UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION I
FIVE POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

FACT SHEET

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES

COMMENT PERIOD: July 22, 2010 – August 20, 2010

NPDES PERMIT NUMBER: **MA0101214**

NAME AND ADDRESS OF APPLICANT:

Board of Selectmen
Town of Greenfield
14 Court Square
Greenfield, MA 01301

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Greenfield Water Pollution Control Plant
384 Deerfield Street (rear)
Greenfield, MA 01301

RECEIVING WATERS: **Deerfield River**
(Deerfield River Watershed, Segment MA33-04)

CLASSIFICATION: **Class B, Warm Water Fishery**

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1. PROPOSED ACTION

The Town of Greenfield has applied to the U.S. Environmental Protection Agency for the re-issuance of its National Pollutant Discharge Elimination System (NPDES) permit to discharge into the designated receiving water. The current permit became effective on October 29, 2002. It expired on October 29, 2007 but remains in effect until the effective date of the new permit as allowed in 40 CFR 122.6. This draft permit is conditioned to expire five (5) years from the effective date.

2. TYPE OF FACILITY AND DISCHARGE LOCATION

The Greenfield Water Pollution Control Plant (WPCP) is a secondary wastewater treatment plant. The plant is currently permitted for an effluent flow of 3.2 million gallons per day (mgd). The Town has requested an increase in permitted flow to 3.4 mgd.

In 1993, the Town of Greenfield prepared a Facilities Plan, which recommended a series of improvements to the treatment plant to accommodate the Town's wastewater needs through the year 2013. The Plan was prepared in response to administrative orders issued by EPA for violations of the 1992 Permit. The project required the preparation of an Environmental Impact Report (EIR) by the Massachusetts Environmental Policy Act (MEPA) office. The final EIR was deemed complete by the Massachusetts Secretary of Environmental Affairs and the Facilities Plan was reviewed and found to be in compliance with all permitting and regulatory requirements by the MassDEP[1]. The Plan recommended that the upgraded facilities be designed for an average daily flow of 4.5 mgd.

The Town chose to implement the plan in two phases. Phase I consisted of the construction of a new headworks, with mechanical screens and aerated grit chambers; construction of a septage receiving facility; modifications to the trickling filters including replacement of the rock media with plastic; new sludge collector mechanisms in the final settling tanks; replacement of the primary effluent pumps; new chlorination/dechlorination facilities, replacement of the plant instrumentation system; and relocation of the outfall from the Green River to the Deerfield River. The Phase I improvements were completed in 1999.

The balance of the improvements was deferred to Phase II, which has yet to be implemented. The deferred improvements include: two additional primary settling tanks; a third final settling tank; replacement of vacuum filters with belt filter presses; construction of an addition to the Operations Building; and the construction of a second gravity sludge thickener.

Following the completion of the Phase I improvements, the Town's consultant reviewed the

[1] Letter from Glen Haas, Director, Division of Watershed Management, MassDEP; dated January 23, 1997, to Trudy Coxe, Secretary of Environmental Affairs, Commonwealth of Massachusetts; RE: Greenfield Wastewater Facilities Plan, Final EIR.

hydraulic capacity of the completed upgraded facilities and concluded that the plant capacity should be re-rated to 3.4 mgd[2]. The revised design flow was approved by MassDEP in a letter dated May 7, 2010[3]. The draft permit is based on the increased design flow of 3.4 mgd.

The facility discharges to the Deerfield River (See Figure 1). The collection system is 100% separate sanitary sewer and serves a total population of 15,700. There are currently no significant industrial dischargers.

The facility's discharge outfall is listed below:

Outfall	Description of Discharge	Receiving Water
01	Secondary-treated Effluent	Deerfield River

3. DESCRIPTION OF DISCHARGE

Quantitative descriptions of the discharge in terms of significant effluent parameters, based on discharge monitoring reports (DMRs) submitted for January 2008 through March 2010, and the March 2007 application, are shown in Tables 1 and 2 of this fact sheet, respectively.

4. LIMITATIONS AND CONDITIONS

The effluent limitations and monitoring requirements may be found in the draft NPDES permit.

5. PERMIT BASIS AND EXPLANATION OF EFFLUENT LIMITATIONS

5.1. Process Description

The Greenfield WPCP is a secondary wastewater treatment facility, which discharges to the Deerfield River. Discharge at the current location began in 1999 following Phase I of the upgrade of the Plant, which included moving the outfall from the Green River to the Deerfield River, where the discharge receives significantly greater dilution.

Wastewater flows to the treatment plant by gravity. The basic flow train is as follows: bar screen, aerated grit chamber, Parshall flume, primary settling, biological treatment in trickling filters, final settling, chlorination and dechlorination (See Figure 2). The wastewater flow is measured by an ultrasonic device in the Parshall flume. Flow measurement data is displayed on a meter near the flume and also transmitted to the main operations building

[2] Letter from Jon R. Pearson, VP, AECOM Water, dated May 3, 2010, to Sandra Shields, Director, Department of Public Works, Town of Greenfield; RE: Greenfield MA Water Pollution Control Plant, Current Plant Capacity.

[3] Letter from Brian Harrington, Deputy Regional Director, Bureau of Resource Protection, MassDEP, Western Regional Office, dated May 7, 2010, to Sandra Shields, Director of Public Works, Town of Greenfield; RE: Greenfield WWM, WWTP Hydraulic Capacity, Project #114-001.

where it is permanently recorded on a chart and totalized.

Sludge is thickened in a gravity thickener and then transported by a licensed hauler to an incineration facility.

EPA is aware that there is currently a proposal by Pioneer Renewable Energy to develop a 47-megawatt (MW) biomass facility in Greenfield. The current proposal anticipates that 90% of the project's cooling water demand, on average 690,000 gallons per day (gpd), would be supplied by treated wastewater from the Greenfield WPCP. According to the Certificate of the Massachusetts Secretary of Energy and Environmental Affairs[4], an average of 135,750 gpd of plant process waters would be returned to the Greenfield WPCP for treatment and discharge. The draft permit does not address the proposed project and the potential changes in the influent character because the project is still in the permitting stage and its construction is not certain. However, if the project proceeds, it would constitute new information under 40 CFR 122.62(a)(2) and possibly require that the NPDES permit be modified. The Town of Greenfield, as the permittee for this NPDES permit, is responsible for notifying EPA and MassDEP of any changes in its influent character.

5.2. Statutory and Regulatory Authority

5.2.1. General Requirements

The Clean Water Act (CWA) prohibits the discharge of pollutants to waters of the United States without a National Pollutant Discharge Elimination System (NPDES) permit unless such a discharge is otherwise authorized by the CWA. An NPDES permit is the mechanism used to implement technology and water quality-based effluent limitations and other requirements, including monitoring and reporting requirements. This draft NPDES permit was developed in accordance with the various statutory and regulatory requirements established pursuant to the CWA and any applicable State regulations. The regulations governing the EPA NPDES permit program are generally found at 40 CFR Parts 122, 124, and 125.

When developing permit limits, EPA is required to consider (a) technology-based requirements, (b) water quality-based requirements, and (c) all limitations and requirements in the current/existing permit. These requirements are described in the following paragraphs.

5.2.2. Technology-based Requirements

Under Section 301(b)(1)(B) of the Clean Water Act ("CWA"), publicly owned treatment works ("POTWs") must have achieved effluent limitations based upon Secondary Treatment by July 1, 1977. The secondary treatment requirements are set forth at 40 C.F.R. Part 133.102. In addition, Section 301(b)(1)(C) of the CWA

[4] Ian A. Bowles, Secretary of Energy and Environmental Affairs, Commonwealth of Massachusetts, dated April 24, 2009, Certificate of the Secretary of Energy and Environmental Affairs on the Environmental Notification Form, RE: Pioneer Renewable Energy, 11 pp.

requires that effluent limitations based on water quality considerations be established for point source discharges when such limitations are necessary to meet state or federal water quality standards that are applicable to the designated receiving water.

Pursuant to 40 C.F.R. § 122.44 (d), permittees must achieve water quality standards established under Section 303 of the Clean Water Act (CWA), including state narrative criteria for water quality. Additionally, under 40 C.F.R. § 122.44 (d)(1)(i), "Limitations must control all pollutants or pollutant parameters which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard." When determining whether a discharge causes, or has the reasonable potential to cause or contribute to an in-stream excursion above a narrative or numeric criterion, the permitting authority shall use procedures which account for existing controls on point and non-point sources of pollution, and where appropriate, consider the dilution of the effluent in the receiving water.

5.2.3. Water Quality Standards; Designated Use; Outfall 001

Effluent from the Greenfield WPCP is discharged to segment MA33-04 of the Deerfield River, which is classified in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00 as a Class B - warm water fishery. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. The Standards define a warm water fishery as waters in which the maximum mean monthly temperature generally exceed 68° F (20° C) during the summer months and are not capable of sustaining a year-round population of cold water stenothermal aquatic life.

Section 303(d) of the Federal Clean Water Act (CWA) requires states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and, as such, require the development of total maximum daily loads (TMDL). This segment of the Deerfield River is listed on the Massachusetts 2008 Integrated List of Waters (303d) as "attaining some uses and other uses not assessed". The segment attains the following uses: aquatic life, primary contact, secondary contact and aesthetics. The segment was not assessed for fish consumption.

5.2.3.1. Available Dilution

Water quality based limits are established with the use of a dilution factor. The previous permit used a dilution factor of 41.4. That dilution factor was calculated with the previous design flow of 3.2 mgd. The draft permit is based on a dilution factor that was determined based on the revised plant design flow of 3.4 mgd and an estimated 7Q10 flow of 225 cubic feet per second (cfs).

A 7Q10 flow is defined as the mean low flow over seven (7) consecutive

days recurring every 10 years. The Deerfield River is a highly regulated river with many dams. Under an agreement with Federal Energy Regulatory Commission (FERC) and documented in its 1997 FERC license[5], the New England Power Company is required to release at least a minimum of 200 cfs at the Deerfield #2 Dam. This dam, also known as the Gardner's Falls Dam, is located at Bardwell Road in Shelburne, MA, upstream of the confluence with the Green River and also upstream of the Greenfield WPCP's point of discharge. The 2002 Fact Sheet used 200 cfs as the 7Q10 flow for purposes of calculating the dilution factor; however, this approach was overly conservative because the estimated flow did not include contributions from the intervening watershed area, including the contribution of the Green River.

The United States Geological Survey (USGS) operates a streamflow gage on the Deerfield River near West Deerfield (01170000). The gage is located approximately two (2) miles downstream of the Gardner's Fall Dam. Using the EPA tool, DFLOW 3.1b, EPA calculated the 7Q10 using gage records for the period 1997-2010. The period was chosen as 1997 represents the start of the guaranteed minimum release of 200 cfs as required by the FERC license. The 7Q10 at the Deerfield River gage was calculated as 213 cfs.

There is an additional 13 mi^2 of drainage area between the Deerfield River gage and just upstream of the confluence with the Green River. Because the Deerfield River is highly regulated, the flow factor for estimating the flow contributed by this area cannot be obtained directly from the gage records. In order to provide an estimate of the flow contribution of the intervening drainage area, EPA used the USGS tool, StreamStats (http://water.usgs.gov/osw/streamstats/). Using StreamStats, the EPA estimated the "unregulated" 7Q10 flow at the gaged location as 73.8 cfs, and just upstream of the confluence with the Green River as 79.2 cfs. The increase in 7Q10 flow is 5.4 cfs. Adding that value to the 213 cfs at the gage gives a reasonable estimate of the 7Q10 flow of 218 cfs for the Deerfield River just upstream of the confluence with the Green River

As previously noted, the 2002 Fact Sheet did not consider the contribution of flow from the Green River in the calculation of dilution. The USGS operates a streamflow gage on the Green River near Colrain, MA (01170100). This gage measures the flow contributed from 41.2 mi^2 of drainage area. The entire drainage of the Green River encompasses 89.4 mi^2. Using a flow factor of 0.11 cfs/mi^2, EPA estimated that the 7Q10 flow of the Green River is 9.85 cfs. Downstream from the gage, the Town of Greenfield is permitted to withdraw 2.12 mgd (3.28 cfs) from the Green River for its public water supply; therefore, leaving 6.57 cfs (9.85-3.28) for dilution purposes during 7Q10 conditions.

