TOTAL MAXIMUM DAILY LOAD ANALYSIS FOR LIMEKILN BROOK, DANBURY, CONNECTICUT

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

JANE K. STAHL **6/6/02**

_____ _____

Jane Stahl, Deputy Commissioner
Air, Waste and Water Programs

ROBERT L. SMITH 6/5/02

_____ _____

Robert L. Smith, Chief
Bureau of Water Management

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3020

Arthur J. Rocque, Jr., Commissioner

INTRODUCTION

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. Section 303(d) of the CWA requires states to develop Total Maximum Daily Loads (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 pollutant loading that a waterbody can receive without exceeding the adopted Water Quality Criteria for that 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 nonpoint 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. 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.

The 1.0 mile section of Limekiln Brook from the confluence of East Swamp Brook to the mouth segment was listed on the 1998 303(d) list, *Connecticut Waterbodies Not Meeting Water Quality Standards* [1]. This section of Limekiln Brook is referred to as the TMDL segment in this document. The listing was based on a review of Aquatic Toxicity Monitoring Reports (ATMRs) submitted to CTDEP from the Danbury Publicly

Owned Treatment Works (POTW). Calculations using data from ATMRs have shown a high probability of exceeding Connecticut Water Quality Criteria for copper and zinc. Therefore, TMDLs were developed for copper and zinc in Limekiln Brook downstream of the Danbury POTW discharge. TMDLs were also developed for chlorine and ammonia to develop water quality based permit limits for these parameters. TMDLs will be implemented by reissuing the National Pollutant Discharge Elimination System (NPDES) permit to the Danbury POTW with limits for copper, zinc, ammonia, and chlorine calculated from Wasteload Allocations developed in this TMDL analysis.

Limekiln Brook Watershed

Limekiln Brook is designated as sub-regional basin 6606 in *the Gazetteer of Drainage Areas of Connecticut* [2] and drains an area of approximately 14 square miles in southwestern Connecticut. The headwaters of Limekiln Brook begin in the town of Newtown and the brook flows northerly through the town of Bethel before its confluence with the Still River in the City of Danbury (Figure 1). Landuse in the watershed is 58% forested, 21% developed, 19% open space, and 2% water/wetland. The majority of the forested category is in the upper watershed and most of the developed category is located in the lower watershed centered around the City of Danbury (Figure 2).

The City of Danbury has a population of 74,848 as of the 2000 Census. Danbury is home to a variety of businesses including the production of pharmaceuticals, electronic components, chemicals, medical instruments and equipment, metal fabrication and special machinery, precision bearings, high tech optical instruments and equipment, printing and publishing, ultrasonic equipment, high tech research and development as well as several corporate headquarter locations.

The City of Danbury POTW is the only point source discharge in the TMDL segment. There has been a wastewater treatment plant on the current site since the early 1900's. The latest plant rehabilitation and expansion was completed in 1993 and the plant currently provides trickling filter pretreatment followed by seasonal nitrification via the activated sludge process. The plant also adds ferric chloride (April-October) to aid with removal of phosphorus. Wastewater is disinfected using the chlorination/dechlorination

