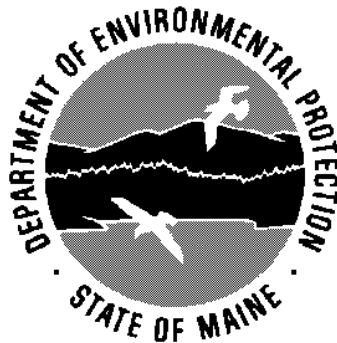


# **Presumpscot River Data Report**

**May 2009**



**Prepared by Donald Albert, P. E.  
Bureau of Land and Water  
Division of Environmental Assessment  
DEPLW-0980**

## Table of Contents

Introduction.....	3
Technical Design of Study.....	4
Hydrologic Data.....	6
Ambient Data.....	6
Temperature and Dissolved Oxygen.....	6
Nutrients.....	9
Chlorophyll-a.....	14
Ultimate BOD.....	15
Effluent Data.....	16
Quality Control.....	21

## Appendices

- A. Location Map
- B. Presumpscot River Intensive Survey Field Data (DO, temperature)
- C. Effluent Samples/Ambient Presumpscot River Samples (Nutrients, chlorophyll-a, and BOD)

## Figures

1. Presumpscot River Temperature.....	7
2. Tributary Temperature.....	7
3. Presumpscot River Dissolved Oxygen.....	8
4. Tributary Dissolved Oxygen.....	8
5. Presumpscot River TP.....	9
6. Tributary TP.....	10
7. Presumpscot Ortho P.....	10
8. Tributary Ortho P.....	11
9. Presumpscot River TKN.....	11
10. Tributary TKN.....	12
11. Presumpscot River NH3.....	12
12. Tributary NH3.....	13
13. Presumpscot River NOx.....	13
14. Tributary NOx.....	14
15. Presumpscot River Chlorophyll-a.....	14
16. Tributary Chlorophyll-a.....	15
17. Presumpscot River BODu.....	16
18. Tributary BODu.....	16
19. Effluent TP.....	17
20. Effluent Ortho P.....	17
21. Effluent TKN.....	18
22. Effluent NH3.....	18
23. Effluent NOx.....	19

24. Effluent Ultimate BOD .....	19
25. Effluent Loading September 2, 2008 .....	20
26. Effluent Loading September 4, 2008 .....	20
27. Effluent Loading September 5, 2008 .....	21
28. % of License BOD5 .....	21

Tables

1. Presumpscot River Sampling Location 2008.....	5
2. Location Coordinates .....	5
3. Duplicate – Effluent Sample .....	22
4. Duplicate – River Sample .....	22

## Introduction

The Presumpscot River originates as the major outlet flowage from Sebago Lake and eventually drains into coastal waters. It has a drainage area (DA) of 441 square miles at its source and 596 square miles at its mouth. The river segment of interest in this study is the former impounded waters of the Smelt Hill dam. This includes a 6.5 mile segment extending upriver from Presumpscot Falls at tidewater to the SAPPI mill. The water quality classification of this river segment is C. Point source discharges within this segment include SAPPI, a paper mill with a licensed flow volume of 10 mgd, and PWD Westbrook, a municipal discharge with a licensed flow volume of 4.54 mgd .

Station PRB is located 5.4 miles upstream of the SAPPI mill and the water classification of this river segment is Class A. Station PRA is located 1.6 miles downstream of PRB and the water classification is Class B.

The Presumpscot River has had historic water quality problems within this segment. Non-attainment of both dissolved oxygen and aquatic life criteria were issues addressed in a Total Maximum Daily Load (TMDL). In November of 1998, a TMDL was approved by EPA for the lower 6.5 miles of the Presumpscot River. The TMDL defined the assimilative capacity of this river segment for point and non-point source discharges. A water quality model<sup>1</sup> was used to define allowable pollutant loads. This resulted in some waste discharge pollutant reductions for BOD and TSS for SAPPI. In addition, a flow regulation curve was defined by the model which requires specified flows to be passed from Sebago Lake in the summer. As temperature in the river increases, more flow is passed to meet dissolved oxygen criteria.

There have been significant actions which should result in much improved water quality in this segment. In 1999, SAPPI, a paper mill in Westbrook, ceased its pulping operation. In addition, the Smelt Hill dam was removed in 2002. It is expected that the changes and implementation of the TMDL should have resulted in significant improvements in water quality.

The primary interest of this study is documentation of the existing state of water quality of the lower Presumpscot River including the trophic state and its effect upon dissolved oxygen (DO) after changes to SAPPI and dam. The changes in the river should result in different hydraulic and chemical properties. The water quality model used to develop the TMDL in this segment will have to be re-calibrated. This report will describe the data collected in the summer of 2008 that will ultimately be used to re-calibrate the water quality model.

---

<sup>1</sup> A water quality model uses complex mathematics to simulate water quality conditions in a water body. The complexity of the math results in the use of computer software. Models are used to predict worse case water quality of such parameters as dissolved oxygen and algae levels as they relate to pollutant loading, river flow, and temperature. Assumptions used in models are calibrated by actual field data.

## Technical Design of Study

Details of the technical design of the Presumpscot River data collection effort of 2008 are explained in the Presumpscot River Work Plan (MDEP, June 2008). Some of the highlights are repeated here for convenience. The data collection effort involved an intensive survey collected over three days. The dates in which this sampling took place were September 2, 4 and 5 of 2008.

When collecting data for model calibration, it is essential that adequate critical conditions approaching low flow and high water temperature occur and that flow in the river remain somewhat steady throughout the three-day survey. It is desirable not to have significant runoff occur during the survey and up to two weeks prior to the survey. The SAPPI mill in Westbrook regulates flow on the Presumpscot River from its source at the Eelweir dam on Sebago lake. SAPPI personnel agreed to regulate the Presumpscot River at 250 cfs during the intensive survey which is the minimum flow that is passed from the lake during critical low lake levels.

The Presumpscot was sampled at ten locations starting at Hurricane Road Bridge to Presumpscot Falls. (Table 1). Dissolved oxygen, and temperature were sampled at all locations twice daily. In addition, samples were collected once each day in the morning for nutrient analysis (NH<sub>3</sub>-N, TKN, NO<sub>2</sub>+NO<sub>3</sub>-N, TP, and PO<sub>4</sub>-P); chlorophyll a, and ultimate BOD at the ten locations (see Table 1). The East and West Branches of the Piscataqua River and Mill Stream are the major tributaries to this segment. Dissolved oxygen, and temperature were sampled here twice daily. Nutrients, chlorophyll-a, and ultimate BOD were sampled on the second day only in the early morning. Effluent samples for the two point sources inputs (Table 1) were composited hourly for 24 hours starting in the early AM the day prior to sample pickup. Thus to account for travel time lags in the river, the load inputs represent the day prior to the actual ambient sampling.

**Table 1 Presumpscot River Sampling Locations 2003**

Ambient Locations

Station Code	Location	DO / Temp	Nitrogen	Phosphorus	Chl a	Ultimate BOD
			TKN, NH3-N, NO2,3-N init., NO2,3-N final	TP PO4-P		
PR1	McGregor Bridge Sappi	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
PR2	Between Westbrook and SAPPi outfalls	2/day 3 days				
PR3	Below Sappi (warehouse west bank)	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
PR4	Rte 302 Bridge	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
Pr5	Above Meader Brook (powerlines east bank)	2/day 3 days				
PR6	Blackstrap Rd	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
PR7	Rte 26	2/day 3 days				
PR8	Maine Turnpike spur bridge	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
PRA	Gambo Road Bridge	2/day 3 days				
PRB	Hurricane Road Bridge	2/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days
TrPrW	West Branch Piscataqua Leighton Rd	2/day 3 days	1/day 1 day	1/day 1 day	1/day 1 day	1/day 1 day
TrPrE	East Branch Piscataqua Falmouth Rd	2/day 3 days	1/day 1 day	1/day 1 day	1/day 1 day	1/day 1 day
TrMS	Mill Stream East Bridge St	2/day 3 days	1/day 1 day	1/day 1 day	1/day 1 day	1/day 1 day
DUPR	River Duplicate	2/day	1/day 3 days	1/day 3 days	1/day 3 days	1/day 3 days

Effluents		DO / Temp	Nitrogen	Phosphorus	BOD5	BODU
SAP	Sappi	1/day 3 days	24 hr comp. 3 days	24 hr comp. 3 days	24 hr comp. 3 days	24 hr comp. 3 days
WEST	PWD Westbrook	1/day 3 days	24 hr comp. 3 days	24 hr comp. 3 days	24 hr comp. 3 days	24 hr comp. 3 days
DUPE	Effluent Duplicate		24 hr comp. 2 days	24 hr comp. 2 days	24 hr comp. 2 days	24 hr comp. 2 days

**Table 2 Station Coordinates**

Station	Location	
PR2	N43°41.295'	W70°20.348'
PR3	N43°41.279'	W70°20.168'
PR4	N43°42.187'	W70°19.505'
PR5	N43°43.050'	W70°19.021'
PR6	N43°43.451'	W70°18.172'

## **Hydrologic Data**

As stated earlier, the flow released from Sebago Lake during both river surveys was 250 cfs. There are currently no flow gages on the Presumpscot River maintained by USGS, but stage measurements at the former Westbrook gage site are still available from USGS. There is also a gauging station on Stony Brook at East Sebago which is a tributary to the Presumpscot River. This information collectively should give a good indication to runoff conditions prior to and during the three-day surveys. This indicates that the requirement for minimal runoff prior to and during the three-day intensive surveys was satisfied.