[5] FERC, 1997, Order Approving Offer of Settlement and Issuing New License, New England Power Company, Project No. 2323-012, Appendix A, Massachusetts Water Quality Certification Conditions, Section B.4.

Therefore, the estimated 7Q10 flow at the Town of Greenfield point of discharge is 224.6 cfs (218 cfs + 6.57 cfs).

The revised dilution can be calculated as follows:

Given:
River flow (7Q10) = 225 cfs * 0.646272 mgd/cfs = 145.4 mgd
Design Flow = 3.4 mgd

$$\frac{\text{River flow (7Q10)} + \text{Daily average design effluent flow}}{\text{River Flow (7Q10)}} = \text{Dilution}$$

$$\frac{145.4 \text{ mgd} + 3.4 \text{ mgd}}{3.4 \text{ mgd}} = 43.8$$

5.2.4. Permit Basis and Explanation of Effluent Limitations

5.2.4.1. Flow

The proposed flow limit is based on the average daily design flow of the treatment plant which has been increased to 3.4 mgd. Flow is to be measured continuously. The permittee shall report the annual average monthly flow using the annual rolling average method (See Permit Footnote 2). The average monthly and maximum daily flow for each month shall also be reported.

A review of DMR data shows that the reported monthly flows have exceeded the 3.2 mgd flow limit 23 times in the past 27 months (range = 2.73-7.91 mgd, avg = 4.03 mgd, n=27). It also appears that the permittee has been reporting the average monthly flow, not the annual average flow as required by the permit. However, if the annual average is calculated from the reported average monthly data, the permittee has violated the flow limit 16 times of the 16 months that were calculated.

Even with proposed flow increase to 3.4 mgd, the permittee will likely continue to exceed the flow limit.

5.2.4.2. Conventional Pollutants

5.2.4.2.1. Biochemical Oxygen Demand (BOD_5)

Concentration limits in the existing permit were based on the secondary treatment requirements set forth at 40 CFR 133.102 (a)(1), (2), (4) and 40 CFR 122.45 (f). The secondary treatment limitations are a monthly average BOD_5 concentration of 30 mg/l and a weekly average concentration of 45

mg/l. The permit also required the permittee to report the maximum daily BOD_5 value each month, but did not establish an effluent limit.

The regulation at 40 CFR §122.45(f) requires the EPA to include mass-based limits. The average monthly and average weekly allowable mass-based (load) limitations for BOD_5 are based on the POTW's previous annual average daily design flow of 3.2 mgd and the appropriate constituent concentration for the respective time period being limited. This assures that the permit does not allow an increase in the loadings over those in the previous permit as required by antidegradation and antibacksliding regulations.

The draft permit proposes reduced BOD_5 concentration limits which are calculated to be equivalent to the mass loading limits necessary to assure that the permit does not allow an increase in loadings over those in the previous permit as required by antidegradation and antibacksliding regulations. The revised limits are a monthly average BOD_5 concentration of 28 mg/l and a weekly average concentration of 42 mg/l. The permit also requires the permittee to report the maximum daily BOD_5 value each month, but does not establish an effluent limit. The monitoring frequency continues to be three times per week.

A review of DMR data submitted over the last 27 months shows that there have been no permit violations of BOD_5 concentration limits. Based on the DMR data, the average values for BOD_5 monthly average, weekly average and maximum daily were 13.6 mg/l (range 6.4-23.4.1 mg/l; n=27), 17.04 mg/l (7.5-29.7 mg/l; n=27) and 21.95 (7.9-40.5 mg/l; n=27), respectively.

BOD_5 Mass Loading Calculations:

Calculations of maximum allowable loads for average monthly, average weekly and maximum daily BOD_5 are based on the following equation:

L = C x DF x 8.34 where:
L = Maximum allowable load in lbs/day.
C = Maximum allowable effluent concentration for reporting period in mg/l.

DF = Annual average design flow of facility in MGD. (In order to comply with antidegradation regulations, the mass limit is based on the previous design flow 3.2 mgd.)
8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

(Concentration limit) [30] X 8.34 (Constant) X 3.2 (Design flow) = 801 lb/day

(Concentration limit) [45] X 8.34 (Constant) X 3.2 (Design flow) = 1201 lb/day

BOD_5 Concentration Limits Calculations:

$C = L/(8.34 * DF_{(Increased)})$ where:
L = Maximum allowable load in lbs/day.
C = Maximum allowable effluent concentration for reporting period in mg/l. Reporting periods are average monthly and weekly and daily maximum.
$DF_{(Increased)}$ = Increased annual average design flow of facility in MGD.
8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

(Mass based limit) [801]/8.34 (Constant) * (3.4) ($DF_{(Increased)}$) = 28 mg/l

(Mass based limit) [1201]/8.34 (Constant)*(3.4) ($DF_{(Increased)}$) = 42 mg/l

5.2.4.2.2. Total Suspended Solids (TSS*)*

Concentration limits in the existing permit were based on the secondary treatment requirements set forth at 40 CFR 133.102 (a)(1), (2), (4) and 40 CFR 122.45 (f). The secondary treatment limitations are a monthly average TSS concentration of 30 mg/l and a weekly average concentration of 45 mg/l. The permit also required the permittee to report the maximum daily TSS value each month, but did not establish an effluent limit.

The regulation at 40 CFR §122.45(f) requires the EPA to include mass-based limits. The average monthly and average weekly allowable mass-based (load) limitations for TSS are based on the POTW's previous annual average daily design flow of 3.2 mgd and the appropriate constituent concentration for the respective time period being limited. This assures that the permit does not allow an increase in the loadings over those in the previous permit as required by antidegradation and antibacksliding regulations.

The draft permit proposes reduced TSS concentration limits which are calculated to be equivalent to the mass loading limits necessary to assure that the permit does not allow an increase in loadings over those in the previous permit as required by antidegradation and antibacksliding regulations. The revised limits are a monthly average TSS concentration of 28 mg/l and a weekly average concentration of 42 mg/l. The permit also requires the permittee to report the maximum daily TSS value each month, but does not establish an effluent limit. The monitoring frequency continues to be three times per week.

A review of DMR data submitted over the last 27 months shows that there

have not been any permit violations of the TSS concentration limits. Based on the DMR data, the average values for TSS monthly average, weekly average and maximum daily were 11.36 mg/l (range 4.1-28.6 mg/l; n=27), 15.86 mg/l (5.8-39.8 mg/l; n=27) and 23.21 (7.2-54 mg/l; n=27), respectively. These values are well below the permit limits of 30 mg/l average monthly and 45 mg/l average weekly.

TSS Mass Loading Calculations:

Calculations of maximum allowable loads for average monthly, average weekly and maximum daily TSS are based on the following equation:

L = C x DF x 8.34 where:
L = Maximum allowable load in lbs/day.
C = Maximum allowable effluent concentration for reporting period in mg/l.
DF = Annual average design flow of facility in MGD. (In order to comply with antidegradation regulations, the mass limit is based on the previous design flow 3.2 mgd.)
8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

(Concentration limit) [30] X 8.34 (Constant) X 3.2 (Design flow) = 801 lb/day
(Concentration limit) [45] X 8.34 (Constant) X 3.2 (Design flow) = 1201 lb/day

TSS Concentration Limits Calculations:

$C = L/(8.34 * DF_{(Increased)})$ where:
L = Maximum allowable load in lbs/day.
C = Maximum allowable effluent concentration for reporting period in mg/l.
$DF_{(Increased)}$ = Increased annual average design flow of facility in MGD.
8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

(Mass based limit) [801]/8.34 (Constant) * (3.4) ($DF_{(Increased)}$) = 28 mg/l

(Mass based limit) [1201]/8.34 (Constant)*(3.4) ($DF_{(Increased)}$) = 42 mg/l

5.2.4.2.3. Eighty-Five Percent (85%) BOD_5 and TSS Removal Requirement

The provisions of 40 CFR 133.102(a)(3), (4) and (b)(3) requires that the 30 day average percent removal for BOD_5 and TSS be not less than 85%. This

requirement was included in the previous permit.

A review of DMR data shows that BOD_5 and TSS removal percentages average 87.3 % and 89.8%, respectively. There have been eight (8) violations of the 85% removal requirement for BOD_5 over the last 27 months and three (3) violations of the TSS percent removal requirement. These violations indicate that the influent flow to the treatment plant is dilute, most likely due to inflow and infiltration (I/I) problems (See Part 6. Inflow/Infiltration Requirements).

5.2.4.2.4. pH

The draft permit includes pH limitations which are required by state water quality standards, and are at least as stringent as pH limitations set forth at 40 C.F.R. §133.102(c). The pH of the effluent shall not be less than 6.5 or greater than 8.3 standard units at any time.

A review of DMR data submitted over the last 27 months shows that there have been two (2) permit violations for pH. Based on the DMR data, the pH values have ranged from 6.4-7.6 standard units (avg=6.64-7.18, n=27). The permittee stated in its cover letter accompanying the NPDES application that the Town's potable water sources have a low pH; and therefore, it is particularly difficult to meet the limit of 6.5 in the summer.

The draft permit requires that in order to obtain an adjustment of its pH limits, the permittee must conduct a pH adjustment demonstration project. The pH limits may be adjusted as long as the pH of the effluent remains between 6.0 – 9.0 SU and the pH of the receiving water remains between 6.5 -8.3.

For discharges to fresh water receiving waters, a demonstration project must be conducted twice over the period of a year, once during the spring months (between March and April, when receiving water flows are high) and once during the summer months (between July and August, when receiving water flows are low).

Detailed procedures for conducting a pH Adjustment Demonstration Project can be found in Attachment B of the Draft Permit.

5.2.4.2.5. Escherichia coli (E. coli)

The previous permit included seasonal Fecal Coliform Bacteria limits which were based on the Massachusetts Surface Water Quality Standards. Since that permit was issued, MassDEP has revised its Surface Water Quality Standards and the revised standards for freshwater use *Escherichia coli* (E. coli) as the indicator bacteria.

A review of DMR data submitted over the last 27 months shows that there has been one (1) permit violation of the fecal coliform bacteria maximum daily limit. Based on the DMR data, the average values for Fecal Coliform Bacteria monthly average and maximum daily were 12 cfu/100 ml (range 4-30 cfu/100 ml; n=14) and 170 (9-800 cfu/100 ml; n=14), respectively. These values are generally well below the permit limits of 200 mg/l average monthly and 400 mg/l maximum daily with exception to the one exceedence in May 2008.

In response to the revisions in the Standards, the draft permit includes E. coli limitations that are based upon the E. coli criteria in the revised Massachusetts Surface Water Quality Standards (314 CMR § 4.05(3)(b). The limits are seasonal and shall apply from March 1st through November 30th. The previous permit required the seasonal limits to be met April 1st to October 31st. The previous permit, however, acknowledged that the permittee might extend the disinfection season if there were "periods of warm weather during the winter period". The disinfection period has been extended (March 1st – November 30th) to better reflect the operations at the treatment facility and clearly defines the period for DMR reporting purposes.