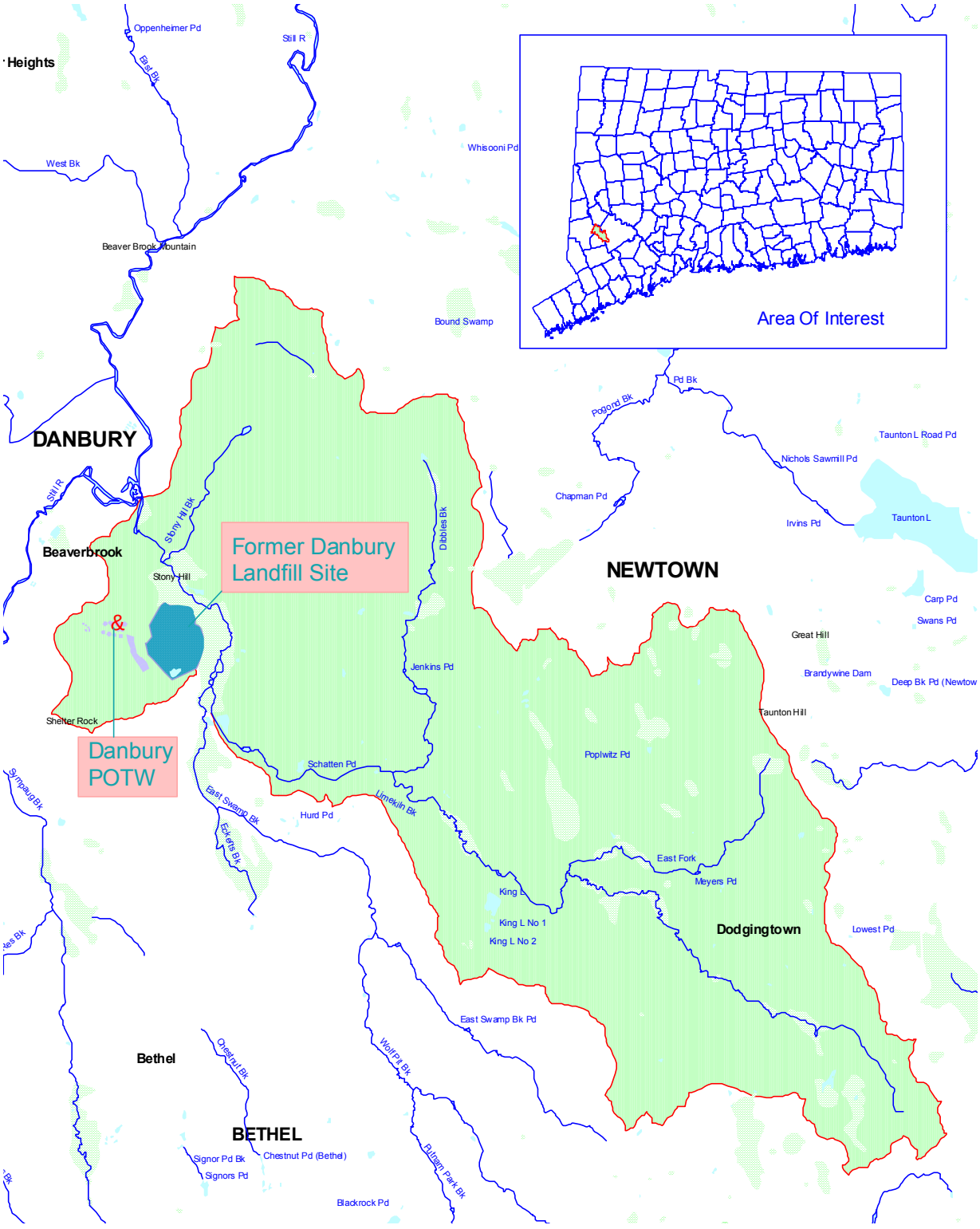


Figure 1. Limekiln Brook watershed.

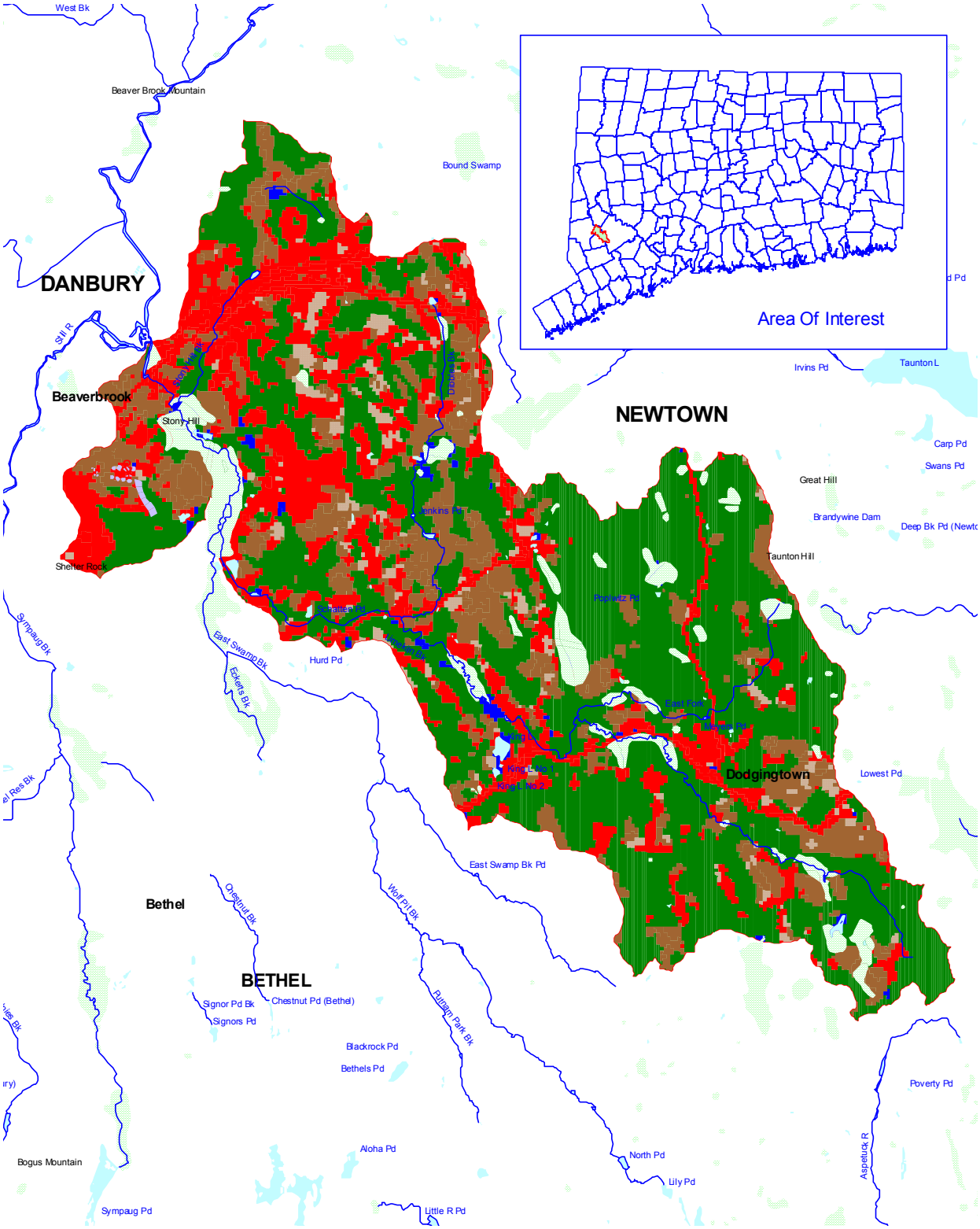


Figure 2. Limekiln Brook landuse. Green is forested, brown is open space, red is developed, and blue is water/wetland.

