

TOTAL MAXIMUM DAILY LOAD ANALYSIS FOR THE UPPER NAUGATUCK RIVER, THOMASTON, CT

8/17/05

**This document has been
established pursuant to the
requirements of Section 303(d) of
the Federal Clean Water Act**

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Introduction

This Total Maximum Daily Load (TMDL) Analysis was developed for a segment of the Naugatuck River in Thomaston, Connecticut that is currently not meeting its designated use for aquatic life support. The Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), requires that states adopt water quality standards that support designated uses for each waterbody within its boundary. Examples of designated uses adopted into Connecticut Water Quality Standards include drinking water supply, fish and wildlife habitat, recreational use, agricultural use, industrial supply, and others (see Connecticut Water Quality Standards ¹ for further information). Section 303(d) of the CWA requires states to develop TMDLs for waters where current pollution controls are not stringent enough to attain or maintain compliance with adopted State Water Quality Standards.

TMDLs represent the maximum loading that a waterbody can assimilate without exceeding the adopted Water Quality Criteria for each identified pollutant. Federal regulations require that the TMDL analysis identify the portion of the total pollutant loading which is allocated to point source discharges (termed the Wasteload Allocation or WLA) and the portion attributed to non point sources and natural background (termed the Load Allocation or LA). In addition, TMDLs include a Margin of Safety or MOS to account for uncertainty in establishing the relationship between pollutant loadings and water quality. Seasonal variability in the relationship between pollutant loadings and attainment of Water Quality Standards must also be considered in TMDL analyses.

A TMDL analysis also provides a written report that describes the pollution control actions necessary to achieve acceptable water quality conditions in the impaired waterbody. Public review and comment is strongly encouraged prior to adopting a final TMDL management plan. Following public review and comment, the TMDL established by the State is submitted to the Regional Office of the Federal Environmental Protection Agency (EPA) for review. EPA can either approve the State's TMDL or disapprove the TMDL and act in lieu of the State. TMDL reports also may include an implementation plan and a description of monitoring activities to implement the TMDL.

Description of Waterbody, Priority Ranking, and TMDL Study Area

The Naugatuck River drains an area of 311 square miles in western Connecticut and is the largest sub-regional basin in the Housatonic River Watershed. The main stem of the Naugatuck River originates at the confluence of its east and west branches in the City of Torrington and flows south for approximately 40 miles before joining with the Housatonic River in Derby.

A section of the Naugatuck River (*Waterbody Segment CT 6900-00_05*) in Thomaston was listed on the *2002 List of Connecticut Waterbodies Not Meeting Water Quality Standards*² for not meeting aquatic life support goals, and the cause of the impairment was not known. The listing is based primarily on a long-term biological monitoring site at Frost Bridge that does not meet aquatic life goals set in the Water Quality Standards³. This waterbody segment was designated in the *2002 List of Connecticut Waterbodies Not Meeting Water Quality Standards* as a priority for development of a TMDL by 2004.

TMDL Study Area

The TMDL Study Area is the 5-mile stretch of the Naugatuck River located in the Thomaston area from the Route 6 Bridge crossing to the Frost Road Bridge crossing (Figure 1). Landuse in the TMDL Study Area (Figure 2) is dominated by forest with a population center approximately 10 miles upstream of the Study Area along the river in Torrington (population 35,434 as reported in 2000 census), and a smaller population center located within the Study Area at Thomaston (population 7,503 as reported in 2000 census).

Support of aquatic life use in the Naugatuck River is determined as outlined in Connecticut's *Consolidated Assessment and Listing Methodology*⁴ using benthic macroinvertebrates as the primary assessment tool. Historic data is confirmed by more recently collected data showing a progressive decrease in total taxa and pollution sensitive taxa proceeding downstream from monitoring locations at Reynolds Bridge to end of the TMDL Study Area at Frost Bridge Road (Figure 3).

