



**Water Quality Data Report
For
Norwalk River Watershed
May through September 2015**



Interns collecting data on the Norwalk River at site NR4.

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Introduction:

Purpose of Study: r. Presently the Norwalk River is monitored on a year round basis with weekly testing at 12 test sites from May 1st through September 30th and monthly testing from October through April. This project was a continuation of research on a selection of 21 sites within the Norwalk River Watershed which began in 1998.

Background: From June 1998 through May 1999, Harbor Watch conducted a first-year water quality monitoring study in the Norwalk River Watershed. This study was funded by the Connecticut Department of Environmental Protection and was intended to provide water quality information in support of the Norwalk River Watershed Initiative. The purpose of the study was to obtain data on the levels of fecal coliform bacteria, dissolved oxygen, and conductivity at selected locations in the Norwalk River and in its major tributaries (Silvermine River, Comstock Brook and Cooper Brook). The study indicated that fecal coliform bacteria levels frequently exceeded the state's water quality criterion for Class B water at a number of sites along the Norwalk River. Most sites met the dissolved oxygen level CT DEP criterion for Class B waters. The first year study also showed that conductivity levels were consistently higher in the upper reaches of the watershed than in the lower watershed. Based upon the water quality data collected, Harbor Watch determined that the water quality in the Norwalk River Watershed was moderately impaired.

The CT DEP and Harbor Watch executed a contract for a second year funding in September 1999 (from September 1, 1999 through November 30, 2000). Harbor Watch was authorized to begin testing for *E. coli* bacteria in November 1999. Sampling was then limited to 12 of the 21 most impacted sites along the Norwalk River. Monthly reports were prepared and submitted to the CT DEP and disseminated to the seven towns comprising the Norwalk River Watershed as well as the Norwalk River Watershed Initiative Advisory Committee and all contributing organizations.

Funding was then made available by the CT DEP to continue testing on the Norwalk River for a third summer (April 1 to September 30, 2001) based on a continuing interest by Norwalk River Watershed Advisory Committees and the CT DEP. The same testing protocols, used in 2000 by Harbor Watch, were again used under the original QAPP. This QAPP was extended on April 25, 2001 to September 30, 2001 by the EPA's Office of Environmental Measurement and Evaluation (Table 1).

During 2002, the CT DEP switched to *E. coli* bacteria as the "preferred" indicator species for freshwater, as it is a more specific indicator of fecal material arising from humans and other warm-blooded animals.

Additional 319 funding was allocated to continue the Harbor Watch testing regime on the Norwalk River for twenty-three months beginning July 2002 and ending June 30, 2004. The last contract with the CT DEP expired on 6/30/05. Harbor Watch again renewed testing of the Norwalk River and its tributaries on May 1, 2005 thanks to the interest and generosity of our municipal partners, watershed organizations, and environmental organization that have collectively continued to provide additional funds to support the monitoring season. Although these monthly reports are submitted to the CT DEEP for review and comment, Harbor Watch is solely responsible for the collection, analysis and interpretation of the water quality data.