process prior to discharging to the effluent channel draining to Limekiln Brook. The plant was expanded in 1993 which increased the design flow to 15 million gallons per day (MGD), a maximum daily flow of 28 MGD, and a wet weather peak flow of 45 MGD. During the 4 year period from January 1996 - December 1999, the range of monthly plant flow was approximately 7.5-13 MGD based on monthly operating reports submitted to CTDEP.

The former City of Danbury Sanitary Landfill is located on approximately 45 acres and is bordered by Limekiln Brook to the east (Figure 1). The landfill stopped accepting solid waste on December 31, 1996 and has been covered with an impermeable geo-membrane cap since September 1999. Leachate (subsurface flow) from the former landfill site contributes to the pollutant loading in Limekiln Brook and is included as a portion of the Load Allocation in this analysis.

Habitat in the TMDL segment is uniform and a function of the topography and local geology. The TMDL segment is low gradient, has little overhead canopy cover, and is composed of primarily shallow run habitat. The stream flows through a *Phragmites* dominated wetland throughout most of the TMDL segment. Substrate is composed of primarily coarse sand. Surficial materials in the TMDL segment are classified as swamp/fines and alluvium/fines (Figure 3). As a result of this natural condition, habitat in the TMDL section is not suitable for the typical Rapid Bioassessment Level III [3] methods to evaluate the macroinvertebrate community.

Fisheries surveys were conducted on July 6, 2001 in the TMDL segment. A total of ten species were collected including white sucker, tessellated darter, redfin pickerel, largemouth bass, longnose dace, blacknose dace, golden shiner, common shiner, spottail shiner, and creek chub. Young of the year white sucker were extremely abundant in the TMDL section of Limekiln Brook. Young of the year tessellated darter, longnose dace, blacknose dace, and largemouth bass were also present. No salmonid species were collected in the TMDL section and the instream habitat is not conducive for spawning in the TMDL location. CTDEP does not stock trout in Limekiln Brook.

During fisheries sampling on July 6, 2001, it was noted by field personnel that the stream channel was impacted by excessive sedimentation. Although it is recognized that the surficial material in the Limekiln Brook basin are naturally composed of alluvium and