The monthly average limitation proposed in the draft permit is 126 colony forming units (cfu) per 100 ml, and is expressed as a monthly geometric mean. The daily maximum limitation proposed in the draft permit is 409 cfu/100 ml. The E. coli monitoring frequency proposed in the draft permit is three times per week. The draft permit also requires that the E. coli samples be collected concurrently with a total residual chlorine (TRC) sample.

5.2.4.3. Non-conventional pollutants

5.2.4.3.6. Total Residual Chlorine

Chlorine is a toxic chemical. The draft permit includes Total Residual Chlorine (TRC) limitations based on state water quality standards [Title 314 CMR 4.05(5)(e)]. Chlorine compounds produced by the chlorination of wastewater can be extremely toxic to aquatic life.

The acute and chronic water quality criteria for chlorine defined in the 2002 EPA National Recommended Water Quality Criteria for freshwater are 19

ug/l and 11 ug/l, respectively. Given the dilution factor of 43.8, the total residual chlorine limits have been calculated as 0.83 mg/l maximum daily and 0.48 mg/l average monthly. The sampling frequency has been maintained as once per day. Samples must be collected concurrently with the samples for E. coli.

The limits are seasonal and shall apply from March 1st through November 30th. The previous permit required the seasonal limits to be met April 1st to October 31st. As stated above, the previous permit recognized that the permittee might extend the disinfection season if there were "periods of warm weather during the winter period". The disinfection period has been extended to better reflect the operations at the treatment facility and clearly defines the period for DMR reporting purposes.

A review of DMR data submitted over the last 27 months shows that there have been no violations for TRC.

Total Residual Chlorine Limitations:

(acute criteria * dilution factor) = Acute (Maximum Daily)
(19 ug/l * 43.8)= 832.2 ug/l = 0.83 mg/l

(chronic criteria * dilution factor) = Chronic (Monthly Average)
(11 ug/l * 43.8) = 481.8 ug/l = 0.48 mg/l

5.2.4.3.7. Nitrogen

It has been determined that excessive nitrogen loadings are causing significant water quality problems in Long Island Sound, including low dissolved oxygen. In December 2000, the Connecticut Department of Environmental Protection (CT DEP) completed a Total Maximum Daily Load (TMDL) for addressing nitrogen-driven eutrophication impacts in Long Island Sound. The TMDL included a Waste Load Allocation (WLA) for point sources and a Load Allocation (LA) for non-point sources.

The point source WLA for out-of-basin sources (Massachusetts, New Hampshire and Vermont wastewater facilities discharging to the Connecticut, Housatonic and Thames River watersheds) requires an aggregate 25% reduction from the baseline total nitrogen loading estimated in the TMDL.

The baseline total nitrogen point source loadings estimated for the Connecticut, Housatonic, and Thames River watersheds were 21,672 lbs/day, 3,286 lbs/day, and 1,253 lbs/day respectively (see table below). The estimated current point source total nitrogen loadings for the Connecticut, Housatonic, and Thames Rivers respectively are 13,836 lbs/day, 2,151 lbs/day, and 1,015 lbs/day, based on recent information and including all POTWs in the watershed. The following table summarizes the

estimated baseline loadings, TMDL target loadings, and estimated current loadings:

Basin	Baseline Loading[1] (lbs/day)	TMDL Target[2] (lbs/day)	Current Loading[3] (lbs/day)
Connecticut River	21,672	16,254	13,836
Housatonic River	3,286	2,464	2,151
Thames River	1,253	939	1,015
Totals	26,211	19,657	17,002

1. Estimated loading from TMDL, (see Appendix 3 to CT DEP "Report on Nitrogen Loads to Long Island Sound," April 1998).
2. Reduction of 25% from baseline loading.
3. Estimated current loading from 2004 – 2005 DMR data – detailed summary attached as **Exhibit A**.

The TMDL target of a 25 percent aggregate reduction from baseline loadings is currently being met, and the overall loading from MA, NH and VT wastewater treatment plants discharging to the Connecticut River watershed has been reduced by about 36 percent.

In order to ensure that the aggregate nitrogen loading from out-of-basin point sources does not exceed the TMDL target of a 25 percent reduction over baseline loadings, EPA intends to include a permit condition for all existing treatment facilities in Massachusetts and New Hampshire that discharge to the Connecticut, Housatonic and Thames River watersheds, requiring the permittees to evaluate alternative methods of operating their treatment plants to optimize the removal of nitrogen, and to describe previous and ongoing optimization efforts. Facilities not currently engaged in optimization efforts will also be required to implement optimization measures sufficient to ensure that their nitrogen loads do not increase, and that the aggregate 25 % reduction is maintained. Such a requirement has been included in this permit. We also intend to work with the State of Vermont to ensure that similar requirements are included in its discharge permits.

Specifically, the draft permit requires an evaluation of alternative methods of operating the existing wastewater treatment facility in order to control total nitrogen levels, including, but not limited to, operational changes designed to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management. This evaluation is required to be completed and submitted to EPA and MassDEP within one year of the effective date of the permit, along with a description of past and ongoing optimization efforts. The draft permit also requires implementation of optimization methods sufficient to ensure that there is no increase in total nitrogen compared to the existing average daily load. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 428 lbs/day. The draft permit requires

annual reports to be submitted that summarize progress and activities related to optimizing nitrogen removal efficiencies, document the annual nitrogen discharge load from the facility, and track trends relative to previous years. The draft permit also includes average monthly and maximum daily reporting requirements for total nitrogen (TN), ammonia nitrogen, total Kjeldahl nitrogen (TKN), total nitrite nitrogen (NO_2), and total nitrate nitrogen (NO_3) at a sampling frequency of once per month in the effluent. This requirement add the parameters of total nitrogen and ammonia nitrogen to the suite of nitrogen parameters monitored by the permittee in the existing permit and increases the monitoring frequency to monthly from semi-monthly (6/year). These changes are necessary to provide the information needed and the increase in frequency is consistent with other POTWs of similar size (e.g. Easthampton, Erving #2) that discharge to the Connecticut River Watershed.

The agencies will annually update the estimate of all out-of-basin total nitrogen loads and may incorporate total nitrogen limits in future permit modifications or reissuances as may be necessary to address increases in discharge loads, a revised TMDL, or other new information that may warrant the incorporation of numeric permit limits. There have been significant efforts by the New England Interstate Water Pollution Control Commission (NEIWPCC) work group and others since completion of the 2000 TMDL, which are anticipated to result in revised wasteload allocations for in-basin and out-of-basin facilities. Although not a permit requirement, it is strongly recommended that any facilities planning that might be conducted for this facility should consider alternatives for further enhancing nitrogen reduction.

5.2.4.3.8. Phosphorus

State water quality standards require any existing point source discharge containing nutrients in concentrations which encourage eutrophication or growth of weeds or algae shall be provided with the highest and best practical treatment to remove such nutrients. Phosphorus interferes with water uses and reduces instream dissolved oxygen.

MassDEP has analyzed several rounds of water quality samples from the Deerfield River for total phosphorus. The Deerfield River Watershed 2000 Water Quality Assessment Report[6] includes data from 1995/1996, and 2000. Additional data was collected in 1998-1999 for the Connecticut River Nutrient Loading Study and was reported in the Connecticut River Basin 1998 Water Quality Assessment Report[7].

In 1995/1996, samples were collected just downstream of the Stillwater Bridge and also downstream of the Route 5/10 Bridge. During this period, the Greenfield WPCP was still discharging to the Green River; however, no samples were collected in the Green River downstream of the treatment plant. The Green River joins the

[6] MassDEP, 2004, Deerfield River Watershed: 2000 Water Quality Assessment Report, 140 p.
[7] MassDEP, 2000, Connecticut River Basin 1998 Water Quality Assessment Report, 110 p.

Deerfield River between these sampling locations, so the impact would be attenuated but still measurable. Near-7Q10 flow conditions (221 cfs) occurred coincident with the October 14, 1995 sampling. Those results show that there is additional phosphorus entering the Deerfield between the sampling locations. Total phosphorus at the upstream location was 0.01 mg/l (10 ug/l) and that increased to 0.16 mg/l (160 ug/l) at the location down stream of the confluence with the Green River.

In 1998/1999, MassDEP measured total phosphorus concentrations in the Deerfield River again near the Route 5/10 bridge (downstream of the confluence with the Green River). Ambient concentrations ranged from 0.02 to 0.11 mg/l. One high measurement of 0.11 mg/l was collected in July 1998. The sample was a second sample collected when turbidity dramatically increased following the collection of the first sample. The elevated total phosphorus count was collected when the turbidity increased. MassDEP was unable to determine the source of the phosphorus or the turbidity.

Samples were also collected in 2000 on the downstream side of the Route 5/10 Bridge. Streamflow during this period was four to six times 7Q10 conditions and the ambient phosphorus concentrations were significantly lower than those measured during 7Q10.

The current permit requires the permittee monitor total phosphorus in the effluent on a bi-monthly basis (every other month). According to DMR data, the average value for total phosphorus on a monthly average is 1.44 mg/l (range 0.64-2.20 mg/l; n=141).

Phosphorus interferes with water uses and reduces in-stream dissolved oxygen. State water quality standards (314 CMR 4.04(5) Control of Eutrophication) require any existing point source discharge containing nutrients in concentrations which encourage eutrophication or growth of weeds or algae shall be provided with the highest and best practicable treatment to remove such nutrients. This segment of the Deerfield River is not on the 303(d) list for nutrients.

EPA has published national guidance documents which contain recommended total phosphorus criteria and other indicators of eutrophication.

EPA's *Quality Criteria for Water 1986* (the Gold Book) recommends, in order to control eutrophication, that in-stream phosphorus concentrations should be less than 100 ug/l (0.100 mg/l) in streams or other flowing waters not discharging directly to lakes or impoundments. More recently, EPA released Ecoregional Nutrient Criteria, established as part of an effort to reduce problems associated with excess nutrients in water bodies in specific areas of the country. The published ecoregion-specific criteria represent conditions in waters minimally impacted by human activities, and thus representative of water without cultural eutrophication. The Greenfield WPCP is within Ecoregion XIV, Eastern Coastal Plain, and Northeastern Coastal Zone.

Recommended criteria for this ecoregion is found in *Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion XIV*, published in December, 2001, and includes a total phosphorus criteria of 23.75 ug/l (0.024 mg/l).

EPA has decided to apply the Gold Book criterion because it was developed from an effects based approach versus the reference conditions-based approach used to develop the ecoregion criteria. The effects-based approach is taken because it is more directly associated with impairment to a designated use (e.g. fishing). The effects-based approach provides a threshold value above which water quality impairments are likely to occur. It applies empirical observations of a causal variable (i.e. phosphorus) and a response variable (i.e. algal growth) associated with designated use impairments. Referenced-base values are statistically derived from a comparison within a population of rivers in the same ecoregional class. They are a quantitative set of river characteristics (physical, chemical, and biological) that represent minimally impacted conditions.

Because some of the historical data indicated that downstream concentrations may exceed 100 mg/l under low flow conditions, EPA conducted a reasonable potential caclulation for phosphorus as follows:

$\{(Q_R + Q_{WWTP}) * C_{WQ} – (Q_R * C_R)\} / Q_{WWTP} = C_{WWTP}$
where:
QR = 7Q10 flow of the Deerfield River = 225 cfs
QWWTP = Design Flow of Deerfield WPCP = 3.4 mgd = 5.26 cfs
CWQ = In-stream water quality criteria = 100 ug/l
CR = In-stream phosphorus concentration (upstream of the discharge) = 10 ug/l
CWWTP = Phosphorus concentration limit for Greenfield WPCP
{(225 cfs + 5.26 cfs) * 100 ug/l – (225 cfs *10 ug/l)} / 5.26 cfs =
3949 ug/l = 4.0 mg/l

Given that the maximum total phosphorus concentration reported in DMRs (2.20 mg/l) is less than 4.0 mg/l, there is no reasonable potential for the Greenfield WPCP to cause an excursion of the State Water Quality Standard for phosphorus. However, EPA requires that the permittee continue to monitor total phosphorus as downstream levels exceed the Gold Book criterion of 100 ug/l.

