# A Total Maximum Daily Load Analysis for Factory Brook, Salisbury, Connecticut

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

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# INTRODUCTION

Section 303(d) of the Federal Clean Water Act (CWA) requires states to develop Total Maximum Daily Loads (TMDLs) for waters where required point and nonpoint source pollution controls are not stringent enough to attain or maintain compliance with State Water Quality Standards (WQS). A TMDL defines the greatest amount of pollutant loading that a waterbody can receive without exceeding the water quality criteria which have been adopted for that pollutant into the WQS. Federal regulations require that TMDLs identify the portion of the total loading which is allocated to point source discharges (termed the Wasteload Allocation or WLA) and the portion attributed to nonpoint sources which contribute that pollutant to the waterbody (termed the Load Allocation or LA). In addition, TMDLs must include a Margin of Safety (MOS) to account for any lack of knowledge concerning the relationship between point and nonpoint pollutant allocations as well as any seasonal variability in the relationship between pollutant loadings and WQS attainment.

TMDLs are adopted by the state in accordance with established public participation practices. Once adopted by the state, TMDLs must be submitted to the Regional Office of the Federal Environmental Protection Agency (EPA) for approval. Adopted TMDLs provide the basis for implementation of the control actions specified in the TMDL. These control actions are intended to achieve the reductions in pollutant loadings necessary to achieve WQS in the waterbody for which the TMDL was developed. TMDLs also frequently include implementation schedules and a description of ongoing monitoring activities designed to confirm that the TMDL has been effectively implemented and that WQS have been achieved as a result.

#### **FACTORY BROOK**

Factory Brook was identified on Connecticut's 1996 List of Waterbodies Not Meeting Water Quality Standards<sup>(1)</sup> for which TMDLs are required under Section 303(d) CWA. This assessment was based on desktop dilution calculations indicating that water quality-based discharge permit limits would be required for the Salisbury sewage treatment plant discharge in order to meet WQS in Factory Brook. The desktop analysis identified the heavy metals copper, lead, and zinc as potential candidates for TMDL development as well as ammonia and chlorine, toxic pollutants for which criteria have been adopted into WQS. Lacking additional monitoring data, Factory Brook was retained on Connecticut's 1998 Impaired Waters List<sup>(2)</sup> and identified as a high priority for development of a TMDL prior to April, 2000.

The entire Factory Brook watershed is located within the boundary of the Town of Salisbury in northwestern Connecticut (Fig 1). The brook drains a watershed of 9.4 square miles from its headwaters at Lake Wononskopomuc to its confluence with Salmon Brook, a distance of approximately 2 miles. Nonpoint sources of pollutants potentially affecting Factory Brook are directly related to land use activities. Land use within the watershed is predominately forest with low to medium density development primarily limited to a narrow corridor stretching between Salisbury and Lakeville (Fig 2). Two major tributaries, Burton Brook and Pettee Brook, drain

predominantly undeveloped areas and contribute significantly to the flow in Factory Brook. Due to the relatively undeveloped character of the watershed, nonpoint sources are not a significant contributor to total pollutant loadings to Factory Brook. Factory Brook is a low gradient stream downstream of the sewage treatment plant discharge with numerous swampy areas and a sandy substrate through much of its length. The riparian zone is relatively open yet does not exhibit visible evidence of disturbance. The brook has been designated a Class A waterbody from the headwaters to the outfall from the Salisbury sewage treatment plant immediately downstream of Burton Brook. Below this point the brook is designated Class B, reflecting the presence of the point source discharge.

The Department of Environmental Protection (DEP) Fisheries Division performed a fisheries survey of Factory Brook in 1997<sup>(3)</sup>. This survey identified the presence of eight fish species including brown trout, creek chub, black and long nose dace. White sucker was the most abundant species collected during the survey. A macroinvertebrate survey was also performed by DEP's Water Management Bureau in the spring of 1997<sup>(4)</sup>. Due to the nature of the substrate and low gradient of the brook, only a qualitative analysis could be performed. Thirty-one macroinvertebrate taxa were collected and identified. The qualitative sampling identified 13 EPT taxa and over one third (39%) of taxa collected were pollution intolerant species. Chronic toxicity testing of the discharge from the Salisbury sewage treatment facility was also performed<sup>(5)</sup>. Two toxicity testing protocols were employed. A sample of the discharge was collected and mixed with water collected from the Brook upstream of the discharge in the proportion anticipated to occur in the brook downstream of the discharge during summer low flow conditions. Survival and reproduction of Ceriodaphnia dubia (an invertebrate species) and survival and growth of Pimephales promelas (Fathead minnow) were monitored in this mixed sample in comparison to organisms similarly exposed to samples of the upstream water. No differences were observed in survival of either species but reproduction of Ceriodaphnia was significantly reduced in the mixed sample. Based on all the available monitoring information, Factory Brook was assessed as "partially supporting aquatic life uses" downstream of the sewage treatment plant discharge consistent with the "weight-of-evidence" approach to assessing use attainment recommended in EPA guidance issued under Section 305(b) CWA<sup>(6)</sup>.

# SALISBURY SEWAGE TREATMENT PLANT

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The Salisbury sewage treatment plant is the only permitted point source discharge in the Factory Brook watershed. The plant is designed to treat 670,000 gpd. Actual flows averaged 490,000 gpd and 430,000 gpd for 1997 and 1998 respectively. The facility has been characterized by DEP Water Bureau Technical Assistance staff as a well run and maintained facility. Treatment is by means of an activated sludge process which can be run in either contact stabilization or extended aeration mode. New, high efficiency mixers were installed within the last three years and the plant has demonstrated a potential to nitrify using existing equipment under most effluent loading conditions. Sludge is not dewatered on site but is trucked off site for dewatering and disposal. On site drying beds are no longer in service. The facility also does not accept septage,

eliminating the potential for increased pollutant loadings from that source. Following secondary treatment, effluent is discharged to underdrained sand filters. Sand filtration provides for additional ammonia removal and results in a final effluent which exhibits a very low solids content, facilitating a planned upgrade to UV disinfection.

# APPLICABLE WATER QUALITY STANDARDS

Connecticut WQS establish the magnitude, frequency, and duration of exposure to toxic pollutants which must not be exceeded in order to protect aquatic organisms from toxic impacts<sup>(7)</sup>. Separate criteria have been adopted to protect against acute effects (one hour exposure) and chronic effects (exposure averaged over four days). Both acute and chronic exposures must not be exceedeed more frequently than once in three years. Since the toxicity of ammonia increases as water temperatures rise, the DEP typically evaluates consistency with ammonia criteria during the summer months based on the criteria applicable at a temperature of 25 degrees C. Ammonia criteria for other seasons are somewhat higher. Criteria for ammonia also differ from those adopted for other toxic contaminants in that no specific frequency or duration of exposure to criteria concentrations are specified in the WQS. Criteria for metals, chlorine, and ammonia applicable to this TMDL are summarized in Table 1.

The WQS specify that criteria do not apply during extreme drought conditions, defined as streamflows below the seven-day, ten-year low flow (7Q10). Although the return frequency (10 years) associated with the 7Q10 exceeds the allowable return frequency of three years specified in the WQS, streamflows of one day duration which are equivalent to the 7Q10 flow rate typically occur several times each year. Since the 7Q10 represents a minimum low flow to which criteria apply, calculation of the TMDL to protect aquatic life in Factory Brook from acute toxicity was performed by developing maximum mass loadings for each pollutant parameter under conditions which would occur during periods of naturally occurring 7Q10 streamflow. Streamflows of four day duration which are equivalent in rate to the 7Q10 also occur more frequently than once every ten years, perhaps as frequently as once every three years. For this reason, TMDL loading estimates based on achieving consistency with chronic criteria were performed under conditions which would occur concurrent with 7Q10 streamflows. TMDL calculations to establish maximum loadings for ammonia were performed using estimated monthly 7Q10 values and projected water temperatures to account for seasonal differences in flow and temperature.

Water quality criteria also apply at flows exceeding the 7Q10. Loading capacity calculations were therefore performed for all pollutant parameters at the estimated average annual streamflow to insure that pollutant concentrations remain below criteria values at flows above the 7Q10.