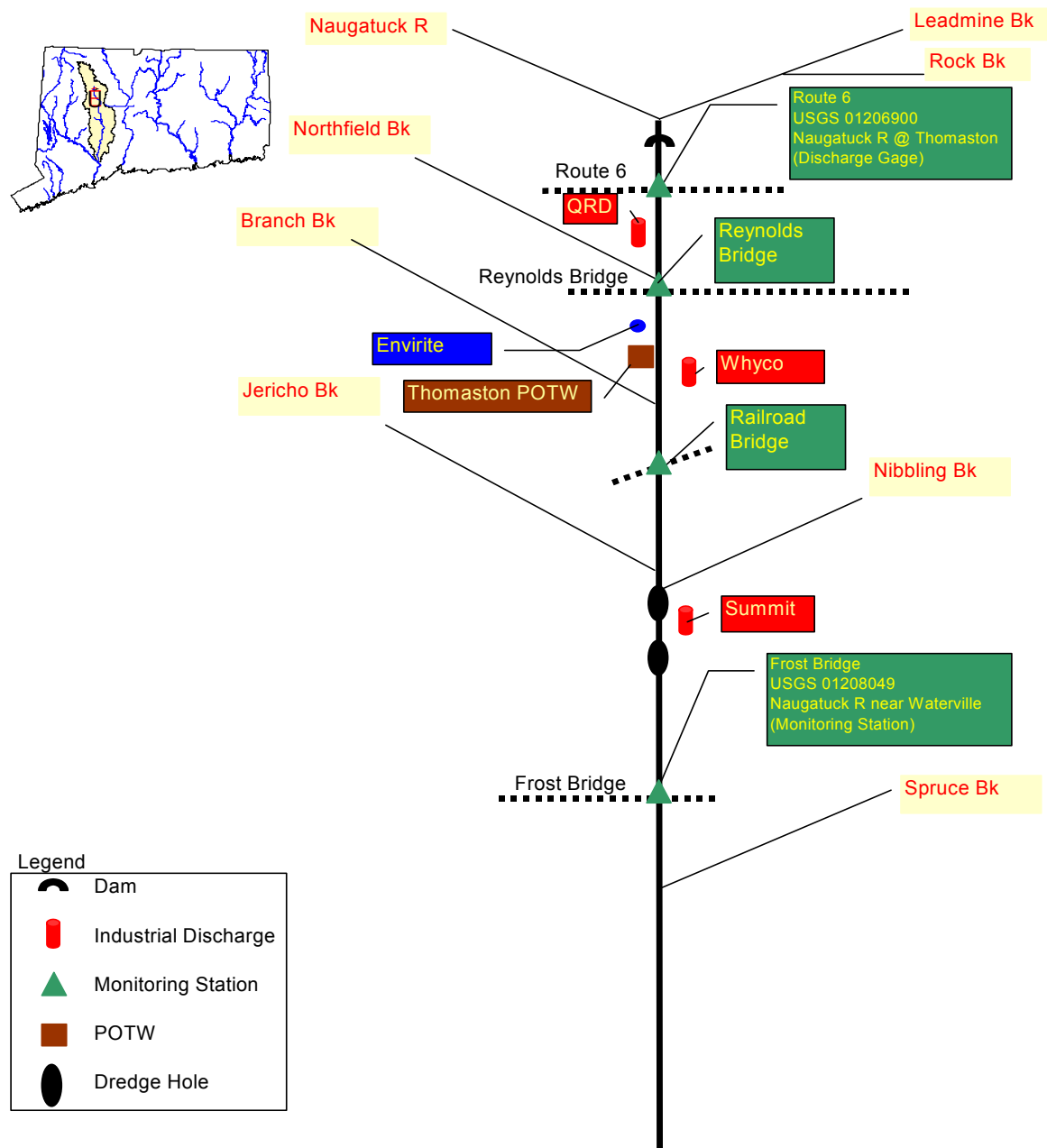


Figure 1. TMDL study area showing upper Naugatuck River near Thomaston (not to scale). Note that the physical location of the Whyco facility is upstream of Branch Brook, but the NPDES discharge from the facility enters the Naugatuck River below Branch Brook.

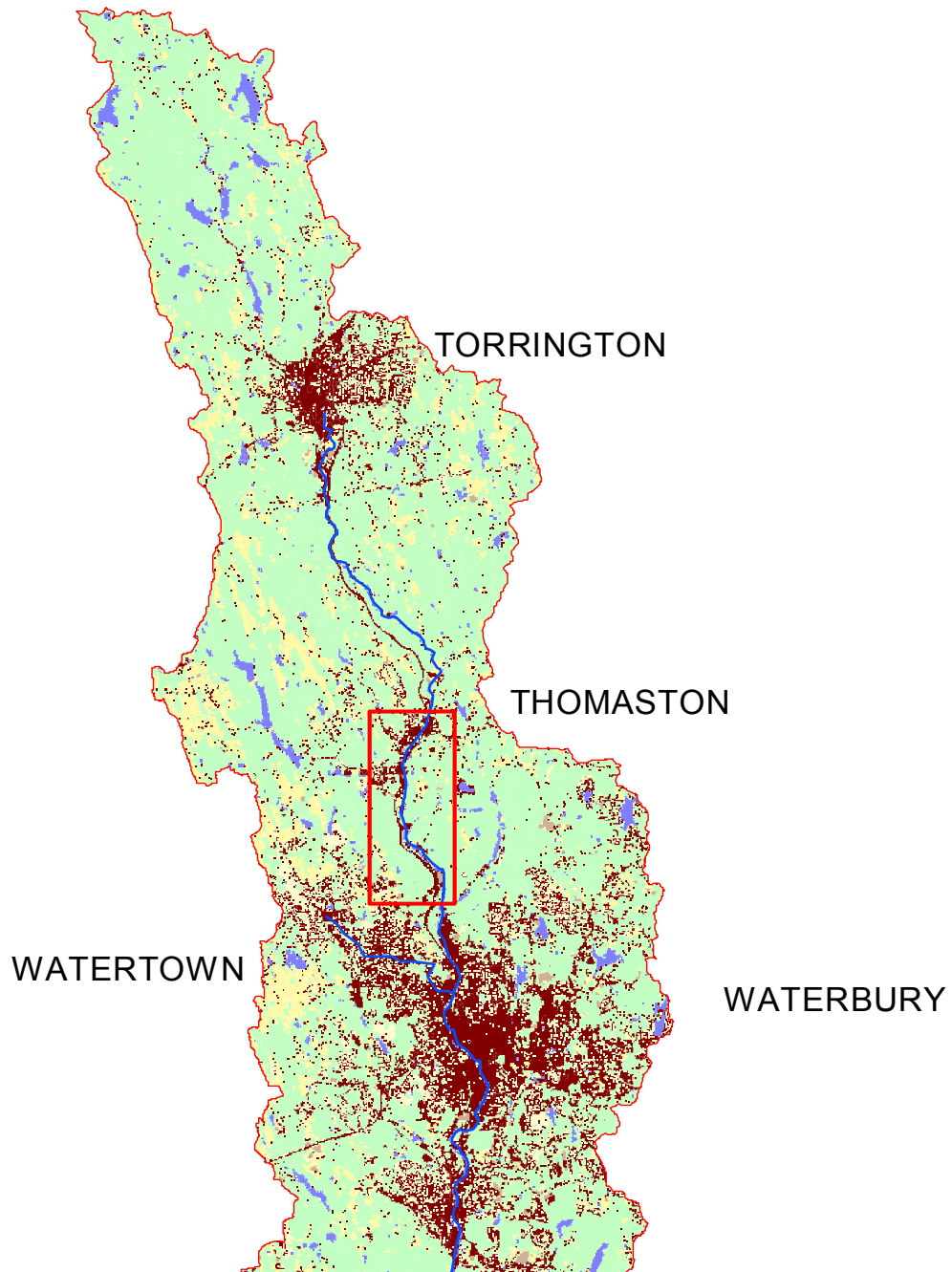


Figure 2. Landuse in upper Naugatuck Basin. Red is developed, yellow is open space, green is forested, and blue is water. The rectangle represents the TMDL Study area. Data are based on LANDSAT Thematic Mapper Satellite Imagery for 1994 and 1995 and SPOT Panchromatic Satellite Imagery. Compiled by the University of Connecticut in raster format (ERDAS), the inventory was later converted from raster to vector (polygon) format by the Environmental and Geographic Information Center, Department of Environmental Protection.