5.2.4.4. Whole Effluent Toxicity (WET)

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts Surface Water Quality Standards include the following narrative statement and requires that EPA criteria established pursuant to Section 304(a)(1) of the CWA be used as guidance for interpretation of the following narrative criteria:

All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife.

National studies conducted by the EPA have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents, aromatic hydrocarbons and others. Based on the potential for toxicity from domestic and industrial sources, the state narrative water quality criterion, and in accordance with EPA national and regional policy and 40 C.F.R. § 122.44(d), the draft permit includes a whole effluent acute toxicity limitation (LC_{50} =100%). (See also "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants", 49 Fed. Reg. 9016 March 9, 1984, and EPA's "Technical Support Document for Water Quality-Based Toxics Control", March, 1991.)

The previous permit required the permittee to conduct quarterly (4/year) acute toxicity tests on a single species, Pimephales promelas (fathead minnow). On October 15, 2009, EPA approved the Town's request for a reduction in the frequency of WET testing to two (2) per year. The draft permit requires that WET testing effluent samples be collected during the second week of the months of March and September of each year. The test results are due by the last day of the month following the completion of the test.

Any WET test failures must be retested once and the results submitted as required in the reporting section of the permit.

The tests must be performed in accordance with the test procedures and protocols specified in Permit Attachment A.

The permit shall be modified or alternatively revoked and reissued, to incorporate additional toxicity testing requirements, including chemical specific limits, if the results of the toxicity tests indicate the discharge causes an exceedance of any state water quality criterion. Results from these toxicity tests are considered "New Information" and the permit may be modified pursuant to 40 CFR 122.62(a)(2).

6. INFLOW/INFILTRATION REQUIREMENTS

Infiltration is groundwater that enters the collection system though physical defects such as cracked pipes, or deteriorated joints. Inflow is extraneous flow entering the collection system through point sources such as roof leaders, yard and area drains, sump pumps, manhole covers, tide gates, and cross connections from storm water systems.

Significant I/I in a collection system may displace sanitary flow, reducing the capacity and the efficiency of the treatment works and may cause bypasses to secondary treatment. It greatly increases the potential for sanitary sewer overflows (SSO) in separate systems, and combined sewer overflows in combined systems.

As previously noted, the treatment plant has violated the 85% removal requirement for

BOD_5 and TSS, and has also violated its flow limit.

The draft permit includes requirements for the permittee to control infiltration and inflow (I/I) into the collection system it owns and operates. The permittee shall each develop an I/I removal program commensurate with the severity of the I/I in their collection system. In sections of the collection system that have minimal I/I, the control program will logically be scaled down. It greatly increases the potential for sanitary sewer overflows (SSO) in separate systems.

The permit standard conditions for 'Proper Operation and Maintenance' are found at 40 CFR §122.41(e). These conditions require proper operation and maintenance of permitted wastewater systems and related facilities to achieve permit conditions. Similarly, the co-permittees have a 'duty to mitigate' as stated in 40 CFR §122.41 (d). This requires the co-permittees to take all reasonable steps to minimize or prevent any discharge in violation of the permit which has a reasonable likelihood of adversely affecting human health or the environment. EPA and MassDEP maintain that an I/I removal program is an integral component of ensuring permit compliance under both of these provisions.

7. SLUDGE INFORMATION AND REQUIREMENTS

The draft permit requires that the permittee comply with all existing federal and state laws that apply to sewage sludge use and disposal practices and with the Clean Water Act Section 405(d) technical standards (see 40 CFR Section 503). Sludge from the Greenfield WPCP is currently sent to an off-site facility for disposal. Because the final disposal or use of the permittees sludge is done by others, the permittee is not subject to the requirements of 40 CFR Section 503. However, if the ultimate sludge disposal method changes, the permittee is responsible for complying with the applicable state and federal requirements (See enclosed Sludge Guidance Document).

The permittee is required to submit to EPA and to MassDEP annually, by February 19th, the various sludge reporting requirements as specified in the guidance document for the chosen method of sludge disposal.

8. INDUSTRIAL USERS

The permittee is required to identify, in terms of character and volume of pollutants, and report to EPA any significant indirect dischargers into the POTW subject to the pretreatment standards under Section 307(b) of the CWA and 40 CFR Part 403.

9. ANTI-BACKSLIDING

Anti-backsliding, as described in Section 402 (o) of the Clean Water Act and 40 CFR §122.44(l)(1), requires reissued permits to contain limitations as stringent as or more stringent than those of the previous permit unless the circumstances allow application of one of the defined exceptions.

10. ANTIDEGRADATION

The Massachusetts Antidegradation Policy is found at Title 314 CMR 4.04. The Commonwealth has also developed implementation procedures[8]. All existing uses of the Deerfield River must be protected. This draft permit is being reissued with an increased flow limit. However, the allowable discharge limits for BOD and TSS maintain the mass loading allowed under the previous permit, the remaining limits are as stringent as the current permit with the same parameter coverage. There is no change in outfall location.

Part 314 CMR 4.04 (2) provides, in part, that the MassDEP may determine that a new of increased discharge is insignificant because it does not have the potential to impair any existing or designated use and cause any significant lowering of water quality. In the case of the increase from 3.2 mgd to 3.4 mgd, it was determine that the increased discharge of potential pollutants would use significantly less than 10% of the available assimilative capacity of the receiving water for that pollutant (See Attachment A of the Fact Sheet).

The public is invited to participate in the antidegradation finding through the permit public notice procedure.

11. ENDANGERED SPECIES ACT

Section 7(a) of the Endangered Species Act (ESA) of 1973, as amended (the "Act"), grants authority to and imposes requirements upon federal agencies regarding endangered or threatened species of fish, wildlife, or plants ("listed species") and the habitats of such species that has been designated as critical ("critical habitat").

Section 7(a)(2) of the Act requires every federal agency in consultation with and with the assistance of the Secretary of the Interior, to ensure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The United States Fish and Wildlife Service (USFWS) administers Section 7 consultations for freshwater species. The National Marine Fisheries Service (NMFS) administers Section 7 consultations for marine species and anadromous fish.

Based on EPA's assessment, the only endangered species potentially influenced by the reissuance of this permit is the shortnose sturgeon (*Acipenser brevirostrum*). It is EPA's preliminary determination that the operation of this facility, as governed by the permit action, is not likely to adversely affect the species of concern. It is our position that this permit action does not warrant a formal consultation under Section 7 of the ESA. The reasoning to support this position follows.

11.1. Environmental Setting

[8] Haas, Glenn, MassDEP, 2009, "Implementation Procedures for the Antidegradation Provisions of the Massachusetts Surface Water Quality Standards, 314 CMR 4.00".

Effluent from the Greenfield WPCP is discharged to segment MA33-04 of the Deerfield River, which is classified in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00 as a Class B - warm water fishery. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other crucial functions, and for primary and secondary contact recreation. The Standards define a warm water fishery as waters in which the maximum mean monthly temperatures generally exceed 68° F (20° C) during the summer months and are not capable of sustaining a year-round population of cold water stenothermal aquatic life.

11.2. Outfall Description

Discharge at the current location began in 1999 following the Phase I upgrade of the Plant, which included moving the outfall from the Green River to the Deerfield River, where the discharge receives significantly greater dilution. The current expected dilution factor is 43.8, assuming a 7Q10 flow at the Town of Greenfield. The discharge is 3 feet from shore and 3 to 10 feet below the surface, depending on the river level. The discharge does not include a diffuser. The facility outfall pipe is approximately 2.5 miles upstream from the confluence with the Connecticut River. The previous permit contained a maximum discharge limit of 3.2 mgd and the proposed permit limit is 3.4 mgd. Sections 2. through 5. of this fact sheet provide detailed information regarding the facility and the permit requirements.

11.3. Shortnose Sturgeon Information

Update information presented in this section on the life history and known habitat of shortnose sturgeon (SNS) in the Connecticut River was obtained from, among other sources, "The Connecticut River IBI Electrofishing NMFS Biological Opinion, Connecticut and Merrimack River Bioassessment Studies" (NMFS BO, July 30, 2009) and the Draft Endangered Species Act Section 7 Consultation Biological Opinion (BO) for the Holyoke Hydroelectric Project (Federal Energy Regulatory Commission (FERC) Permit #2004), issued to FERC by NOAA Fisheries on January 27, 2005 (NMFS BO 2005). Information dealing with the potential effects of pollutants on SNS was obtained from, among other sources, a detailed ESA response letter from NMFS to EPA regarding the Montague WPCF, dated September 10, 2008 (Montague Letter).

Information gathered from a variety of sources confirms the presence of shortnose sturgeon in the Connecticut River. The continuous presence of shortnose sturgeon in the Deerfield River has not been verified. However, the area where the Deerfield River meets the Connecticut River is a known concentration area for SNS. The Greenfield WPCP discharge is 2.5 miles upstream of this concentration area. Since SNS could potentially move into the Deerfield River to forage and enter an area where the diluted discharge from the Greenfield WPCP is present, EPA has decided to take a conservative approach and include a full discussion of potential impacts to SNS from the facility.

As reported above, a population of endangered shortnose sturgeon occurs in the Connecticut River. The population is largely divided by the Holyoke Dam, although limited successful downstream passage does occur. Modifications to the dam are currently ongoing to ensure

the safe and successful upstream and downstream passage of fish, including shortnose sturgeon, at the Dam (Montague Letter).

The Holyoke Dam separates shortnose sturgeon in the Connecticut River into an upriver group (above the Dam) and a lower river group that occurs below the Dam to Long Island Sound. The abundance of the upriver group has been estimated by mark-recapture techniques using Carlin tagging (Taubert 1980) and PIT tagging (Kynard unpublished data). Estimates of total adult abundance calculated in the early 1980s range from 297 to 516 in the upriver population to 800 in the lower river population. Population estimates conducted in the l990s indicated populations in the same range. The total upriver population estimates ranged from 297 to 714 adult shortnose sturgeon, and the size of the spawning population was estimated at 47 and 98 for the years 1992 and 1993 respectively. The lower Connecticut River population estimate for sturgeon >50 cm TL was based on a Carlin and PIT tag study from 1991 to 1993. A mean value of 875 adult shortnose sturgeon was estimated by these studies. Savoy estimated that the lower river population may be as high as 1000 individuals, based on tagging studies from 1988-2002. It has been cautioned that these numbers may overestimate the abundance of the lower river group because the sampled area is not completely closed to downstream migration of upriver fish (Kynard 1997). Other estimates of the total adult population in the Connecticut River have reached 1200 (Kynard 1998) and based on Savoy's recent numbers the total population may be as high as 1400 fish (Montague Letter). Regardless of the actual number of SNS in the river, the effective breeding population consists of only the upriver population, as no lower river fish are successfully passed upstream at the present time. This effective breeding population is estimated at approximately 400 fish (NMFS BO 2009).

Several areas of the river have been identified as concentration areas. In the downriver segment, a concentration area is located in Agawam, MA which is thought to provide summer feeding and over-wintering habitat. Other concentration areas for foraging and over wintering are located in Hartford, Connecticut, at the Head of Tide (Buckley and Kynard 1985) and in the vicinity of Portland, Connecticut (CTDEP 1992). Shortnose sturgeon also make seasonal movements into the estuary, presumably to forage (Buckley and Kynard 1985; Savoy in press). Above the Dam, there are also several concentration areas. Many SNS overwinter at Whitmore. During summer, shortnose sturgeon congregate near Deerfield (NMFS BO). SNS that use the habitat in this area are most likely to move into the Deerfield River. These fish have the highest potential to encounter the diluted plume from the Greenfield WPCP.