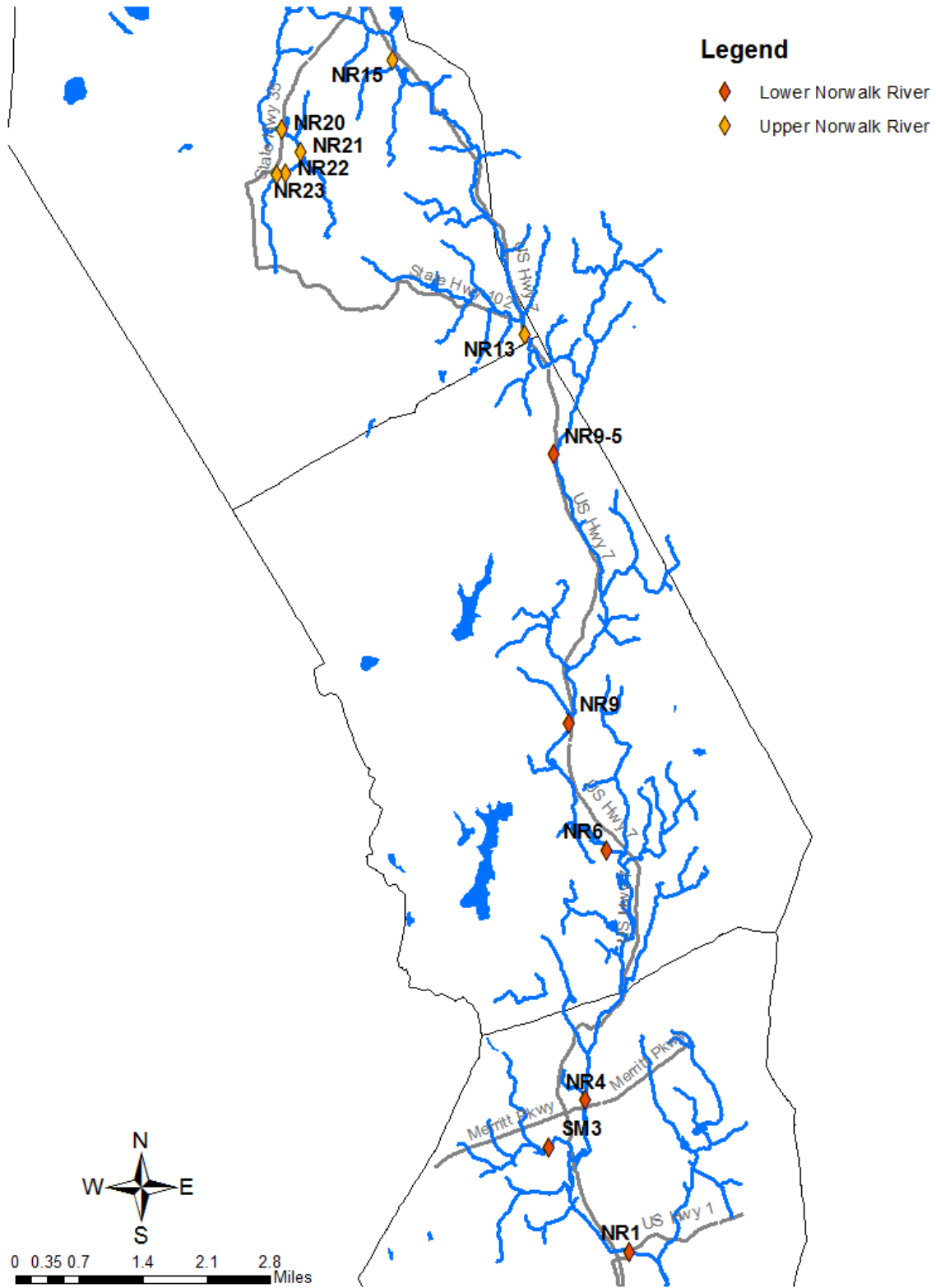


Figure 1. Location of 12 monitoring sites in the Norwalk River Watershed.

Methods: Water monitoring is carried out under Quality Assurance Project Plan (QAPP) RFA#10160 approved by CT DEEP and EPA on 9/10/10 for five years. Monitoring teams leave Earthplace in Westport in the mid-morning and return within 2-3 hours. The team is comprised of a fully trained Harbor Watch employees and volunteers. Water samples are collected at 12 (Figure 1) monitoring sites along the length of the river. These sites, which represent the more impacted sites and developed areas, were selected in concert with the CT DEEP, because results from the first year’s study consistently demonstrated elevated fecal coliform bacteria counts at these locations.

The following tests are run *in situ*: dissolved oxygen (QAPP Appendix A3.2) and conductivity (QAPP Appendix A3.3). Water and air temperatures, as well as general observations and storm events are also recorded at each site visit. Observations are recorded (QAPP Appendix 5) on the Harbor Watch data sheet.

Upon return to the lab, fecal coliform bacteria membrane filtration tests (QAPP Appendix A3.5) are performed and *E. coli* testing is carried out according to Standard Methods, 22nd edition (9222D & 9222G) and recorded (QAPP Appendix 5) on the Harbor Watch bacteria log. During the monitoring period represented in this report, sites were monitored once per week.