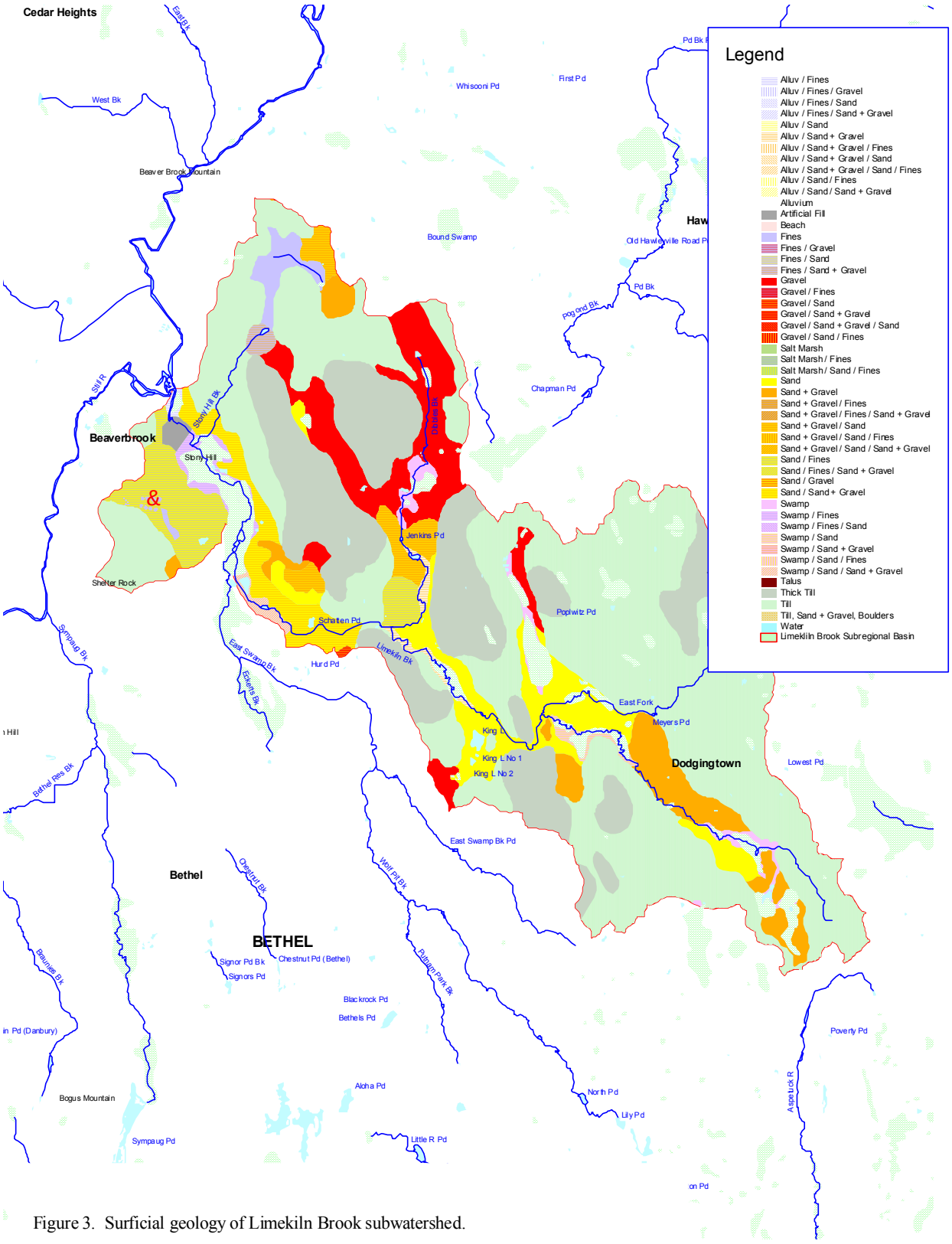


Figure 3. Surficial geology of Limekiln Brook subwatershed.

fine deposits, the excess sedimentation documented in Limekiln Brook is beyond what would be expected if stormwater Best Management Practices (BMPs) were functioning properly. Further investigation revealed three sites tributary to Limekiln Brook near Plumtrees Road that could benefit from stormwater erosion control. These site locations are currently under investigation by CTDEP Permitting and Enforcement Section. Implementation of stormwater BMPs would greatly reduce the sediment load to Limekiln Brook and does not require quantification through the TMDL process at this point.

CONNECTICUT WATER QUALITY STANDARDS AND WATER QUALITY CRITERIA

Connecticut Water Quality Standards have established separate water quality criteria to protect aquatic life from acute exposure (one hour) and chronic exposure (four-day average) to pollutants [4]. Recently adopted state water quality criteria for copper, zinc, chlorine and ammonia that are applicable to this TMDL analysis are outlined in Table 1.

Connecticut is in the process of revising its water quality criteria for ammonia to reflect the most current scientific information published by the Environmental Protection Agency (EPA-822-R-99-014) in the December 1999 [5]. The changes in the proposed revision to Connecticut' s Water Quality Criteria follow recommendations in the 1999 EPA ammonia guidance. A TMDL Support Document was developed to discuss the determination of the applicable ammonia criteria for this TMDL [6].

Site specific criteria for copper have been adopted into the Connecticut Water Quality Standards for Limekiln Brook below the Danbury POTW, which includes the entire TMDL segment. Site specific criteria for copper have been adopted for several waterbody segments that receive a contribution of biologically treated wastewater greater than or equal to 20% of base flow because these streams have been shown to exhibit a greater capacity to assimilate copper [7].

Limekiln Brook is a Class C/B surface water in the TMDL section. The C/B surface water classification means that Limekiln Brook is not meeting Water Quality Criteria or not supporting one or more designated use. The goal for Limekiln Brook is achievement of Class B Water Quality Criteria and attainment of Class B designated

uses. Designated uses for Class B surface waters include recreational use; fish and wildlife habitat; agricultural and industrial supply; and other legitimate uses including navigation.

Limekiln Brook meets criteria for Class A surface waters upstream of the TMDL segment. Designated uses for Class A waterbodies include potential drinking water supply; fish and wildlife habitat; recreational use; agricultural, and industrial supply; and other legitimate uses including navigation.

Table 1. Connecticut Freshwater Water Quality Criteria applicable to the Limekiln Brook TMDL.

Pollutant	**Acute Criterion**	**Chronic Criterion**
Copper [1,2]	25.7 *u*g/l	18.1 *u*g/l
Zinc [2]	65.0 *u*g/l	65.0 *u*g/l
Summer ammonia [3]	17.03 mg/l	2.02 mg/l (30-d average) 5.05 mg/l (4-d average)
Winter ammonia [3]	17.03 mg/l	3.98 mg/l (30-d average) 9.95 mg/l (4-d average)
Chlorine [2]	19 *u*g/l	11 *u*g/l

[1] Site specific criteria for copper

[2] For acute exposure, biological integrity is impaired when the acute criteria is exceeded for 1 hour more than once every three years on average. For chronic exposure, biological integrity is impaired when 4-day average exceeds the chronic criteria more than once every three years on average.

[3] The acute criterion (one-hour average exposure) is based on pH and presence or absence of salmonid species and the chronic criterion (30-day average exposure) is dependent on pH and temperature and presence or absence of early life stages of fish species. In addition, the highest four-day average can not exceed 2.5 times the chronic criterion. Also see EPA Ammonia Criteria Document[5] and TMDL Support Document [6] for further explanation.