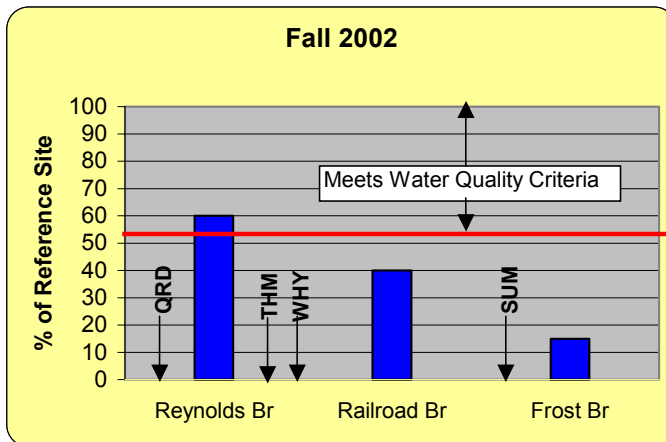
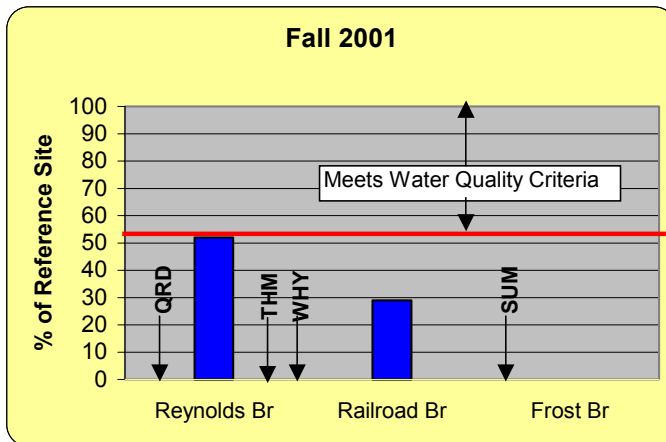
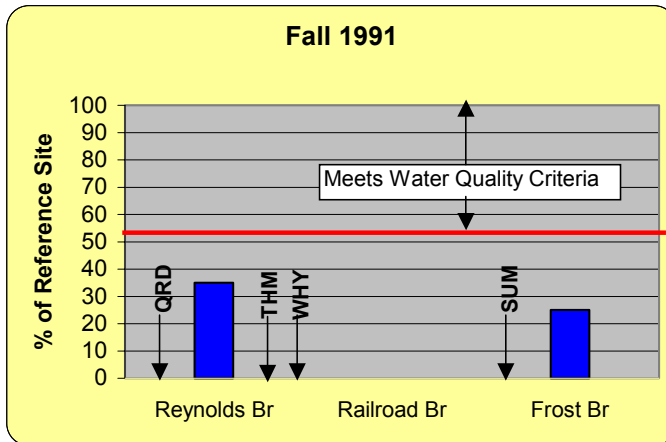


Figure 3. Macroinvertebrate Rapid Bioassessment Protocol III following Plafkin et al. (EPA 444/4-89/001) for sites in the TMDL Study section of the Naugatuck River. A bar below the red solid line indicates that the site does not meet the Connecticut Water Quality Criteria. Point sources are noted by an arrow at the location the discharge enters the river.

Surface Water Classification and Water Quality Standards

The Surface Water Classification for the TMDL Study Area is Class C/B which means that the current Surface Water Class is Class C and the Surface Water goal is Class B. Chemical constituents for Class B waters are not allowed in concentrations or combinations which would be harmful to designated uses. Water Quality Standard Number 12 outlines the authority of the Department to regulate discharges to surface waters to assure that such discharges do not cause acute or chronic toxicity to aquatic life and do not impair the biological integrity of aquatic ecosystems.

Identification of a Pollutant of Concern

An impairment to the aquatic life in the TMDL Study Area was identified using bioassessment protocols as outlined in Connecticut's *Consolidated Assessment and Listing Methodology* ⁴. Although bioassessments can be helpful to identify an impaired aquatic community, they often do not identify the cause of impairment. For example, the *2002 List of Waterbodies Not Meeting Water Quality Standards* has outlined 87 waterbody segments that have documented impairments to the aquatic community but have no cause associated with the impairment. Linking biological effects with causes becomes increasingly more complex with the addition of potential stressors. For this analysis, all potential stressors were evaluated and the most likely candidate stressor was the focus of TMDL development.

Toxicity from point source discharges was identified as the pollutant of concern for this TMDL analysis by a weight of evidence approach using techniques consistent with EPA's *Stressor Identification Document* ⁵. Several factors were considered in this analysis including habitat perturbations; chemical stressors from industrial, municipal and non point sources; changes in hydrology caused by impoundments; historic land use characteristics; and impacts to aquatic life caused by toxicity. While many of these may be contributing factors to aquatic life impairments, the weight of evidence suggests that toxicity from point source discharges in the TMDL Study Area is the primary pollutant of concern ^{6,7}.

A summary of the weight of evidence to support toxicity as the primary stressor and the subsequent development of a TMDL for toxicity is as follows:

- 1) The USGS has operated a stream discharge gage in the Naugatuck River at Route 6, Thomaston (01206900), from 1959-present. This location delineates the beginning of the TMDL Study Area. The stream gage is located on the downstream side of the bridge on US Route 6 and 202, Thomaston, 1.5 miles downstream from Thomaston Reservoir and 2.5 miles upstream from Branch Brook. Drainage area is 99.8 square miles at this location. The 7Q10¹ flow based on the statistical period 1962-1998 is 12.6 cfs. The 7Q10 at Frost Bridge (end of TMDL Study Area) was calculated to be 17.2 cfs by scaling the values at Route 6 by the drainage area ratio. The cumulative zone of influence currently allocated to point source discharges in the TMDL Study Area is 54.2 cfs. At low flow conditions such as 7Q10, the Naugatuck River may be over allocated by as much as 37 cfs suggesting that the zones of influence within the TMDL Study Area should be reallocated.

- 2) Low flow events in the Naugatuck River occur in the TMDL Study Area with regular frequency and can last for considerable periods of time (Figure 4). For example, in 1999, there were a total of 28 days in which the flow entering the TMDL Study Area was equal to or less than 13 cfs (approximately the 7Q10 at this location). The duration or longest consecutive span for 1999 was 19 days. The potential impacts from point source discharges to the aquatic biota are most significant during these periods of extended low flow.

¹ 7Q10 is the lowest seven consecutive-day mean stream flow with recurrence interval of ten years.