E. coli bacteria were evaluated using the criteria published in the CT DEEP Surface Water Quality Standards, 10/10/13. The CT DEEP *E. coli* criterion for Class AA, A, and B water is established at three levels (Table 1).

The Norwalk River is classified for “all other recreational uses” because people do not bathe in or drink the river water and it is too shallow for swimming. The report will focus on *E. coli* bacteria levels, because it is the indicator bacteria of choice by the CT DEEP.

Table 1. CT DEEP criterion for *E. coli* bacteria levels as applied to recreational use, effective 10/10/13

Designated Use Recreation	Class	Indicator	Criteria
Designated Swimming	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126CFU/100mLs; Single Sample Maximum 235CFU/100mLs
Non-designated Swimming	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126CFU/100mLs; Single Sample Maximum 410CFU/100mLs
All Other Recreational Uses	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126CFU/100mLs; Single Sample Maximum 576CFU/100mLs

CFU stands for Colony Forming Units. A colony is raised from a single bacterium to a visible colony for counting by providing the preferred heat range and media for 24 hours.

Results and Discussion:

Bacteria

Observed *E. coli* geometric means exceeded the CT DEEP *E. coli* criterion for a class B river of < 126 CFUs/100mLs at site NR21, NR20, NR9, NR6, and NR1 (Figure 2, Table 2). In addition, NR21, NR20, NR9, and NR1 exceeded the CT DEEP single sample maximum of < 10% over 576 CFU/100mL of all samples taken at a single site for a Class B river (Table 2). Samples taken on 9/10/15 saw a large increase in

bacteria concentrations due to the 1.41 inches of rain that fell prior to sample collection and analysis (Table 2). Other elevated counts which attributed to the failure of the single sample maximum criteria were observed on days that saw minimal rainfall the day of sampling as well as on days that were dry for at least 7 days. Causes for these observed elevated counts are unknown.

It should be noted that site NR22 is the effluent for the Ridgefield Wastewater Treatment Plant. This is the reason for the geometric mean value of 5 CFU/100mL and the consistent observed result of 0 CFU/100mLs. From April through October the plant treats the effluent with UV light before it leaves the plant in order to kill bacteria. Occasional observed counts above 0 CFU/100mL can be linked to rainfall events which may have caused the plant to have to process more than their capacity and reduce their efficiency.

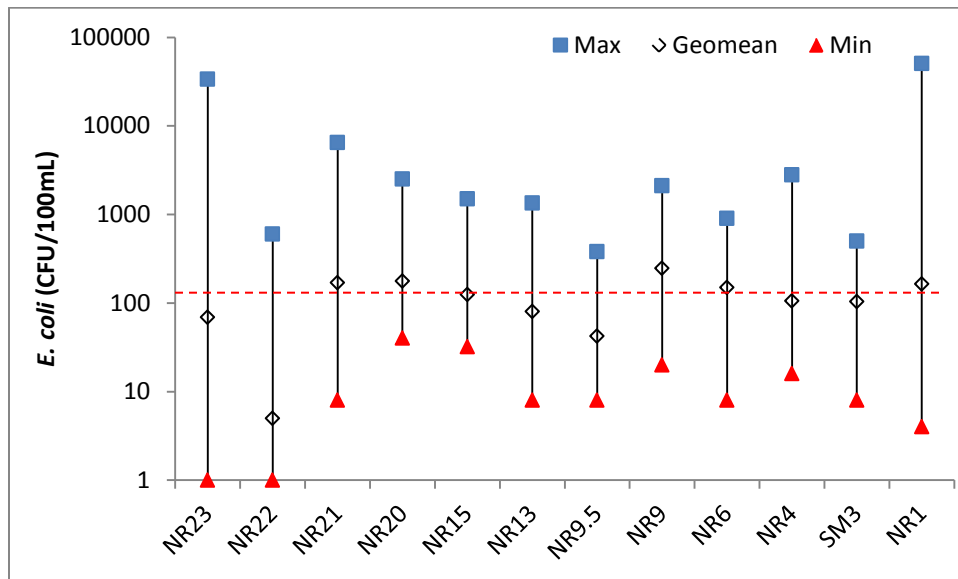


Figure 2. Maximum, geometric means, and minimum *E. coli* values for twelve sites in the Norwalk River watershed from May through September 2015. Red line indicates CTDEEP geometric mean criterion.