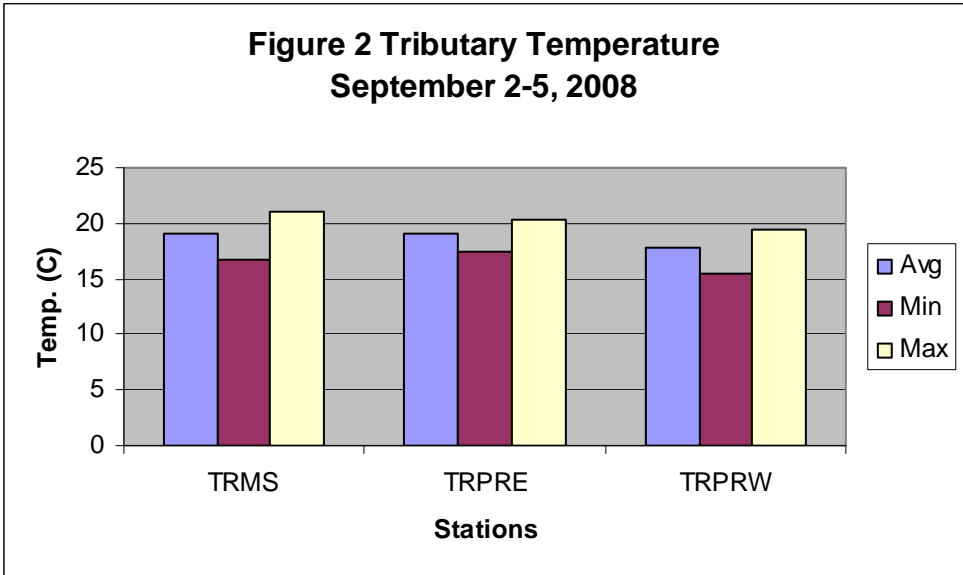
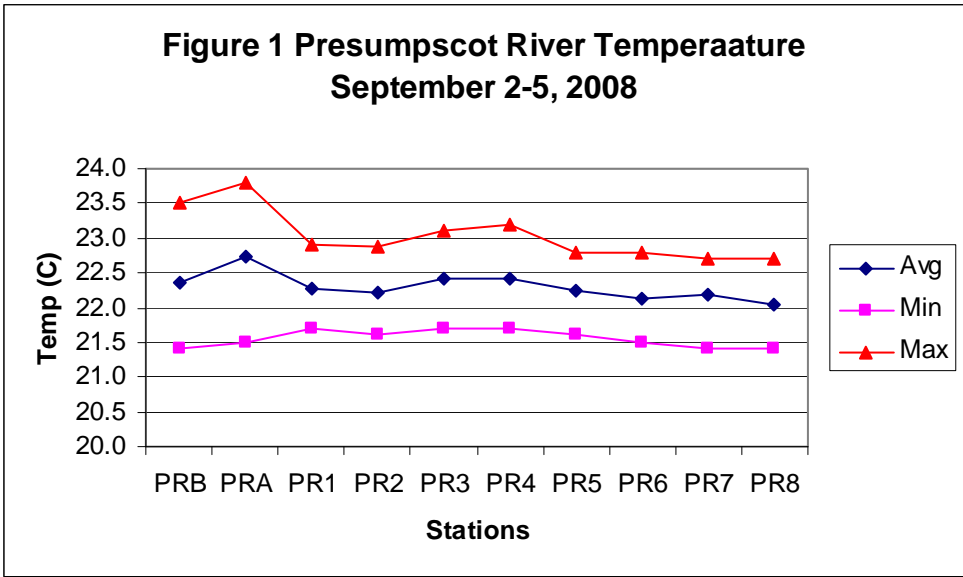
## **Ambient Data**

### **Temperature and Dissolved Oxygen**

Temperature is ordinarily measured in conjunction with dissolved oxygen (DO) due to its correlation with DO solubility. Maintaining adequate dissolved oxygen levels becomes increasing more difficult at higher water temperatures. Temperature and dissolved oxygen (DO) were sampled twice daily in two of the three days of the intensive survey. The early morning readings typically are an indication of daily minimum DO due to algal respiration (which consumes oxygen) occurring at night time. During the daytime oxygen production from photosynthesis in the presence of sunlight typically exceeds oxygen consumption from respiration resulting in a daily maximum DO in mid to late afternoon. Water temperature typically follows the same pattern of lower readings in the early morning and higher readings in the afternoon due to the interaction with air temperatures along the water surface.

The temperature data indicate that warmer water temperatures were experienced July 2003 as compared to September 2008 (Figure 1). Temperatures on the Presumpscot River in July of 2003 were usually in-between 24 and 24.5 °C in the morning and about 1 °C warmer in the afternoon. Temperatures on the Presumpscot River in September of 2008 were usually in-between 21.4 and 23.8 °C (Figure 1) and average 22.3 °C.

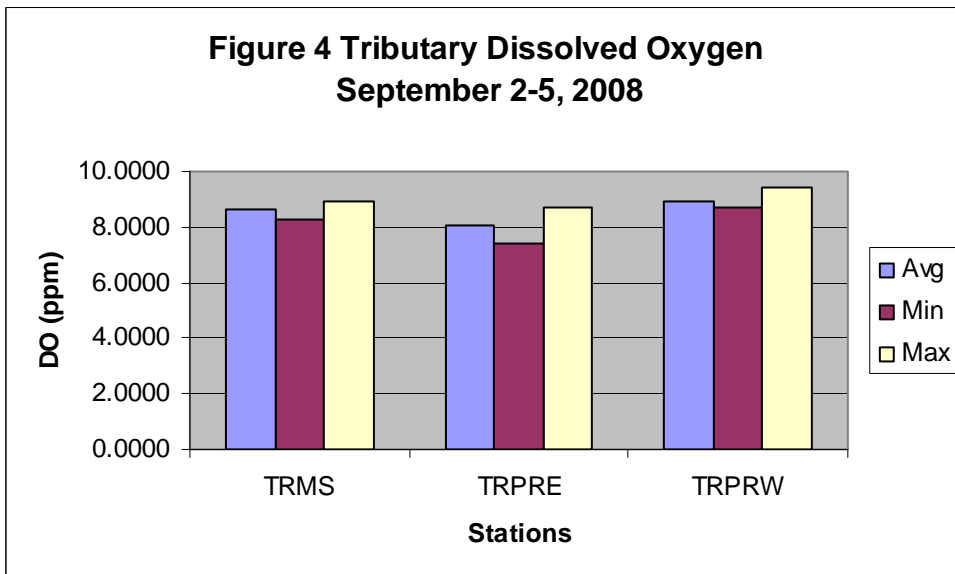
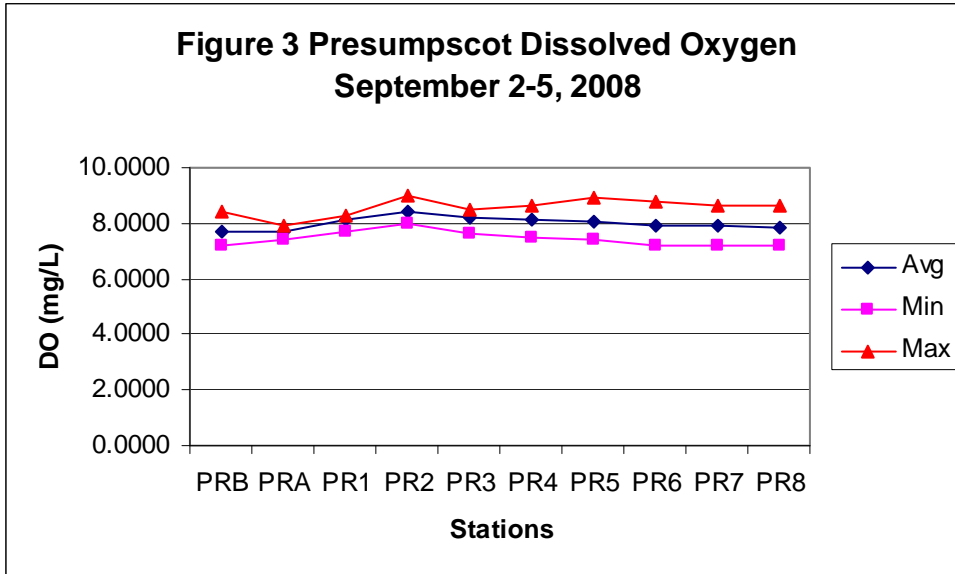
Tributary water temperatures were typically cooler than the Presumpscot River water temperatures (Figure 2). Temperatures on the West Branch of the Piscataqua averaged about 18 °C in the morning during the July 2003 survey and about a degree warmer in the afternoon. Both the morning and afternoon temperature readings here averaged about a degree cooler during the August 2004 survey. Temperatures on the East Branch of the Piscataqua averaged slightly over 19 °C in the morning and about 1 °C warmer in the



afternoon.

A waterbody must have adequate levels of dissolved oxygen (DO) to support a healthy aquatic ecosystem. Sources of dissolved oxygen depletion could include organic matter from both point and non-point sources of pollution, and to a lesser extent natural sources. The organic matter causing the depletion of oxygen could occur in the water column as dissolved and/or particulate matter or as bottom sediment from particulate matter that has settled to the river bottom. When significant levels of algae are evident, a diurnal trend of low early morning DO from extended nighttime respiration and high afternoon DO from photosynthesis occurs. Each water quality classification in state law specifies a particular level of dissolved oxygen that must be maintained.

Early morning dissolved oxygen (DO) readings on the Presumpscot are compared to the minimum class C criteria of 5 ppm (Figure 3). In all cases, criteria are easily met and always exceeded 7.0 ppm. On tributaries, DO readings met minimum class B minimum criteria of 7 ppm on the West Branch of the Piscataqua, Mill Stream and East Branch of the Piscataqua in all cases (Figure 4).