Connecticut WQS designate the minimum daily flow for seven consecutive days that can be expected to occur once in ten years under natural conditions (7Q10) as the minimum flow to which surface water standards apply. In order to protect aquatic organisms in Limekiln Brook, TMDL load calculations were performed using a steady-state model under different flow scenarios and the most protective condition was applied in this analysis.

TMDL

A steady-state model was used to simulate loading capacity of each pollutant in Limekiln Brook below the Danbury POTW under critical conditions (Table 2). Critical conditions were defined as the "worst case" scenario of environmental conditions in Limekiln Brook in which the pollutant load capacity expressed in a TMDL will not exceed Water Quality Criteria adopted by the State of Connecticut.

Table 2. Critical conditions used in the development of the Limekiln Brook TMDL.

Location	Drainage Area (mi^2)	Till (mi^2)	Stratified Drift (mi^2)	Cervione 7Q10 (cfs) [1]	Critical Summer Flow Condition (cfs) [2]	Critical Winter Flow Condition (cfs) [3]
Limekiln Brook above Danbury POTW outfall	13.90	9.34	4.56	3.15	3.15	3.15
Limekiln Brook below Danbury POTW outfall	13.90	9.34	4.56	3.15	16.31	17.22

[1] Cervione 7Q10 (cfs) = (0.67 * square miles stratified drift) + (0.01 * square miles till) [8]
[2] Critical Summer Flow (cfs) = Cervione 7Q10 + flow additions. Flow additions were equal to 13.15 cfs for the critical summer flow for the Danbury POTW and 0.007 cfs for the critical flow from the former Danbury Landfill site.
[3] Critical Winter Flow (cfs) = Cervione 7Q10 + flow additions. Flow additions were equal to 14.06 cfs for the critical winter flow for the Danbury POTW and 0.007 cfs for the critical flow from the former Danbury Landfill site.

The ammonia TMDL was developed using a separate critical flow conditions for summer and winter because Water Quality Criteria for ammonia vary seasonally. TMDLs for the 30-day chronic ammonia condition were calculated using the applicable criteria and 30Q10 because of the new ammonia criteria has a 30-day averaging period (see ammonia support document and EPA Ammonia Guidance for further explanation). For all other pollutants, TMDLs were developed using critical summer conditions (more restrictive condition) and applied during all seasons.

There are no stream gauging stations that could provide discharge information on Limekiln Brook. Therefore, estimates of 7Q10 streamflow were calculated using Cervione Method [8]. The best predictors of 7Q10 in Connecticut streams were determined to be the area of coarse-grained stratified drift (SD) and till-mantled bedrock (till) in upstream drainage areas. The equation to estimate 7Q10 in cubic feet per second is 7Q10

(cfs) = (0.67*SD) + (0.01*till) where SD and till are area expressed in square miles. The Cervione 7Q10 below the Danbury POTW point of discharge used in this analysis was:

Cervione 7Q10 = (0.67*4.56) + (0.01*9.34) = 3.15 cfs.

The Cervione 7Q10 accounts only for "natural flow" and does not consider any additions (e.g. POTW discharge) or withdrawals (e.g. diversion) of flow. Any significant additions or removal of water from the basin requires an adjustment to the Cervione 7Q10 estimate. For this TMDL analysis, flow from the Danbury POTW and estimated leachate flow from the landfill was added to the calculated Cervione 7Q10. There are no diversions registered with the Department that would affect this analysis.

The Danbury POTW flow was estimated from discharge data submitted to CTDEP. POTW flow was estimated separately for summer months (July-October) and winter months (November- June) from discharge data from 1996-1999. The lowest monthly average flow for the summer months and winter months was used as conservative estimates of seasonal flow. These values of 13.15 cfs (summer flow) and 14.06 cfs (winter flow) were added to the Cervione 7Q10 estimate for the corresponding season.

Leachate flow rate was estimated at 4500 gallons/day (0.007 cfs). This value was calculated by multiplying (100 gallons/acre/day) by the area of the landfill footing (45 acres). The 100 gallons/acre/day is commonly used to estimate leachate flow rate for landfills with membrane cap and represent a maximum flow rate expected from a capped landfill [9]. The flow rate of 0.007 cfs was applied to all seasons in this analysis.

TMDL SUMMARY

TMDLs were calculated for copper, zinc, and chlorine by multiplying the adopted WQC for each pollutant (Table 1) by the appropriate critical streamflow condition in the Limekiln Brook below the Danbury POTW (Table 2). Calculation of the ammonia criteria and resultant TMDLs is discussed in the ammonia support document . A summary of load calculations is provided in Table 3.

Table 3. Summary of TMDLs in Limekiln Brook below the Danbury POTW point of discharge. All values are grams/day except ammonia which are kilograms/day.