Table 2. Observed *E. coli* counts on each sampling date, geometric means and % frequency exceeding 576 CFUs/100mLs for each site in the Norwalk River watershed during the May through September 2015 monitoring period. Numbers in blue indicate an actual bacteria count of zero, but geometric mean cannot be calculated with zeros so a value of 1 was substituted when necessary.

	5/7/2015	5/14/2015	5/21/2015	5/28/2015	6/4/2015	6/11/2015	6/18/2015	6/25/2015	7/2/2015	7/9/2015	7/16/2015
NR23	1	20	76	560	44	64	76	64	108	110	120
NR22	30	1	1	1	1	1	1	72	600	100	200
NR21	8	48	228	88	40	152	108	88	72	110	180
NR20	48	54	220	660	40	320	220	72	136	200	100
NR15	36	40	112	164	32	60	60	200	184	140	240
NR13	8	24	36	64	44	212	68	36	148	170	60
NR9.5	8	20	8	20	36	52	52	36	100	70	24
NR9	20	68	92	132	56	228	252	220	168	280	192
NR6	8	26	132	320	96	204	276	380	156	300	208
NR4	16	48	172	220	120	144	132	208	236	190	196
SM3	24	50	136	116	212	256	220	272	500	170	120
NR1	4	62	192	124	108	156	148	440	380	1000	196
Rain (in)	0	0.02	0.89	0.19	3.1	0.32	1.25	1.3	2.16	0.5	0.61
Days Prior	0	2	4	0	2	3	3	2	1	0	2

	7/23/2015	7/30/2015	8/6/2015	8/13/2015	8/20/2015	8/27/2015	9/3/2015	9/10/2015	9/17/2015	9/22/2015	Geomean	% Freq over 576 CFU/100mL
NR23	100	100	20	70	4	52	72	33600	24	140	69	5%
NR22	260	65	1	1	1	1	1	1	1	1	5	5%
NR21	200	250	1200	310	440	100	380	6500	132	400	170	10%
NR20	390	180	350	60	400	108	160	2500	N/A	N/A	177	11%
NR15	230	110	330	100	64	112	260	1500	128	88	124	5%
NR13	140	70	90	110	120	36	68	400	40	1340	80	5%
NR9.5	40	56	40	90	76	80	128	380	24	16	42	0%
NR9	310	540	360	410	580	400	760	2100	520	360	247	10%
NR6	130	180	140	240	104	116	132	900	208	104	149	5%
NR4	100	64	30	140	24	60	24	2800	76	120	105	5%
SM3	150	124	110	160	8	16	52	350	88	48	103	0%
NR1	160	112	140	120	56	108	72	50400	48	200	164	10%
Rain (in)	0.33	0.68	0.54	2.11	0.01	0.34	0	1.41	1.85	0		
Days Prior	5	0	7	2	4	6	7	0	5	7		

Dissolved Oxygen

All twelve sites passed the CT DEEP mean minimum of 5 mg/L for dissolved oxygen (Figure 3). However there were two sites, NR21 and NR20, that fell below 5 mg/L on multiple days (Table 3). These low values may be attributable to the low flow within the watershed due to low rainfall during the monitoring season. Although the low readings on 7/9/15 and 9/10/15 were observed on days with recent rainfall, it is possible that the rainfall was responsible for moving the already-hypoxic water downriver rather than aerating it. Sites NR21 and NR20 are located below the “Great Swamp” in Ridgefield. In this part of the river, the water moves slowly and is exposed to prolonged sunlight and heat throughout the summer months which may contribute to low oxygen levels downstream. The increase in mean dissolved oxygen at NR4 may be related to the substantial algal growth observed at that site which increases dissolved oxygen the water through photosynthesis.