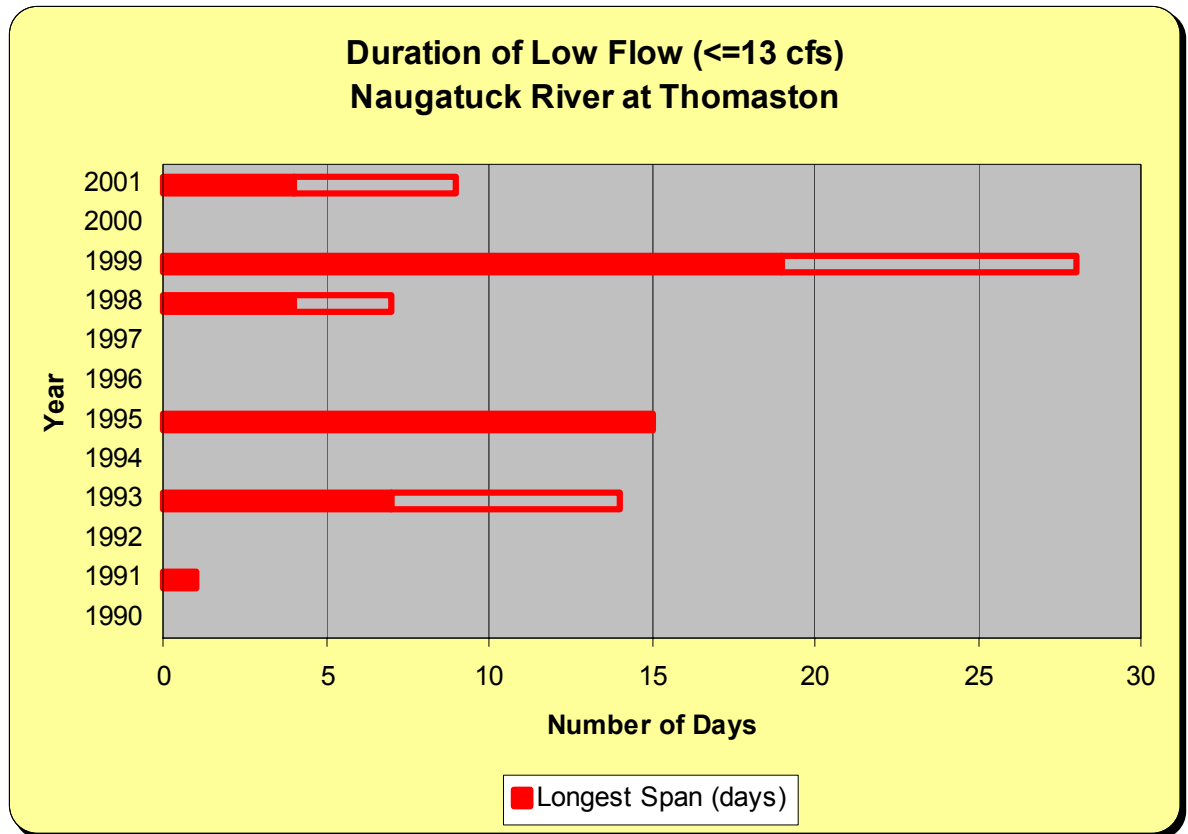


Figure 4. Total number of days of flow events < 13 cfs (total bar) and longest consecutive span (solid bar) measured in the TMDL Study Area from average daily flow values at the USGS Gage at Route 6, Thomaston (01206900).

- Results of chronic toxicity testing completed in January 2003 by CTDEP and EPA indicate the presence of chronic toxicity to one or both of the test species (*Ceriodaphnia dubia* and *Pimephales promelas*) from each of the three industrial facilities that discharge to the TMDL Study Area ⁸. In addition, 48-hour acute toxicity tests from grab samples collected by CTDEP from each of the three industrial discharges measured acute toxicity to test organisms (Table 1). Effluent from the Thomaston POTW has not shown measurable toxicity in any of the 48-hour screening level acute toxicity tests conducted by CTDEP (100% survival for *P. promelas* and *Daphnia pulex* on three different test dates) or from any of the recent self-monitoring test results, 1994-2003 (90-100% survival for *P. promelas* and *D. pulex*, n=37).

Table 1. Average (range) of LC₅₀ values from 48-hour static acute toxicity test for *Daphnia pulex* and *Pimephales promelas* as measured by CTDEP toxicity laboratory.

Facility	<i>Daphnia pulex</i>	<i>Pimephales promelas</i>	N
QRD	34% (11-68%)	44% (12-75%)	7
Thomaston POTW *	> 100%	> 100%	3
Whyco	39% (19-64%)	52% (18-100%)	7
Summit	30% (2-77%)	62% (11-100%)	7

* No mortality observed in undiluted POTW effluent

- 4) Effluent chemistry from the industrial facilities collected concurrent with toxicity test samples did not indicate any strong correlations with measured toxicity of effluent samples. This suggests that no single chemical pollutant is responsible for toxicity;

- 5) Biological monitoring at sites in the TMDL Study Area show a progressive increase in impact to the benthic community from upstream to downstream monitoring locations. The impact to the benthic community is coincident with the locations of the three industrial outfall locations and one municipal POTW. This suggests that point sources are responsible for the documented impairments;

- 6) A review of the ambient monitoring data collected by CTDEP Water Management Staff and from USGS monitoring stations at Frost Bridge showed no exceedances in numerical chemical criteria. This suggests that an aggregate measure such as whole effluent toxicity is needed to quantify pollutant loads.

Potential Sources of Pollutant of Concern

There are four National Pollutant Discharge Elimination System (NPDES) permitted point source discharges in the TMDL Study Area (Figure 1). Discharge permits for each of these facilities include water quality-based limits for chemical pollutants as well as whole effluent toxicity testing requirements. The current permit limits for each facility were derived consistent with EPA's *Technical Support Document for Water Quality-based Toxics Control*⁹ incorporating the following assumptions:

- Effluent flow rate equal to the average daily permitted flow

- Zone of Influence allocation equal to a statistical estimate of 7Q10 flow
- Background concentration of pollutant equal to zero
- Variability in pollutant concentration calculated from discharge monitoring data

Numerical permit limits for individual pollutants were expressed as mass loadings. Whole effluent toxicity limits were derived using the average daily flow and a zone of influence consistent with the requirements of 22a-430-4(j) of the *Regulations of Connecticut State Agencies*. Reported violations of permit terms and conditions have been infrequent in recent years.

The following section contains a brief discussion of each NPDES discharge in the TMDL Study Area.

Quality Rolling and Deburring

Treated wastewater from this metal plating and finishing facility enters the Naugatuck River in accordance with NPDES Permit CT0025305 approximately 0.5 mile downstream of the Route 6 crossing in Thomaston. The facility cleans, deburrs, and plates materials generated elsewhere. Principal plating materials include nickel, zinc, tin, chromium, and copper. The treatment system consists of equalization, oil skimming, chemical treatment, pH neutralization, settling and filtration, and biological treatment. The current average monthly permitted flow is 100,800 gpd with an allocated zone of influence of 11.4 cfs. Actual average monthly flows over the last 3 years have been close to average monthly permitted flow.

Thomaston POTW

The Thomaston Publicly Owned Treatment Works (POTW) discharges to the TMDL Study Area approximately 1.9 miles downstream of the Route 6 crossing in Thomaston and 0.2 miles upstream of the confluence of Branch Brook (adjacent to Whyco Technologies). The POTW was last upgraded in 2001 and provides advanced treatment of domestic wastewater including denitrification via the activated sludge process followed by ultraviolet disinfection. The design flow for the Thomaston POTW is 1.38

mgd. Actual average monthly flows over the last 3 years have been approximately 0.7 mgd.

Whyco Technologies Inc

Treated wastewater from this metal plating and finishing facility is discharged to the Naugatuck River in accordance with NPDES Permit CT0001457 approximately 2.0 miles downstream of the Route 6 crossing in Thomaston, just downstream from the confluence of Branch Brook. The facility electroplates, cleans, degreases, and provides corrosion protection of materials generated elsewhere. Principal materials include chromium, copper, nickel and zinc. The treatment system consists of hexavalent chromium reduction, cyanide destruction, ammonia and fluoride removal, pH neutralization, settling, filtration, and ion exchange. The current average monthly permitted flow is 195,500 gpd with an allocated zone of influence of 18 cfs. Actual average monthly flows over the last 3 years have been approximately 98,675 gpd.