Pollutant	Condition	TMDL	WLA	LA		MOS
				Natural Background LA	Existing and Future Nonpoint LA	
Copper	Acute	1026.77	995.73	30.87	0.17	0.00
	Chronic	723.13	692.09	30.87	0.17	0.00
Zinc	Acute	2596.89	2562.25	30.87	3.77	0.00
	Chronic	2596.89	2562.25	30.87	3.77	0.00
Summer Ammonia	Acute	680.39	668.73	10.96	0.70	0.00
	Chronic	85.99	74.34	10.96	0.70	0.00
Winter Ammonia	Acute	718.48	706.82	10.96	0.70	0.00
	Chronic	178.31	166.65	10.96	0.70	0.00
Chlorine	Acute	759.09	759.09	0.00	0.00	0.00
	Chronic	439.47	439.47	0.00	0.00	0.00

Load Allocations (LA)

The Load Allocation (LA) for the Limekiln Brook TMDL was separated into two components:

1) natural background (**Natural Background LA**) and

2) existing and future nonpoint sources (**Existing and Future Nonpoint LA**).

The sum of Natural Background LA plus Existing and Future Nonpoint LA is equal to the Load Allocation and is summarized in Table 4.

Table 4. Load Allocation Summary in Limekiln Brook below Danbury POTW

Pollutant	Load Allocation	Natural Background LA	Existing and Future LA
Copper	31.04 g/day	30.87 g/day	0.17 g/day
Zinc	34.64 g/day	30.87 g/day	3.77 g/day
Ammonia	11.66 kg/day	10.96 kg/d	0.70 kg/d
Chlorine	0.00 g/day	0.00 g/day	0.00 g/day

Natural Background LA

The Natural Background LA assumes nonpoint loading from "natural" sources can be estimated by multiplying the critical streamflow by an estimated concentration of each pollutant. It is important to note that "Natural Background" used in this context does not refer to water draining a pristine condition, but rather a condition that is considered the normal use of the land. This is consistent with Connecticut's Water Quality Standard #8 that states *"Conditions which exist in the water, in part due to normal uses of the land, may be considered natural".* It would not be considered normal use of the land if designated uses were not met. As such, the Natural Background may contain some imputs from anthropogenic sources, but not in sufficient quantities that would result in the loss of an existing use or preclude attaining a designated use. The term Natural Background is used to maintain consistency with EPA guidance.

Estimated Natural Background LA concentrations in Limekiln Brook were assumed comparable to those measured in the Mattabessett River which drains a similarly developed watershed (Figure 4) and is impacted by no point source discharges. Water quality data for the period 1996-2000 at USGS stream monitoring gauge 1192704 was used to establish natural background pollutant concentrations [10].

The Natural Background LA was calculated by as follows:

Copper:

The estimated concentration of copper used to develop the Natural Background portion of the Load Allocation was 4.0 *u*g/l under all flow conditions. The value of 4.0 *u*g/l was the 95th percentile of the dissolved copper concentration measured in the Mattabessett River from 1996-2000. The estimated copper concentration was multiplied by 3.15 cfs (Cervione 7Q10) to calculate Natural Background LA.

Natural Background LA for copper = (4.0 *u*g/l) (3.15 cfs) = 30.87 g/day

Zinc:

The estimated concentration of zinc used to develop the Natural Background portion of Load Allocation was 4.0 *u*g/l under all flow conditions. The value of 4.0 *u*g/l was 95th percentile of the dissolved zinc concentration measured in the Mattabessett

River from 1996-2000. The estimated zinc concentration was multiplied by 3.15 cfs (Cervione 7Q10) to calculate Natural Background LA.

Natural Background LA for zinc = (4.0 *u*g/l) (3.15 cfs) = 30.87 g/day

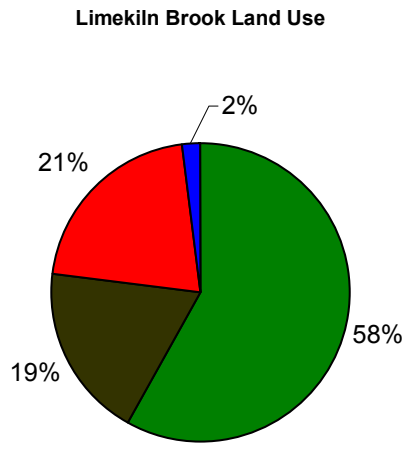
Ammonia

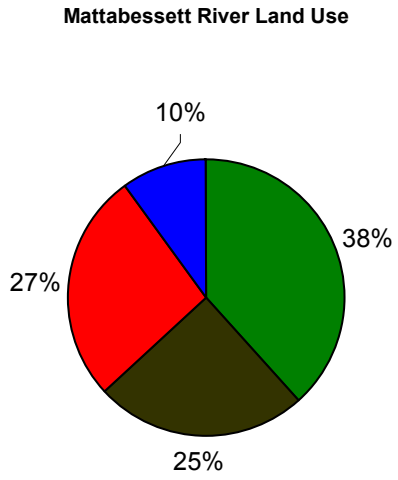
The estimated concentration of ammonia used to develop the Natural Background portion of Load Allocation was 1.42 mg/l under all flow conditions. The value of 1.42 mg/l was 95th percentile of the ammonia nitrogen concentration measured in the Mattabessett River from 1996-2000. The estimated ammonia concentration was multiplied by 3.15 cfs (Cervione 7Q10) to calculate Natural Background LA.

Natural Background LA for ammonia = (1.42 mg/l) (3.15 cfs) = 10,960 g/day

Chlorine

The estimated concentration of chlorine used to develop the Natural Background portion of the Load Allocation was 0 g/day. No natural source of chlorine is known to exist.