Table 1. Connecticut Water Quality Criteria (1997)				
Pollutant	Acute Criteria	Chronic Criteria		
Dissolved Copper	25.7 ug/l	18.1 ug/l		
Dissolved Lead	30.0 ug/i	1.2 ug/1		
Dissolved Zinc	63.6 ug/l	58.2 ug/l		
Chlorine	19.0 ug/l	11.0 ug/1		
Ammonia	13.2 mg/l (summer) 23.1 mg/l (winter)	1.43 mg/l (summer) 2.47 mg/l (winter)		

# TMDL CALCULATIONS

Loading capacity calculations were performed for each pollutant using a steady-state model assuming all pollutants behave conservatively following discharge to the waterbody. The output of this model is presented in Attachments 1-5. Loading capacity at base low flow were uniformly lower than loading capacity at higher streamflows. The TMDL for Factory Brook was therefor established using model results for low streamflow periods. A summary of the final TMDL is provided in Table 2. Individual components of the analysis are described below:

#### Hydrology

The seven-day, ten year low flow (7Q10) and average annual flow (AAF) was estimated at five locations on Factory Brook based on the area of stratified drift and glacial till deposits up gradient in the watershed using the methods of Cervione et.al.<sup>(8)</sup>. No permitted withdrawals, diversions, or flow augmentation is know to exist in the basin which would require adjustment of these flow estimates. Base low flow (BLF) below the discharge from the Salisbury sewage treatment facility was estimated by adding the design flow of the treatment plant (.67 MGD) to the naturally occurring 7Q10 streamflow. Base Average Annual Flow (BAAF) was derived by adding the design flow of the treatment plant (.67 MGD) to the naturally occurring 7Q10 streamflow. Base Average Annual Flow (BAAF) was derived by adding the design flow of the treatment plant to the calculated AAF. Seasonally adjusted 7Q10 flow rates in Factory Brook for use in development of the ammonia TMDL were derived by scaling the annual 7Q10 streamflow calculated for the Brook in proportion to monthly 7Q10 values for similar small drainage area watersheds in northwestern Connecticut where flow is regularly gauged <sup>(9)</sup>.

# Total Maximum Daily Load (TMDL)

The maximum loading capacity was calculated by multiplying the base flow by the adopted water quality criteria. Separate loading capacity calculations were made for achieving consistency with acute and chronic criteria under BLF and BAAF streamflows.

#### Load Allocation (LA)

The allocation of loading to non-point sources (including natural background) was calculated by multiplying the "background" concentration of each pollutant parameter by the natural streamflow occurring under the conditions applicable to the loading calculation being performed (7Q10 or AAF). Background pollutant concentrations were estimated as follows:

Copper: Background copper concentrations were assumed equal to 4.8 ug/l. Previous studies conducted by DEP established 4.8 ug/l as the upper 95th percentile of median dissolved copper concentrations for waterbodies demonstrating high levels of biological integrity <sup>(10)</sup>. Insufficient data is available to suggest that background levels vary predictably in response to streamflow rates in Factory Brook, therefore this value (4.8 ug/l) was utilized for loading capacity calculations under all flow conditions. This estimate of background concentration reflects both nonpoint sources and natural background contributions.

Lead: Background lead concentrations in Connecticut waters at sites monitored by the U.S. Geological Survey in cooperation with the DEP are routinely below the reporting level of  $1.0 \text{ ug/l}^{(9)}$ . Background concentrations of lead were assumed to be one half this value (0.5 ug/l) under all flow conditions.

Zinc: Background dissolved zinc concentrations were assumed equal to 12.3 ug/l. This value is equivalent to be the upper 95th percentile of median dissolved zinc concentrations in streams with a high degree of biological integrity based on prior DEP studies <sup>(11)</sup>. Since data is unavailable to correlate ambient zinc concentrations with streamflow rates in Factory Brook, the median background estimate of 12.3 ug/l was used for loading capacity calculations under both 7Q10 and AAF conditions.

Chlorine: In the absence of a point source discharge or chemical spill, chlorine is not present in Connecticut surface waters. The load allocation to natural background and non-point sources was therefore set at "zero".

Ammonia: Ammonia is typically present at concentrations below 0.1 mg/l in streams unaffected by point source discharges with the possible exception of streams draining wetlands where anaerobic sediments are found near the sediment/water interface<sup>(9)</sup>. The background concentration of ammonia in Factory Brook was set at a nominal 0.1 mg/l under all flow conditions and temperatures.

#### Wasteload Allocation (WLA)

The WLA to the Salisbury sewage treatment plant was calculated by subtracting the LA from the maximum loading capacity available at the point of discharge. No other point sources currently exist or are anticipated in the watershed. Therefor 100% of the WLA was assigned to the

Salisbury facility with no allocation reserved for future point sources. The WLA available to the Salisbury plant was uniformly lower under BLF conditions than at BAAF. This more restrictive WLA was designated as the WLA for the facility under all streamflow conditions.

#### Margin of Safety (MOS)

The MOS was derived by subtracting the sum of the LA and WLA from the TMDL. Under the more restrictive design BLF condition, the MOS is zero at the point of discharge by the Salisbury sewage treatment plant for all pollutants. The MOS increases gradually downstream of the discharge outfall as additional assimilative capacity is provided by the increase in BLF as the drainage area grows. Under BAAF conditions a significant MOS is available at all locations reflecting the lower WLA assigned to the Salisbury facility necessary to achieve consistency with the WQS at BLF.

In addition to the MOS explicitly identified in this TMDL analysis, a substantial implicit MOS is incorporated into the loading capacity calculations. A significant factor in the analysis which contributes to the implied MOS is the use of a steady-state model to establish acceptable maximum loadings. The use of assumptions regarding natural background contaminant levels for copper and zinc which represent the highest (as opposed to average) median levels typically observed in clean reference streams also contributes to the implicit MOS. Use of the design flow from the Salisbury sewage treatment plant to calculate BLF for performing TMDL calculations overestimates the hydraulic contribution from this source since treatment plant discharge flows are typically below design flows during extended dry periods. The steady-state model calculates the TMDL/WLA under critical conditions, which are combinations of worst-case assumptions regarding flow, effluent quality, and potential to cause environmental effects. Each condition, by itself, has a low probability of occurrence, the combination of conditions may rarely, if ever occur

For metals, the assumption that all metal present exists in the dissolved form provides an additional implicit MOS since some proportion of the total metal concentration in-stream will be adsorbed to particulate material and less toxic to aquatic organisms. Finally, attenuation of pollutants in Factory Brook was assumed to occur only through dilution. Natural processes which serve to attenuate the toxicity of pollutants, such as oxidation of ammonia to nitrate or uptake by aquatic vegetation, following discharge to the brook were not accounted for in the model resulting in an overestimation of downstream concentrations.

#### SEASONAL ANALYSIS

No seasonal analysis was performed for copper, lead, zinc, or chlorine since criteria do not vary seasonally for these pollutants. TMDLs for these pollutant parameters are based on annual critical low flow (BLF) and are protective of all seasonal conditions. Seasonal loading capacity steady-state model analysis results for ammonia are presented in Attachment 5. This analysis was performed similar to those for other pollutant parameters except that BLF conditions (7Q10 plus design treatment plant flow) calculated on a monthly basis were used to develop seasonal allocations. Water quality criteria for ammonia were also varied seasonally to reflect seasonal temperature variation in Factory Brook. Loading capacity calculations for ammonia under BAAF conditions are not presented since the WLA to the treatment plant under BFL conditions is more restrictive in both summer and winter.