Two areas above Holyoke Dam, near Montague, have more consistently been found to provide spawning habitat for SNS. This spawning habitat is located at river km 190-192 and is the most upstream area of use. It is located just downstream of the species' historical limit in the Connecticut River at Turners Falls (river km 198). Across the latitudinal range of the species, spawning adults typically travel to approximately river km 200 or further upstream where spawning generally occurs at the uppermost point of migration within a river (Kynard 1997; NMFS 1998). The Montague sites have been verified as spawning areas based on successful capture of sturgeon eggs and larvae in 1993, 1994, and 1995, that were 190 times the number of fertilized eggs and 10 times the number of embryos found in the Holyoke site

(Vinogradov 1997). In seven years of study (1993-1999), limited successful spawning, as indicated by capture of embryos or late stage eggs, occurred only once (1995) at Holyoke Dam (Vinogradov 1997; Kynard et al. 1999c). Using this same measure, successful spawning occurred at Montague during 4 of 7 years. Both Montague and Holyoke sites have been altered by hydroelectric dam activities, but all information suggests that females spawn successfully at Montague, not at Holyoke Dam. Thus, it appears that most, if not all, recruitment to the population comes from spawning in the upriver segment (NMFS BO).

The effects of the Holyoke Project on the shortnose sturgeon's ability to migrate in the Connecticut River have likely adversely affected the shortnose sturgeon's likelihood of surviving in the river. An extensive evaluation of shortnose sturgeon rangewide revealed that shortnose sturgeon above Holyoke Dam have the slowest growth rate of any surveyed (Taubert 1980, Kynard 1997) while shortnose sturgeon in the lower Connecticut River have a high condition factor and general robustness (Savoy, in press). This suggests that there are growth advantages associated with foraging in the lower river or at the fresh-and salt-water interface. There are four documented foraging sites downstream of the Holyoke Dam, while only one exists upstream. The presence of the Holyoke Dam has likely resulted in depressed juvenile and adult growth due to inability to take advantage of the increased productivity of the fresh/salt water interface. This likely has negatively impacted the survival of the Connecticut River population of shortnose sturgeon and impeded recovery. This has also likely made the spawning periodicity of females greater (NMFS BO 2005).

11.4. Pollutant Discharges Permitted

11.4.1. Biochemical Oxygen Demand (BOD_5)

The draft permit proposes more stringent BOD_5 concentration limits than those in the current permit, which were based on the secondary treatment requirements set forth at 40 CFR 133.102 (a)(1), (2), (4) and 40 CFR 122.45 (f). The secondary treatment limitations are a monthly average BOD_5 concentration of 30 mg/l and a weekly average concentration of 45 mg/l. The draft permit requires a monthly average concentration of 28 mg/l and a weekly average concentration of 42 mg/l. The draft permit also requires the permittee to report the maximum daily BOD_5 value each month, but does not establish an effluent limit. The monitoring frequency continues to be three times per week.

Shortnose sturgeon are known to be adversely affected by DO levels below 5 mg/L (Jenkins et. al1994, Niklitschek 2001). The permit conditions above are designed to ensure that the discharge meets the Massachusetts Water Quality Standards for Class B waterbodies, which requires that waters attain a minimum DO of 5 mg/L. Discharges meeting these criteria are not likely to have any negative impacts on SNS.

11.4.2. Total Suspended Solids (TSS)

TSS can affect aquatic life directly by killing them or reducing growth rate or resistance to disease, by preventing the successful development of fish eggs and lawae, by modifying natural movements and migration, and by reducing the

abundance of available food (EPA 1976). These effects are caused by TSS decreasing light penetration and by burial of the benthos. Eggs and larvae are most vulnerable to increases in solids.

The draft permit proposes more TSS concentration limitations than those in the existing permit. The average monthly and average weekly limitation in the current permit were based on the secondary treatment requirements set forth at 40 CFR 133.102 (b)(1), (2) and 40 CFR 122.45 (f) and are a monthly average TSS concentration of 30 mg/l, and a weekly average concentration of 45 mg/l. The draft permit requires a monthly average concentration of 28 mg/l and a weekly average concentration of 42 mg/l. The draft permit requires the permittee to report the maximum TSS value each month, but does not establish a maximum daily effluent limit. The monitoring frequency continues to be three times per week.

Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580mg/L to 700,000mg/L depending on species. Sublethal effects have been observed at substantially lower turbidity levels. For example, prey consumption was significantly lower for striped bass larvae tested at concentrations of 200 and 500 mg/L compared to larvae exposed to 0 and 75 mg/L (Breitburg 1988 in Burton l993). Studies with striped bass adults showed that pre-spawners did not avoid concentrations of 954 to 1,920 mg/L to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton l993). While there have been no directed studies on the effects of TSS on shortnose sturgeon, SNS juveniles and adults are often documented in turbid water. Dadswell (1984) reports that shortnose sturgeon are more active under lowered light conditions, such as those in turbid waters (Montague Letter). As such, shortnose sturgeon are assumed to be as least as tolerant to suspended sediment as other estuarine fish such as striped bass.

As noted above, shortnose sturgeon eggs and larvae are less tolerant to sediment levels than juveniles and adults. Several studies have examined the effects of suspended solids on fish lavae. Observations in the Delaware River indicated that larval populations may be negatively affected when suspended material settles out of the water column (Hastings 1983). Larval survival studies conducted by Auld and Schubel (1978) showed that striped bass larvae tolerated 50 mg/l and 100 mg/l suspended sediment concentrations and that survival was significantly reduced at 1000 mg/L. According to Wilber and Clarke (2001), hatching is delayed for striped bass and white perch eggs exposed for one day to sediment concentrations of 800 and 1000 mg/L, respectively (Montague Letter).

In a study on the effects of suspended sediment on white perch and striped bass eggs and larvae performed by the ACOE (Morgan et al. 1973), researchers found that sediment began to adhere to the eggs when sediment levels of over 1000 parts per million (ppm) were reached. No adverse effects to demersal eggs and larvae have been documented at levels at or below 50mg/L (Montague Letter). This is above the

highest level authorized by this permit. Based on this information, it is likely that the discharge of sediment in the concentrations allowed by the permit will have an insignificant effect on shortnose sturgeon.

11.4.3. pH

The draft permit requires that the pH of the Greenfield WPCP effluent shall not be less than 6.5 or greater than 8.3 standard units at any time. Since a pH from 6.0 to 8.3 is considered harmless to most marine organisms (Ausperger 2004), no adverse effects to SNS are likely to occur as a result of a discharge meeting the above pH range.

11.4.4. Escherichia coli (E. coli)

Fecal coliform and E. coli bacteria are indicators of the presence of fecal wastes from warmblooded animals. As these bacteria are often associated with viruses and other pathogens, the primary concern regarding elevated levels of these bacteria is for human health and exposure to pathogen-contaminated recreational waters. Fecal bacteria are associated with fecal matter, which is known to contain nutrients that support plant and animal growth. Algae and other organisms which utilize these nutrients can deplete oxygen under certain environmental conditions (particularly warm water conditions). While fecal bacteria are not known to be toxic to aquatic life, including SNS, water elevated levels of these bacteria are indicative of water quality problems, including lowered dissolved oxygen levels (Montague Letter).

The draft permit includes seasonal (April 1st – October 31st) E. coli limitations which are based upon the E. coli criteria in the revised Massachusetts Surface Water Quality Standards (314 CMR § 4.05(3)(b). The monthly average limitation proposed in the draft permit is 126 colony forming units (cfu) per 100 ml, and shall be expressed as a monthly geometric mean. The daily maximum limitation proposed in the draft permit is 409 cfu/100 ml. The E. coli monitoring frequency proposed in the draft permit is three times per week. The draft permit also requires that the E. coli samples be collected concurrently with a total residual chlorine (TRC) sample.

The E. coli limits set for this facility are designed to protect human health and to insure that dissolved oxygen (DO) criteria are met. As discussed above, shortnose sturgeon are known to be adversely affected by DO levels below 5 mg/L (Jenkins et. al1994, Niklitschek 2001). The E. coli draft permit conditions are designed to ensure that elevated bacteria do not occur in the Deerfield River as a result of the discharge, causing DO levels to fall below 5 mg/L. Discharges meeting these E. coli criteria are not likely to have any negative direct or indirect impacts on SNS.

11.4.5. Total Residual Chlorine

The acute and chronic water quality criteria for chlorine defined in the 2002 EPA National Recommended Water Quality Criteria for freshwater are 19 ug/l and 11 ug/l, respectively. Given the dilution factor of 43.8 at the outfall of the Greenfield WPCP, the total residual chlorine limits have been calculated as 0.84 mg/l maximum daily and 0.48 mg/l average monthly. The sampling frequency has been maintained

as once per day.

There are a number of studies that have examined the effects of TRC (Post 1987; Buckley 1976; EPA 1986) on fish; however, no directed studies that have examined the effects of TRC on shortnose sturgeon. The EPA has set the Criteria Maximum Concentration (CMC or acute criteria; defined in 40 CFR 131.36 as equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (up to 96 hours) without deleterious effects) at 19 ug/L, based on an analysis of exposure of 33 freshwater species in 28 genera (EPA 1986) where acute effect values ranged from 28 ug/L for *Daphia magna* to 710 ug/L for the threespine stickleback. The CMC is set well below the minimum effect values observed in any species tested (Montague Letter). As the water quality criteria levels have been set to be protective of even the most sensitive of the 33 freshwater species tested, it is reasonable to judge that the criteria are also protective of shortnose sturgeon.

As noted above, the "end-of-pipe" concentration (i.e., the concentration of TRC in the effluent as it discharges into the receiving water) required by the permit is 19 ug/L. The anticipated TRC level at the outfall satisfies the EPA's ambient water quality criteria and is lower than TRC levels known to effect aquatic life. As such, the discharge of the permitted concentrations of TRC are likely to have an insignificant effect on shortnose sturgeon.

11.4.6. Nitrogen

It has been determined that excessive nitrogen loadings are causing significant water quality problems in Long Island Sound, including low dissolved oxygen. In December 2000, the Connecticut Department of Environmental Protection (CT DEP) completed a Total Maximum Daily Load (TMDL) for addressing nitrogen-driven eutrophication impacts in Long Island Sound. The TMDL included a Waste Load Allocation (WLA) for point sources and a Load Allocation (LA) for non-point sources.

The point source WLA for out-of-basin sources (Massachusetts, New Hampshire and Vermont wastewater facilities discharging to the Connecticut, Housatonic and Thames River watersheds) requires an aggregate 25% reduction from the baseline total nitrogen loading estimated in the TMDL. A detailed discussion of nitrogen loading in the Connecticut River is included in Section 5.2.4.3.7. of this fact sheet.

The TMDL target of a 25 percent aggregate reduction from baseline loadings is currently being met, and the overall loading from MA, NH and VT wastewater treatment plants discharging to the Connecticut River watershed has been reduced by about 36 percent.

In order to ensure that the aggregate nitrogen loading from out-of-basin point sources does not exceed the TMDL target of a 25 percent reduction over baseline loadings, the draft permit requires an evaluation of alternative methods of operating the existing wastewater treatment facility in order to control total nitrogen levels,

including, but not limited to, operational changes designed to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management. This evaluation is required to be completed and submitted to EPA and MassDEP within one year of the effective date of the permit, along with a description of past and ongoing optimization efforts. The draft permit also requires implementation of optimization methods sufficient to ensure that there is no increase in total nitrogen compared to the existing average daily load. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 428 lbs/day.