Summit Corporation

Treated wastewater from this plating and finishing facility is discharged to the Naugatuck River in accordance with NPDES Permit CT0001180 approximately 3.5 miles downstream of the Route 6 crossing in Thomaston. The facility specializes in plating of machine metal parts and thin metal strips of materials generated elsewhere. Principal materials include activators, brighteners, hydrochloric acid, nitric acid, sulfamic acid, sulfuric acid, cleaners, copper sulfate, cyanide salt, nickel, gold, strippers, tin, and palladium. The treatment system consists of pH treatment, cyanide destruction, chlorination, flocculation and clarification, and sodium thiosulfate treatment for dechlorination. The current average monthly permitted flow is 330,000 gpd with an allocated zone of influence of 18 cfs. Actual average monthly flows over the last 3 years have been approximately 182,175 gpd.

The following section contains a brief discussion of three known contaminated groundwater locations in the TMDL Study Area (Figure 1). These sites are discussed in more detail in a separate TMDL Support Document ¹⁰.

Envirite

Envirite is an approximately five acre site that contains a 12,000 square foot waste treatment and storage building. Approximately one acre was a hazardous waste disposal area. The site is bounded on the west by Branch Brook, and on the east by the Naugatuck River. The Thomaston POTW and town transfer station are to the south. The site was a hazardous waste treatment and disposal facility in operation from 1975-1990. The facility treated liquid wastes and pumpable slurries that contained metals and cyanides. Wastes were batch treated on site using cyanide destruction and hexavalent chromium reduction followed by neutralization and precipitation and then discharged to the Thomaston POTW under a CTDEP permit. Treatment residues were deposited on site. Solid waste disposal capacity was reached at the Thomaston site in 1989. At that time, Envirite continued to treat waste at the Thomaston facility, but transported residues to an Envirite facility in York, PA. In May, 1990, Envirite suspended all commercial treatment of hazardous waste at the Thomaston site. EPA Region I is the lead regulatory agency and the site is being remediated under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program.

Whyco Technologies

Whyco Technologies is a metal plating facility that generates electroplating wastes and currently discharges to the Naugatuck River in accordance with a NPDES Permit issued by CTDEP (see above). Prior to 1985, treated wastewater from the facility was directed to a series of recharge lagoons at the southern end of the property. Sludge from the waste treatment was disposed of onsite. The lagoons have been capped and closed under a DEP/EPA approved RCRA closure plan in February, 1990. CTDEP is the lead agency and the site is being remediated under the RCRA Corrective Action Program and the Connecticut Property Transfer Program.

Summit Corporation

Summit Corporation is a metal plating facility that generates electroplating wastes and currently discharges to the Naugatuck River in accordance with a NPDES Permit issued by CTDEP (see above). Prior to 1987, dewatered sludge was stored on-site in two waste lagoons that were closed under a DEP/EPA approved RCRA closure plan in 1989.

Today, solids waste generated on site are trucked offsite to Pennsylvania. Some liquid wastes are collected by United Industrial Services. CTDEP is the lead agency and the site is being remediated under the RCRA Corrective Action Program and the Connecticut Property Transfer Program.

Total Maximum Daily Load

A steady-state model was used to simulate loading capacity in the TMDL Study Area of the Naugatuck River under critical conditions. Critical conditions were defined as the reasonably expected "worst case" scenario of environmental conditions in the Naugatuck River in which the loading capacity expressed in the TMDL will not result in acute or chronic toxicity to aquatic organisms consistent with the Water Quality Standards adopted by the State of Connecticut. Analysis of the hydrology has shown that low flow events occur in the Naugatuck River TMDL Study Area with regular frequency and can last for considerable periods of time. Because toxicity has been identified as the stressor most likely responsible for the impairment under low flow conditions, the critical streamflow condition was determined to be a function of low streamflow in the Naugatuck River (7Q10) combined with flow contributed by treated effluents from Quality Rolling and Deburring, Whyco, Summit, and the Thomaston POTW. Critical flow conditions at nine model locations in the TMDL Study Area are shown in Table 2.

Table 2. Critical flows for the upper Naugatuck River TMDL Study Area.

Location	Method of Estimation	Flow (cfs)	Flow (gallons/sec)
Naugatuck River @ Route 6	USGS Gage 01206900 @ Thomaston 1962-1998	12.60	93.24
Naugatuck River @ QRD	Permitted Flow for Quality, Rolling, and Deburring	12.76	94.42
Naugatuck River @ Northfield Brook	Cervione 7Q10 Estimate for mouth of Northfield Brook	12.87	95.24
Naugatuck River @ Thomaston POTW	Permitted Flow for Thomaston POTW	14.97	110.78
Naugatuck River @ Branch Brook	Cervione 7Q10 Estimate for mouth of Branch Brook	15.75	116.55
Naugatuck River @ Whyco	Permitted Flow for Whyco Technologies	16.05	118.77
Naugatuck River @ Nibbling Brook	Cervione 7Q10 Estimate for mouth of Nibbling Brook	16.12	120.00
Naugatuck River @ Summit Corp	Permitted Flow for Summit Corporation	16.63	123.06
Naugatuck River @ Frost Bridge	Drainage area ratio	17.17	127.06

Critical flows were estimated from gaging information provided by the USGS, the average monthly flow as established in the current NPDES permits to point sources, standard procedures for estimating groundwater flows¹¹, methods provided in Cervione et al.¹², and by scaling based on drainage area ratio (drainage area of unknown site/drainage area of gaged site * flow at gaged site).

The TMDL was developed under the assumption that acute toxicity occurs at 0.33 times the LC₅₀² concentration. This assumption is consistent with the definition of a non-acutely toxic concentration established in *Section 22a-430-4(l)(5)* of the *Regulations of Connecticut State Agencies*. TMDL calculations of toxicity loadings were expressed as acute toxic units (ATU) where $ATU = 100 / LC_{50}$. The major advantage of using toxic units is that they can be multiplied by a flow rate to yield a "mass" of toxicity.

An acutely toxic condition can then be defined as any effluent concentration exceeding 0.33 ATU. A chronically toxic condition occurs at 1.0 Chronic Toxic Unit (CTU) and the relationship between ATU and CTU can be expressed as $1 CTU = 0.05 ATU$.

TMDLs were calculated by multiplying the critical flow estimates (in gallons/second) at each model location by the maximum allowable toxicity (0.33 ATU for acute toxicity and 1 CTU for chronic toxicity). TMDL loadings for whole effluent toxicity are therefore expressed in gallons acute toxic units per second for acute toxicity (gATU/sec) and gallons chronic toxicity units per second for chronic toxicity (gCTU/sec) and are shown in Table 3.

Wasteload Allocation (WLA)

A flow proportional approach was employed to derive individual Wasteload Allocations (WLA) for the three industrial point sources discharging to the TMDL Study Area. Acute and chronic WLAs were developed for model locations in the Naugatuck River below each industrial point source. WLAs were calculated by multiplying the TMDL entering the TMDL Study Area (Route 6) by the proportion of flow that each discharge contributes to the total loading (Table 4). No additional wasteload allocation was made

² LC stands for Lethal Concentration. The LC₅₀ is a calculated percentage of effluent at which 50 percent of the organisms die in the test period.

