3.0 APPLICABLE WATER QUALITY STANDARDS

3.1 National Shellfish Sanitation Program Standards

New York State participates in the National Shellfish Sanitation Program (NSSP) which recommends strict bacteriological water quality standards for shellfishing areas to be designated as approved, or certified, for the harvest of shellfish for human consumption [Note: New York State's water quality standards for certified shellfish lands are specified in 6 NYCRR, Part 47, "Certification of Shellfish Lands."]

The standards are developed for specific indicator organisms, which are assumed to indicate the presence of human pathogenic organisms associated with fecal material from warm blooded animals.

NSSP guidelines (2003) allow either total or fecal coliform standards for growing area classification. Two sampling strategies, adverse pollution condition (APC) and systematic random sampling (SRS) are acceptable per NSSP guidelines for total or fecal coliform determination. For APC sampling, a minimum of the 15 most recent samples collected under APC (with a minimum of five annually) are required to classify growing areas. These sampling stations are to be established adjacent to actual or potential sources of pollution. For SRS sampling, a minimum of the 30 most recent samples (with a minimum of six annually), collected under various environmental conditions during the certified period, are required to classify growing areas affected by pollution sources. Remote areas are required to have a minimum of 15 samples (with a minimum of two samples collected annually) to classify growing areas. Although the NSSP guidance dictates that transitioning from APC to SRS should only allow up to 15 of the most recent APC samples prior to SRS collection to be used for a transition period not to exceed three years, there were some stations where more than 15 APC samples were used for the statistical analyses in order to reach the 30 sample minimum.

Prior to June 1998, NYS used both total and fecal coliforms as indicator organisms for classifying shellfish harvest areas. Between June 1998 and January 2001, however, only total coliforms were used as indicators, due to laboratory staffing shortages. After January 2001, the laboratory resumed testing for both coliforms, but as of February 13, 2003, the lab has only been testing for fecal coliforms. Table 3-1 tabulates these temporal changes in the indicator organisms used by New York State.

Table 3-1. Changes in Indicator Organisms Used for Classification of Harvest Areas.

	Total Coliforms	Fecal Coliforms
Before June 1998	X	X
June 1998-January 2001	X	
January 2001-February 2003	X	X
February 2003-present		X

The type of sampling used to test NYS shellfish harvesting areas has also changed over the years. Prior to January 1997, NYS used APC sampling for determining whether the embayments and tributaries of Peconic Bay estuary met NYS and NSSP standards for certified areas. APCs were considered to exist when rainfall is greater than 0.25 inches but less than 3.0 inches in one or more of the days during the 96 hours (4 days) prior to sampling. APC sampling was conducted only during outgoing tides. Although APC sampling was primarily phased out in 1997 (in favor of SRS sampling, as described below), some limited APC sampling is still done in areas uncertified for shellfish harvesting. APC sampling is targeted to limited post-rainfall (0.05" - 1.5") conditions. It is performed in those areas in which the local Towns have requested that NYSDEC perform a water quality study to determine if the area is suitable for a

rainfall related conditional harvesting program. If the results of this limited APC sampling are acceptable, the shellfishing area may be opened to harvesting on a conditional basis.

Beginning in 1998, NYS began to utilize SRS to test the waters of shellfish harvesting areas. SRS sampling events are scheduled randomly in advance (also only during outgoing tides) to develop a collection of data that includes water quality during different weather conditions.

Thresholds to determine harvest area compliance with coliform standards listed in the NSSP are calculated using geometric mean (MPN, or $X_{geomean}$) and 90th percentile values (X_{90}). A geometric mean is used versus an average or typical mean to dampen the effect of very high or low values which oftentimes occurs in fecal sampling; as levels can vary anywhere from 10 to 10,000 fold over a given period. The 90th percentile takes into account the variability factor which assumes 90 percent of the samples were collected under uniform conditions (variability only due to the test procedure and the additional allowance for some additional variability arising from changing conditions in the water being sampled). This statistical method assumes no more than 10 percent of the samples derived under uniform conditions will exceed the MPN standards. Some shellfish water sampling data may be collected following intermittent pollution events which increases the variability when combined with data collected under normal conditions. As variability is increased, the 90th percentile will reflect the increased variability and will protect against the potential public health problems that may result when shellfish are consumed from growing waters that are adversely affected by intermittent pollution events and improperly classified.

The standards for when APC-sampled water bodies and SRS-sampled water bodies are designated as certified for shellfish harvesting are described in Table 3-2. APC data collected between 1987 and 1996 at all the water bodies, and being collected now at selected water bodies, are reviewed and analyzed based on the standards in Table 3-2. NSSP Standards listed in the table below apply to each station.

Table 3-2. NSSP Standards for Shellfish Harvesting Areas Affected by Point and Nonpoint Pollution Sources.