Diurnal DO or the difference between the early morning and afternoon DO readings is a good indication of plant activity on a water body. The larger the difference, the more plants are present. The plants could be either floating phytoplankton, or algae or rooted plants that are stationary and are attached to the bottom. Diurnal DO readings on the Presumpscot were low as compared to other water bodies with point source discharges

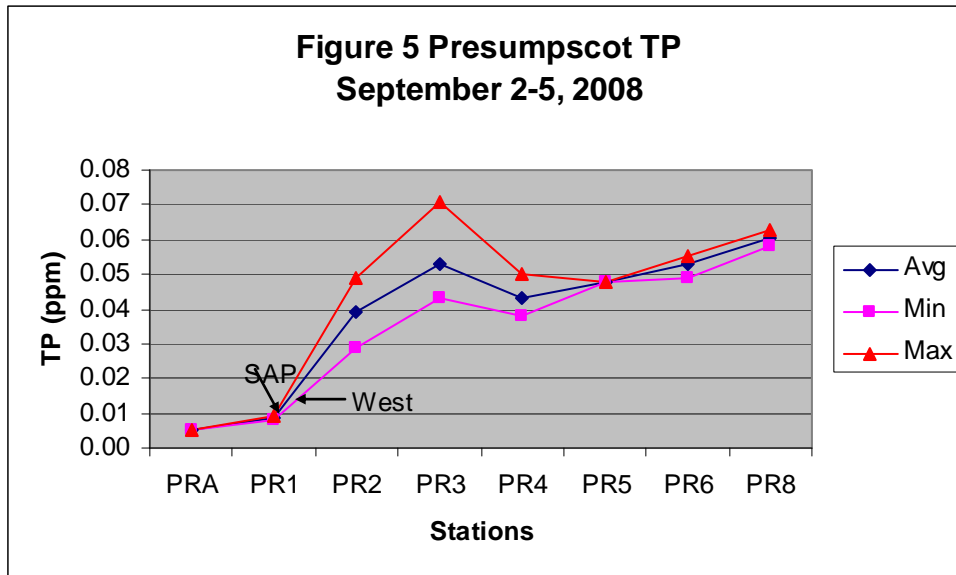
and did not exceed 1.0 ppm. The low diurnal DO indicates that a low level of plant activity occurs on the Presumpscot River.

Diurnal DO on tributary sites did not exceed 0.6 ppm on the West Branch of the Piscataqua and on Mill stream. This is an indication of low plant activity. On the East Branch of the Piscataqua, diurnal DO was higher at 1.0 ppm.

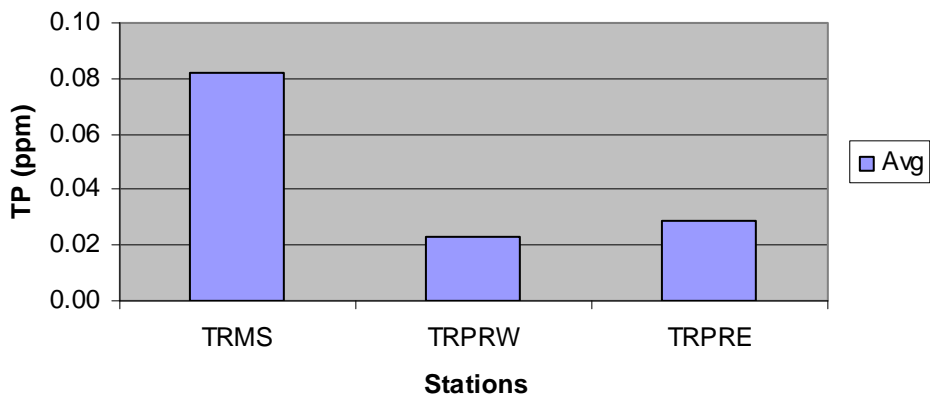
### Nutrients

Nitrogen and phosphorus are the primary nutrients that could be controlling factors for plant growth and the development of excessive growth. It should be mentioned that moderate levels of nutrients and algae are desirable and, in fact, are a vital component of the food chain. It is only when nutrients reach an excessive threshold point resulting in blooms do they become objects of water quality concern.

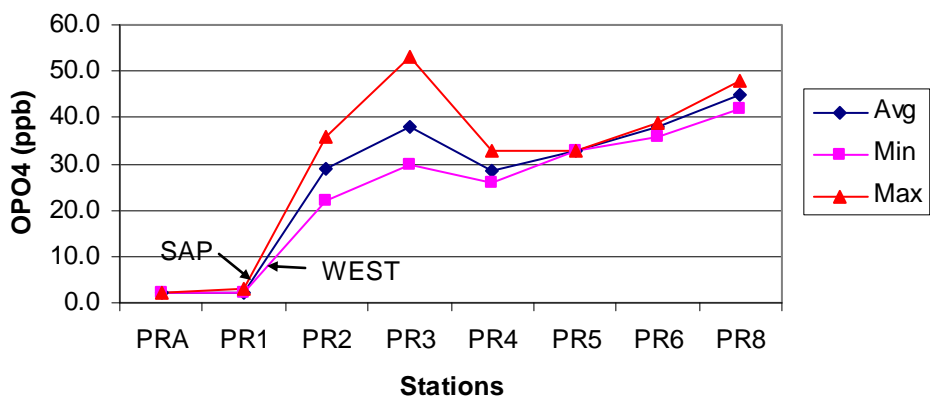
The data indicate that phosphorus concentration levels on the Presumpscot River locations are relatively high. The Presumpscot River phosphorus data plotted by river mile (Figure 5) indicate that concentration levels of total phosphorus of 10 to 20 ppb occur above the Sappi and Westbrook discharges which increases in the two locations below the discharges to about 40 ppb. In the three locations below this, concentration levels increase to more than 50 ppb. Presumpscot River orthophosphorus concentration levels (Figure 7) of 1 to 2 ppb occur above the point source discharges which increase to in the two locations below discharges and 30 to 50 ppb in the three locations below this.

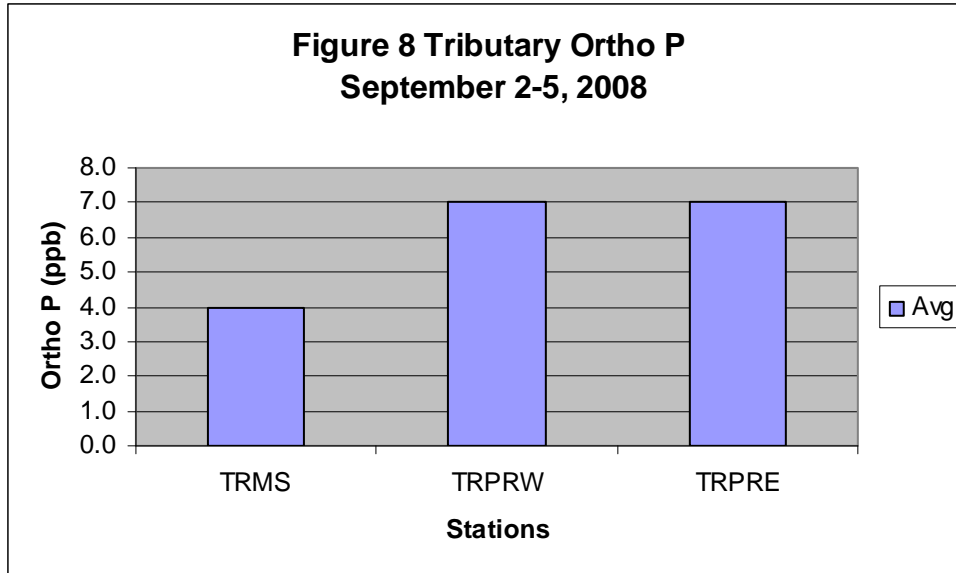


**Figure 6 Tributary TP  
September 2-5, 2800**



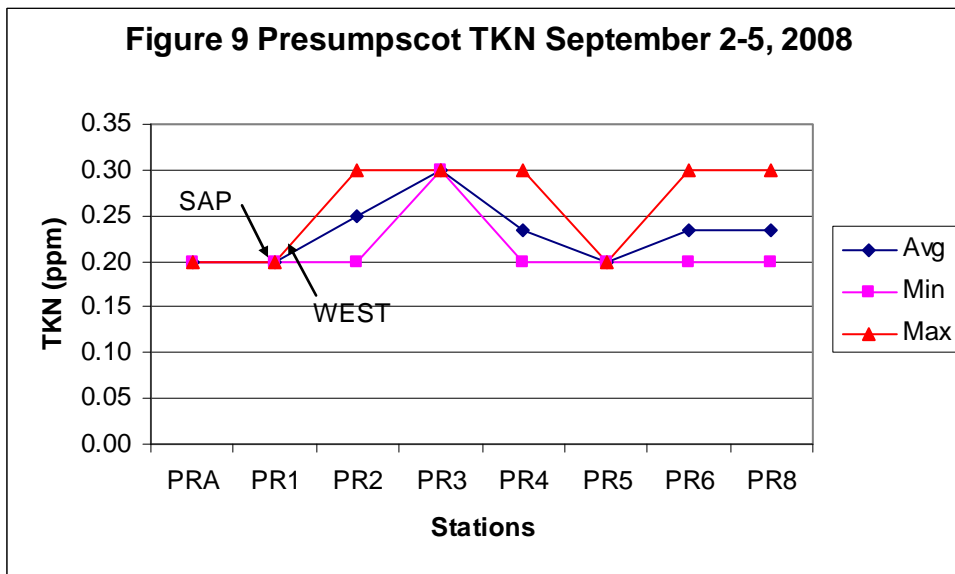
**Figure 7 Presumpscot Ortho P  
September 2-5, 2008**



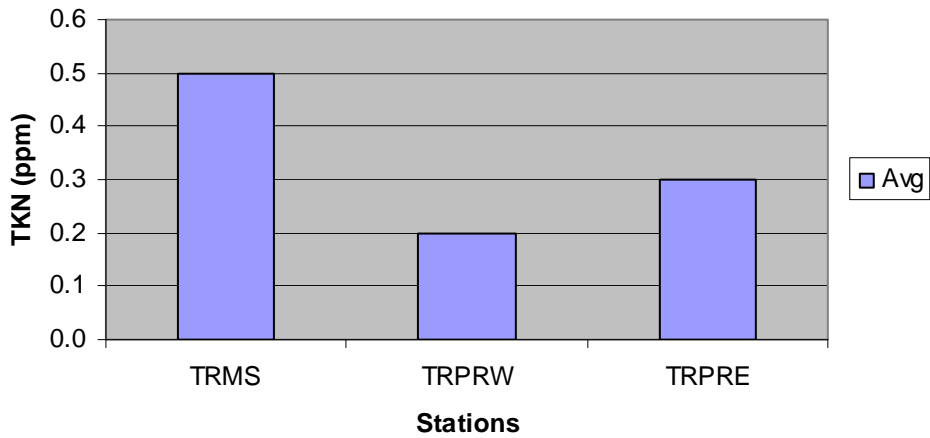


Tributary total phosphorus concentration levels (Figure 6) ranged from 2 to 80 ppb for the West Branch of the Piscataqua, East Branch of the Piscataqua and Mill Stream. Orthophosphorus concentration levels for all three tributaries ranged from 4 to 7 ppb (Figure 8).