The draft permit also includes average monthly and maximum daily reporting requirements for total nitrogen (TN), ammonia nitrogen, total Kjeldahl nitrogen (TKN), total nitrite nitrogen (NO_2), and total nitrate nitrogen (NO_3) at a sampling frequency of once per week in the effluent.

Elevated nitrogen levels are associated with eutrophication and indicative of water quality problems including lowered dissolved oxygen levels. The permit requirements related to nitrogen will ensure that the facility is not discharging this pollutant at a level that could impact dissolved oxygen levels in a way that may affect shortnose sturgeon.

11.4.7. Phosphorus

According to the Deerfield River Watershed 2000 Water Quality Assessment Report, total phosphorus measurements in the Deerfield River near the Route 5/10 bridge (downstream of the treatment plant discharge) ranged from 0.018 to 0.022 mg/l and from 0.02 to 0.11 mg/l during the "1998-1999 Connecticut River Nutrient Loading project." One high measurement of 0.11 mg/l was collected in July 1998. The sample was a second sample collected when turbidity dramatically increased following the collection of the first sample. The elevated total phosphorus count was collected when the river was turbid. MassDEP was unable to determine the source of the phosphorus or the turbidity. The remaining fourteen (14) measurements did not exceed 0.06 mg/l.

State water quality standards require any existing point source discharge containing nutrients in concentrations which encourage eutrophication or growth of weeds or algae shall be provided with the highest and best practical treatment to remove such nutrients. Phosphorus interferes with water uses and reduces instream dissolved oxygen. The draft permit includes a six (6) per year monitoring and reporting requirement for effluent phosphorus. If a Total Maximum Daily Load (TMDL) or other data demonstrates that the WPCP is contributing to eutrophication of the river, EPA and MassDEP may reopen the permit under Part II.A.4 of the permit and modify the limit. In order to modify the limit, a formal public review process would be required. Monitoring for phosphorous levels will ensure that the facility is not discharging this pollutant at a level that could impact dissolved oxygen levels in a way that may affect shortnose sturgeon.

11.5. Finding

Based on the above analysis of the location of the discharge, the permit limits and the water quality effects of the permit action, EPA has made the preliminary determination that the proposed reissuance of the NPDES permit for this facility is not likely to adversely affect shortnose sturgeon. Therefore, EPA has judged that a formal consultation pursuant to Section 7 of the ESA is not required. EPA is seeking concurrence from NMFS regarding this determination through the information in this fact sheet as well as a letter under separate cover.

Reinitiation of consultation will take place: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat is designated that may be affected by the identified action.

12. ESSENTIAL FISH HABITAT

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq. (1998)), EPA is required to consult with the National Marine Fisheries Services (NMFS) if EPA's action or proposed actions that it funds, permits, or undertakes, may adversely impact any essential fish habitat (16 U.S.C. § 802(10)). The Amendments broadly define "essential fish habitat" (EFH) as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. § 1802(10)). "Adverse impact" means any impact which reduces the quality and/or quantity of EFH (50 CFR § 600.910(a)). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences or actions.

Essential fish habitat is only designated for species for which federal fisheries management plans exist (16 U.S.C. § 1855(b)(a)(A)). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

The Atlantic salmon (*Salmo salar)* is the only managed species with designated EFH in the Deerfield River, which is classified in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00 as a Class B - warm water fishery. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other crucial functions, and for primary and secondary contact recreation.

EPA has determined that the draft permit has been conditioned in such a way so as to minimize any adverse impacts to EFH for the following reasons:

- This permit action is a reissuance of an existing NPDES permit.

- The draft permit allows a minor increase in flow but the same mass-based limits have been

established.

- Limits specifically protective of aquatic organisms have been established for chlorine, based on EPA water quality criteria

- The facility withdraws no water from the Deerfield River, so no life stages of Atlantic salmon are vulnerable to impingement or entrainment from this facility.

- The draft permit prohibits the discharge from violating state water quality standards.

- The draft permit prohibits the discharge of pollutants or combination of pollutants in toxic amounts.

- The draft permit requires toxicity testing twice a year to ensure that the discharge does not present toxicity problems.

- The effluent limitations and conditions in the draft permit were developed to be protective of all aquatic life.

EPA believes that the conditions and limitations contained within the draft permit adequately protects all aquatic life, including those with designated EFH in the receiving water, and that further mitigation is not warranted. Should adverse impacts to EFH be detected as a result of this permit action, or if new information is received that changes the basis for EPA's conclusions, NMFS will be contacted and an EFH consultation will be re-initiated.

As the federal agency charged with authorizing the discharge from this facility, EPA has submitted the Draft Permit and fact sheet, along with a cover letter, to NMFS Habitat Division for their review.

12. MONITORING AND REPORTING

The permittee is obliged to monitor and report sampling results to EPA and the MassDEP within the time specified in the permit. The effluent monitoring requirements have been established to yield data representative of the discharge by the authority under Section 308(a) of the CWA in accordance with 40 CFR 122.441(j), 122.44, and 122.48.

The remaining general conditions of the permit are based primarily on the NPDES regulations 40 CFR 122 through 125 and consist primarily of management requirements common to all permits.

The effluent monitoring requirements have been established to yield data representative of the discharge under authority of Section 308 (a) of the CWA in accordance with 40 CFR §§122.41 (j), 122.44 (l), and 122.48.

The Draft Permit includes new provisions related to Discharge Monitoring Report (DMR) submittals to EPA and the State. The Draft Permit requires that, no later than one year after the effective date of the permit, the permittee submit all monitoring data and other reports required by the permit to

EPA using NetDMR, unless the permittee is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for submitting DMRs and reports ("opt out request").

In the interim (until one year from the effective date of the permit), the permittee may either submit monitoring data and other reports to EPA in hard copy form, or report electronically using NetDMR.

NetDMR is a national web-based tool for regulated Clean Water Act permittees to submit discharge monitoring reports (DMRs) electronically via a secure Internet application to U.S. EPA through the Environmental Information Exchange Network. NetDMR allows participants to discontinue mailing in hard copy forms under 40 CFR 122.41 and 403.12. NetDMR is accessed from the following url: http://www.epa.gov/netdmr Further information about NetDMR, including contacts for EPA Region 1, is provided on this website.

The Draft Permit requires the permittee to report monitoring results obtained during each calendar month using NetDMR no later than the 15th day of the month following the completed reporting period. All reports required under the permit shall be submitted to EPA as an electronic attachment to the DMR. Once a permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of DMRs or other reports to EPA and will no longer be required to submit hard copies of DMRs to MassDEP. However, permittees must continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP.

The Draft Permit also includes an "opt out" requests process. Permittees who believe they can not use NetDMR due to technical or administrative infeasibilities, or other logical reasons, must demonstrate the reasonable basis that precludes the use of NetDMR. These permittees must submit the justification, in writing, to EPA at least sixty (60) days prior to the date the facility would otherwise be required to begin using NetDMR. Opt outs become effective upon the date of written approval by EPA and are valid for twelve (12) months from the date of EPA approval. The opt outs expire at the end of this twelve (12) month period. Upon expiration, the permittee must submit DMRs and reports to EPA using NetDMR, unless the permittee submits a renewed opt out request 60 days prior to expiration of its opt out, and such a request is approved by EPA.

Until electronic reporting using NetDMR begins, or for those permittees that receive written approval from EPA to continue to submit hard copies of DMRs, the Draft Permit requires that submittal of DMRs and other reports required by the permit continue in hard copy format.

13. STATE PERMIT CONDITIONS

The NPDES Permit is issued jointly by the U. S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection under federal and state law, respectively. As such, all the terms and conditions of the permit are, therefore, incorporated into and constitute a discharge permit issued by the MassDEP Commissioner.

14. GENERAL CONDITIONS

The general conditions of the permit are based on 40 CFR Parts 122, Subparts A and D and 40 CFR 124, Subparts A, D, E, and F and are consistent with management requirements common to other permits.

15. STATE CERTIFICATION REQUIREMENTS

The staff of the Massachusetts Department of Environmental Protection ("MassDEP") has reviewed the draft permit. EPA has requested permit certification by the State pursuant to 40 CFR § 124.53 and expects that the draft permit will be certified.

16. PUBLIC COMMENT PERIOD AND PROCEDURES FOR FINAL DECISION

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the U.S. EPA, Office of Ecosystem Protection, Municipal Permits Branch, Five Post Office Square, Suite-100, Mail Code: OEP06-1, Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing for a public hearing to consider the draft permit to EPA and the State Agency. Such requests shall state the nature of the issues proposed to be raised in the hearing. Public hearings may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates a significant public interest. In reaching a final decision on the draft permit, the Regional Administrator will respond to all significant comments and make these responses available to the public at EPA's Boston office.

Following the close of the comment period and after a public hearing, if such a hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice.

17. EPA AND MASSDEP CONTACTS

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

Michele Cobban Barden
Office of Ecosystem Protection
U.S. Environmental Protection Agency
Five Post Office Square, Suite-100
Mail Code: OEP06-1
Boston, MA 02109-3912

Telephone: (617) 918-1539
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Kathleen Keohane
Surface Water Permit Program
Division of Watershed Management
Department of Environmental Protection
627 Main Street, Second Floor

Worcester, MA 01608
Telephone: (508) 767-2856

E-mail: kathleen.keohane@state.ma.us

July 19, 2010
Date

Stephen Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

Greenfield WPCP
Chemistry From WET Test Samples

WWTP Effluent

	3/11/2009	12/10/2008	9/10/2008	6/11/2008	3/12/2008	12/12/2007	9/12/2007	6/14/2007	3/15/2007	Average	Water Quality Criteria* Chronic	Acute
Cadmium** (mg/l)	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0388	0.034
Cooper (mg/l)	0.024	0.041	0.046	0.057	0.02	0.062	0.07	0.037	0.027	0.043	0.1555	0.117
Nickel (mg/l)	0.002	0.002	0.002	0.004	0.002	0.002	0.004	0.003	0.02	0.005	5.9535	0.6619
Lead (mg/l)**	0.001	0.0005	0.0005	0.002	0.0005	0.0005	0.0005	0.002	0.0005	0.001	0.5732	0.0223
Zinc (mg/l)	0.057	0.035	0.073	0.097	0.037	0.094	0.081	0.055	0.064	0.066	1.268	1.268
Hardness- CaCO3 (mg/l)	114.000	82.9	77.4	95.6	82.7	89	84.9	78.2	84.1	87.644		

Receiving Water

	3/11/2009	12/10/2008	9/10/2008	6/11/2008	3/12/2008	12/12/2007	9/12/2007	6/14/2007	3/15/2007		Water Quality Criteria*	
Cadmium (mg/l)**											0.0388	0.034
Copper	0.0005	0.007	0.0005	0.002	0.003	0.0005	0.0005	0.003	0.003	0.002	0.1555	0.117
Nickel (mg/l)	0.001	0.001	0.002	0.002	0.002	0.0005	0.0005	0.002	0.002	0.001	5.9535	0.6619
Lead (mg/l)**	0.001	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.5732	0.0223
Zinc (mg/l)	0.018	0.016	0.023	0.005	0.014	0.007	0.006	0.008	0.012	0.012	1.268	1.268
Hardness- CaCO3 (mg/l)	15.9	16.7	21.9	28.7	14.2	14.6	21.9	27.3	22.2	20.378		

* Cadmium, Copper, Nickel, Lead, and Zinc criteria are hardness - based. The criteria shown in the table are based on 25 mg/l hardness and are expressed as total recoverable metal
** Non detects averaged as a value 1/2 of detection level