Sampling Technique	Indicators	NSSP Standards* *Note: values are based on a 3-tube, decimal dilution test.	
APC Sampling	**Total coliform**	The median of samples shall not exceed 70 MPN/100ml	Not more than 10% of the samples may exceed 330 MPN/100ml
	Fecal coliform	The median of samples shall not exceed 14 MPN/100ml	Not more than 10% of the samples shall exceed 49 MPN/100ml
SRS Sampling	**Total coliform**	Geometric mean of samples shall not exceed 70 MPN/100ml	The estimated 90th percentile (X90) value shall not exceed 330 MPN/100ml
	Fecal coliform	Geometric mean of samples shall not exceed 14 MPN/100ml	The estimated 90th percentile (X90) value shall not exceed 49 MPN/100ml
Remote Classification*	**Total Coliform**	Geometric mean of samples shall not exceed 70 MPN/100ml	Not more than 10% of the samples shall exceed 330 MPN/100ml
	Fecal Coliform	Geometric mean of samples shall not exceed 14 MPN/100ml	Not more than 10% of the samples shall exceed 49 MPN/100ml

* A shellfish growing area that is classified as remote has no human habitation and is not impacted by any actual or potential pollution sources. Remote areas must be sampled at least twice annually.

$X_{geomean}$ and X_{90} are calculated as below:

$$X_{geomean} = Anti\log[(\sum_{i=1}^{n} \log(X_i)) / n]$$

where X_1, ... X_n are the coliform concentrations from the SRS sampling. The estimated 90th percentile is computed as:

$$X_{90} = \text{Anti}\log[(S_{\log})*1.28 + XAVG_{\log}]$$

where $S_{\log}$ is the standard deviation of the logarithms of the MPN values and $XAVG_{\log}$ is the mean of the logarithms of the MPN values comprising the data set (also known as the log mean or the arithmetic average of the logarithms - the geometric mean is the antilog of $XAVG_{\log}$). $S_{\log}$ is calculated as follows:

$$S_{\log} = \sqrt{\sum_{i=1}^{n} (\log(X_i) - XAVG_{\log})^2 / (n-1)}$$

Although the NYS water quality standard for Class SA is expressed as a median value of 70 MPN/100ml, the same numerical value is used as geometric mean criterion for SRS data. According to NSSP guidelines (NSSP, 2003), these two are equivalent in terms of public protection.

3.2 NYSDEC Water Quality Regulations

NYSDEC maintains water quality regulations for surface water and groundwater as Title 6, Chapter X Sections 700-706, last amended August 4, 1999. Contained within these regulations are standards for coliform (Section 703.4). The New York Commissioner of Environmental Conservation determines which waters are acceptable for shellfishing. Water quality closures (year-round, conditional and seasonal) are defined in Section 1.1.

The determination of conformance is based on whether the waters meet appropriate standards. The standard for total coliform in SA waters as outlined in Title 6, Chapter X, Section 703.4: the median most probable number (MPN) value in any series of representative samples shall not be in excess of 70. However, since 2003, the NYSDEC shellfish sanitation program classifies shellfish harvest areas based on fecal coliform standards. Fecal coliform standards are not currently addressed within NYSDEC water quality regulations. The National Shellfish Sanitation Program has developed the following guidelines regarding fecal coliform: for an area to be certified, the geometric mean should not exceed 14 FC/100ml and the 90th percentile value should not exceed 49 FC/100ml. These standards apply to each station. A station on a closure line should also meet certified criteria.

3.3 Standard Used for Shellfish TMDLs

The NSSP program standards are used by the state's shellfish program to determine whether or not shellfish waters are open for harvesting. Since shellfish harvesting is the designated use for the 25 water bodies covered in this report, the standards used to determine the usability of the shellfish harvesting waters are used in the TMDL. As noted in Section 3-1, the NYS shellfish standard of "a median value of 70MPN/100ML" is equivalent to NSSP standards of a geometric mean criterion for SRS data. Therefore, the NSSP standards are used as the endpoint in achieving acceptable water quality in the water bodies.

Since NYSDEC's shellfish sanitation program now only analyzes water samples for fecal coliform bacteria, in the future the assessment of the effectiveness of achieving the TMDLs will have to be based on fecal coliform data.

4.0 WATER QUALITY AND WATERSHED CHARACTERIZATION

A wide range of data and information were used to characterize the Peconic Bay water bodies and their corresponding watersheds, or contributing zones. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollution sources and their contributions, and ambient water quality monitoring data. Table 4-1 summarizes the various data types and data sources used in this characterization. Some of these data types are described in the subsequent sections.

Table 4-1. Summary of Data Types and Sources Used in Water Quality and Watershed Characterization.