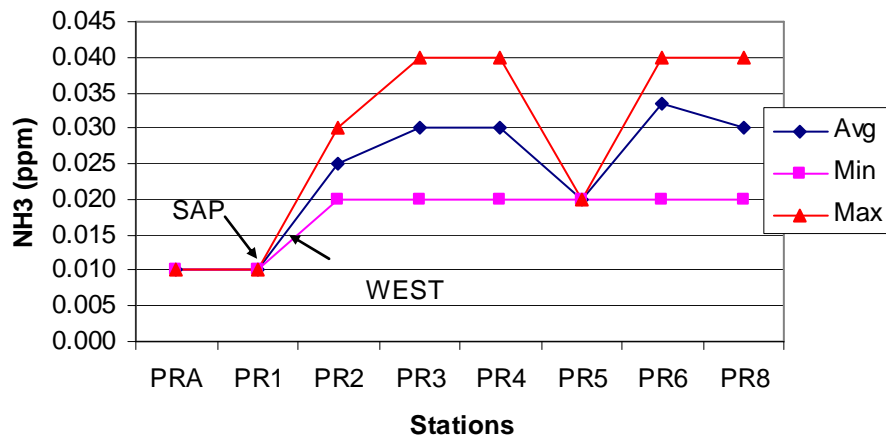
The data indicate that nitrogen concentration levels on the Presumpscot River locations and the three tributaries sampled were low. Nitrogen concentration levels are plotted as TKN, NH<sub>3</sub>-N and NO<sub>2</sub>+3-N (Figure 9, 11 and 13). Total kjeldhal nitrogen concentration levels of about 0.2 to 0.3 ppm occur above and below point sources. Ammonia nitrogen concentration levels were low, falling within a range of 0.01 to 0.04 ppm. Nitrite plus nitrate concentration levels usually were within a range of 0.10 to 0.20 ppm.

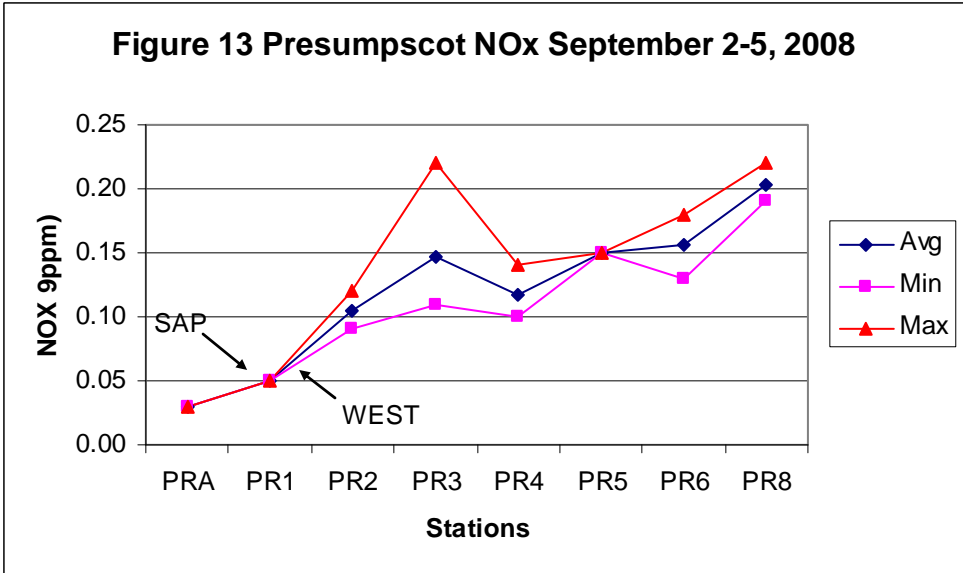
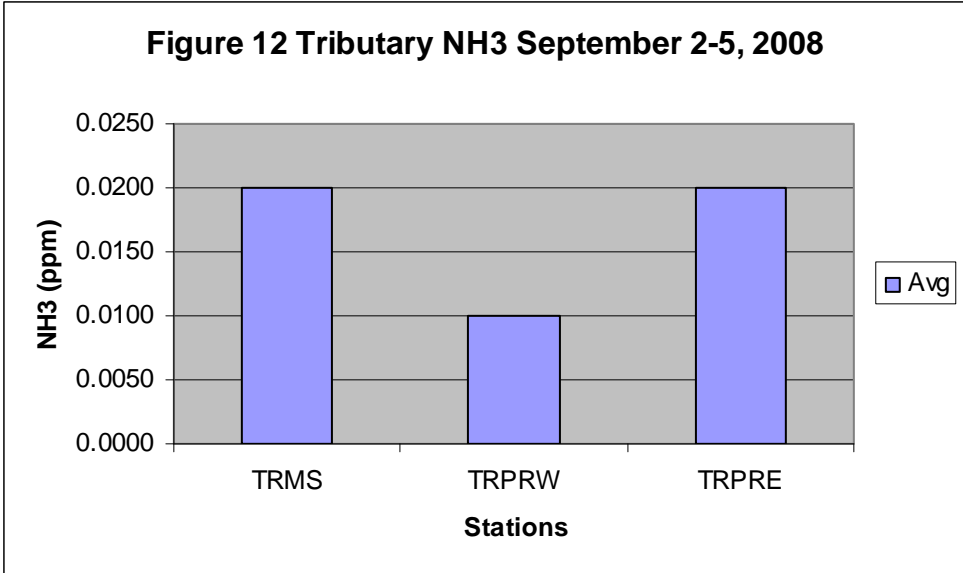