Table 2. Summar	ry of Acute and Chro	onic TMDL Facto	ry Brook at Moi	uth *	
POLLUTANT	CONDITION	TMDL	WLA	LA	MOS
Copper	acute	94.33	75.08	5.36	13.89
	chronic	66.43	52.20	5.36	8.87
Lead	acute	110.11	90.05	0.56	19.50
	chronic	4.77	3.67	0.56	0.54
Zinc	acute	233.43	185.69	13.74	34.00
	chronic	213.60	170.00	13.74	29.86
Chlorine	acute	69.74	57.18	0.00	12.56
	chronic	40.37	33.11	0.00	7.26
Ammonia	acute	48.45	39.68	0.11	8.66
(Summer)	chronic	5.25	4.250	0.11	0.89
Ammonia	acute	159.96	100.43	0.44	59.09
(Winter)	chronic	17.10	10.58	0.44	6.08

#### SUMMARY OF TMDL

# **CONTROL ACTIONS**

Achieving the TMDL for Factory Brook requires issuance of an NPDES permit<sup>(13)</sup> to the Salisbury sewage treatment plant which includes limitations derived from the WLA established in the TMDL. The permit for the Salisbury facility expired November 12, 1990 and the Town submitted an application to the DEP for reissuance of the permit August 7, 1990. No additional control actions are necessary at this time to implement the TMDL.

# IMPLEMENTATION SCHEDULE

The TMDL will be implemented consistent with the schedule incorporated into the NPDES permit issued to the Salisbury sewage treatment plant. Under the terms of the NPDES permitting regulations <sup>(14)</sup>, this schedule can not exceed the term of the permit (five years from the date of reissuance). Reissuance of the NPDES permit is anticipated during 1999.

# MONITORING PLAN

Monitoring of the Salisbury sewage treatment plant discharge will be performed by the Town of Salisbury in accordance with the monitoring provisions established in the NPDES permit. Monitoring by the DEP to determine attainment of WQS in Factory Brook will be performed consistent with the Rotating Basin Ambient Monitoring Plan<sup>(15)</sup> with a detailed assessment scheduled no later that 2002. The Bureau of Water Management will also continue to provide assessment updates on Factory Brook consistent with the State's obligations under Section 305(b) and 303(d) CWA. In addition, the Water Management Bureau is currently negotiating with the DEP Fisheries Division to perform additional fisheries assessment work on Factory Brook and similar resources during Fiscal Year 2000.

### 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 modification to the TMDL shall made following an opportunity for public participation and be subject to the review and approval of the U.S. EPA. New information which will be generated during TMDL implementation includes effluent monitoring data collected by the Town of Salisbury WPCF as required under the terms of the NPDES permit and also physical, chemical and biological monitoring data for Factory Brook collected by DEP. 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.

As proposed, the permit requires that the frequency of effluent monitoring for heavy metals be increased from quarterly to weekly and that all analysis be performed using sensitive analytical techniques in accordance with provisions appearing in Section 6(A) of the permit <sup>(16)</sup>. The permit continues to require the WPCF perform quarterly acute whole effluent toxicity testing of the discharge effluent and adds a requirement to perform an annual chronic toxicity monitoring test utilizing water from Factory Brook collected upstream of the WPCF outfall for diluent. This will provide new information regarding instream conditions and assist in the evaluation of sub-lethal toxicity which may be present in the discharge.

Biological monitoring of Factory Brook performed by the DEP in accordance with the monitoring plan incorporated into the TMDL and any monitoring performed by other parties in accordance with an approved QA/QC plan will be evaluated as this data becomes available. In the event that monitoring of Factory Brook indicates that aquatic life uses are not fully supported following implementation of the control actions specified in the TMDL, the Department will review all readily available data and assess the need to modify the TMDL. This review shall include a review of the effectiveness of the NPDES permit in implementing the TMDL. The Department will revise the NPDES permit to include limits on the concentration of pollutants in the discharge in lieu of or in addition to the mass limits in the current proposed permit if the review indicates such modifications are necessary to insure that the TMDL will be effectively implemented. The Department may propose other modifications to the permit or TMDL analysis if the review indicates such a modification is warranted and consistent with the anti-degredation provisions in Connecticut Water Quality Standards. Factory Brook shall continue to be listed in *Connecticut Waterbodies Not Meeting Water Quality Standards* until such time as monitoring data confirms that aquatic life uses are fully supported.

### **PUBLIC PARTICIPATION PROCESS**

This TMDL was jointly noticed with the NPDES permit proposed for issuance to the Town of Salisbury for the Salisbury sewage treatment plant. Public comment on the TMDL was 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.

# FIGURES

- 1. Factory Brook Hydrology / Site Map
- 2. Factory Brook Watershed Land Use

# ATTACHMENTS

- 1. Copper TMDL Model Calculations
- 2. Lead TMDL Model Calculations
- 3. Zinc TMDL Model Calculations
- 4. Chlorine TMDL Model Calculations
- 5. Ammonia TMDL Model Calculations

# DOCUMENTATION

- Connecticut Waterbodies not Meeting Connecticut Water Quality Standards in 1996., DEP, Water Management Bureau, November 1996.
- (2) Connecticut Waterbodies Not Meeting Water Quality Standards 1998., DEP Water Management Bureau, April 1998.
- (3) DEP Fisheries Division, Fisheries Survey file data., 1997.
- (4) DEP Bureau of Water Management, Ambient Monitoring Program file data., 1997.
- (5) DEP Bureau of Water Management, Water Toxics Laboratory ambient toxicity monitoring program file data., 1997.
- (6) DEP Bureau of Water Management, 305(b) assessment electronic update for Connecticut. 1998.
- (7) DEP, Connecticut Water Quality Standards., adopted 1997.
- (8) Cervione, M.A., R. Melvin, and K. Cyr., A Method of Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut. Connecticut Water Resources Bull. No.34. 1982.
- U.S. Geological Survey., Water Resources Data for Connecticut, annual published reports 1980-1997.
- (10) DEP Water Management Bureau., Numerical Water Quality Criteria for Dissolved Copper. March 1990.
- (11) DEP Water management Bureau., Numerical Water Quality Criteria for Dissolved Zinc. March 1990.
- (12) USEPA, 1991., Technical Support Document for Water Quality-based Toxics Control. Office of Water. EPA/505/2-90-001.
- (13) NPDES permit NO. CT0100498, expired November 12, 1990.
- (14) Section 22a-430-3 and 22a-430-4 Regulations of Connecticut State Agencies.
- (15) DEP Water Management Bureau., 1998 305(b) Water Quality Report to Congress (in prep.)
- (16) Municipal NPDES Permit issued to Town of Salisbury WPCF, CT0100498. Draft Noticed for Public Comment, August 9, 1999.



# LAND USE/LAND COVER STATISTICS BY SUBREGIONAL BASIN 05/26/1999 DEP - NRC/GIS

6005

10,044.83 acres 15.70 sq miles 100.00 % has LULC data

	LAND USE/LAND COVER	ACREAGE	SQ MILE	PERCENT
1	SURFACE - IMPERV	0.89	0.00	0.01
2	RES/COM -H DEN	12.99	0.02	0.13
3	RES -MED DEN	306.28	0.48	3.05
4	SURFACE -ROOF	0.22	0.00	0.00
6	TURF/GRASS	248.10	0.39	2.47
7	SOIL/GRASS/HAY	683.16	1.07	6.80
8	GRASS/HAY/PAST	475.82	0.74	4.74
9	SOIL/CORN	11.70	0.02	0.12
10	GRASS/CORN	3.94	0.01	0.04
13	FOREST -DECID	6,265.10	9.79	62.37
14	FOREST -CONIF	524.04	0.82	5.22
15	WATER -DEEP	631.19	0.99	6.28
16	WATER -SHALLOW	210.71	0.33	2.10
17	WETLAND -NONFOR	2.00	0.00	0.02
18	WETLAND -FOREST	400.03	0.63	3.98
19	LAND -BARREN	23.09	0.04	0.23
20	SOIL -BARE	56.83	0.09	0.57
25	ROAD -MAJOR	188.72	0.29	1.88