Data Category	Description	Data Source(s)
Watershed Physiographic Data	Land Use	The Nature Conservancy[3]
	Weather Information	National Climatic Data Center
	Stream Flows	USGS
	Storm Water Drainage Outfalls	Suffolk County
Environmental Monitoring Data	303(d) Listed Waters	NYSDEC
	Ambient Water Quality	NYSDEC
	Monitoring Data	Suffolk County

4.1 Water Quality Data

The water quality data relevant for development of TMDLs in the study area were assembled from a series of databases originating from the NYSDEC and Suffolk County. Attachment 1 contains the geomean and 90th percentile statistical values for both fecal and total coliform. The entire dataset for each sample station was used to calculate the geomean and 90th percentile for fecal and total coliform at the stations. Calculations were performed for sampling stations which did not contain the minimum 30 samples, per NSSP guidelines, and are indicated as such in Attachment 1. Additional calculations were also performed for areas classified with seasonal closures, determining the geomean and 90th percentile of fecal and total coliform during the closed period (Attachment 1). Subsequently, the stations within each water body that possess values that exceed state standards for shellfish harvesting areas are identified. These water bodies may be subject to further study necessary to establish TMDLs. These include load reduction analyses, watershed modeling of sources, and the determination of acceptable TMDLs. As described in Section 1.1, any sampling station that was located within a conditionally certified area at the writing of this report is treated as being within a closed area.

[3] These land use data were originally developed by the Suffolk County Planning Department in 1997 and subsequently updated by the Nature Conservancy in 2001.

4.1.1 NYSDEC Data

The NYSDEC shellfish sanitation program has typically collected 8 to 16 samples per year since 1986 at ambient water quality monitoring stations throughout Peconic Bay. Since 1986, NYSDEC has examined water samples for total and fecal coliform bacteria, although not necessarily simultaneously (see Table 3-1 for clarification). Prior to 1997, samples were collected using APC sampling. Since January 1997, NYSDEC samples have been collected using systematic random sampling (SRS) (see Section 3.1 for further clarification). The datasets provided by NYSDEC contain monitoring for both fecal and total coliform, with a lack of fecal coliform readings from mid-1998 through 2000, and an end to total coliform measurements occurring between 2002 and 2003.

The NYSDEC total coliform data is generally constrained by a minimum detection limit of 3 MPN/100mL and a maximum limit of 2,400 MPN/100mL. Indeterminate sample results below the sensitivity of the MPN procedure used by NYSDEC are reported as <3 MPN/100ml. Sample results above the sensitivity of the MPN procedure are reported as ˙2400 MPN/100ml. For purposes of data analyses, NYSDEC converts <3 MPN/100ml values to 2.9 MPN/100ml and ˙2400 MPN/100ml values to 2501 MPN/100ml. Data within some of the sampling stations recorded a "0" reading. These "0" values have been confirmed by NYSDEC to represent no data collection during that sampling date. Therefore, "0"s were not used during the analysis.

Differences existed among the frequency, time of year of the sampling, and type of sampling (SRS versus APC) which affected the use of the data. Refer to Section 3.1 for NSSP standards. A summary of the datasets by shellfish growing area and the range of data collection dates are shown in Table 4-2. The timeframes of the compiled data sampling sets varied among sampling stations (see Column 2, Table 4-2). Some of the monitoring stations within each water body did not have the required 30 samples post 1997. As samples prior to 1997 were collected under APC conditions, these stations have a component of data which is reflective of APC conditions. Stations having APC sampling within the data analysis are noted in the two right columns of Table 4-2. A large portion of the stations having APC measurements are the ones positioned in closed areas. Geomean and 90th percentile values were also determined during the "closed" periods of seasonally certified stations, which typically required a longer timeframe to accumulate the minimum 30 samples. Calculations of stations below the 30 minimum samples are indicated in Attachment 1 and their sample sizes are given.

4.1.2 Suffolk County Data

Suffolk County has conducted long-term monitoring for both total and fecal coliform at stations throughout the Peconic Estuary dating back to 1976. The County identifies their sampling stations using the prefix '060' followed by a three-digit station number. In this report, the County sampling stations are identified using only the station number. Some County stations ceased monitoring in 1989 (e.g., 150, 160, 190, 200). These stations were not included in the exceedance analyses because the data were determined to be too old and not relevant to recent conditions. The total and fecal coliform detection minimums used by the County differed from NYSDEC protocol. The detection minimum as reported by Suffolk County was '<20'. If a result was reported as '<20', it was not used in the exceedance calculations because the actual value is not known and using an assumed value may artificially inflate or deflate the statistical results. As is noted in the Attachment 1 tables, all of the County stations had fewer than the standard minimum requirement of 30 samples.

Table 4-2. NYSDEC Data Overview of APC Sampling Within This Study.