**Figure 10 Tributary TKN September 2-5, 2008**

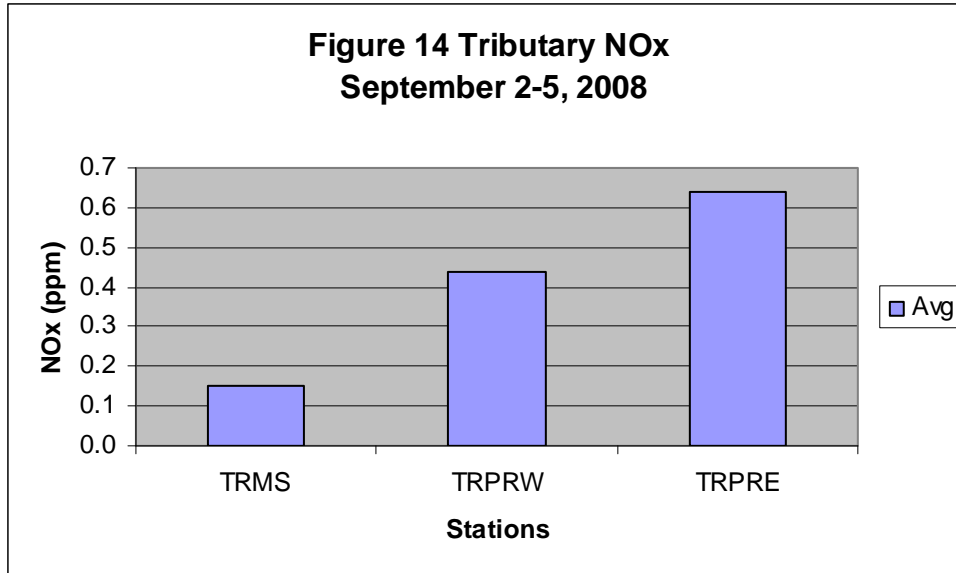


**Figure 11 Presumpscot NH3 September 2-5, 2008**



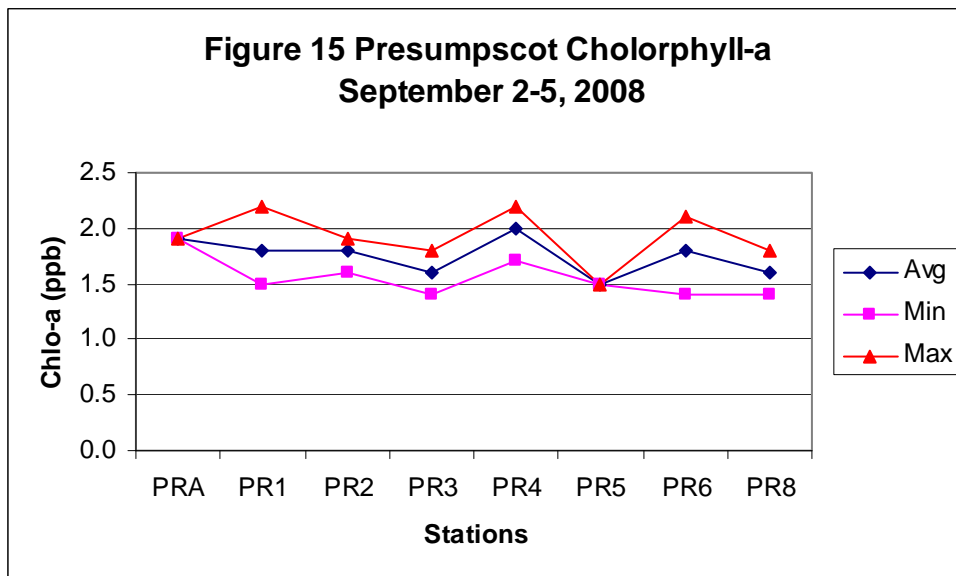


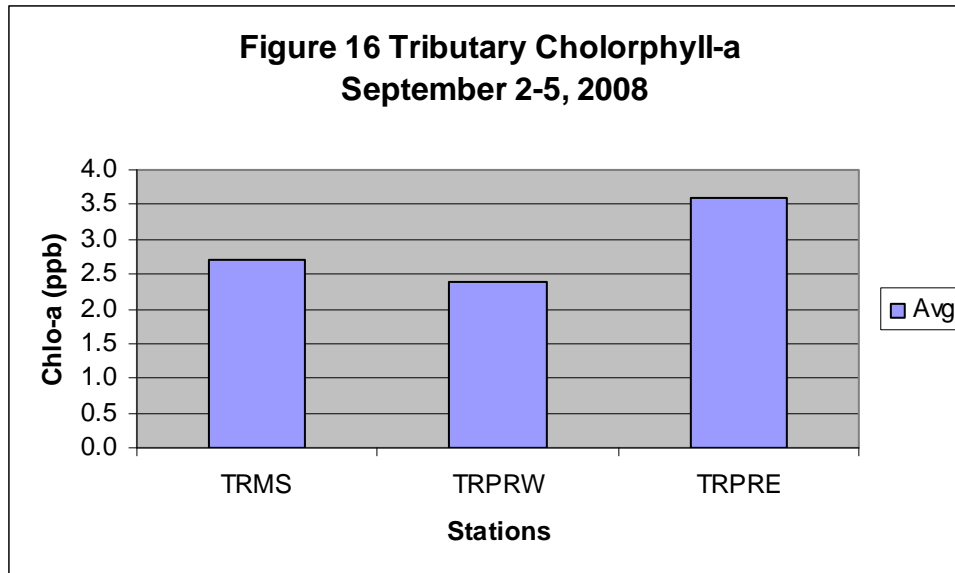
Tributary nitrogen concentration levels (Figures 10, 12, and 14) for all three tributaries were as follows: TKN was usually around 0.3 ppm; NH<sub>3</sub>-N for all three tributaries ranged from 0.01 to 0.02 ppm; and NO<sub>2</sub>+3-N ranged from 0.2 to 0.6 ppm.



### Chlorophyll-a

Chlorophyll-a is used as an indicator for the levels of water column algae biomass. The chlorophyll-a data, in general, indicate that low levels of phytoplanktonic algae occur on the Presumpscot River and its tributaries. Chlorophyll-a levels on the Presumpscot River were usually within a range of 1.5 to 2.2 ppb (Figure 15). Chlorophyll-a levels on the West Branch of the Piscataqua and Mill Stream were within a range of 2 to 3 ppb (Figure 16). On the East Branch of the Piscataqua, chlorophyll-a ranged from 3 to 4 ppb (Figure 16) which can be considered to be moderately elevated.





### Ultimate BOD

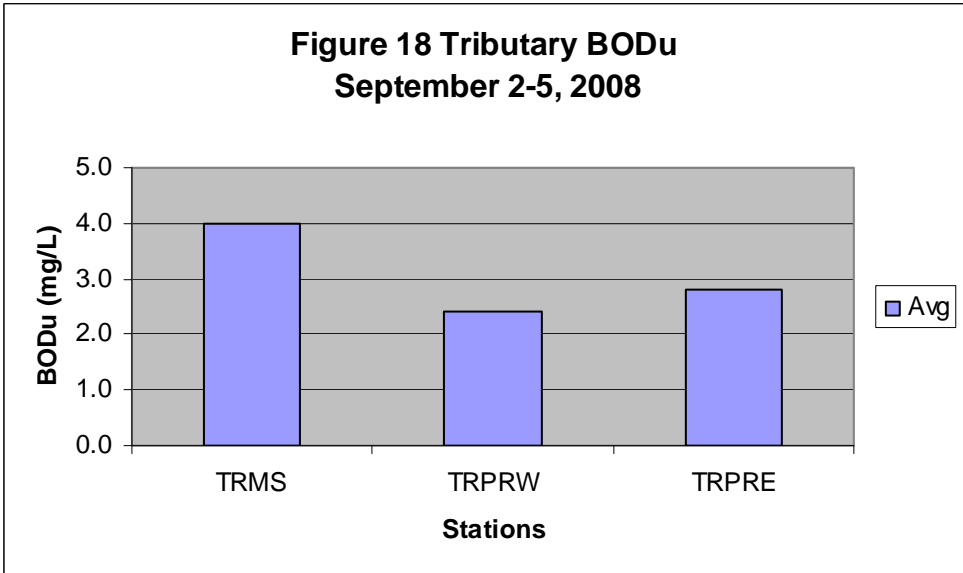
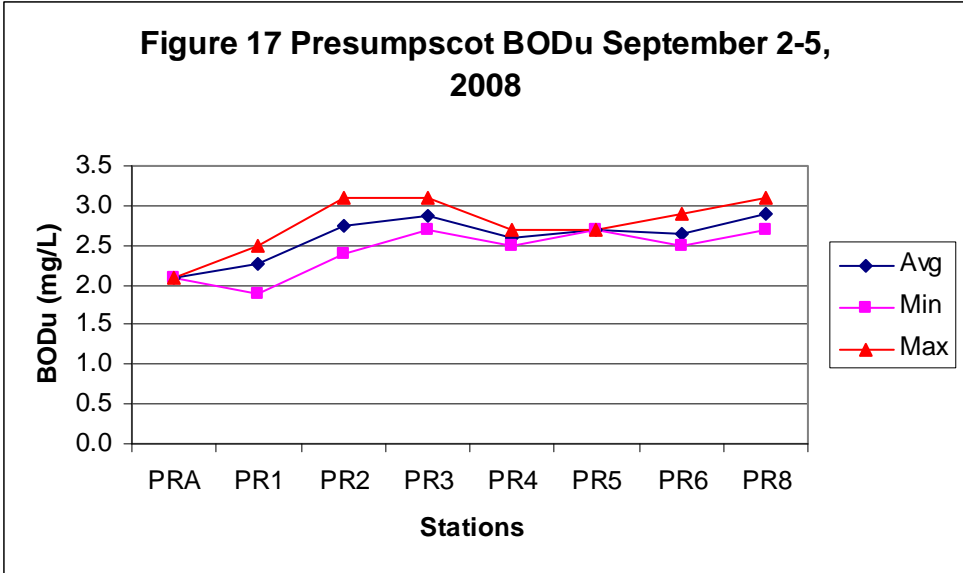
BOD is measured for a period of 60 days or more in the laboratory to determine ultimate BOD. Several DO readings are made on each sample within this period. A curve of DO depletion vs. time is fit onto the data using a least squares regression equation as indicated by the following:

$$BOD_x = BOD_u (1 - e^{-kt})$$

where  $BOD_x$  = BOD level in ppm at any time  $t$   
 $BOD_u$  = ultimate BOD in ppm  
 $K$  = first order reaction rate in units of /day  
 $T$  = time in days

The nitrogenous component of total ultimate BOD is estimated by the difference of the initial and final nitrate multiplied by 4.33. The carbonaceous component of total BOD is assumed to be the difference of total and nitrogenous BOD.

Background total ultimate BOD on the Presumpscot River ranged from 2 to 3 ppm above point sources and below point sources (Figure 17). Tributary total ultimate BODs were all within a range of 2.8 to 4.0 ppm (Figure 18). The total ultimate BOD of the Presumpscot River locations was comprised on the average of 82% carbonaceous and 18% nitrogenous in both summers of 2003 and 2004. For 2008, the carbonaceous averaged 89.6% carbonaceous and 10.4% nitrogenous. The BOD bottle or laboratory decay rate was 0.025 /day for 2003, 0.04 /day for 2004 and 0.025/day for 2008. River decay rates and the laboratory decay rates are not necessarily the same but the laboratory rates establish a lower boundary for the actual river decay rate which is of interest within the water quality model.

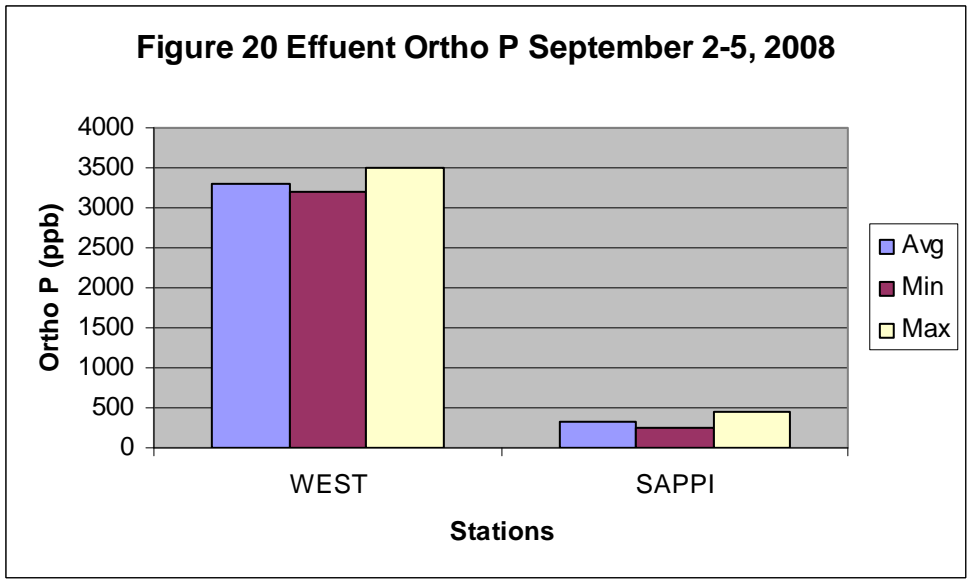
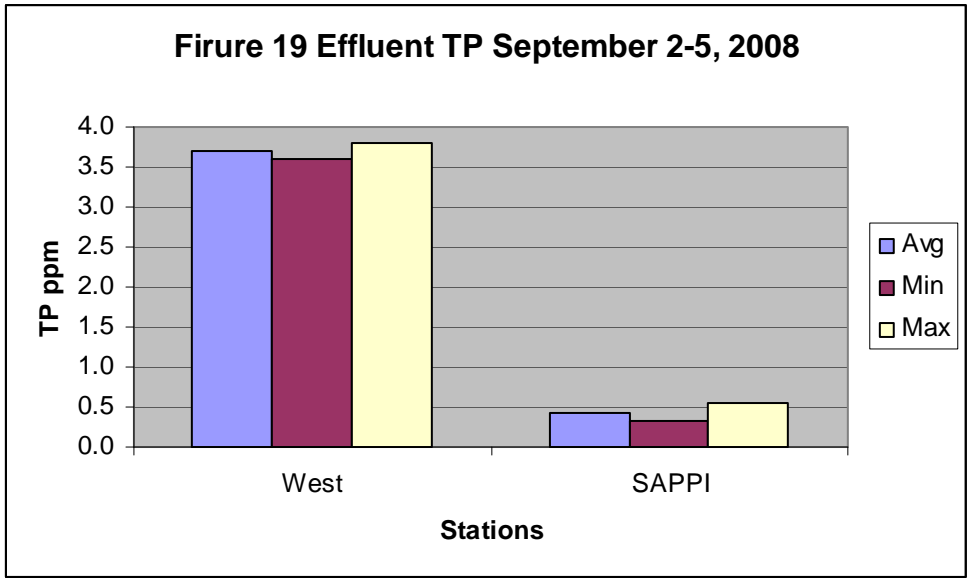