Pasta - David Mudalamy	1				(	
Eactory Brook Hydrology Location Factory Brook above Burton Brk Burton Brook at Mouth	DA(sqml) 3.13 3.67	Till(sqmi) 3.05 3.56	SDA(sqmi) 0.08 0.11	7Q10(cfs) 0.06 0.11	AAF(cfs) 5.49 6.41	
Factory Brook below Burton Brk	6.80	6.61	0.19	0.19	11.90	
Factory Brook above Pette Brk	7,44	7.06	0.38	0.33	12.71	
Factory Brook at Lime Rock Rd	9.28	8.79	0,49	0.42	15.82	
Factory Brook at Mouth	9.37	8.62	0.55	0.46	15.88	
Factory Brook / Loading Calculations	]		Aceto		Chronic	
Location at BLF	BLF(cfs)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)	
Factory Brook above Burton Brk	0.08	4.8	0.99	4.8	0.99	
Factory Brook below Burton Brk	0.19	4.8	2,27	4.0 18.1	2.27 54.47	
Factory Brook above Pette Brk	1.37	25.7	86.15	18.1	60.67	
Factory Brook at Lime Rock Rd	1.46	25.7	91.81	18.1	64.66 66.42	
Factory Brook at Mouth	1.50	25.7	94.33	10,1	00.43	
Location at BAAF	BAAF(cfs)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)	
Factory Brook above Burton Brk	5.49	4.8	139.74	4.8	139.74	
POTW at design flow (.67 MGD)	12.94	25.7	813.72	18.1	573.09	
Factory Brook above Pette Brk	13.75	25.7	864.65	18.1	608.96	
Factory Brook at Lime Rock Rd	16.86	25.7	1060.22	18.1	746.69	
Factory Brook at Mouth	16.92	25.7	1064.00	10.1	749.33	
Factory Brook / LA (Background + Non-point Source)	)				•	
Location at 7Q10	WQC(ug/l)	7Q10(cfs)	LA(g/d)			
Factory Brook above Burton Brk	4.8	0.08	0.99			
Factory Brook below Burton Brk	4.8	0.19	2.27			
Factory Brook above Pene Brk Factory Brook at Lime Book Bri	4.0 4.8	0.33	4.89			
Factory Brook at Mouth	4.8	0.46	5.36			
Location at AAF	WQC(ug/l)	AAF(cfs)	LA(g/d)			
Factory Brook above Burton Brk	4.8	5.49	64.48			
Factory Brook below Burton Brk	4.8	11.90	139.74			
Factory Brook above Pette Brk Factory Brook at Lime Bock Bri	4.0	15.82	185.83			
Factory Brook at Mouth	4.8	15.88	186.46			
Fectory Brook / WLA to Point Source at Design Flow	7					
	Condillon				MOS(a/d)	
WLA ODJECTIVE Protection Aquatic Life / Acute Effects	BIF	77.35	2.27	75.08	0.00	
Protection Aquatic Life / Acute Effects	BAAF	813.72	139.74	673.98	0.00	
Protection Aquatic Life / Chronic Effects	BLF	54.47	2,27	52.20	0.00	
Protection Aquatic Life / Chronic Effects	BAAF	573.09	139.74	433.35	0.00	
Factory Brook / Acute TLC Summary	]					
Location	BLF(cfs)	TLC(a/d)	WLA(g/d)	LA(g/d)	MOS(g/d)	
Factory Brook above Burton Brk	0.08	0.99	0.00	0.99	0.00	
Factory Brook below Burton Brk	0.19	2.27	0.00	2.27	0.00	
POTW at design flow (.67 MGD)	1.23	77,35 86.16	75.08	2.27	0.00	
Factory prook above Pene Brk Factory Brook at Lime Bock Rd	1.46	91.81	75.08	4.89	11.84	
Factory Brook at Mouth	1.50	94.33	75.08	5.36	13.89	
Location	BAAF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)	
Factory Brook above Burton Brk	5.49	64.48	0.00	04.48 120 74	0.00	
Factory Brook below Burton Brk	11.90	139.74	75.08	139.74	598.90	
For wat design now (.d/ MGD) Factory Brook above Pétte Brk	13.75	864.65	75.08	149.25	640.32	
Factory Brook at Lime Rock Rd	16.86	1060.22	75.08	185.83	799.31	
Factory Brook at Mouth	16.92	1064.00	75.08	186.46	802.46	
Factory Brook / Chronic TLC Summary	]	Cheople	Chronic	Chronic	Chronic	
Location	BLF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)	
Factory Brook above Burton Brk	0.08	0.99	0.00	0.99	0.00	
Factory Brook below Burton Brk	0.19	2.27	0.00	2.27	0.00	
POTW at design flow (.67 MGD)	1.23	54.47	52.2	2.27	0.00	
Factory Brook at Lime Book Bd	1.37	00.07 64.66	52.2	3.02 4.89	7.57	
Factory Brook at Mouth	1.50	66.43	52.2	5.36	8.87	
Location	BAAF(cfs)	TLC(g/d)	WLA(g/d)	L <b>A(g/</b> d)	MOS(g/d)	ļ
Factory Brook above Burton Brk	5.49	64.48	0.00	64.48	0.00	
Factory Brook below Burton Brk	11.90	139.74	0.00	139.74	0.00	
POTW at design flow (.67 MGD)	12.94	573.09 808 04	52.2	139.74	301.15	
Factory Brook above Pene Dik Factory Brook at Lime Rock Rd	16.86	746.69	52.2	185.83	509.03	
Factory Brook at Mouth	16.92	749.35	52.2	186.46	510.69	
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	DA	Watershed Drainage Area	Measured	sa mi
	TIII	Watershed Glacial Till Area	Measured	an.pe
	SDA	Watershed Stratified Drift Area	Measured	sq.mi
	7Q10	7-day 10-year Low Streamflow	7010 = 67(SDA) + 01(Till)	sq.mi
	AAF	Average Annual Streamflow	$\Delta AE = 1 P(DA)$	Cfs
	BIF	Base I ow Flow	P[E = 7010 + Point Plantaura Planta	cfs
	BAAF	Base Average Flow	BLC = 7010 + Point Discharge Flow)	cfs
	TEC	Total Loading Consolity	DAAF = AAF + Point Discharge Flow)	cfs
			ILC = (WQC)(BLF or BAAF)	g/day
		Load Allocation	LA = (Background Pollutant Concentration)(7Q10 or AAF)	g/dav
	WLA	wasteload Allocation	WLA = (TLC - LA)	α/day
	MOS	Margin of Safety	MOS = (TLC - WLA - LA)	n/dav
	WQC	Copper Water Quality Criteria	WQC = 4.8 (95th percentile median for unimpacted waters	gruay ua/l
			WQC = 25.7 (acute criteria site-specific waters)	ug/i
			WQC = 18.1 (chronic criteria site-specific waters)	ug/i
	BĠ		a a she torr (onronic chiena she specific waters)	ug/i