Shellfish Growing Area Name	Data Range (years)		Stations with APC Fecal Coliform Sampling*	Stations with APC Total Coliform Sampling*
	Fecal	Total		
Shelter Island Sound	1997-2004	1997-2002	None	None
Stirling Basin	2001-2004	1999-2002	None	None
Southold Bay (Goose Creek, Town & Jockey Creeks, Inner Jockey Creek)	1997-2004	1997-2002	None	None
Hashamomuck (Hashamomuck, Long Creek, Mill Creek, & Budd's Pond	1997-2004	1997-2004	None	None
Little Peconic Bay (Richmond Creek & North Sea)	No Data	No Data	N/A	N/A
Great Peconic Bay (James Creek & Deep Hole Creek)	1988-2004	1988-2002	8a, 9c	8a, 9c
Flanders Bay SGA 29	1997-2004	1988-2002	None	1
Flanders Bay SGA 29C (Flanders Bay & Reeves Bay)	1988-2004	1988-2002	4, 6a, 6b, 7-10, 12, 14, 15, 16C, 26, 17C, 19, 18	4, 6a, 6b, 7-10, 12, 14, 15, 16C, 26, 19, 18
Sebonac Creeks (Sebonac Creek, Bullhead Bay, Scallop Pond)	1997-2004	1987-2002	None	None
North Sea Harbor	1990-2004	1990-2003	5, 6	5, 6
Wooley Pond	1988-2004	1988-2002	None	None
Noyac Bay	1988-2004	1988-2002	8, 8.1	None
Sag Harbor	1986-2004	1986-2003	1.1, 1.2, 4	1.1, 1.2, 4
Northwest Harbor (Outer Northwest Creek)	1990-2004	1990-2003	5, 6, 7, 8	5, 6, 7, 8
Acabonac Harbor	1997-2004	1997-2002	None	None
Montauk Harbor	1988-2004	1988-2002	2, 5-11, 30	2, 5-11, 30

*Stations listed here include primarily data prior to 1997 where sampling was conducted under APC.

4.1.3 Data Analysis

The data from both NYSDEC and Suffolk County were screened for relevance and acceptability and statistical analyses were performed based on the following set of rules:

- Sampling stations must be located within Class SA waters within the water bodies listed in Table 1-1;
- If a station had 30 or more samples taken during the SRS period (1997-present), then all of those SRS samples were used to calculate exceedances.
- If a station had fewer than 30 samples taken during the SRS period, then samples taken during the APC period (pre-1997) were included in the calculations, until a sample size of 30 was reached.

- If a station had fewer than 30 samples taken overall (i.e., during *both* the SRS and APC periods), then all of the samples, regardless of whether they were APC or SRS, were used in the calculations.
- At both state and county stations that were located in seasonally certified shellfish areas, the exceedances were calculated using only data taken during the closed period of the year.
- At both state and county stations that were located in uncertified shellfish areas, the exceedances were calculated using data taken throughout the year, regardless of season.
- Some Suffolk County sampling data were expressed as '< 20' or '< 2', indicating the detection minimum. Since the actual measurement is not known and choosing one would be random and arbitrary, these data were not included in the exceedance calculations.
- Some Suffolk County sampling stations had data only from 1976 until 1989, with no results from more recent times. Exceedances were not calculated from these stations, in order to prevent irrelevant historic data from affecting the exceedance results. Other stations had data taken only during the timespan of a few days in 1995. Due to the narrow scope of this sampling scheme, exceedances were not calculated for these stations.

Following these rules, statistical analyses were conducted on all relevant NYSDEC and Suffolk County data associated with monitoring stations located within the appropriate Class SA boundary of each water body listed in Table 1-1.

Maps of NYSDEC and Suffolk County sampling locations within each water body are provided in Section 2.0. As depicted on the maps, each water body contains a variety of different shellfish classification areas (i.e., closed, seasonally certified) and, naturally, the sampling stations are located in differently classified waters. Conditionally open areas are not shown separately on the maps because their designation changes on an annual basis. Any areas that may be conditionally certified are included within the 'closed' sections of the maps (see Section 1.1 for clarification).

Attachment 1 provides the results of the analysis of NYSDEC and County water quality data and includes the geomean and 90th percentile statistical values for both fecal and total coliform. As stated in Section 3, these values are equivalent in terms of public protection. Those data sets that fail to meet the minimum requirements of acceptability associated with quantifying coliform exceedances are noted. Ultimately, the water bodies that possess one or more stations that indicate impairment (i.e., total or fecal coliform levels in excess of state standards) are selected for further analysis in accordance with the TMDL process.