Greenfield WPCP

Antidegradation Calculations

	Average Upstream Receiving Water Concentration (C_s)	Average Effluent Concentration (C_d)	Calculated Downstream Concentration at 3.2 MGD ($Cr_{2.89}$)	Chronic Criteria at Hardness = 22 mg/l	Assimilative Capacity (AC)	10 percent of AC
Cadmium (mg/l)	0.0000	0.0005	0.000012	0.0307	0.03069	0.0031
Copper (mg/l)	0.0022	0.0427	0.003201	0.1049	0.10170	0.0102
Nickel (mg/l)	0.0014	0.0046	0.001520	0.5941	0.59258	0.0593
Lead (mg/l)	0.00078	0.00089	0.000780	0.01900	0.01822	0.0018
Zinc (mg/l)	0.0121	0.0659	0.013413	1.3619	1.34849	0.1348
Hardness- CaCO3 (mg/l)	20	88	22.006018			

	Calculated Downstream Concentration at 3.4 MGD ($C_{r4.15}$)	Increase in Concentration at 4.15 MGD ($C_{r4.15}$-$C_{r2.89}$)	10% AC -Increase in Concentration at 4.15 MGD
Cadmium (mg/l)	0.000013	0.000001	0.003068 (increase less than 10 percent of assimilative capacity)
Copper (mg/l)	0.003261	0.000060	0.010110 (increase less than 10 percent of assimilative capacity)
Nickel (mg/l)	0.001524	0.000005	0.059253 (increase less than 10 percent of assimilative capacity)
Lead (mg/l)	0.000781	0.000000	0.001822 (increase less than 10 percent of assimilative capacity)
Zinc (mg/l)	0.013492	0.000079	0.134769 (increase less than 10 percent of assimilative capacity)
Hardness- CaCO3 (mg/l)	22.105170		

Exhibit A
Nitrogen Loads

NH, VT, MA Discharges to Connecticut River Watershed

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW (MGD)[1]	AVERAGE FLOW (MGD)[2]	TOTAL NITROGEN (mg/l)[3]	TOTAL NITROGEN - Existing Flow(lbs/day)[4]
NEW HAMPSHIRE					
Bethlehem Village District	NH0100501	0.340	0.220	19.600	35.962
Charlestown WWTF	NH0100765	1.100	0.360	19.600	58.847
Claremont WWTF	NH0101257	3.890	1.610	14.060	188.789
Colebrook WWTF	NH0100315	0.450	0.230	19.600	37.597
Groveton WWTF	NH0100226	0.370	0.290	19.600	47.405
Hanover WWTF	NH0100099	2.300	1.440	30.000	360.288
Hinsdale WWTF	NH0100382	0.300	0.300	19.600	49.039
Keene WWTF	NH0100790	6.000	3.910	12.700	414.139
Lancaster POTW	NH0100145	1.200	1.080	8.860	79.804
Lebanon WWTF	NH0100366	3.180	1.980	19.060	314.742
Lisbon WWTF	NH0100421	0.320	0.146	19.600	23.866
Littleton WWTF	NH0100153	1.500	0.880	10.060	73.832
Newport WWTF	NH0100200	1.300	0.700	19.600	114.425
Northumberland Village WPCF	NH0101206	0.060	0.060	19.600	9.808
Sunapee WPCF	NH0100544	0.640	0.380	15.500	49.123
Swanzey WWTP	NH0101150	0.167	0.090	19.600	14.712
Troy WWTF	NH0101052	0.265	0.060	19.600	9.808
Wasau Paper (industrial facility)	NH0001562		5.300	4.400	194.489
Whitefield WWTF	NH0100510	0.185	0.140	19.600	22.885
Winchester WWTP	NH0100404	0.280	0.240	19.600	39.231
Woodsville Fire District	NH0100978	0.330	0.230	16.060	30.806
New Hampshire Total		**24.177**	**19.646**		**2169.596**
VERMONT					
Bellows Falls	VT0100013	1.405	0.610	21.060	107.141
Bethel	VT0100048	0.125	0.120	19.600	19.616
Bradford	VT0100803	0.145	0.140	19.600	22.885
Brattleboro	VT0100064	3.005	1.640	20.060	274.373
Bridgewater	VT0100846	0.045	0.040	19.600	6.539
Canaan	VT0100625	0.185	0.180	19.600	29.424
Cavendish	VT0100862	0.155	0.150	19.600	24.520
Chelsea	VT0100943	0.065	0.060	19.600	9.808
Chester	VT0100081	0.185	0.180	19.600	29.424
Danville	VT0100633	0.065	0.060	19.600	9.808
Lunenberg	VT0101061	0.085	0.080	19.600	13.077
Hartford	VT0100978	0.305	0.300	19.600	49.039
Ludlow	VT0100145	0.705	0.360	15.500	46.537
Lyndon	VT0100595	0.755	0.750	19.600	122.598
Putney	VT0100277	0.085	0.080	19.600	13.077
Randolph	VT0100285	0.405	0.400	19.600	65.386
Readsboro	VT0100731	0.755	0.750	19.600	122.598
Royalton	VT0100854	0.075	0.070	19.600	11.442

St. Johnsbury	VT0100579	1.600	1.140	12.060	114.662

NH, VT, MA Discharges to Connecticut River Watershed

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW (MGD)[1]	AVERAGE FLOW (MGD)[2]	TOTAL NITROGEN (mg/l)[3]	TOTAL NITROGEN - Existing Flow(lbs/day)[4]
Saxtons River	VT0100609	0.105	0.100	19.600	16.346
Sherburne Fire Dist.	VT0101141	0.305	0.300	19.600	49.039
Woodstock WWTP	VT0100749	0.055	0.050	19.600	8.173
Springfield	VT0100374	2.200	1.250	12.060	125.726
Hartford	VT0101010	1.225	0.970	30.060	243.179
Whitingham	VT0101109	0.015	0.010	19.600	1.635
Whitingham Jacksonville	VT0101044	0.055	0.050	19.600	8.173
Cold Brook Fire Dist.	VT0101214	0.055	0.050	19.600	8.173
Wilmington	VT0100706	0.145	0.140	19.600	22.885
Windsor	VT0100919	1.135	0.450	19.600	73.559
Windsor-Weston	VT0100447	0.025	0.020	19.600	3.269
Woodstock WTP	VT0100757	0.455	0.450	19.600	73.559
Woodstock-Taftsville	VT0100765	0.015	0.010	19.600	1.635
Vermont Totals		**15.940**	**10.960**		**1727.302**
MASSACHUSETTS					
Amherst	MA0100218	7.100	4.280	14.100	503.302
Athol	MA0100005	1.750	1.390	17.200	199.393
Barre	MA0103152	0.300	0.290	26.400	63.851
Belchertown	MA0102148	1.000	0.410	12.700	43.426
Charlemont	MA0103101	0.050	0.030	19.600	4.904
Chicopee	MA0101508	15.500	10.000	19.400	1617.960
Easthampton	MA0101478	3.800	3.020	19.600	493.661
Erving #1	MA0101516	1.020	0.320	29.300	78.196
Erving #2	MA0101052	2.700	1.800	3.200	48.038
Erving #3	MA0102776	0.010	0.010	19.600	1.635
Gardner	MA0100994	5.000	3.700	14.600	450.527
Greenfield	MA0101214	3.200	3.770	13.600	427.608
Hadley	MA0100099	0.540	0.320	25.900	69.122
Hardwick G	MA0100102	0.230	0.140	14.600	17.047
Hardwick W	MA0102431	0.040	0.010	12.300	1.026
Hatfield	MA0101290	0.500	0.220	15.600	28.623
Holyoke	MA0101630	17.500	9.700	8.600	695.723
Huntington	MA0101265	0.200	0.120	19.600	19.616
Monroe	MA0100188	0.020	0.010	19.600	1.635
Montague	MA0100137	1.830	1.600	12.900	172.138
N Brookfield	MA0101061	0.760	0.620	23.100	119.445
Northampton	MA0101818	8.600	4.400	22.100	810.982
Northfield	MA0100200	0.280	0.240	16.800	33.627
Northfield School	MA0032573	0.450	0.100	19.600	16.346
Old Deerfield	MA0101940	0.250	0.180	9.200	13.811
Orange	MA0101257	1.100	1.200	8.600	86.069
Palmer	MA0101168	5.600	2.400	18.800	376.301
Royalston	MA0100161	0.040	0.070	19.600	11.442
Russell	MA0100960	0.240	0.160	19.600	26.154
Shelburne Falls	MA0101044	0.250	0.220	16.900	31.008
South Deerfield	MA0101648	0.850	0.700	7.900	46.120
South Hadley	MA0100455	4.200	3.300	28.800	792.634
Spencer	MA0100919	1.080	0.560	13.600	63.517
Springfield	MA0101613	67.000	45.400	4.300	1628.135

Sunderland	MA0101079	0.500	0.190	8.700	13.786
Templeton	MA0100340	2.800	0.400	26.400	88.070

NH, VT, MA Discharges to Connecticut River Watershed

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW (MGD)[1]	AVERAGE FLOW (MGD)[2]	TOTAL NITROGEN (mg/l)[3]	TOTAL NITROGEN - Existing Flow(lbs/day)[4]
Ware	MA0100889	1.000	0.740	9.400	58.013
Warren	MA0101567	1.500	0.530	14.100	62.325
Westfield	MA0101800	6.100	3.780	20.400	643.114
Winchendon	MA0100862	1.100	0.610	15.500	78.855
Woronoco Village	MA0103233	0.020	0.010	19.600	1.635
Massachusetts Totals		**166.010**	**106.950**		**9938.820**

1. Design flow – typically included as a permit limit in MA and VT but not in NH.
2. Average discharge flow for 2004 – 2005. If no data in PCS, average flow was assumed to equal design flow.
3. Total nitrogen value based on effluent monitoring data. If no effluent monitoring data, total nitrogen value assumed to equal average of MA secondary treatment facilities (19.6 mg/l), average of MA seasonal nitrification facilities (15.5 mg/l), or average of MA year round nitrification facilities (12.7 mg/l). Average total nitrogen values based on a review of 27 MA facilities with effluent monitoring data. Facility is assumed to be a secondary treatment facility unless ammonia data is available and indicates some level of nitrification.
4. Current total nitrogen load.

Total Nitrogen Load = 13,836 lbs/day
MA (41 facilities) = 9,939 lbs/day (72%)
VT (32 facilities) = 1,727 lbs/day (12%)
NH (21 facilities) = 2170 lbs/day (16%)
TMDL Baseline Load = 21,672 lbs/day

TMDL Allocation = 16,254 lbs/day (25% reduction)

MA Discharges to Housatonic River Watershed

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW (MGD)[1]	AVERAGE FLOW (MGD)[2]	TOTAL NITROGEN (mg/l)[3]	TOTAL NITROGEN - Existing Flow(lbs/day)[4]
MASSACHUSETTS					
Crane	MA0000671		3.100	8.200	212.003
Great Barrington	MA0101524	3.200	2.600	17.000	368.628
Lee	MA0100153	1.000	0.870	14.500	105.209
Lenox	MA0100935	1.190	0.790	11.800	77.745
Mead Laurel Mill	MA0001716		1.500	6.400	80.064
Mead Willow Mill	MA0001848		1.100	4.600	42.200
Pittsfield	MA0101681	17.000	12.000	12.400	1240.992
Stockbridge	MA0101087	0.300	0.240	11.100	22.218
West Stockbridge	MA0103110	0.076	0.018	15.500	2.327
Massachusetts Totals			**22.218**		**2151.386**

1. Design flow – typically included as a permit limit in MA and VT but not in NH.
2. Average discharge flow for 2004 – 2005. If no data in PCS, average flow was assumed to equal design flow.
3. Total nitrogen value based on effluent monitoring data. If no effluent monitoring data, total nitrogen value assumed to equal average of MA secondary treatment facilities (19.6 mg/l), average of MA seasonal nitrification facilities (15.5 mg/l), or average of MA year round nitrification facilities (12.7 mg/l). Average total nitrogen values based on a review of 27 MA facilities with effluent monitoring data. Facility is assumed to be a secondary treatment facility unless ammonia data is available and indicates some level of nitrification.
4. Current total nitrogen load.