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Factory Brook Hydrology	.•					<u>/</u> ;
Location Factory Brook above Burton Brk Burton Brook at Mouth Factory Brook above Pette Brk Pette Brook at Mouth Factory Brook at Ume Rock Rd Factory Brook at Mouth	DA(sqmi) 3.13 3.07 6.80 7.44 1.83 9.28 9.37	Till(sqml) 3.05 3.56 6.61 7.06 1.73 8.79 8.82	SDA(sqml) 0.08 0.11 0.19 0.38 0.10 0.49 0.55	7Q10(cfs) 0.08 0.11 0.19 0.33 0.08 0.42 0.46	AAF(cfs) 5.49 6.41 11.90 12.71 3.11 15.82 15.88	
Factory Brook / TLC Location at BLF Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Lime Rock Rd	BLF(cfs) 0.08 0.19 1.23 1.37 1.46 1.50	WQC(ug/l) 30 30 30 30 30 30 30	Acute TLC(g/d) 5.87 13.95 90.29 100.57 107.17 110.11	WQC(ug/l) 1.3 1.3 1.3 1.3 1.3 1.3 1.3	Chronic TLC(g/d) 0.25 0.60 3.91 4.36 4.64 4.77	
Location at BAAF Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Mouth	BAAF(cfs) 5.49 11.90 12.94 13.75 16.86 16.92	WQC(ug/l) 30 30 30 30 30 30 30	TLC(g/d) 403.00 873.52 949.87 1009.33 1237.62 1242.02	WQC(ug/l) 1.3 1.3 1.3 1.3 1.3 1.3	TLC(g/d) 17.46 37.85 41.16 43.74 53.63 53.82	
Factory Brook / LA (Background + Non-point Source) Location at 7Q10 Factory Brook above Burton Brk Factory Brook below Burton Brk Factory Brook above Pette Brk Factory Brook at Ume Rock Rd Factory Brook at Mouth	WQC(ug/l) 0.5 0.5 0.5 0.5 0.5 0.5	7Q10(cfs) 0.08 0.19 0.33 0.42 0.46	LA(g/d) 0.10 0.24 0.40 0.51 0.56			
Location at AAF Factory Brook above Burton Brk Factory Brook below Burton Brk Factory Brook above Petie Brk Factory Brook at Line Rock Rd Factory Brook at Mouth	WQC(ug/l) 0.5 0.5 0.5 0.5 0.5	AAF(cfs) 5.49 11.90 12.71 15.82 15.88	LA(g/d) 6.72 14.56 15.55 19.35 19.43			
Factory Brook / WLA to Point Source at Design Flow WLA Objective Protection Aquatic Life / Acute Effects Protection Aquatic Life / Acute Effects Protection Aquatic Life / Chronic Effects Protection Aquatic Life / Chronic Effects	Condition BLF BAAF BLF BAAF BAAF	TLC(g/d) 90.29 949.87 3.91 41.16	LA(g/d) 0.24 14.56 0.24 14.55	WLA(g/d) 90.05 935.31 3.67 26.60	MOS(g/d) 0.00 0.00 0.00 0.00	
Factory Brook / Acute TLC Summary	]					
Location Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Moulh	BLF(cfs) 0.08 0.19 1.23 1.37 1.46 1.50	TLC(g/d) 5.87 13.95 90.29 100.57 107.17 110.11	WLA(g/d) 0.00 90.05 90.05 90.05 90.05 90.05	LA(g/d) 0.1 0.24 0.24 0.4 0.51 0.56	MOS(g/d) 5.77 13.71 0.00 10.12 16.61 19.5	
Location Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Mouth	BAAF(cfs) 5.49 11.90 12.94 13.75 16.86 16.92	) TLC(g/d) 403.00 873.52 949.87 1009.33 1237.62 1242.02	WLA(g/d) 0.00 90.05 90.05 90.05 90.05 90.05	LA(g/d) 6.72 14.56 14.56 15.55 19.35 19.43	MOS(g/d) 396.28 858.96 845.26 903.73 1128.22 1132.54	
Factory Brook / Chronic TLC Summary Location Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Mouth	BLF(cfs) 0.08 0.19 1.23 1.37 1.46 1.50	Chronic TLC(g/d) 0.25 0.60 3.91 4.36 4.64 4.77	Chronic ) WLA(g/d) 0.00 0.00 3.67 3.67 3.67 3.67 3.67	Chronic ) LA(g/d) 0.24 0.24 0.40 0.51 0.56	Chronic MOS(g/d) 0.15 0.36 0.00 0.29 0.46 0.54	
Location Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rook Rd Factory Brook at Mouth	BAAF(cfs 5.49 11.90 12.94 13.75 16.86 16.92	) TLC(g/d 17.46 37.85 41.16 43.74 53.63 53.82	) WLA(g/d 0.00 0.00 3.67 3.67 3.67 3.67	) LA(g/d) 6.72 14.56 14.56 15.55 19.35 19.43	MOS(g/d) 10,74 23,29 22,93 24,52 30,61 30,72	I

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DA	Watershed Drainage Area	Measured	sa.mi
Till	Watershed Glacial Till Area	Measured	sa mi
SDA	Watershed Stratified Drift Area	Measured	sa mi
7Q10	7-day, 10-year Low Streamflow	7Q10 = .67(SDA) + .01(Till)	ofe
AAF	Average Annual Streamflow	AAF = 1.8(DA)	ofo
BLF	Base Low Flow	BLF = 7Q10 + Point Discharge Flow)	CIS
BAAF	Base Average Flow	BAF = AAF + Point Discharge Flow)	015
TLC	Total Loading Capacity	TLC = (WOC)/BLE or BAAE)	- Ciş
LA	Load Allocation	LA = (Background Pollutant Concentration)(7010 or AAE)	g/day
WLA	Wasteload Allocation	$WI A^{-}$ (TI C - I A)	g/day
MOS	Margin of Safety	MOS = (TLC - W(A - 1A))	g/day
WOC	Copper Water Quality Criteria	WOO = (100 - WUA - LA)	g/day
11020	Copper Water Quality Criteria	WOC = 0.5 estimate median for unimpacted waters	∵ ug/i
		WQC = 30.0 (acute criteria )	ug/l
, Éo		WQC = 1.3 (chronic criteria)	ug/l
é é c		WQC = 1.3 (chronic criteria)	ug/i







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Factory Brook Hydrology	<u>.</u>				
Location	DA(aqmi)	Till(sqml)	SDA(sqmi)	7Q10(cfs)	AAF(cfs)
Factory Brook above Burton Brk	3.13	3.05	0.08	0.08	5.49
Burton Brook at Mouth	3.67	3,56	0.11	0.11	6.41
Factory Brook below Burton Brk	6.60	6.61	0.19	0.19	11.90
Factory Brook above Pette Brk	7.44	7.06	0.38	0.33	12.71
Pette Brook at Mouth	1.83	1.73	0.10	0.08	3.11
Factory Brook at Lime Rock Rd	9.28	8.79	0.49	0.42	15.82
Factory Brook at Mouth	9,37	8.82	0.55	0.46	15.88

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Factory Brook / TLC	· .				
<u> </u>			Acute		Chronic
Location at BLF	BLF(cfs)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)
Factory Brook above Burton Brk	0.08	12.3	2.41	12,3	2.41
Factory Brook below Burton Brk	0.19	12.3	5.72	12.3	5.72
POTW at design flow (.67 MGD)	1.23	63.6	191.41	58.2	175.72
Factory Brook above Pette Brk	1.37	63.6	213.2	58.2	195.10
Factory Brook at Lime Rock Rd	1.46	63.6	227.2	58.2	207.91
Factory Brook at Mouth	1.50	63.6	233.43	58.2	213.60
Location at BAAF	BAAF(cis)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)
Factory Brook above Burton Brk	5,49	12.3	165.23	12.3	165.23
Factory Brook below Burton Brk	11.90	12.3	358.15	12.3	358.15
POTW at design flow (.67 MGD)	12.94	63.6	2013.72	58.2	1842.74
Factory Brook above Pette Brk	13.75	63.6	2139.77	58.2	1958.09
Factory Brook at Lime Rock Rd	16.86	63.6	2623.75	58.2	2400.97
Factory Brook at Mouth	16.92	63.6	2633.08	58.2	2409.52

# Factory Brook / LA (Background + Non-point Source)

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Location at 7Q10	WQC(ug/l)	7Q10(cfs)	LA(g/d)
Factory Brook above Burton Brk	12.3	0.08	2.41
Factory Brook below Burton Brk	12.3	0.19	5.72
Factory Brook above Pette Brk	12.3	0.33	9.79
Factory Brook at Lime Rock Rd	12.3	0.42	12.53
Factory Brook at Mouth	12.3	0.46	13.74
Location at AAF	WQC(ug/l)	AAF(cfs)	LA(g/d)
Location at AAF Factory Brook above Button Brk	WQC(ug/l) 12.3	AAF(cfs) 5.49	LA(g/d) 165.23
Location at AAF Factory Brook above Burton Brk Factory Brook below Burton Brk	WQC(ug/) 12.3 12.3	AAF(cfs) 5.49 11.90	LA(g/d) 165.23 358.15
Location at AAF Factory Brook above Burton Brk Factory Brook below Burton Brk Factory Brook above Pette Brk	WQC(ug/l) 12.3 12.3 12.3	AAF(cfs) 5.49 11.90 12.71	LA(g/d) 165.23 358.15 382.52
Location at AAF Factory Brook above Burton Brk Factory Brook below Burton Brk Factory Brook above Pette Brk Factory Brook at Lime Rock Rd	WQC(ug/) 12.3 12.3 12.3 12.3 12.3	AAF(cis) 5.49 11.90 12.71 15.82	LA(g/d) 165.23 358.15 382.52 476.12
Location at AAF Factory Brook above Burton Brk Factory Brook below Burton Brk Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Mouth	WQC(ug4) 12.3 12.3 12.3 12.3 12.3 12.3	AAF(cfs) 5.49 11.90 12.71 15.82 15.88	LA(9/d) 165.23 358.15 382.52 476.12 477.93