The 90th percentile value for fecal coliform measurements exceeded the NSSP thresholds most often, and was therefore, determined to be the most sensitive indicator for this study. According to the NYSDEC, closures of shellfish lands are rarely based on water quality at a station failing to meet the geometric mean component of the total or fecal coliform standards. Typically water quality problems at a station were determined by the failure to meet the estimated 90th percentile component of the standard. Failure to meet the 90th percentile component of the standard means that water quality at the station is more variable than the inherent variability of the most probable number (MPN) method used for examining samples. Therefore, TMDL standards and modeling will be conducted using primarily fecal coliform data. Table 4-3 shows the water bodies and the stations within them that exceeded any of the NSSP standards for both fecal and total coliform, although those stations that exceeded the NSSP 90th percentile threshold of 49 MPN for fecal coliform are most noteworthy. Table 4-3 identifies the water bodies for which subsequent TMDL analyses will be performed. Water bodies or zones not listed within Table 4-3 will not undergo TMDL analysis due to either lack of sufficient data for analysis or lack of coliform exceedances (refer to Attachment 1). Water bodies not exceeding the applicable standards included Dering Harbor and Scallop Pond. Existing loads in Dering Harbor, however, were very close to exceedances levels, and therefore, a

TMDL was developed. Water bodies without sufficient data for analysis included Downs Creek, Halls Creek, Unnamed Pond, and Oyster Pond. Individual zones within larger water bodies also may not have exhibited exceedances, and therefore were not included in Table 4-3. These zones include TJC-2, NH-4, NC-2, SH-1, SH-3, SH-4, and AH-1.

Table 4-3. Summary of Stations in Each 303(d) Water Body that Exhibits Exceedances for Fecal and Total Coliform.

PWL Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Sampling Station	Geomean	90th percentile	n	Sampling Station	Geomean	90th percentile	n
Budds Pond (1701-0234)	N/A	109	28.7	124	14	-	-	-	-
Stirling Creek and Basin (1701-0049)	N/A	-	-	-		TC-3	-	412	19
Town/Jockey Creeks and tidal tributaries (1701-0235)	TJ-1	2.1	19.1	180.9	24	-	-	-	-
	TJ-1	2.3	21	93	25	-	-	-	-
	TJ-1	2.5	20.9	78	24	-	-	-	-
Goose Creek (1701-0236)	N/A	G2	-	115.8	27	-	-	-	-
	N/A	G3	16.1	141	27	-	-	-	-
	N/A	G4	16.3	151.8	27	-	-	-	-
	N/A	FC1_3	-	51	27	-	-	-	-
	N/A	G6	-	59	26	-	-	-	-
Hashamomuck Pond (1701-0162)	HP-1	FC-1	-	204	35	TC-1	-	460	40
	HP-1	FC-1.1	14.5	460	36	TC-1.1		460	42
	HP-1	FC-1.2	-	53.7	40	-	-	-	-
	HP-1	-	-	-	-	TCA	-	350	46
	HP-2	350	25.2	-	3	-	-	-	-
	HP-2	340	20	-	3	-	-	-	-
Richmond Creek and tidal tributaries (1701-0245)	N/A	FC-7.4	17.1	93	30	-	-	-	-
	N/A	FC-7.4A	33.8	262	30	-	-	-	-
	N/A	FC-7.4B	23.9	95.7	30	-	-	-	-
Tidal Tributaries - Gr Peconic Bay, Deep Hole Ck (1701-0247)	N/A	FC-9C	18.1	-	30	-	-	-	-
Tidal Tributaries - Gr James Ck (1701-0247)	N/A	FC-8A	22.9	93	30	-	-	-	-
Flanders Bay, east/center, and tributaries (1701-0030)	N/A	FC-6B	-	53.7	30	-	-	-	-
	N/A	FC-7	-	66.9	30	-	-	-	-
	N/A	FC-26	-	76.8	30	-	-	-	-
	N/A	FC-15	-	168	49	-	-	-	-
	N/A	170	34.4	86	10	-	-	-	-

Table 4–3. Summary of Stations in Each 303(d) Water Body that Exhibits Exceedances for Fecal and Total Coliform, continued.