**Effluent Data**

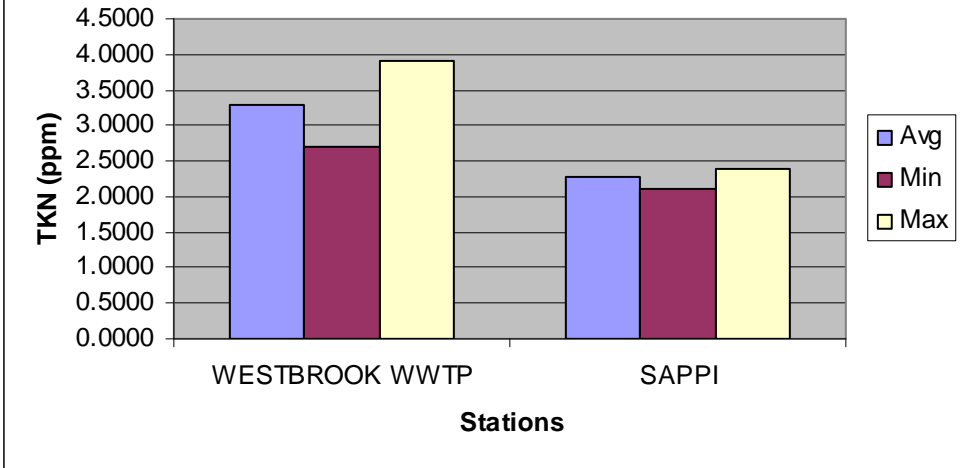
Effluent data were collected as 24-hour composite sample started during the morning previous to collection (also in the AM). The quantity or load of various pollutant parameters are of interest, when developing the water quality model. Loads are plotted for total ultimate BOD, total and orthophosphorus, and total nitrogen. The data show that SAPPI contributed an average of 2150 lbs/day of ultimate BOD during the August 2004 and 596 lbs/day during the September 2008 intensive surveys (Figure 25, 26 and 27). PWD Westbrook contributed 556 ppd and 612 ppd ultimate BOD during the August 2004 and September 2008 intensive surveys, respectively.

Effluent total-P loads for PWD Westbrook were 64 ppd and 95 ppd total-P during the August 2004 and September 2008 intensive surveys, respectively. PWD Westbrook contributed 58 ppd and 75 ppd total-P during the August 2004 and September 2008 intensive surveys, respectively.

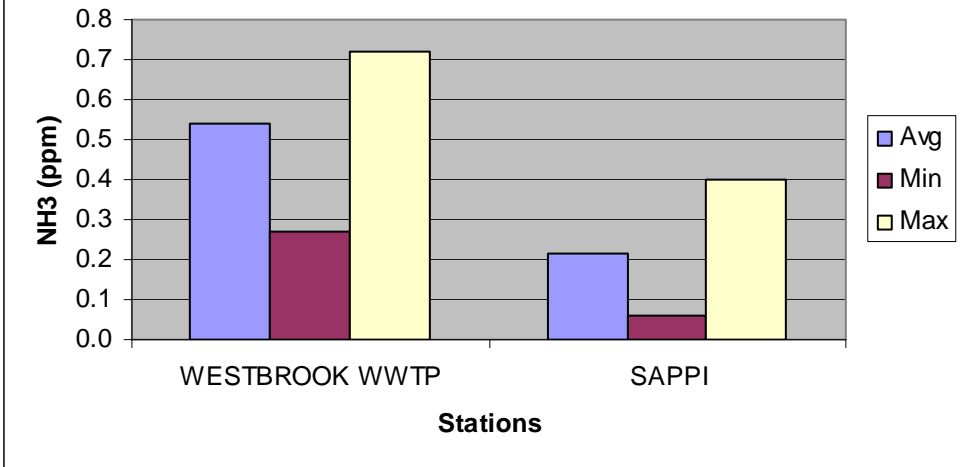
Effluent total-N loads were 227 ppd and 479 ppd during the August 2004 and September 2008 intensive surveys, respectively. PWD Westbrook contributed 138 and 362 ppd total-N during the August 2004 and September 2008 intensive surveys, respectively

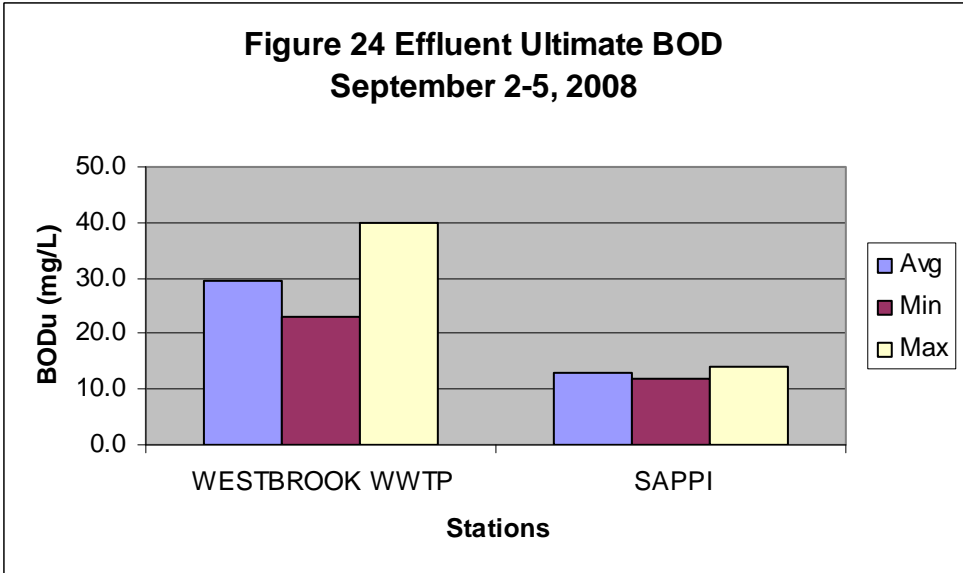
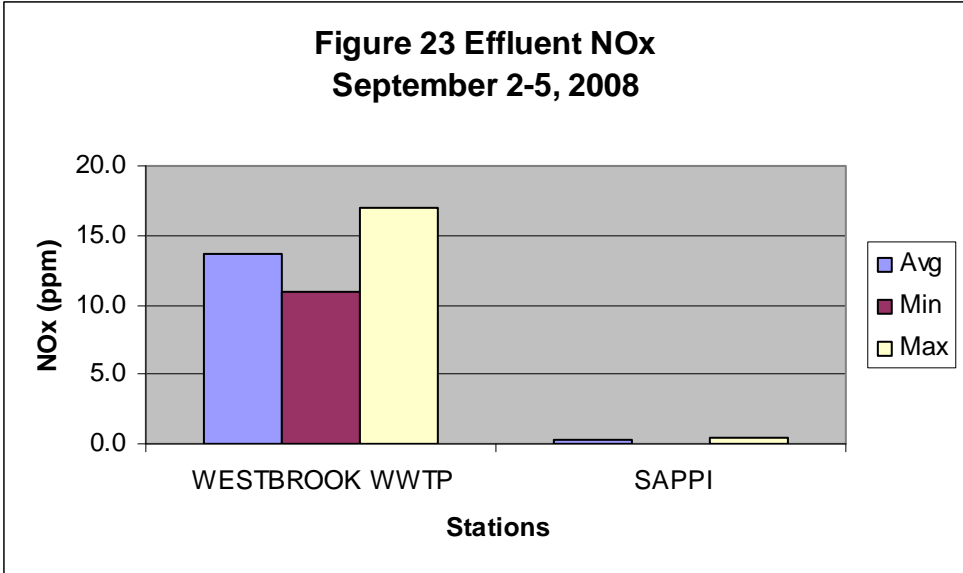