#### Factory Brook / WLA to Point Source at Design Flow

WLA Objective Protection Aquatic Life / Acute Effects	Condition BLF	TLC(g/d) 191 41	LA(g/d)	WLA(g/d) 185.69	MOS(g/d)
Protection Aquatic Life / Acute Effects	BAAF	2013.72	358.15	1655.57	0.00
Protection Aquatic Life / Chronic Effects Protection Aquatic Life / Chronic Effects	BLF BAAF	175.72 1842.74	5.72 358.15	170.00 1484.59	0.00 0.00

# Factory Brook / Acute TLC Summary

Location Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd Factory Brook at Mouth	BLF(cfs) 0.08 0.19 1.23 1.37 1.46 1.50	TLC(g/d) 2.41 5.72 191.41 213.20 227.20 233.43	WLA(g/d) 0.00 185.69 185.69 185.69 185.69 185.69	LA(g/d) 2.41 5.72 5.72 9.79 12.53 13.74	MOS(g/d) 0.00 0.00 17.72 28.98 34.00
Localion Factory Brook above Burton Brk Factory Brook below Burton Brk	BAAF(cfs) 5.49 11.90	TLC(g/d) 165.23 358.15	WLA(g/d) 0.00 0.00	LA(g/d) 165.23 358.15	MOS(g/d) 0.00 0.00
POTW at design flow (.67 MGD) Factory Brook above Pette Brk	12.94 13.75	2013.72 2139.77	185.69 185.69	358.15 382.52	1469.88 1571.56
Factory Brook at Lime Rock Rd Factory Brook at Mouth	16.86 16.92	2623.75 2633.08	185.69 185.69	466.12 477.93	1971.94 1969.46
Factory Brook / Chronic TLC Summary	l				
	•	Chronic	Chronic	Chronic	Chronic
Location	BLF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)
Factory Brook above Burton Brk	0.08	2.41	0.00	2.41	0.00
Factory Brook below Burton Brk	0.19	5.72	0.00	5.72	0.00
POTW at design flow (.67 MGD)	1.23	175.72	170.00	5.72	0.00
Factory Brook above Pette Brk	1.37	195.10	170.00	9.79	15,31
Factory Brook at Lime Rock Rd	1.46	207.91	170.00	12.53	25.38
Factory Brook at Mouth	1.50	213.60	170.00	13.74	29.86
Location	BAAF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)
Factory Brook above Burton Brk	5.49	165.23	0.00	165.23	0.00
Factory Brook below Burton Brk	11.90	358.15	0.00	358.15	0.00
POTW at design flow (.67 MGD)	12.94	1842.74	170.00	358.15	1314.59
Factory Brook above Pette Brk	13.75	1958.74	170.00	382.52	1406.22
Factory Brook at Lime Rock Rd	16.86	2400.97	170.00	466.12	1764,85
Factory Brook at Mouth	16.92	2409.52	170.00	477.93	1761.59

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DA	Watershed Drainage Area	Measured	sa.mi
Till	Watershed Glacial Till Area	Measured	sa.mi
SDA	Watershed Stratified Drift Area	Measured	sa.mi
7Q10	7-day,10-year Low Streamflow	7Q10 = .67(SDA) + .01(Till)	cfs
AAF	Average Annual Streamflow	AAF = 1.8(DA)	cfs
BLF	Base Low Flow	BLF = 7Q10 + Point Discharge Flow)	cfs
BAAF	Base Average Flow	BAAF = AAF + Point Discharge Flow)	cfs
TLC	Total Loading Capacity	TLC = (WQC)(BLF or BAAF)	g/dav
LA	Load Allocation	LA = (Background Pollutant Concentration)(7Q10 or AAF)	d/dav
WLA	Wasteload Allocation	WLA = (TMDL - LA)	d/dav
MOS	Margin of Safety	MOS = (TMDL - WĹA - ĹĂ)	d/dav
WQC	Copper Water Quality Criteria	WQC = 12.3 (95th percentile median for unimpacted water	ua/
		WQC = 63.6 (acute criteria site-specific waters)	ua/l
,		WQC = 58.2 (chronic criteria site-specific waters)	ua/l
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DA(sqml)	Till(sqml)	SDA(sqmi)	7Q10(cfs)	AAF(cfs)
3.13	3.05	0.08	0.08	5.49
3.67 ~~	3.56	0.11	0.11	6.41
6.80	6.61	0.19	0.19	11.90
7.44	7.06	0.38	0.33	12.71
1.83	1.73	0.10	0.08	3.11
9.28	8.79	0.49	0.42	15.82
9.37	8.82	0.55	0.46	15.68
	DA(sqmi) 3.13 3.67 6.80 7.44 1.83 9.28 9.37	DA(sqml) Till(sqml)   3.13 3.05   3.67 3.56   6.80 6.61   7.44 7.06   1.83 1.73   9.28 8.79   9.37 8.82	J DA(sqmi) Till(sqmi) SDA(sqmi)   3.13 3.05 0.08   3.67 3.56 0.11   6.80 6.61 0.19   7.44 7.06 0.38   1.83 1.73 0.10   9.28 8.79 0.49   9.37 8.82 0.55	J DA(sqmi) Till(sqmi) SDA(sqmi) 7Q10(cfs)   3.13 3.05 0.08 0.08   3.67 3.56 0.11 0.11   6.80 6.61 0.19 0.19   7.44 7.06 0.38 0.33   1.83 1.73 0.10 0.08   9.28 8.79 0.49 0.42   9.37 8.82 0.55 0.46

Factory Brook / TLC					bhus sta
			Acute		Chronic
Location at BLF	BLF(cfs)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)
Factory Brook above Burton Brk	0.08	19	3,72	11	2.15
Factory Brook below Burton Brk	0.19	19	8.82	11	5.11
POTW at design flow (.67 MGD)	1.23	19	57.18	11	33.11
Factory Brook above Pette Brk	1.37	19	63.69	11	36.67
Factory Brook at Lime Bock Rd	1.46	19	67.88	11	39.3
Factory Brook at Mouth	1.50	19	69.74	11	40.37
Location at BAAF	BAAF(cfs)	WQC(ug/l)	TLC(g/d)	WQC(ug/l)	TLC(g/d)
Factory Brook above Burton Brk	5.49	19	255.23	11	147.77
Fectory Brook below Burton Brk	11.90	19	553.23	11	320.29
POTW at design flow (.67 MGD)	12.94	19	601.58	11	348.28
Factory Brook above Pette Brk	13.75	19	639.24	11	370.09
Factory Brook at Lime Bock Rd	16.86	19	783.82	11	453.79
Factory Brook at Mouth	16.92	19	786.61	11	455.41

#### Factory Brook / LA (Background + Non-point Source)

Location at 7Q10	WQC(ug/l)	7Q10(cls)	LA(g/d)
Factory Brook above Burton Brk	0.00	0.08	0.00
Factory Brook below Burton Brk	0.00	0.19	0.00
Factory Brook above Pette Brk	0.00	0.33	0.00
Factory Brook at Lime Rock Rd	0.00	0.42	0.00
Factory Brook at Mouth	0.00	0.46	0.00
Location at AAF	WQC(ug/t)	AAF(cfs)	LA(g/d)
Factory Brook above Burton Brk	0.00	5.49	0.00
Factory Brook below Burton Brk	0.00	11.90	0.00
Factory Brook above Pette Brk	0.00	12.71	0.00
Factory Brook at Lime Rock Rd	0.00	15.82	0.00
Factory Brook at Mouth	0.00	15.88	0.00