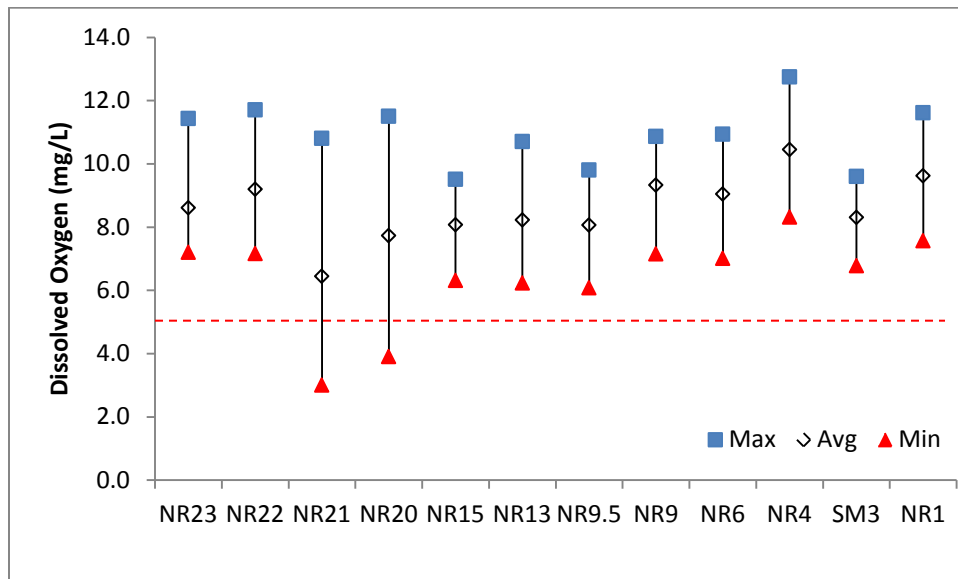


Figure 3. Maximum, average, and minimum dissolved oxygen values for twelve sites in the Norwalk River watershed from May through September 2015. Red line indicates CT DEEP minimum criterion for dissolved oxygen.

Table 3. Observed dissolved oxygen readings that fell below 5mg/L during the 2015 May through September monitoring period

Site	Date	DO (mg/L)
NR21	7/9/2015	3.0
	9/10/2015	3.2
	9/17/2015	4.6
NR20	7/9/2015	4.5
	9/10/2015	3.9

Conductivity

Mean conductivity values across sites ranged from a maximum of 1236 μ S at NR23 to a minimum of 333 μ S at SM3. The widest conductivity range within a site across the season was observed at NR23 with a

range of 1208 μS and narrowest at NR9 and SM3 with ranges of 174 μS (Figure 5). Wide conductivity ranges are anticipated in the upper Norwalk River watershed due to the presence of limestone beds which add natural ions to the water. Ranges begin to narrow as the river flows south due to the influence of tributaries such as Comstock Brook, Cooper Brook, and Branchville Brook which dilute the sites sequentially. Lower levels of rainfall can increase the stability of conductivity throughout the watershed by reducing the amount of ions entering the river through runoff. The wide range observed at NR4 may have been caused by construction of an apartment complex that was occurring on the riverbank adjacent to the site with runoff inputs from the excavation and building materials.