Total Nitrogen Load = 2151.386 lbs/day

TMDL Baseline Load = 3,286 lbs/day
TMDL Allocation = 2,464 lbs/day (25% reduction)

MA Discharges to Thames River Watershed

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW (MGD)[1]	AVERAGE FLOW (MGD)[2]	TOTAL NITROGEN (mg/l)[3]	TOTAL NITROGEN - Existing Flow(lbs/day)[4]
MASSACHUSETTS					
Charlton	MA0101141	0.450	0.200	12.700	21.184
Leicester	MA0101796	0.350	0.290	15.500	37.488
Oxford	MA0100170	0.500	0.230	15.500	29.732
Southbridge	MA0100901	3.770	2.900	15.500	374.883
Sturbridge	MA0100421	0.750	0.600	10.400	52.042
Webster	MA0100439	6.000	3.440	17.400	499.199
Massachusetts Totals		**11.820**	**7.660**		**1014.528**

1. Design flow – typically included as a permit limit in MA and VT but not in NH.
2. Average discharge flow for 2004 – 2005. If no data in PCS, average flow was assumed to equal design flow.
3. Total nitrogen value based on effluent monitoring data. If no effluent monitoring data, total nitrogen value assumed to equal average of MA secondary treatment facilities (19.6 mg/l), average of MA seasonal nitrification facilities (15.5 mg/l), or average of MA year round nitrification facilities (12.7 mg/l). Average total nitrogen values based on a review of 27 MA facilities with effluent monitoring data. Facility is assumed to be a secondary treatment facility unless ammonia data is available and indicates some level of nitrification.
4. Current total nitrogen load.

Total Nitrogen Load = 1014.528 lbs/day

TMDL Baseline Load = 1,253 lbs/day

TMDL Allocation = 939 lbs/day (25% reduction)

Greenfield Water Pollution Control Plant
Discharge Monitoring Reports Summary

Fact Sheet # MA0101214
2010 Reissuance, Table 1

	Flow (MGD)		BOD_5 (mg/l)			BOD_5 lbs/day		BOD % Removal %	TSS (mg/l)			TSS lbs/day		TSS % Removal %	pH (S.U)		Fecal Coliform Bacteria cfu/100 ml		Total Residual Chlorine mg/l		Total Kjeldahl Nitrogen mg/l	Total Nitrate mg/l	Total Nitrite mg/l	Total Phosphorus mg/l	LC50 %
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Minimum	Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Minimum	Minimum	Maximum	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Average Monthly	Average Monthly	Average Monthly	Maximum Daily
Effluent Limit	3.2	Report	30	45	Report	801	1202	85%	30	45	Report	801	1202	85%	6.5	8.3	200	400	0.46	0.79	Report	Report	Report	Report	100
May-10																									***
Apr-10																					***	***	***	***	***
Mar-10	3.85	11.05	10	12.6	16.9	559	1140	84.2	7.3	10	13.5	386	696	88.4	7	7.5	***	***	***	***	1.3	7.8	0.11	1	100
Feb-10	3.78	9.58	11.2	12.8	19.5	331	551	91.7	9.4	13.9	33	301	629	91.6	7	7.4	***	***	***	***	***	***	***	***	***
Jan-10	3.758	7.153	8.7	9.5	11.4	267	404	92	9.2	14.9	30	339	797	91.2	7	7.6	***	***	***	***	2.2	12	0.17	2.2	***
Dec-09	3.75	7.36	11.0	11.8	13.3	399	475.0	88.2	10.3	12.2	15.6	380.0	492.0	88.0	6.9	7.3	***	***	***	***	***	***	***	***	
Nov-09	3.85	5.29	12.6	15.0	16.6	395	477.0	87.4	12.2	16.0	17.6	392.0	520.3	87.0	6.5	7.3	***	***	***	***	2.5	11	0.15	1.5	***
Oct-09	3.8	5.3	23.4	25.5	34.9	660	991.0	81.8	19.0	27.4	34.0	552.0	1051.0	83.8	6.8	7.3	13	98	0.22	0.51	***	***	***	***	***
Sep-09	2.87	4.2	19.8	22.8	31.1	494	739.0	86.5	12.6	15.2	19.2	307.0	443.0	90.8	6.7	7.1	9	116	0.39	0.73	2.9	11	0.1	1.7	100
Aug-09	3.86	8.21	18.7	20.2	23.0	515	589.0	85.6	15.2	17.8	19.2	455.0	641.0	87.9	6.5	7.4	17	104	0.31	0.72	***	***	***	***	***
Jul-09	4.41	7.63	16.9	17.8	22.4	611	741.7	84.5	13.2	14.7	19.6	459.0	580.3	90.1	6.7	7.3	11	48	0.18	0.46	2.8	11	0.14	1.7	***
Jun-09	3.45	6.65	21.9	24.8	32.8	584	874.0	83.1	28.6	39.8	54.0	741.0	1148.0	76.0	6.5	7	12	220	0.15	0.63	***	***	***	***	100
May-09	3.06	4.22	17.6	25.2	27.4	454	597.0	87.4	21.1	35.5	43.0	539.0	832.0	84.3	6.5	7.1	6	63	0.07	0.62	3.1	9.5	0.07	1.9	***
Apr-09	4.06	6.01	9.9	12.0	15.5	334	404.0	89.8	5.1	7.2	9.2	170.0	192.0	94.8	6.6	7.2	4	9	0.01	0.04	***	***	***	***	***
Mar-09	5.00	8.40	7.7	11.3	17.1	346	688.7	89.8	5.3	7.8	13.2	237.0	465.8	93.2	6.6	7.2	***	***	***	***	2.24	6	0.06	0.85	100
Feb-09	3.25	4.50	6.9	7.6	9.0	184	225.0	94.1	5.3	6.1	8.8	142.0	180.0	95.5	6.7	7.1	***	***	***	***	***	***	***	***	***
Jan-09	3.44	5.03	6.4	7.5	7.9	180	250.7	94.5	4.1	5.8	7.2	117.0	195.0	96.3	6.7	7.4	***	***	***	***	1.86	9.1	0.16	1.4	***
Dec-08	5.50	12.90	7.8	9.6	17.8	337	493.0	88.1	8.2	9.9	22.8	363.0	493.0	89.9	6.7	7.3	***	***	***	***	***	***	***	***	100
Nov-08	3.46	5.10	8.2	9.8	13.3	228	318.7	92.4	6.4	8.4	13.6	188.0	284.0	94.7	6.6	7.2	***	***	***	***	3.53	9.75	0.12	1.4	***
Oct-08	3.09	6.02	16.6	21.7	28.3	441	580.7	86.6	7.8	8.9	11.6	209.0	302.0	93.7	6.6	7.0	8	18	0.25	0.47	***	***	***	***	***
Sep-08	3.48	7.71	19.4	29.7	40.5	487	668.0	84.4	11.6	16.7	26.8	306.0	543.3	91.2	6.4	7.1	18	62	0.19	0.46	2.24	7.4	0.04	1.5	100
Aug-08	4.34	11.92	22.1	23.8	30.7	788	1204.0	79.0	16.2	19.1	31.7	602.0	1021.0	86.6	6.5	7.1	30	384	0.33	0.61	***	***	***	***	***
Jul-08	3.25	5.90	19.8	25.3	30.7	563	1000.0	81.8	16.1	22.2	34.0	492.0	920.5	85.0	6.5	7.0	12	200	0.15	0.33					***
Jun-08	2.73	5.26	18.8	22.0	26.3	435	532.0	88.6	23.4	29.1	44.0	591.0	1049.8	87.1	6.5	6.9	12	38	0.11	0.31	***	***	***	***	100
May-08	3.38	5.87	13.6	23.3	32.5	344	493.7	89.3	8.5	15.0	18.4	216.0	317.5	92.9	6.4	6.9	6	800	0.13	0.26					***
Apr-08	5.41	8.50	12.5	22.8	27.6	614	1359.5	87.8	5.0	12.9	15.2	263.0	675.7	95.4	6.5	6.9	7	223	0.17	0.35	***	***	***	***	***
Mar-08	7.91	13.78	7.0	9.2	11.5	464	664.7	84.9	6.9	10.1	18.8	459.0	718.8	90.6	6.5	7.1	***	***	***	***	1	5.3	0.08	0.64	100
Feb-08	6.29	12.05	8.9	13.1	17.5	583	957.0	85.7	10.4	19.8	36.7	687.0	1374.0	85.9	6.8	7.1	***	***	***	***	***	***	***	***	***
Jan-08	3.69	5.68	10.6	13.4	17.2	324	488.3	88.5	8.3	11.7	16.0	252.0	389.0	91.7	6.6	7.0	***	***	***	***					***
Min	2.73	4.20	6.40	7.50	7.90	180.00	225.00	79.00	4.10	5.80	7.20	117.00	180.00	76.00	6.40	6.90	4.00	9.00	0.01	0.04	1.00	5.30	0.04	0.64	100.00
Max	7.91	13.78	23.40	29.70	40.50	788.00	1359.50	94.50	28.60	39.80	54.00	741.00	1374.00	96.30	7.00	7.60	30.00	800.00	0.39	0.73	3.53	12.00	0.17	2.20	100.00
Avg	4.03	7.45	13.63	17.04	21.95	441.52	663.21	87.32	11.36	15.86	23.21	375.74	627.81	89.76	6.64	7.18	11.79	170.21	0.19	0.46	2.33	9.08	0.11	1.44	100.00

Greenfield Water Pollution Control Plant
2007 Application Effluent Data

Parameter	Maximum Daily Value	Average Daily Value	Units	Number of Samples
pH (minimum)	6.5	***	s.u.	***
pH (maximum)	7.2	***	s.u.	***
Flow Rate	2.9570	2.5486	mgd	28
Temperature (winter)	6.6	12	◦C	365
Temperature (Summer)	21.6	17.5	□C	365
BOD	44.7	17.9	mg/l	156
CBOD	***	***	mg/l	***
Fecal Coliform Bacteria	338	6	cfu/100 ml	120
Total Suspended Solids (TSS)	47.5	9.7	mg/l	204
Ammonia	0.74	0.40	mg/l	6
Total Residual Chlorine	0.76	0.05	mg/l	223
Dissolved Oxygen	13.3 (max)/7.1 (min)	10	mg/l	365
Total Kjeldahl Nitrogen	3.08	2.48	mg/l	8
Nitrate plus nitrite	14.9	13.5	mg/l	8
Oil and Grease	9.2	3.1	mg/l	3
Total Phosphorus	3.3	2.4	mg/l	8
Total Dissolved Solids	407	364	mg/l	4
Cadmium	<0.001	<0.001	mg/l	4
Chromium	0.001	<0.001	mg/l	4
Copper	0.054	0.039	mg/l	4
Lead	0.002	0.002	mg/l	4
Nickel	<0.003	<0.002	mg/l	4
Silver	0.001	***	mg/l	3
Zinc	0.093	0.068	mg/l	4
Total Phenolic Compounds	0.147	0.11	mg/l	3
Hardness	86.6	83.9	mg/l	4
Chlorodibromo-methane	1.7	<0.9	ug/l	3
Chloroform	10.3	6.6	ug/l	3
Dichlorobromo-methane	2.9	<2.9	ug/l	3
Ethylbenzene	1.2	<1.2	ug/l	3
Toluene	1.2	<1.2	ug/l	3
Bis(2-ethylhexyl) Phthalate	6.99	<3.0	ug/l	3