Legend Color	Land Use Category	Limekiln Brook Percentage	Mattabessett River Percentage
	Forested	58	38
	Open Space	19	25
	Developed	21	27
	Water/Wetland	2	10
	Total	100	100

Figure 4. Comparison of landuse between Limekiln Brook subregional basin and Mattabessett River subregional basin.
Data were generated from a statewide data layer comprised of a polygon shapefile of landuse and landcover data in Connecticut.
The Connecticut Landuse Landcover Data Layer is a representation of LANDSTAT Thematic Mapper Satellite Imagery Information.

Existing and Future Nonpoint LA

The Existing and Future Nonpoint LA represent the portion of the Load Allocation beyond which is Natural Background LA. For this analysis, the pollutant loading contributed by the former Danbury landfill facility was calculated by multiplying measured pollutant concentrations from monitoring wells by 0.007 cfs estimated leachate flow rate for capped landfills in the **TMDL** section above [10].

The Existing and Future Nonpoint LA was calculated by as follows:

Copper:

The estimated concentration of copper used to develop the Existing and Future Nonpoint LA portion of the Load Allocation was 10 *u*g/l under all flow conditions. The value of 10 *u*g/l was the 95th percentile of the dissolved copper concentration measured in the monitoring wells draining to Limekiln Brook.

Existing and Future Nonpoint LA for copper = (10 *u*g/l) (0.007 cfs) = 0.17 g/day

Zinc:

The estimated concentration of zinc used to develop the Existing and Future Nonpoint LA portion of the Load Allocation was 220 *u*g/l under all flow conditions. The value of 220 *u*g/l was the 95th percentile of the dissolved zinc concentration measured in the monitoring wells draining to Limekiln Brook.

Existing and Future Nonpoint LA for zinc = (220 *u*g/l) (0.007 cfs) = 3.77 g/day

Ammonia:

The estimated concentration of ammonia used to develop the Existing and Future Nonpoint LA portion of the Load Allocation was 40.6 mg/l under all flow conditions. The value of 40.6 mg/l was the 95th percentile of the ammonia nitrogen concentration measured in the monitoring wells draining to Limekiln Brook.

Existing and Future Nonpoint LA for ammonia = (40.6 mg/l) (0.007 cfs) = 700 g/day

Chlorine

The estimated concentration of chlorine used to develop the Existing and Future Nonpoint LA portion of the Load Allocation was 0 g/day. No nonpoint source of chlorine is known to exist.

The contribution of the Load Allocation during the critical conditions defined in this TMDL (i.e. 7Q10 low flow) is suspected to be minor in comparison to the contribution from the sole point source, the Danbury POTW. That is because the storm events necessary to transport anthropogenic nonpoint sources generally do not occur during low flow conditions. When storm events occur, an added dilution effect would reduce the impact of any additional loadings contributed by an increase in the Load Allocation.

Wasteload Allocation (WLA)

The Danbury POTW is the only point source in the TMDL segment of the Limekiln Brook for this TMDL analysis. One hundred percent of the Waste Load Allocation was allocated to the Danbury POTW at the point of discharge. The WLA was calculated by subtracting the Load Allocation from the TMDL.

Margin of Safety (MOS)

A numerical Margin of Safety was calculated by subtracting the sum of the Load Allocation and Waste Load Allocation from the Load Capacity. Under the critical condition identified in this TMDL, the numerical MOS is zero at the Danbury POTW point of discharge.

This TMDL analysis also has an implicit MOS built into the analysis. The TMDL was developed using a steady-state model under critical, or worst-case, conditions in the Limekiln Brook. The modeled critical conditions, by definition, represent flow conditions that have a low probability of occurrence. The combination of 7Q10 flow in the Limekiln Brook plus the average flow estimate for the Danbury POTW during the low flow months of July-October represent a conservative approach to protecting aquatic life in the TMDL segment of Limekiln Brook.

To further support an implicit MOS, the TMDLs for copper and zinc assume that all of the available heavy metals will be in the dissolved form. This is a conservative approach because some portion of the total metal concentration will be adsorbed to particulate material in stream and therefore will not be available to cause toxicity to aquatic organisms.

Seasonal Analysis

Water Quality Criteria for ammonia were varied to account for seasonal water temperature and pH variations in Limekiln Brook. Separate TMDLs were developed under average summer and winter conditions. The seasons were based primarily on differences in water temperature throughout the year since pH shows little seasonal variance. The ammonia criteria were calculated by grouping data into summer season (May-October) and winter season (November-April). A TMDL support document was developed to provide more detail on the determination of the ammonia criteria. The summer ammonia TMDLs were calculated using critical summer flows and the winter ammonia TMDLs were calculated using critical winter flows.

No seasonal variation was applied to the Water Quality Criteria concentration for copper, zinc, or chlorine in this analysis since criteria adopted by the State of Connecticut do not vary seasonally for these pollutants. Critical conditions were developed under the assumption that the critical period in the Limekiln Brook occurs during low flow months of July-October. Critical conditions in the TMDL segment were determined to be a function of natural streamflow in the Limekiln Brook combined with flow of the Danbury POTW and the former Danbury Landfill site.