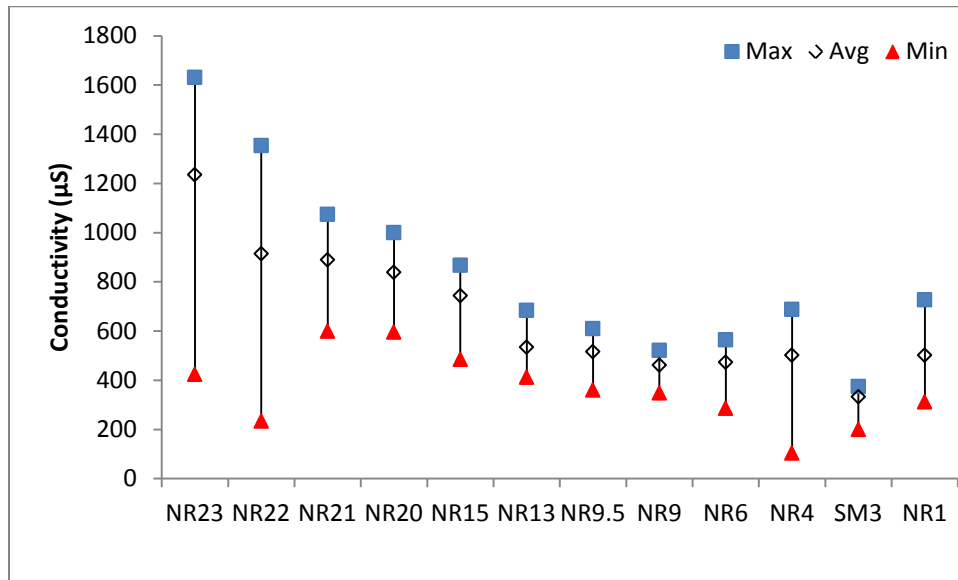


Figure 4. Maximum, average, and minimum conductivity values for twelve sites in the Norwalk River watershed from May through September 2015.

Water Temperature and Rainfall

Water temperatures throughout the watershed remained relatively consistent from site to site. Temperature ranges remained similar over the course of the monitoring season. Slight variations in temperature from site to site may be attributed to differences in canopy cover (Figure 5). Sites such as NR21, NR13, and NR4 do not have canopy cover and receive direct sunlight all day which may explain the elevated water temperatures at those sites. Site NR22 is the effluent discharge for the Ridgefield Wastewater Treatment Plant and increased water temperature at that site may be attributed to the time spent by the water being processed within the plant.

The monitoring season from May through September 2015 was very dry compared to previous years. The average monthly rainfall was only 3.2 inches of rain with June receiving the highest at 5.67 inches total and May receiving the lowest at 1.64 inches total (Figure 6).

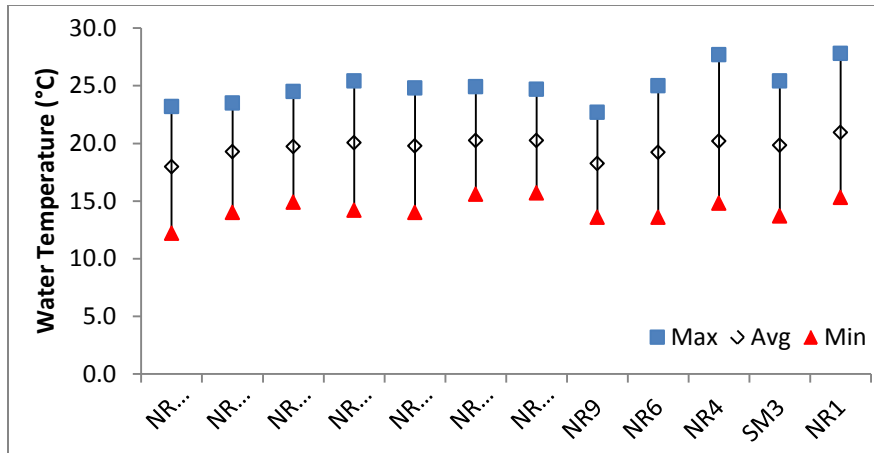


Figure 5. Maximum, average, and minimum water temperature values for twelve sites in the Norwalk River watershed from May through September 2015.