**Figure 21 Effluent TKN September 2-5, 2008**

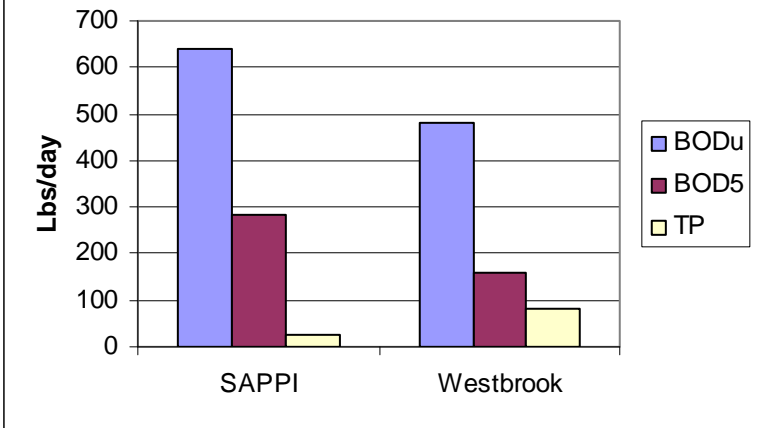


**Figure 22 Effluent NH3 September 2-5, 2008**

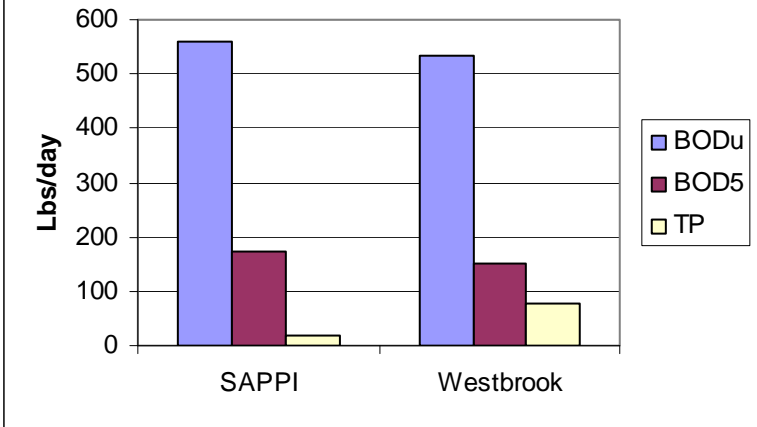


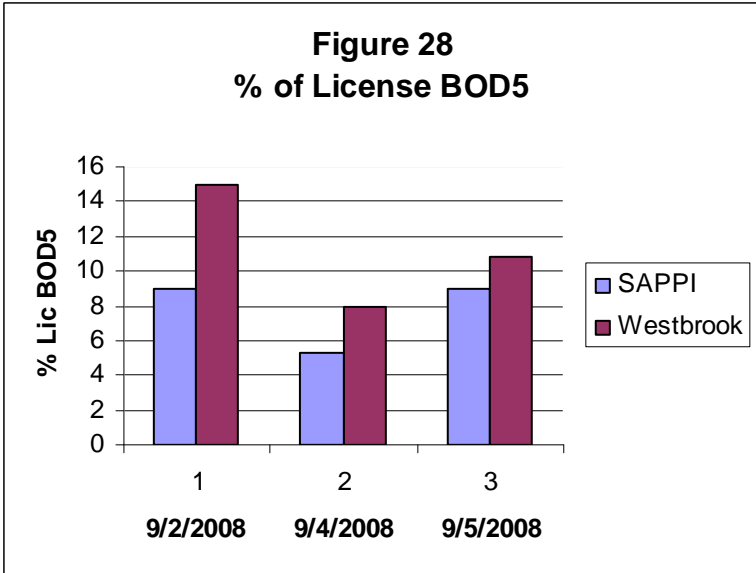
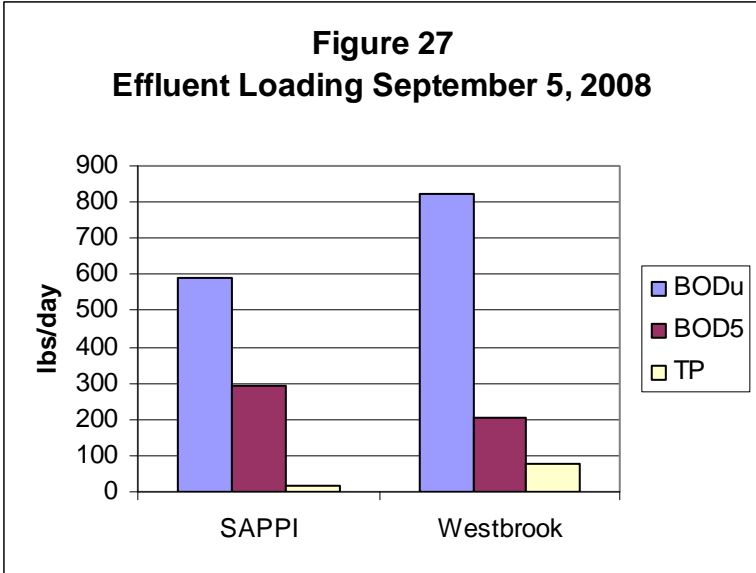


**Figure 25 Effluent Loading  
September 2, 2008**



**Figure 26  
Effluent Loading September 4, 2008**





**Quality Control**

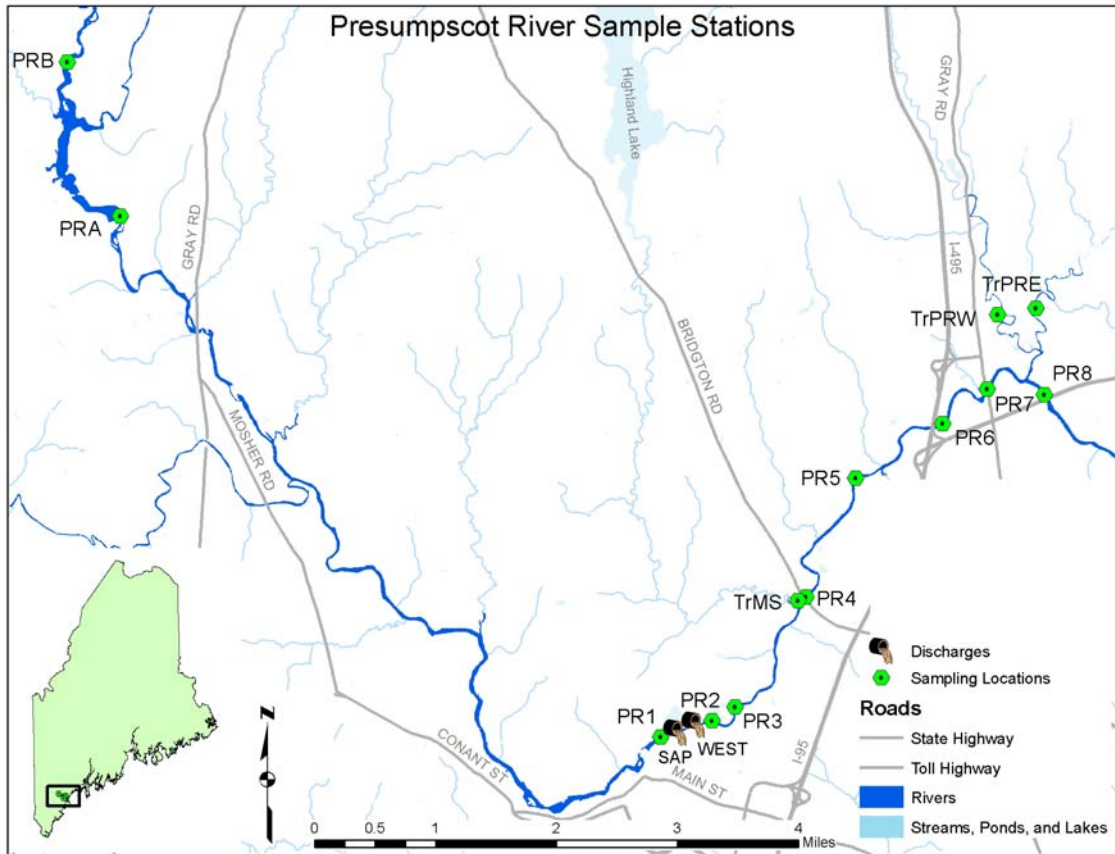
Proper quality control is essential for any sampling effort to assure data collected are of acceptable quality. Quality control procedures were practiced in both field sampling and the laboratory analysis of various parameters. DO meters were calibrated prior to and as needed during sampling. In addition, meters were cross checked with the other sampling team to assure consistency and accuracy of results. The DO meters were cross-checked after initial morning calibration.

Table 3 Duplicate – Effluent Sample September 4, 2008			
Analyte	Westbrook	Duplicate	Units
Ammonia Nitrogen	0.63	0.64	Mg/L
BOD 60 Days	25	25	Mg/L
TKN	3.3	3.3	Mg/L
Phosphorus, Ortho	3200	3200	Ug/L
NO3+NO2	13	14	Mg/L
BOD	7.1	9.3	Mg/L
Phosphorus, Total	3.6	3.7	Mg/L

Table 4 Duplicate – River Sample September 5, 2008			
Analyte	PR8	Duplicate	Units
Ammonia Nitrogen	0.03	0.03	Mg/L
BOD 60	2.9	2.5	Mg/L
TKN	0.3	0.3	Mg/L
Phosphorus, Ortho	48	47	Mg/L
Chlorophyll-a	0.003	0.0036	Mg/L
NO3+NO2	0.19	0.19	Mg/L
Phosphorus, Total	0.063	0.064	Mg/L



## Appendix A. Location Map



Appendix B. Presumpscot River Intensive Survey Field Data (DO, temperature)

**Sampling date 9/2/2008**

Station	Location	First Run					Second Run				
		Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp (C)	Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp (C)
PR1	McGregor Bridge	9:15 AM	0	7.7	87.6	21.7					
PR2	Between Westbrook and Sappi	8:02 AM	0	8.2	93.4	21.8					
			1	8.2	93.4	21.8					
			2	8.2	93.4	21.8					
			3	8.2	93.4	21.8					
PR3	Below Sappi	8:25 AM	0	8.1	92.6	22.0					
			1	8.1	92.6	22.0					
			2	8.1	92.6	22.0					
			3	8.1	92.6	22.0					
PR4	Route 302 Bridge	8:50 AM	0	8.0	91.3	21.9					
			1	8.0	91.3	21.9					
			2	8.0	91.3	21.9					
			3	8.0	91.3	21.9					
PR5	Above Meader Road	9:13 AM	0	7.7	87.7	21.8					
			1	7.7	87.7	21.8					
			2	7.7	87.7	21.8					
			3	7.7	87.7	21.8					
PR6	Blackstrap Road	9:40 AM	0	7.6	86.6	21.8					
			1	7.6	86.6	21.8					
			2	7.6	86.6	21.8					
			3	7.6	86.6	21.8					
PR8	Halfway between Turnpike and Falls	10:09 AM	0	7.5	85.3	21.7					
			1	7.5	85.3	21.7					
			2	7.5	85.3	21.7					
			3	7.5	85.3	21.7					
PRA	Gambo Road	8:40 AM	0	7.5	85.0	21.5					
PRB	Hurricane Road	8:05 AM	0	7.3	83.0	21.7					