PWL Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Sampling Station	Geomean	90th percentile	n	Sampling Station	Geomean	90th percentile	n
Reeves Bay and tidal tributaries (1701-0272)	N/A	FC-12	-	93	30	-	-	-	-
	N/A	FC-16C	-	75	30	-	-	-	-
	N/A	FC-17C	15.7	75	30	-	-	-	-
	N/A	FC-20A	19.4	240	30	-	-	-	-
	N/A	210	78.3	478	10	-	-	-	-
Sebonac Creek / Bullhead Bay and tidal tributaries (1701-0051)	N/A	FC-2	19.1	85.8	17	-	-	-	-
	N/A	148	49	58	2	-	-	-	-
North Sea Harbor and tributaries (1701-0037)	NH-1	FC-3	22.8	240	40	TC-3	87.3	460	42
	NH-1	-	-	-	-	TC-3.1	140.6	418.3	2
	NH-2	FC-4.2	-	71.8	52	-	-	-	-
	NH-2	FC-9	-	93	51	-	-	-	-
	NH-2	FC-10	-	93	51	-	-	-	-
	NH-3	FC-7	26.2	225.3	30	TC-7	-	438	30
	NH-5	104	30.1	67	8	-	-	-	-
Wooley Pond (1701-0048)	N/A	FC-2	-	93	30	-	-	-	-
	N/A	FC-3	32.5	240	30	TC-3	78.3	1100	30
	N/A	FC-4	33.1	240	30	TC-4	-	460	30
	N/A	300	31.7	60	6	-	-	-	-
Noyac Creek and Tidal Tribs. (1701-0237)	NC-1	310	26.4	56	5	-	-	-	-
Sag Harbor and Sag Harbor Cove (1701-0035)	SH-2	FC-9	-	78	44	-	-	-	-
Northwest Harbor and tidal tributaries (1701-0046)	N/A	FC-4	-	195.9	34	TC-4	-	460	40
	N/A	FC-5	15.4	262	30	TC-5	-	524	30
	N/A	FC-6	19.1	460	30	TC-6	72.5	1240.1	30
	N/A	FC-7	21.7	460	30	TC-7	-	460	30
	N/A	FC-8	24.2	460	30	TC-8	-	1100	30
	N/A	FC-9	-	213	34	TC-9	-	460	41
	N/A	FC-10	-	65.4	34	-	-	-	-
	N/A	FC-15	-	78	34	-	-	-	-
	N/A	131	36.9	140	14	-	-	-	-

Table 4–3. Summary of Stations in Each 303(d) Water Body that Exhibits Exceedances for Fecal and Total Coliform, continued.

PWL Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Sampling Station	Geomean	90th percentile	n	Sampling Station	Geomean	90th percentile	n
Acabonac Harbor (1701-0047)	AH-2	133	21.5	80	11	-	-	-	-
	AH-2	FC-13	-	73	45	-	-	-	-
	AH-3	FC-15	81.7	460	24	TC-15	308.4	2501	30
	AH-3	FC-16	24.4	195.9	24	TC-16	-	460	30
	AH-4	FC-33	28.7	460	24	TC-33	-	524	30
	AH-4	FC-34	38.6	460	28	TC-34	-	524	30
	AH-4	FC-35	31	460	24	TC-35	71.2	1100	30
	AH-4	FC-36	29.6	240	24	TC-36	-	460	30
	AH-4	FC-4	46.3	652	28	TC-4	-	460	30
	AH-4	FC-5	23.8	240	24	TC-5	-	1100	30
	AH-4	FC-6	20.7	306	28	TC-6	-	460	30
	AH-4	FC-6.1	22.9	213	24	TC-6.1	-	716	27
	AH-5	FC-1	17.6	240	52	TC-1	-	1100	55
	AH-5	FC-2	14.3	240	52	-	-	-	-
	AH-5	FC-3	39.2	460	24	TC-3	-	1100	30
Montauk Lake (1701-0031)	LM-1	FC-14	-	-	-	TC-14	-	416	46
	LM-1	FC-17	-	93	37	-	-	-	-
	LM-2	FC-9	-	-	-	TC-9	-	460	30
	LM-2	FC-11		98.7	30	TC-11	81.3	1100	30
	LM-3	FC-28	-	53	30	-	-	-	-
	LM-3	135	-	25.3	11	-	-	-	-
Little Sebonac Creek (1701-0253)	N/A	FC-3	14.2	93	17	TC-3	-	460	30

4.2 Land Use

The analysis of land use information is necessary to determine the likely sources of pathogens to receiving waters. The relative magnitude of pathogen transport from sources within the watershed can be assessed by evaluating land uses within specific contributing zones. For this study, land use information is used in a watershed model (Section 6) to determine relative pathogen loads to each impaired water body.

Land use data were immediately available through the EPA BASINS program; however, these data are based on a relatively coarse spatial scale. This was of concern because some of the Peconic Bay water bodies, and contributing watersheds, are relatively small in size and the resolution difference in the BASINS land use data could limit confidence levels of the pathogen loading analysis. However, land use data have been developed by The Nature Conservancy for Suffolk County based on a finer scale of resolution. These land use data are based on aggregations of parcel attributes originally developed for the Suffolk County Real EstateTax Map. The categories available within the Suffolk County GIS maps were

aggregated into 15 general land use categories as part of an effort to establish accurate GIS data at the tax map scale (Suffolk County Department of Planning, 2000). The 15 categories are defined in Table 4-4.

Table 4-4. Fifteen Land Use Categories Associated with the Suffolk County Department of Planning Land Use.

