5		
JONE-315-S-2004	North Branch Jones Falls	8/3/2004	7.8		