### Factory Brook / WLA to Point Source at Design Flow

WLA Objective	Condition	TLC(g/d)	LA(g/d)	WLA(g/d)	MOS(g/d)
Protection Aquatic Life / Acute Effects	BLF	57.16	0.00	57.18	0.00
Protection Aquatic Life / Acute Effects	BAAF	601.58	0.00	601.58	0.00
Protection Aquatic Life / Chronic Effects	BLF	33.11	0.00	33.11	0.00
Protection Aquatic Life / Chronic Effects	BAAF	348.28	0.00	348.28	0.00

### Factory Brook / Acute TLC Summary

Location	BLF(cfs)	TLC(a/d)	WLA(a/d)	LA(a/d)	MOS(q/d)
Factory Brook above Burton Brk	0.08	3.72	0.00	0.00	3.72
Factory Brook below Button Brk	0.19	8.82	0.00	0.00	8.82
POTW at design flow (.67 MGD)	1.23	57.18	57.18	0.00	0.00
Factory Brook above Pette Brk	1.37	63.69	57.18	0.00	6.51
Factory Brook at Lime Rock Rd	1.46	67.88	67.18	0.00	10.7
Factory Brook at Mouth	1.50	69.74	57.18	0.00	12.56
	BAAE(cfs)	TI C(o/d)	WLA(q/d)	LA(a/d)	MOS(a/d)
Eactory Brook above Burton Brk	5.49	255.23	0.00	0.00	255.23
Factory Brook below Burton Brk	11.90	553.23	0.00	0.00	553.23
POTW at design flow ( 67 MGD)	12.94	601.58	57.18	0.00	544.40
Factory Brook above Patte Brk	13.75	639.24	57.18	0.00	582.06
Factory Brook at Lime Bock Bd	16.86	783.82	57.18	0.00	726.64
Factory Brook at Mouth	16.92	786.61	57.18	0.00	729.43
Fectory Brook / Chronic TLC Summary	]				
		Chronic	Chronic	Chronic	Chronic
Location	BLF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)
Factory Brook above Burton Brk	0.08	2.15	0.00	0.00	2.15
Factory Brook below Burton Brk	0.19	5.11	0.00	0.00	5.11
POTW at design flow (.67 MGD)	1.23	33.11	33.11	0.00	0
Factory Brook above Pette Brk	1.37	36.87	33.11	0.00	3.76
Factory Brook at Lime Rock Rd	1.46	39.3	33.11	0.00	6.19
Factory Brook at Mouth	1.50	40.37	33.11	0.00	7.26
Location	BAAF(cfs)	TLC(g/d)	WLA(g/d)	LA(g/d)	MOS(g/d)
Factory Brook above Burton Brk	5.49	147.77	0.00	0.00	147.77
Factory Brook below Burton Brk	11.90	320.29	0.00	0.00	320.29
POTW at design flow (.67 MGD)	12.94	348.28	33.11	0.00	315.17
Factory Brook above Pette Brk	13.75	370.09	33.11	0.00	336.98
Factory Brook at Lime Rock Rd	16.86	453.79	33.11	0.00	420.68
Easton, Brook at Mouth	16 92	455 A 1	33 11	0.00	422.3

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	DA	Watershed Drainage Area	Measured	sq.mi
	Till	Watershed Glacial Till Area	Measured	sq.mi
	SDA	Watershed Stratified Drift Area	Measured	sq.mi
	7Q10	7-day,10-year Low Streamflow	7Q10 = .67(SDA) + .01(Till)	cfs
	AAF	Average Annual Streamflow	AAF = 1.8(DA)	cfs
	BLF	Base Low Flow	BLF = 7Q10 + Point Discharge Flow)	cfs
	BAAF	Base Average Flow	BAAF = AAF + Point Discharge Flow)	cfs
	TLC	Total Loading Capacity	TLC = (WQC)(BLF or BAAF)	g/day
	LA	Load Allocation	LA = (Background Pollutant Concentration)(7Q10 or AAF	g/day
	WLA	Wasteload Allocation	WLA = (TLC - LA)	g/day
	MOS	Margin of Safety	MOS = (TLC - WLA - LA)	g/day
	WQC	Copper Water Quality Criteria	WQC = 0.0 estimate median for unimpacted waters	ug/i
			WQC = 19.0 (acute criteria )	ug/i
	,		WQC = 11.0 (chronic criteria)	ug/l
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Factory Brook Acute TMDL at Base Low Flow



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-1	Factory Brook Hydrology	<b>]</b>			0		
	Location	DA(somi)	Till(somi)	SDA(somi)	ZO10(cfs)	7()1()(cfe)	
	Factory Brook above Button Brk	3.13	3.05	0.08	0.08	0.31	
	Burton Brook at Mouth	3.67	3.56	0.11	0.11	0.43	
	Factory Brook below Burton Brk	6.80	6.61	0.19	0.19	0.74	
	Factory Brook above Pette Brk	7.44	7.06	0.38	0.33	1.29	
	Pette Brook at Mouth	1.83	1.73	0.10	0.08	0.31	
	Factory Brook at Lime Rock Rd	9.26	8.79	0.49	0.42	1.64	
	Factory Brook at Mouth	9.37	8.82	0.55	0.46	1.79	
	Factory Brook / TLC						
	· ·······	/	Acute	Acute	Chronic	Chronic	
	Location at BLF (Summer)	BLF(cfs)	WQC(ma/l)	TLC(Ka/d)	WQC(ma/i)	TLC(Ka/d)	
	Factory Brook above Burton Brk	0.08	13.2	2,58	1.43	0,28	
	Factory Brook below Burton Brk	0.19	13.2	6.14	1.43	0.66	
	POTW at design flow (.67 MGD)	1.23	13.2	39.73	1.43	4.30	



		Acute	Acute	Chronic	Chronic
Location at BLF (Summer)	BLF(cfs)	WQC(mg/l)	TLC(Kg/d)	WQC(mg/i)	TLC(Kg/d)
Factory Brook above Burton Brk	0.08	13.2	2.58	1.43	0.28
Factory Brook below Burton Brk	0.19	13.2	6.14	1.43	0.66
POTW at design flow (.67 MGD)	1.23	13.2	39.73	1.43	4.30
Factory Brook above Pette Brk	1.37	13.2	44.25	1.43	4.79
Factory Brook at Lime Rock Rd	1.46	13.2	47.16	1.43	5,11
Factory Brook at Mouth	1.50	13.2	48.45	1.43	5.25
Location at BLF (Winter)	BLF(cfs)	WQC(mg/l)	TLC(Kg/d)	WQC(mg/l)	TLC(Kg/d)
Factory Brook above Burton Brk	0.31	23.1	17,52	2.47	1.87
Factory Brook below Burton Brk	0.74	23.1	41.83	2.47	4.47
POTW at design flow (.67 MGD)	1.78	23.1	100.61	2.47	10.76
Factory Brook above Pette Brk	2.33	23.1	131.70	2.47	14.08
Factory Brook at Lime Rock Rd	2.68	23.1	151,48	2.47	16.20
Factory Brook at Mouth	2.83	23.1	159.96	2.47	17.10

### Factory Brook / LA (Background + Non-point Source)

WQC(mg/l)	7Q10(cfs)	LA(Kg/d)
0.1	0.08	0.02
0.1	0.19	0.05
0.1	0.33	0.08
0.1	0.42	0.10
0.1	0.46	0.11
WQC(mg/l)	7Q10(cfs)	LA(Kg/d)
0.1	0.31	0.08
0.1	0.74	0.18
0.1 0.1	0.74	0.18 0.32
0.1 0.1 0.1	0.74 1.29 1.64	0.18 0.32 0.40
	WQC(mg/l) 0.1 0.1 0.1 0.1 0.1 WQC(mg/l) 0.1	WQC(mg/) 7010(cfs) 0.1 0.08 0.1 0.19 0.1 0.33 0.1 0.42 0.1 0.46 WQC(mg/) 7010(cfs) 0.1 0.31

### Factory Brook / WLA to Point Source at Design Flow

WLA Objective	Season	TLC(Kg/d)	LA(Kg/d)	WLA(Kg/d)	MOS(Kg/d)
Protection Aquatic Life / Acute Effects	Summer	39.73	0.05	39.68	0.00
Protection Aquatic Life / Acute Effects	Winter	100.61	0.18	100.43	0.00
Protection Aquatic Life / Chronic Effects	Summer	4.30	0.05	4.25	0.00
Protection Aquatic Life / Chronic Effects	Winter	10.76	0.18 ·	10.58	0.00