Cat. #	Description	Description
1	Low Density Residential	≤ 1 dwelling unit (d.u.)/acre
2	Medium Density Residential	> 1 to <5 d.u./acre
3	High Density Residential	≥ 5 d.u./acre
4	Commercial	Hotels, retail and office buildings, sports areas, marinas
5	Industrial	Storage/warehouse facilities, mining/quarrying operations, gas or water pipelines
6	Institutional	Schools, churches, hospitals, government offices, military installations, jails
7	Recreation/Open Space	Golf courses, parks, conservation land, camps, cemeteries
8	Agriculture	Livestock, field crops, orchards, poultry farms
9	Vacant	Vacant lots, abandoned agricultural land, private forest lands
10	Transportation	Roads, highways, tunnels, railroad
11	Utilities	Power generation facilities, water supply, communication infrastructure, utility pipelines
12	Waste Handling & Management	Landfills, sewage treatment
13	Surface Waters	Oysterlands, private or government owned land under water
14	Not documented	Probably open coastal waters[4]
15	Not documented	Probably forested land[1]

Table 4-5 summarizes the 1999 land use acreage for each contributing watershed in the study areas (Section 4.1.3).

[4] See discussion of these categories in Section 6.2.1.

Table 4-5. Watershed Land Use

Water Body	ACREAGE														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Low Density	Medium Density	High Density	Commercial	Industrial	Institutional	Recreation/ Open Space	Agriculture	Vacant	Transportation	Utilities	Waste Handle. and Mgmt.	Surface Waters	Unknown	Unknown
Dering Harbor	69.34	41.01	8.36	13.49	0.54	1.22	22.50		38.98	30.42	0.36		235.99	3.91	
Budds Pond	1.59	14.44		9.67	1.96		2.48	15.55	10.45	7.31			15.80		
Stirling Creek	2.83	34.22	24.25	23.97	4.24	6.50	13.69		31.72	23.42	0.02		39.47		
Town/Jockey Creeks															
TJC-1	49.40	136.95	10.2	14.6		11.89	3.08		26.00	44.24	1.26		70.84		
TJC-2	33.94	53.53	2.5	7.89	0.97	45.06	2.83	4.33	12.98	20.83	0.02		12.43		1.00
Goose Creek	64.39	204.64	2.89	2.36		6.97	13.43	27.28	60.00	59.00	0.35		88.50		12.77
Hashamomuck															
HP-1	15.42	77.51	3.7	4.89		0.84	7.62	66.76	34.00	28.74			37.65		0.79
HP-2	32.43	43.53	2.36	3.19	7.37		70.13	94.04	112.13	28.48	0.47		140.71		31.71
Richmond Creek	59.31	20.62	0.21	0.39			7.16	67.63	20.23	15.42	0.75		82.66		4.18
Downs Creek	38.58	7.85					27.75		16.02	5.05			22.07	19.47	
Deep Hole Creek	30.07	110.88	1.31	2.27				16.12	18.04	25.65	1.78		43.96		1.91
Halls Creek	24.47	10.95	0.18				12.46	2.96	6.26	4.38			7.15		23.74
Unnamed Pond	6.95	24.33	0.15					3.12	6.88	6.59			12.92		1.91
James Creek	37.74	67.85	3.12	10.85	0.16		4.72		23.93	18.80	0.16		26.02		
Flanders Bay	269.65	457.82	114.21	197.41	59.15	95.95	3949.6	66.35	587.53	483.51	57.75	0.59	2928.25	167.08	37.27
Reeves Bay	58.00	139.47	45.66	13.64		2.63	147.29		137.96	72.49			398.00		
Sebonac Creek	20.05	13.38					3.45		65.27	15.92			67.21	184.91	
Scallop Pond	6.84	12.75	5.25				283.21		0.80	6.19			124.87		
North Sea Harbor															
NSH-1	39.67	50.28	10.69	5.39	0.07	0.95	25.08		38.77	30.3			41.82		
NSH-2	41.53	65.9	0.4			0.01	14.2		74.89	20.98			26.03		
NSH-3	11.00	49.86		0.03	0.003		6.95		10.89	15.46			7.03		
NSH-4	62.67	8.9	1.22	0.28			8.82		36.29	9.35			20.32		
NSH-5	12.39	26.64	5.7	2.62			110.56		20.57	19.08			124.71		

Table 4–5. Watershed Land Use, continued.