Table 3. TMDLs for whole effluent toxicity at nine locations in the TMDL Study Area. Acute TMDL is expressed as gallons acute toxicity units/second and chronic TMDL is gallons chronic toxicity units/second.

Location	Flow (gallons/second)	Acute TMDL (gATU/sec)	Chronic TMDL (gCTU/sec)
Naugatuck River @ Route 6	93.24	30.77	93.24
Naugatuck River @ QRD	94.42	31.16	94.42
Naugatuck River @ Northfield Brook	95.24	31.43	95.24
Naugatuck River @ Thomaston POTW	110.78	36.56	110.78
Naugatuck River @ Branch Brook	116.55	38.46	116.55
Naugatuck River @ Whyco	118.77	39.19	118.77
Naugatuck River @ Nibbling Brook	120.00	39.60	120.00
Naugatuck River @ Summit Corp	123.06	40.61	123.06
Naugatuck River @ Frost Bridge	127.06	41.93	127.06

Table 4. Average monthly permitted flow in gallons per day and the proportion of each industrial discharge and wasteload allocations for the TMDL Study Area. Acute WLA is expressed as gallons acute toxicity units/second and chronic WLA is gallons chronic toxicity units/second.

Facility	Average Monthly Flow (gpd)	Proportion of Total Permitted Flow	Acute WLA (gATU/sec)	Chronic WLA (gCTU/sec)
Quality, Rolling, and Deburring	100,800	0.16	4.96	15.02
Whyco Technologies	195,000	0.31	9.59	29.05
Summit Corp	330,000	0.53	16.22	49.17
Total	625,800	1.00	30.77	93.24

to the Thomaston POTW because extensive monitoring indicates that this effluent is not a source of toxicity.

Load Allocation (LA)

The Load Allocation from stormwater and surface runoff was assumed to be zero at each model location because there are no known sources of stormwater flow during the defined critical condition for the TMDL.

Individual load allocations were made to three sites in the TMDL Study Area where contaminated groundwater is known to exist in close proximity to the Naugatuck River. Estimates of groundwater delivery rates were calculated for sites designated under the RCRA located at Whyco Chromium and Summit Corporation, as well as the Envirite site located adjacent to the Thomaston POTW ¹¹.

Consistent with the procedure used to derive Surface Water Protection criteria in Connecticut's Remediation Standards Regulations (Section 22a-133k-1 Regulation of Connecticut State Agencies), load allocations were calculated by multiplying the maximum allowable acute and chronic toxicity (0.33 ATU and 1.0 CTU respectively) by ten times the estimated groundwater flow rate. These calculated values (Table 5) incorporate a high degree of uncertainty since the groundwater contamination plumes are poorly defined. However, in recognition of the potential for this groundwater to contribute to toxicity in the river, specific allocations were made with the understanding that adjustments to these allocations may be necessary in the future when the sites are more fully characterized.

Table 5. Average daily groundwater flow estimates in gallons per day and Load Allocations (LA) for three remediation sites located adjacent to the Naugatuck River in the TMDL Study Area. Acute LA is expressed as gallons acute toxicity units/second and chronic LA is gallons chronic toxicity units/second.

Remediation Site	Average Groundwater Outflow (gpd)	Proportion of Total	Acute LA (gATU/sec)	Chronic LA (gCTU/sec)
Envirite	18,000	0.50	0.69	2.06
Whyco Technologies	3,000	0.08	0.10	0.34
Summit Corp	15,000	0.42	0.56	1.72
Total	36,000	1.00	1.35	4.12

Margin Of Safety (MOS)

A numerical MOS can be calculated by subtracting the sum of the LA and WLA from the TMDL at each model point. Under the critical condition identified in this TMDL, the numerical MOS is largest at Naugatuck River at Route 6 upstream of the first WLA and smallest below Summit Corporation (Figure 5). A portion of this numerical MOS may need to be allocated at some future date if, for example, additional sources of groundwater contamination are discovered in the study reach. Any reduction in the MOS however will be contingent upon a reduction in the uncertainty associated with the TMDL analysis that may result from TMDL Implementation activities. Changes in the TMDL or allocations made to individual facilities or remediation sites may require formal revision to the TMDL as discussed under the heading “**Provisions for Revising the TMDL**” at the conclusion of this document.

The TMDL also has an implicit MOS built into the analysis. The TMDL was developed using a steady-state model under critical 7Q10 flow conditions in the Naugatuck River. Although 100 % of the assimilative capacity provided by 7Q10 streamflow entering the TMDL Study Area is eventually allocated to point sources, much of the assimilative capacity provided by the additional flow that enters the TMDL Study Area directly

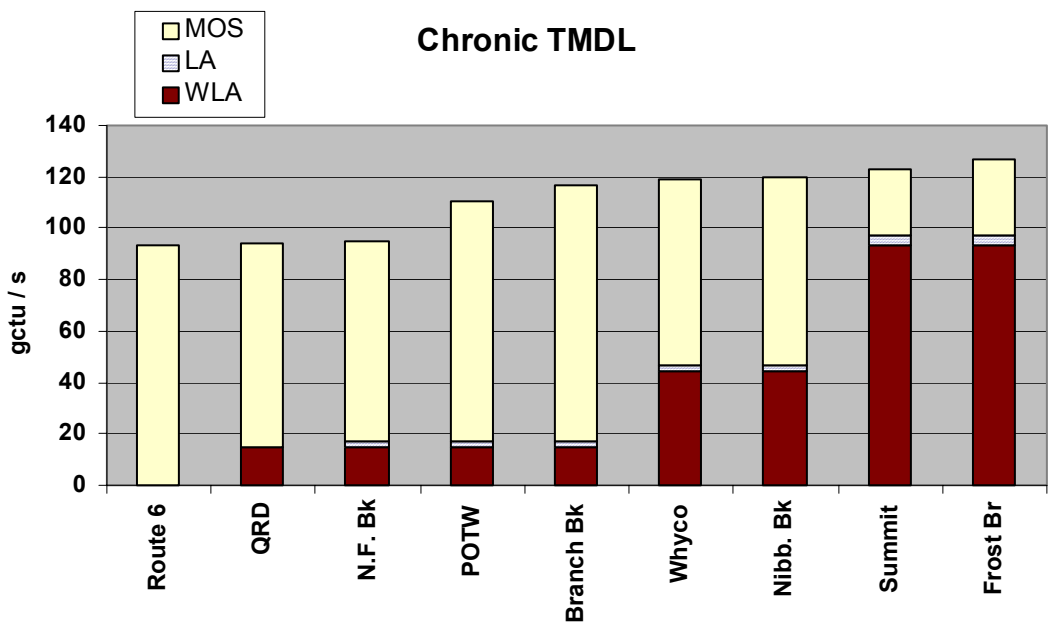
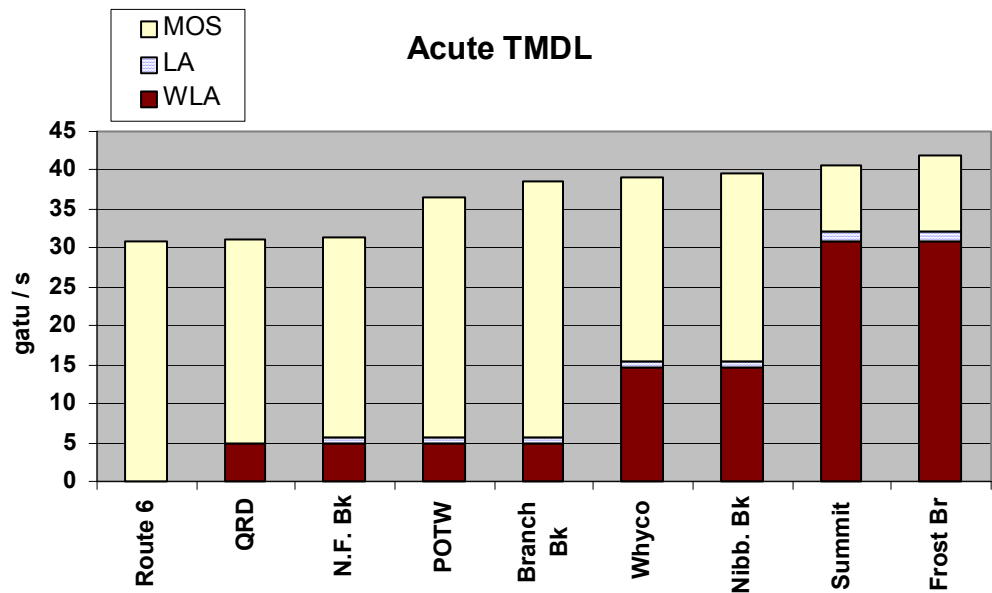