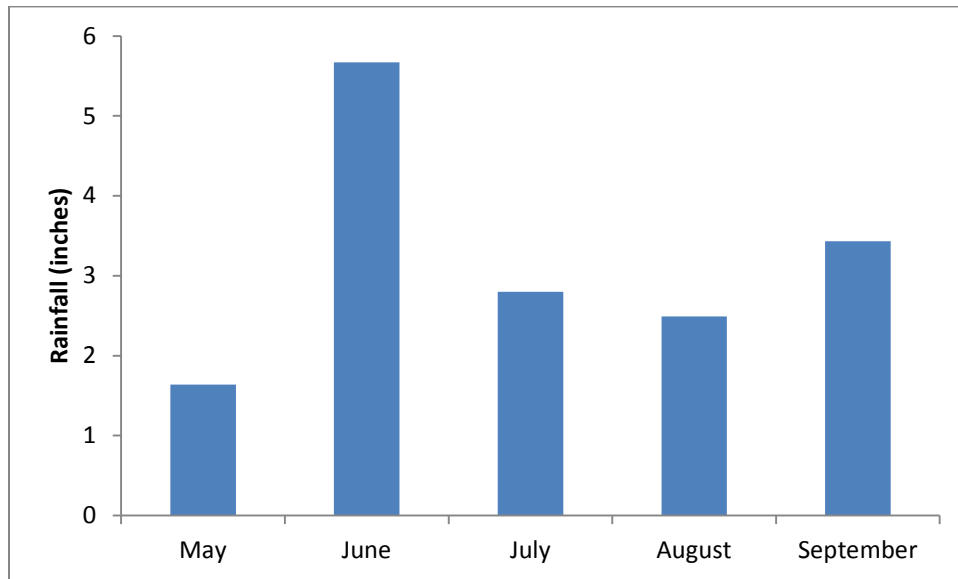


Figure 6. Rainfall for the monitoring period May through September 2015.

Conclusions: These data suggest that a pollution source is contaminating the water upstream of site NR9 which may also be driving the *E. coli* geomean at NR6 to exceed the CT DEEP criteria as well. Harbor Watch will begin investigating the river above site NR9 in order to identify a possible source. Investigation will include Harbor Watch scientists walking the river and surveying the bank for any sign of pollution input such as grey water or discharge pipes. Additional sample sites will also be added to identify where the bacteria concentrations decrease.

Acknowledgements: Harbor Watch appreciates the support of the Norwalk River Watershed Initiative, Town of Wilton, The City of Norwalk and the Norwalk Mayor’s Water Quality Committee, King Industries, Norwalk River Watershed Association, NRG-Manresa, Town of Ridgefield, Copsps Island Oysters, Atlantic Clam Farms, Leslie Bloom-Miklovich, Trout Unlimited (Mianus Chapter and Nutmeg chapter), Newman’s Own Foundation, Sun Hill Foundation, and private donors.

Appendix A

Table A1. Sample location coordinates and description, Asterisk indicates that the site is on a tributary to the Norwalk River

Site No.	Site Area	Town	GPS Coordinates
NR23	Steep Brook next to South Street WTP	Ridgefield	Latitude: N 41° 17' 24.3" Longitude: W 73° 29' 35.6"
NR22	South Street WTP outfall	Ridgefield	Latitude: N 41° 17' 26.8" Longitude: W 73° 29' 29.6"
NR21	Farmingville Road at the Great Swamp outlet	Ridgefield	Latitude: N 41° 17' 40.2" Longitude: W 73° 29' 18.5"
NR20	Danbury Road north of Farmingville Road intersection	Ridgefield	Latitude: N 41° 17' 52.1" Longitude: W 73° 29' 32.2"
NR15	Stonehenge Road at the top of the dam	Ridgefield	Latitude N 41° 18' 32.0" Longitude: W 73° 28' 8.3"
NR13	Branchville at the railroad station (Route 7)	Ridgefield/Wilton	Latitude: N 41° 15' 55.8" Longitude: W 73° 26' 27.2"
NR 9.5	Downstream of the Georgetown Wastewater Treatment Plant -- Old Mill Road	Wilton	Latitude: N 41° 14' 46.0" Longitude: W 73° 26' 2.5"
NR9	School Road	Wilton	Latitude: N 41° 12' 15.3" Longitude: W 73° 25' 51.6"
NR6	Near Wolfpit Road in back of the Wilton Corporate Office Complex	Wilton	Latitude: N 41° 11' 0.1" Longitude: W 73° 25' 18.4"
NR4	Upstream of Route 15 (Glover Avenue) and downstream of the Merritt 7 Office Complex	Norwalk	Latitude: N 41° 8' 3.5" Longitude: W 73° 25' 35.8"
SM3*	James Street (on the Silvermine River)	Norwalk	Latitude: N 41° 8' 10.3" Longitude: W 73° 26' 4.0"
NR1	Post Road (US Route 1) adjacent to the Ash Creek Grille Restaurant	Norwalk	Latitude: N 41° 7' 10.8" Longitude: W 73° 25' 1.3"