Water Body	ACREAGE														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Low Density	Medium Density	High Density	Commercial	Industrial	Institutional	Recreation/ Open Space	Agriculture	Vacant	Transportation	Utilities	Waste Handle. and Mgmt.	Surface Waters	Unknown	Unknown
Wooley Pond	44.49	63.3	1.68	1.57		0.93	2.13		45.67	28.54			37.42		
Noyac Creek	35.57	31.85	0.49	0.43		0.79	122.41		19.59	11.28			114.04		
Sag Harbor															
SH-1	4.83	24.08	1.50	1.07			16.20		4.25	13.29			28.35		
SH-2	8.97	19.86	5.27	0.62		1.70	11.08		2.31	9.52			14.04		
SH-3	66.98	175.84	30.45	7.51		32.79	19.83		41.91	64.15			386.86		
SH-4	2.20	9.59	6.46	17.49		4.72	6.56		12.26	14.86	0.86		30.57		
Northwest Creek	106.98	3.93	0.53	3.55			408.84		56.08	31.73				18.07	
Acabonac Harbor															
AH-1	27.64	121.61	0.55				17.9		26.33	31.83			18.79		
AH-2	81.34	65.25	0.19				101.33		39.44	22.25			141.45		
AH-3	24.00	10.71	0.38	1.76		6.52	56.35		27.03	9.56			28.45		
AH-4	67.10	6.1					118.6		14.86	10.28			87.82		
AH-5	38.43	18.29	0.32				20.18		5.58	7.02			20.79		
Montauk Lake															
LM-1	10.22	64.58	26.27	52.43	4.88	2.05	110.24		42.79	64.68	4.00		74.59		
LM-2	15.41	1.12		20.68	0.56		99.48		8.34	27.21			66.42		
LM-3	287.80	433.8	45.66	22.57			406.84	29.59	317.20	325.7	7.3		922.96	177.04	
Oyster Pond	39.06	8.66					1,341.37		77.15	63.55					
Little Sebonac Creek	150.38	29.52	1.26	1.74			542.81		127.09	29.32			276.87	7.42	

4.3 Climate

Official climatic data from the National Climatic Data Center recorded since January 1971 were available from Riverhead Research Farm and Bridgehampton, New York (Station Numbers: 307134 and 300889, respectively), as well as from Brookhaven National Laboratory (BNL). The Riverhead Research Farm Station is located near the mouth of the Peconic River and should be somewhat representative of conditions at the western end of the Peconic estuary. The Bridgehampton station is located midway along the south fork of Long Island and is the most easterly station on Long Island with available recent rainfall data. BNL is located in Upton, NY, west of the Peconic Estuary mouth. Table 4-6 summarizes the annual precipitation averages for each station throughout the period of record that is coincident with the water quality data analysis. The wettest year across all stations was 2003 and the driest year for every station but Bridgehampton was 1997.

Table 4-6. Precipitation Data (in inches) from the Brookhaven National Laboratory, the Riverhead Research Farm, and in Bridgehampton, New York.

Year	Brookhaven National Laboratory	Riverhead Research Farm	Bridgehampton	Average
1997	40.04	38.38	47.47	41.96
1998	56.61	42.89	55.79	51.76
1999	51.72	48.58	43.91	48.07
2000	54.37	43.19	43.29	46.95
2001	45.55	46.59	49.27	47.14
2002	52.07	46.50	52.50	50.36
2003	**63.11**	**57.50**	**60.10**	**60.24**
2004	35.86	44.34	53.46	48.90
AVERAGE	49.92	46.00	50.72	-

4.4 Watershed Contributing Zones

Total and fecal coliform delivery to the Peconic Estuary is believed to be primarily driven by storm water transport due to the relatively high hydraulic conductivity of the soils and aquifer materials in this region of New York. This results in high rates of surface water infiltration of surface waters and the recharge of groundwater, which acts as a net sink for pathogens. However, precipitation landing on impervious surfaces such as rooftops, parking lots, and roads is often routed through storm water infrastructure to either infiltration beds or directly to receiving water bodies. Infiltration beds are effective in upper watersheds where the distance between the land's surface and the water table (vadose zone) can be significant. However, in urbanized coastal areas, storm water systems are often designed to discharge into tidal creeks and estuaries to avoid the risk of flooding due to the relatively lower infiltration capacity.

Rather than delineating topographically-based whole watersheds, a series of contributing zones, or subwatersheds, have been delineated for each of the Peconic Bay water bodies that are based on existing Peconic Bay storm water contributing zones. These zones were provided by the Peconic Estuary Program (PEP). These delineations are based on an existing stormwater contributing zone map of the entire Peconic Bay watershed (Suffolk County, NY). All of the water bodies in this study required slight modification to this bay-wide contributing zone due to their relatively small size. Water body-specific contributing zones were delineated on a GIS by overlaying the Peconic Bay stormwater contributing area over spatially rectified USGS quad maps (supplied by EPA Region 2). Subsequent delineations of each contributing zone were based on local topography and road networks.

Each zone is shown, with respect to sampling locations and closure status, in Section 2.