### Factory Brook / Acute TLC Summary

Location / Summer	BLF(cfs)	TLC(Kg/d)	WLA(Kg/d)	LA(Kg/d)	MOS(Kg/d)
Factory Brook above Burton Brk	0.08	2.58	0.00	0.02	2.56
Factory Brook below Burton Brk	0.19	6,14	0.00	0.05	6.09
POTW at design flow (.67 MGD)	1.23	39.73	39.68	0.05	0.00
Factory Brook above Pette Brk	1.37	44.25	39.68	0.08	4.49
Factory Brook at Lime Rock Rd	1.46	47.16	39.68	0.10	7.38
Factory Brook at Mouth	1.50	48.45	39.68	0.11	8.66
Location / Winter	BLF(cfs)	TLC(Kg/d)	WLA(Kg/d)	LA(Kg/d)	MOS(Kg/d)
Location / Winter Factory Brook above Burton Brk	BLF(cfs) 0.31	TLC(Kg/d) 17.52	WLA(Kg/d) 0.00	LA(Kg/d) 0.08	MOS(Kg/d) 17,44
Location / Winter Factory Brook above Burton Brk Factory Brook below Burton Brk	BLF(cts) 0.31 0.74	TLC(Kg/d) 17.52 41.83	WLA(Kg/d) 0.00 0.00	LA(Kg/d) 0.08 0.18	MOS(Kg/d) 17.44 41.65
Location / Winter Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD)	BLF(cfs) 0.31 0.74 1.78	TLC(Kg/d) 17.52 41.83 100.61	WLA(Kg/d) 0.00 0.00 100.43	LA(Kg/d) 0.08 0.18 0.18	MOS(Kg/d) 17.44 41.65 0.00
Location / Winter Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk	BLF(cts) 0.31 0.74 1.78 2.33	TLC(Kg/d) 17.52 41.83 100.61 131.70	WLA(Kg/d) 0.00 0.00 100.43 100.43	LA(Kg/d) 0.08 0.18 0.18 0.32	MOS(Kg/d) 17,44 41.65 0.00 30.95
Location / Winter Factory Brook above Burton Brk Factory Brook below Burton Brk POTW at design flow (.67 MGD) Factory Brook above Pette Brk Factory Brook at Lime Rock Rd	BLF(cfs) 0.31 0.74 1.78 2.33 2.68	TLC(Kg/d) 17.52 41.83 100.61 131.70 151.48	WLA(Kg/d) 0.00 0.00 100.43 100.43 100.43	LA(Kg/d) 0.08 0.18 0.18 0.32 0.40	MOS(Kg/d) 17,44 41.65 0.00 30.95 50.65

# Factory Brock / Chronic TLC Summary

	Chronic	Chronic	Chronic	Chronic	
BLF(cfs)	TLC(Kg/d)	WLA(Kg/d)	LA(Kg/d)	MOS(Kg/d)	
0.08	0,28	0.00	0.02	0.26	
0.19	0.66	0.00	0.05	0.61	
1.23	4.30	4.25	0.05	0.00	
1.37	4.79	4.25	0.08	0.46	
1.46	5.11	4.25	0.10	0.76	
1.50	5.25	4.25	0.11	0.89	
BAF(cfs)	TLC(Kg/d)	WLA(Kg/d)	LA(Kg/d)	MOS(Kg/d)	
0.31	1 87	0.00	0.00	1 70	
0.01	1.01	0.00	0.00	1.79	
0.74	4.47	0.00	0.08	4.29	
0.74	4.47 10.76	0.00	0.18 0.18	4.29 0.00	
0.74 1.78 2.33	4.47 10.76 14.08	0.00 10.58 10.58	0.18 0.18 0.32	4.29 0.00 3.18	
0.74 1.78 2.33 2.68	4.47 10.76 14.08 16.2	0.00 10.58 10.58 10.58	0.08 0.18 0.32 0.4	4.29 0.00 3.18 5.22	
	BLF(cfs) 0.08 0.19 1.23 1.37 1.46 1.50 BAF(cfs) 0.31	Chronic   BLF(cfs) TLC(Kg/d)   0.08 0.28   0.19 0.66   1.23 4.30   1.37 4.79   1.46 5.11   1.50 5.25   BAF(crfs) TLC(Kg/d)	Chronic Chronic Chronic   BLF(cfs) TLC(Kg/d) WLA(Kg/d)   0.08 0.28 0.00   0.19 0.66 0.00   1.23 4.30 4.25   1.37 4.79 4.25   1.46 5.11 4.25   1.50 5.25 4.25   BAF(cfs) TLC(Kg/d) WLA(Kg/d)	Chronic <t< td=""></t<>	

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AMMONIA		2000	1. 1994 1. 1994	
	DA	Watershed Drainage Area	Measured	sa.mi
	Till	Watershed Glacial Till Area	Measured	sa mi
	SDA	Watershed Stratified Drift Area	Measured	sa mi
	7Q10	7-day,10-year Low Streamflow	7Q10 = .67(SDA) + .01(TIII)	cfe
	AAF	Average Annual Streamflow	AAF = 1.8(DA)	ofe
	BLF	Base Low Flow	BLF = 7Q10 + Point Discharge Flow)	. cis
	BAAF	Base Average Flow	BAAF = AAF + Point Discharge Flow)	cia ofo
	TLC	Total Loading Canacity	TLC = (WOC)/BLE or BAAE)	CIS r/deu
	IA	Load Allocation	$I \Delta = (Background Pollutant Concentration)(7010 or AAE)$	g/day
•		Wasteload Allocation	$\Delta = (Dackground Follotant Concentration)(70(10 of AAF))$	g/day
	MOG	Margin of Colety	WLA = (TLO - LA)	g/day
	WOO	Margin of Salety	MOS = (1LC - WLA - LA)	g/day
	WQC	water Quality Criteria	WQC = 0.1 nominal background for unimpacted waters	ug/i
			WQC = 13.2 (acute criteria at 25 degrees)	ug/l
			WQC = 1.43 (chronic criteria at 25 degrees)	
			WQC = 23.1 (acute criteria at 0 degrees)	ua/l
	•		WQC = 2.47 (chronic criteria at 0 degrees)	0

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Seasonal Low Flow Analysis												
Location Pomperaug River Sceling Factor	Jan 3.3 5.2	Feb 35.7 5.5	Mar 71.9 11.2	Apr 73.9 11.5	May 38.9 6.1	Jun 18.6 2.9	Jul 11.6 1.8	Aug 7.4 1.2	Sep 6.4 1.0	Oct 9 1.4	Nov 16.2 2.5	Dec 24.8 3.9
Factory Brook above Burton Brk Burton Brook at Mouth Factory Brook below Burton Brk Factory Brook above Pette Brk Pette Brook at Mouth Factory Brook at Lime Rock Rd Factory Brook at Mouth	0.42 0.67 0.99 1.72 0.42 2.19 2.40	0.42 0.58 1.00 1.74 0.42 2.21 2.42	0.88 1.22 2.10 3.65 0.88 4.64 5.08	0.92 1.27 2.20 3.82 0.93 4.86 5.33	0.50 0.69- 1.20 2.08 0.51 2.65 2.91	0.23 0.32 0.55 0.96 0.23 1,22 1.33	0.14 0.20 0.34 0.59 0.14 0.75 0.82	0.09 0.13 0.22 0.38 0.09 0.49 0.53	0.08 0.11 0.19 0.33 0.08 0.42 0.46	0.11 0.16 0.27 0.47 0.11 0.60 0.65	0.20 0.28 0.48 0.83 0.20 1.06 1.16	0.31 0.43 0.74 1.29 0.31 1.64 1.79
Temp	0	0	5	10	15	20	25	25	25	10	10	0
Model Inputs Temp 7Q10	Summer 25.00 Sep	Winter 0.00 Dec										

BRKFLOW.WK4\

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