Figure 5. Acute (top) and chronic (bottom) TMDLs for upper Naugatuck River. The bars represent the TMDL at each TMDL model location. Allocations to WLA (red), LA (blue stripes) and MOS (yellow) are shown at each TMDL model location.

(e.g. clean ground water infiltration, tributary flow, non-toxic discharge flow) is not allocated and becomes part of the MOS. For example, data from US Army Corp of Engineers gages on Northfield Brook and Branch Brook show that these tributaries provide some additional surface water flow inputs during extended dry periods. Under non-drought conditions, these tributaries provide substantial quantities of additional dilution to the Naugatuck River and provide an added MOS. Field observations from Department staff corroborate these data. It is also likely that groundwater flow and effluent flow from the Thomaston POTW will help assimilate toxicity during critical low flow periods as well as when streamflow exceeds 7Q10. In addition, attenuation of toxicity may also contribute to the MOS since discharges upstream may be less toxic by the time the effluent reaches TMDL model locations downstream.

TMDL Summary

Toxicity was determined to be the most likely stressor and cause of aquatic life impairments in the TMDL Study Area of the upper Naugatuck River. TMDLs were calculated for acute and chronic toxicity in the section of the Naugatuck River from Route 6 Bridge crossing to the Frost Road Bridge crossing and are summarized in Tables 6 and 7. TMDLs were calculated under critical low flow conditions using flow data provided by USGS, average monthly permitted flow, and estimated using statistical methods where direct measurements were unavailable. Wasteload allocations were developed for industrial point sources consistent with *Section 22a-430-4(l)(5)* of the *Regulations of Connecticut State Agencies*. Load allocations were developed for three known sources of contaminated groundwater adjacent to the river and set equal to zero for other non point sources because there are no other known sources of toxicity from non point sources in the TMDL Study Area under the defined critical condition. The TMDL includes both a numeric and implicit Margin of Safety.

Table 6 . Acute TMDLs, WLA, LA, and MOS for nine model locations in the TMDL Study Area expressed in gallons acute toxic units per second (gATU/sec).

Location	TMDL (gATU/sec)	WLA (gATU/sec)	LA (gATU/sec)	MOS (gATU/sec)
Naugatuck River @ Route 6	30.77	0	0	30.77
Naugatuck River @ QRD	31.16	4.96	0	26.20
Naugatuck River @ Northfield Brook	31.43	4.96	0.69	25.78
Naugatuck River @ Thomaston POTW	36.56	4.96	0.69	30.91
Naugatuck River @ Branch Brook	38.46	4.96	0.69	32.81
Naugatuck River @ Whyco	39.19	14.55	0.79	23.85
Naugatuck River @ Nibbling Brook	39.60	14.55	0.79	24.26
Naugatuck River @ Summit Corp	40.61	30.77	1.35	8.49
Naugatuck River @ Frost Bridge	41.93	30.77	1.35	9.81

Table 7 . Chronic TMDLs, WLA, LA, and MOS for nine model locations in the TMDL Study Area expressed in gallons chronic toxic units per second (gCTU/sec).

Location	TMDL (gCTU/sec)	WLA (gCTU/sec)	LA (gCTU/sec)	MOS (gCTU/sec)
Naugatuck River @ Route 6	93.24	0	0	93.24
Naugatuck River @ QRD	94.42	15.02	0	79.40
Naugatuck River @ Northfield Brook	95.24	15.02	2.06	78.16
Naugatuck River @ Thomaston POTW	110.78	15.02	2.06	93.70
Naugatuck River @ Branch Brook	116.55	15.02	2.06	99.47
Naugatuck River @ Whyco	118.77	44.07	2.40	72.30
Naugatuck River @ Nibbling Brook	120.00	44.07	2.40	73.53
Naugatuck River @ Summit Corp	123.06	93.24	4.12	25.70
Naugatuck River @ Frost Bridge	127.06	93.24	4.12	29.70

Seasonal Component

The LAs and WLAs for toxicity established in this TMDL will be used to develop clean up goals and permit limits that will be applicable during all times of the year. A steady-state model, by definition, assumes that the controlling input parameters such as flow and concentration of pollutants remain constant. During higher flows, the added dilution will increase the assimilative capacity of the river and will therefore buffer the added pollutant load contributed by stormwater runoff and non point sources. Steady-state model calculations at flows higher than 7Q10 confirm this fact (i.e. TMDL is greater under higher flow conditions). Therefore, TMDLs calculated under the critical conditions will be protective of all seasons.

Monitoring Plan

Surface water chemistry and benthic macroinvertebrate data will continue to be collected from the Naugatuck River by CTDEP Bureau of Water Management. Water quality monitoring and assessment will be conducted as described in the CTDEP Rotating Basin Ambient Monitoring Strategy¹³. Benthic macroinvertebrates will continue to provide the primary metric to measure the progress of meeting Aquatic Life Support uses in the TMDL Study Area of the Naugatuck River. The goal of this TMDL is to improve the water quality in the TMDL Study Area so that water quality fully supports aquatic life uses in the river.