Sampling date 9/4/2008

Station	Location	First Run					Second Run				
		Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp (C)	Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp (C)
PR1	McGregor Bridge	10:30 AM	0	8.3	95.1	22.1					
PR2	Between Westbrook and Sappi	6:58 AM	0	8.6	97.6	21.6	1:33 PM	0	9.0	104.3	22.7
			1	8.6	97.6	21.6		1	9.0	104.3	22.7
			2	8.6	97.6	21.6		2	8.9	103.2	22.7
						3	8.8	102.0	22.7		
PR3	Below Sappi	7:06 AM	0	8.5	96.7	21.7	3:40 PM	0	8.4	98.1	23.1
			1	8.5	96.8	21.8		1	8.4	98.1	23.1
			2	8.5	96.8	21.8		2	8.4	98.1	23.1
PR4	Route 302 Bridge	7:29 AM	0	8.3	94.4	21.7	3:27 PM	0	8.5	99.5	23.2
			1	8.3	94.4	21.7		1	8.5	99.5	23.2
			2	8.2	93.2	21.7		2	8.5	99.5	23.2
PR5	Above Meader Road	7:53 AM	0	8.1	91.9	21.6	2:03 PM	0	8.8	102.0	22.7
			1	8.1	91.9	21.6		1	8.9	102.8	22.5
			2	8.1	91.9	21.6		2	8.9	102.8	22.5
						3	8.8	101.6	22.5		
PR6	Blackstrap Road	8:07 AM	0	7.9	89.5	21.5	2:16 PM	0	8.8	101.6	22.5
			1	7.9	89.5	21.5		1	8.7	100.5	22.5
			2	7.9	89.5	21.5		2	8.8	101.6	22.5
			3	7.9	89.5	21.5					
PR7	Route 26	8:22 AM	0	7.8	88.2	21.4	2:24 PM	0	8.6	99.1	22.4
			1	7.8	88.2	21.4		1	8.6	98.9	22.3
			2	7.8	88.2	21.4		2	8.5	97.8	22.3
PR8	Halfway between Turnpike and Falls	8:32 AM	0	7.9	89.3	21.4	2:34 PM	0	8.6	99.1	22.4
			1	7.9	89.3	21.4		1	8.5	98.0	22.4
			2	7.9	89.3	21.4		2	8.6	99.1	22.4
			3	7.8	88.2	21.4		3	8.5	98.0	22.4
PRA	Gambo Road	7:05 AM	0	7.4	84.5	21.9	1:45 PM	0	7.8	92.1	23.7
PRB	Hurricane Road	6:50 AM	0	7.2	81.4	21.4	1:30 PM	0	7.9	91.9	22.9
TRMS	East Bridge Street	9:00 AM	0	8.4	86.4	16.7	2:15 PM	0	8.8	98.5	20.9
TRPRE	Falmouth Road	7:55 AM	0	7.4	77.2	17.4	2:50 PM	0	8.3	91.6	20.2
TRPRW	Leighton Road	8:25 AM	0	8.8	88.0	15.4	2:40 PM	0	8.8	95.6	19.4

Sampling date 9/5/2008

Station	Location	First Run				
		Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp
PR1	McGregor Bridge	9:05 AM	0	8.3	95.7	22.4
PR2	Between Westbrook and Sappi	7:11 AM	0	8.0	92.0	22.3
			1	8.0	92.0	22.3
			2	8.0	92.0	22.3
PR3	Below Sappi	7:20 AM	0	7.8	89.9	22.4
			1	7.7	88.9	22.5
			2	7.6	87.8	22.5
PR4	Route 302 Bridge	7:39 AM	0	7.5	86.4	22.4
			1	7.5	86.4	22.4
			2	7.5	86.4	22.4
PR5	Above Meader Road	8:01 AM	0	7.4	85.1	22.3
			1	7.4	85.1	22.3
			2	7.4	85.1	22.3
PR6	Blackstrap Road	8:19 AM	0	7.2	82.8	22.3
			1	7.3	84.0	22.3
			2	7.3	84.0	22.3
PR7	Route 26	8:30 AM	0	7.2	82.8	22.3
			1	7.2	82.8	22.3
			2	7.2	82.8	22.3
PR8	Halfway between Turnpike and Falls	8:38 AM	0	7.2	82.8	22.3
			1	7.2	82.8	22.3
			2	7.2	82.8	22.3
PRA	Gambo Road	7:00 AM	0	7.9	91.7	22.8
PRB	Hurricane Road	6:50 AM	0	7.6	87.4	22.3
TRMS	East Bridge Street	7:30 AM	0	8.3	87.7	18.0
TRPRE	Falmouth Road	8:50 AM	0	7.7	82.5	18.7
TRPRW	Leighton Road	8:45 AM	0	8.7	90.2	17.1

Second Run				
Time	Depth	D.O. (mg/l)	D.O. (% Sat)	Temp (C)
3:40 PM	0	8.2	95.4	22.9
12:33 PM	0	8.5	98.8	22.87
	1	8.3	96.2	22.7
	2	8.4	97.2	22.6
12:37 PM	0	8.3	96.6	22.9
	1	8.3	96.6	22.9
	2	8.3	96.6	22.9
12:53 PM	0	8.6	100.4	23.1
	1	8.6	100.3	23.0
	2	8.6	100.3	23.0
1:06 PM	0	8.2	95.2	22.8
	1	8.2	95.2	22.8
	2	8.2	95.2	22.8
	3	8.2	95.2	22.8
1:11 PM	0	8.2	95.2	22.8
	1	8.2	95.2	22.8
	2	8.2	95.2	22.8
1:15 PM	0	8.0	92.7	22.7
	1	8.0	92.7	22.7
	2	8.0	92.7	22.7
1:23 PM	0	7.9	91.6	22.7
	1	7.9	91.6	22.7
	2	7.9	91.6	22.7
2:10 PM	0	7.8	92.3	23.8
2:00 PM	0	8.4	98.9	23.5
2:40 PM	0	8.9	99.8	21.0
3:05 PM	0	8.7	96.3	20.3
2:55 PM	0	9.4	102.2	19.4

Appendix C. Effluent Samples/Ambient Presumpscot River Samples (Nutrients, chlorophyll-a,  
and BOD)

Station	Date	AMMONIA (MG/L)	BOD 5 day (MG/L)	BOD 60 day (MG/L)	CHLORO- PHYLL-A (MG/L)	CHLORO- PHYLL-A CORRECTED (MG/L)	NBOD (MG/L)	NOx (MG/L)	NOx 60 day (MG/L)	NOx60-NOx (MG/L)	ORTHO P (UG/L)	TKN (MG/L)	TP (MG/L)
PRA	9/5/2008	0.01		2.1	0.0019	0.003	0.3464	0.03	0.11	0.08	2	0.2	0.005
PR1	9/2/2008	0.01		2.4	0.0022	0.0035	0.2598	0.05	0.11	0.06	3	0.2	0.009
	9/4/2008	0.01		2.5	0.0015	0.0021	0.2598	0.05	0.11	0.06	2	0.2	0.009
	9/5/2008	0.01		1.9	0.0017	0.003	0.2165	0.05	0.1	0.05	2	0.2	0.008
PR2	9/4/2008	0.02		3.1	0.0016	0.0022	0.3464	0.09	0.17	0.08	22	0.2	0.029
	9/5/2008	0.03		2.4	0.0019	0.0033	0.3464	0.12	0.2	0.08	36	0.3	0.049
PR3	9/2/2008	0.02		2.7	0.0018	0.0026	0.2598	0.22	0.28	0.06	53	0.3	0.071
	9/4/2008	0.04		3.1	0.0015	0.0023	0.5629	0.11	0.24	0.13	30	0.3	0.043
	9/5/2008	0.03		2.8	0.0014	0.0028	0.4763	0.11	0.22	0.11	31	0.3	0.044
PR4	9/2/2008	0.02		2.5	0.0017	0.0031	0.3031	0.14	0.21	0.07	33	0.2	0.05
	9/4/2008	0.04		2.6	0.002	0.0036	0.3031	0.11	0.18	0.07	26	0.2	0.041
	9/5/2008	0.03		2.7	0.0022	0.0039	0.433	0.1	0.2	0.1	26	0.3	0.038
PR5	9/2/2008	0.02		2.7	0.0015	0.0024	0.2598	0.15	0.21	0.06	33	0.2	0.048
PR6	9/2/2008	0.02		2.5	0.0021	0.0041	0.2598	0.18	0.24	0.06	39	0.2	0.055
	9/4/2008	0.04		2.9	0.0014	0.002	0.3897	0.16	0.25	0.09	39	0.2	0.054
	9/5/2008	0.04		2.5	0.0018	0.0028	0.433	0.13	0.23	0.1	36	0.3	0.049
PR8	9/2/2008	0.02		2.7	0.0017	0.0031	0.2598	0.22	0.28	0.06	45	0.2	0.061
	9/4/2008	0.04		3.1	0.0014	0.0023	0.4763	0.2	0.31	0.11	42	0.2	0.058
	9/5/2008	0.03		2.9	0.0018	0.003	0.5196	0.19	0.31	0.12	48	0.3	0.063
TRMS	9/4/2008	0.02		4	0.0027	0.0036	0.3897	0.15	0.24	0.09	4	0.5	0.082
TRPRW	9/4/2008	0.01		2.4	0.0024	0.0035	0.2598	0.44	0.5	0.06	7	0.2	0.023
TRPRE	9/4/2008	0.02		2.8	0.0036	0.0047	0.0866	0.64	0.66	0.02	7	0.3	0.029
WESTBROOK WWTP	9/2/2008	0.27	7.5	23			-4.33	17	16	-1	3500	2.7	3.8
	9/4/2008	0.63	7.1	25			0	13	13	0	3200	3.3	3.6
	9/5/2008	0.72	10	40			-14.722	11	7.6	-3.4	3200	3.9	3.7
SAPPI	9/2/2008	0.06	6.2	14			3.0743	0.01	0.72	0.71	450	2.1	0.56
	9/4/2008	0.4	3.8	12			4.1568	0.44	1.4	0.96	280	2.3	0.43
	9/5/2008	0.18	6.5	13			3.0743	0.26	0.97	0.71	250	2.4	0.32