The TMDLs for the Limekiln Brook have been modeled using worst case low flow conditions which has been defined in Connecticut's Water Quality Standards as 7Q10. TMDLs were calculated using a steady-state simple dilution model assuming constant 7Q10 conditions. 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 nonpoint 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.

IMPLEMENTATION

The TMDL will be implemented by incorporating the Wasteload Allocations for copper, zinc, ammonia, and chlorine in this TMDL into a renewed NPDES permit for the Danbury POTW.

MONITORING

Water quality monitoring and assessment will be conducted by the Town of Danbury and CTDEP. The NPDES permit issued to the Danbury POTW will include monitoring requirements for copper, zinc, ammonia, and chlorine.

Surface water chemistry will continue to be collected from Limekiln Brook by CTDEP Bureau of Water Management. Water quality monitoring and assessment will be conducted as described in the CTDEP Rotating Basin Ambient Monitoring Strategy [11]. The goal of this TMDL is to improve the water quality in the TMDL segment so that all aquatic life will be fully supporting the uses of the river. Throughout the TMDL segment, Limekiln Brook has a low gradient and a substrate composed of coarse sand. Habitat is unsuitable to assess use EPA's Rapid Bioassesment Protocols [3] due to the paucity of riffle habitat. Fish population data will provide the primary metric to measure the progress of meeting Aquatic Life Support uses in the TMDL segment of the Limekiln Brook. The Bureau of Water Management will continue to work closely with the Fisheries Division to monitor the fish population in Limekiln Brook.

REASONABLE ASSURANCES

The NPDES permit issued to the City of Danbury POTW provides a legally enforceable control document and offers reasonable assurances that WQS will be met in the TMDL segment of Limekiln Brook. This TMDL analysis is consistent with the CTDEP anti-degradation policy because achievement of the loading capacity calculations instream will result in meeting Water Quality Criteria adopted by the State of Connecticut.

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. Any new source of copper, zinc, ammonia, or chlorine (e.g. new stormwater NPDES Permit) that may affect TMDL calculations will be carefully considered by the Department and if necessary, revisions will be made to the TMDL. The Department will provide an opportunity for public participation prior to any modification of the TMDL and any modifications will be subject to the review and approval of the U.S. EPA as required by Federal law.

Biological monitoring of Limekiln Brook performed by the DEP in accordance with the monitoring plan and any monitoring performed by other parties in accordance with an approved quality controlled plan will be evaluated as this data becomes available. In the event that monitoring of Limekiln Brook indicates that aquatic life uses are not fully supported following implementation of the TMDL, the Department will review all readily available data and assess the need to modify the TMDL. The Department may propose other modifications to the TMDL analysis if the review indicates such a modification is warranted and consistent with the anti-degradation provisions in Connecticut Water Quality Standards. Limekiln Brook will continue to be listed in *Connecticut Waterbodies Not Meeting Water Quality Standards* [1] until monitoring data confirms that aquatic life uses are fully supported.

PUBLIC PARTICIPATION

This TMDL analysis has been modified from earlier draft versions to reflect comments received from reviewers. A Public Notice soliciting comments from the public on the TMDL was published in the *Danbury News-Times* on January 25, 2002 [12]. Public comments on the TMDL were reviewed and modifications to the TMDL made as a result of this process. Documentation of public participation and DEP's response to comments received on the TMDL is included in the transmittal letter submitting the TMDL to EPA for review and approval.

REFERENCES

[1] CTDEP 1998. *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. 32 pp.

[2] Nosal, T. 1977. *Gazetteer of drainage areas of Connecticut*. State of Connecticut, Department of Environmental Protection Water Resources Bulletin Number 45, 79 Elm Street, Hartford, CT 06106-5127.

[3] USEPA. 1999. *Rapid bioassesment protocols for use in wadable streams and rivers*, *2nd edition*. EPA 841-B-99-002. Office of Water, Washington, DC, 20460.

[4] CTDEP 1997. *Water quality standards*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127. 39 pp.

[5] USEPA 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia EPA 822-R-99-014.* US Environmental Protection Agency. Office of Water. Office of Research and Development, Mid-Continent Ecology Division, Duluth, MN.

[6] CTDEP 2001. TMDL Support Document. Determination of Applicable Ammonia Criteria for the Limekiln Brook TMDL. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

[7] CTDEP 1990. *Derivation of a site-specific dissolved copper criteria for selected freshwaters in Connecticut*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

[8] 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.

[9] James Fitting, personal communication. State of Connecticut, Department of Environmental Protection, Bureau Water Management, Permitting, Enforcement, and Remediation Division. 79 Elm Street, Hartford, CT 06106-5127.

[10] CTDEP. 2001. *Limekiln Brook TMDL support document: Estimating Load Allocations for the Limekiln Brook TMDL*. State of Connecticut, Department of Environmental Protection, Bureau of Water Management, 79 Elm Street, Hartford, CT 06106-5127.

[11] CTDEP. 1999. *Final Draft 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.

[12] Public Notice. January 25, 2002. In Legal Classified Section of *Danbury News-Times*.