Implementation Plan

The TMDL will be implemented by incorporating the Wasteload Allocations for whole effluent toxicity established in this TMDL into the NPDES permits for Quality Rolling and Deburring, Whyco Technologies, Thomaston POTW, and Summit Corporation when these permits are reissued. Load Allocations for groundwater established in the TMDL will be implemented under the authority of Connecticut's Remediation Standard Regulations. As the remediation process proceeds and the sites become better characterized, adjustments to the TMDL may be made to insure that the TMDL is achieved in the most cost-effective manner.

Although analysis by CTDEP has determined that whole effluent toxicity is the probable cause of the aquatic life impairment, permit limits for metals must be reassessed as part of the overall TMDL implementation. A TMDL Support Document has been prepared that recommends procedures for determining metals limits for the reissued NPDES Permits¹⁴. Load Allocations for metals as established in the TMDL Support Document will help in establishing cleanup goals of impacted groundwater for Envirite, Whyco Technologies, and Summit Corporation.

Reasonable Assurances

The Department has committed to developing a coordinated response to the regulated facilities within the TMDL study area. The goals identified in the TMDL, attainment of water quality standards and full support of designated uses, are shared by the various permitting and remediation programs within the agency, and the Department has the regulatory authority to implement Water Discharge Permit Regulations and Remediation Standard Regulations.

Further assurance that designated uses will be supported following full implementation of the TMDL is provided by the existence of clear linkages between Water Quality Standards and both discharge permitting and site remediation activities. For example, federal and state regulations governing remediation of waste sites include a provision requiring development of ecological risk assessments to insure that remediation goals protect human health and the environment. Connecticut's NPDES regulations similarly require that NPDES permits include limits or conditions established in order to achieve consistency with water quality standards.

Water chemistry data and biological assessments will continue to be collected in the Naugatuck River to evaluate TMDL progress. This TMDL analysis is consistent with the CTDEP anti-degradation policy¹ because achievement of the loading capacity calculations instream will result in improvements to water quality conditions and ultimately achieving consistency with Connecticut's Water Quality Standards.

Provisions For Revising The TMDL

The Department reserves the authority to modify the TMDL as needed to account for new information made available during the implementation of the TMDL. These modifications may include reapportioning the TMDL established in this document among the WLA, LA, and MOS components. Modification of the TMDL will only be made following an opportunity for public participation and be subject to the review and approval of the EPA. Monitoring data collected during implementation of the TMDL will be reviewed by DEP and evaluated in regards to the numeric TMDL target values. Site characterization data and any ecological risk assessments performed during implementation of groundwater remediation activities will also be reviewed and considered new information for purposes of evaluating the need to propose modifications to the TMDL. New information may also include new or revised State or Federal regulations adopted pursuant to Section 303(d) of the Clean Water Act, or the publication by EPA of national or regional guidance relevant to the implementation of the TMDL program. The DEP will propose modifications to the TMDL analysis only in the event that a review of the available data indicates such a modification is warranted and is consistent with the anti-degradation provisions in Connecticut Water Quality Standards. This section of the Naugatuck River will continue to be included on the *List of Connecticut Water bodies Not Meeting Water Quality Standards* until monitoring data confirms that aquatic life uses are fully supported.

Public Participation

The Department has summarized its public participation efforts for this TMDL in Response to Comments for *A Total Maximum Daily Load Analysis for the Upper Naugatuck River, Thomaston, Connecticut and supporting documents*¹⁵.

In Brief, the Department held several meeting with the government officials, the regulated community, and well as EPA regarding this TMDL. A *Notice of Intent to Adopt A Total Maximum Daily Load Analysis for the Upper Naugatuck River, Thomaston Connecticut* was published in the Public Notice section of the Waterbury Republican-American Newspaper on June 17, 2004¹⁶. As published, the comment period ended July

19, 2004. CTDEP received a request to extend the comment period and the Department agreed to this request. Written comments were accepted until the end of July 2004. Public comments were reviewed and several modifications were made to the TMDL and Support Documents as a result of this process. All changes made to the TMDL and its support documents have been documented in *Response to Comments for A Total Maximum Daily Load Analysis for the Upper Naugatuck River, Thomaston, Connecticut and supporting documents*.

References

- ¹ CTDEP. 2002. *Water Quality Standards*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127. 39 pp.
- ² CTDEP. 2002. *List of Connecticut Waterbodies Not Meeting Water Quality Standards*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.
- ³ CTDEP. 2002. *2002 Water Quality Report To Congress: Prepared Pursuant to Clean Water Act Section 305 (b)*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.
- ⁴ CTDEP. 2002. *Connecticut Consolidated Assessment and Listing Methodology for 305 (b) and 303(d) Reporting*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.
- ⁵ United States Environmental Protection Agency. 2000. *Stressor identification guidance document*. EPA 822-B-00-025.
- ⁶ CTDEP. 2003. *Upper Naugatuck River TMDL Support Document: Determining the Probable Candidate Cause*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.
- ⁷ CTDEP. 2003. *Comparative Risk Analysis Potential for Pollutants to Cause Water Quality Impairment Naugatuck River, Thomaston*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.
- ⁸ CTDEP File Memo. 2003. Chronic toxicity test results: January 2003. Whyco, Summit Corp., and Quality, Rolling and Deburring; Naugatuck River Study. From David MacDonald, EPA Region I to Ernest Pizzutto, CTDEP.

⁹ United States Environmental Protection Agency. 1991. *Technical support document for water quality-based toxics control*. EPA 505-2-90-001.

¹⁰ CTDEP. 2004. *Potential Environmental Impacts on the Naugatuck River from four Industrial Facilities located in Thomaston*. Connecticut Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

¹¹ CTDEP. 2004. Interdepartmental memo from Traci Iott to Chris Bellucci *Groundwater flow estimates for RCRA facilities in Thomaston*. Connecticut Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

¹² Cervione, M.A., Jr., R.L. Melvin, and K.A. Cyr. 1982. *A method for estimating the 7-day, 10-year low flow of streams in Connecticut*. Connecticut Department of Environmental Protection. Connecticut Water Resources Bulletin No. 34.17 pp.

¹³ CTDEP. 1999. *Ambient monitoring strategy for rivers and streams rotating basin approach*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

¹⁴ CTDEP. 2003. *Upper Naugatuck River TMDL Support Document TMDL Implementation: Recommended Procedures For Determining the NPDES Permit Limits for Metals*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

¹⁵ CTDEP. 2004. *Response to Comments for A Total Maximum Daily Load Analysis for the Upper Naugatuck River, Thomaston, Connecticut and supporting documents*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

¹⁶ Public Notice. June 17, 2004. In Legal Classified Section of *Waterbury Republican*.

08/17/05