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

FACT SHEET

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

NPDES PERMIT NO: **MA0100404**

NAME AND ADDRESS OF PERMITTEE:

Massachusetts Water Resources Authority
Charlestown Navy Yard
100 First Avenue
Boston, MA 02129

The Towns of Clinton and Lancaster are co-permittees for specific activities required by the permit. See Section VI of this fact sheet and Sections I.C. and I.D. of the draft permit. The responsible municipal departments are:

Town of Clinton
Department of Public Works
242 Church Street
Clinton, MA 01510

Lancaster Sewer District
P.O. Box 773
226 Main Street
South Lancaster, MA 01561

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Massachusetts Water Resources Authority
Clinton Wastewater Treatment Facility
677 High Street
Clinton, MA 01510

RECEIVING WATERS: **South Branch Nashua River (MA81-09)**

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

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I. PROPOSED ACTION

The above named applicant 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 co-permittees discharge wastewater to the treatment plant owned and operated by the applicant. The current permit was signed on September 27, 2000 and became effective sixty (60) days later. The permit expired November 26, 2005. A re-application was received on May 27, 2005. The draft permit proposes an expiration date five (5) years from the effective date of the final permit.

II. TYPE OF FACILITY AND DISCHARGE LOCATION

The Massachusetts Water Resources Authority (MWRA) owns and operates the Clinton Wastewater Treatment Plant (WWTP) as part of an agreement with the Town of Clinton. In exchange for taking land to be flooded by the Wachusett Reservoir, MWRA supplies Clinton with water and treats Clinton's wastewater The Lancaster Sewerage District also contributes a small flow to the facility. The facility is an advanced wastewater treatment plant with a permitted flow of 3.01 million gallons per day (MGD), which discharges to the South Branch of the Nashua River (Figure 1 Location Map). The WWTP serves a population of approximately 14,500 in Clinton and approximately 1,500 in Lancaster.

The facility=s discharge outfalls are listed below:

Outfall	Description of Discharge	Receiving Water
001	Treated Effluent	South Nashua River

The Towns of Clinton and Lancaster Sewer District own and operate the collection system, with the exception of an approximately one-mile MWRA-owned interceptor sewer line that delivers wastewater to the WWTP. The collection system is 100% separate sanitary sewers. Since 2004, there have been three sanitary sewer overflows (SSOs) reported in the Town of Clinton, two of which occurred on the Weetabix property. No SSOs have been reported in the MWRA or Lancaster Sewer District collection systems.

III. DESCRIPTION OF DISCHARGE

Quantitative descriptions of the discharge in terms of significant effluent parameters, based on discharge monitoring reports (DMRs) submitted for January 2007 through December 2009, are shown in Appendix A of this fact sheet.

IV. LIMITATIONS AND CONDITIONS

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

V. PERMIT BASIS AND EXPLANATION OF EFFLUENT LIMITATION DERIVATION

A. PROCESS DESCRIPTION

The facility is an advanced activated sludge facility with year-round sodium hypochlorite disinfection and dechlorination. The facility discharges to the South Nashua River. The facility has a previously permitted flow of 3.01 MGD. In addition to the sanitary sewer flow, there are two non-categorical significant industrial dischargers users: Weetabix (non-categorical) and Central Mass Powder Coating (non-discharging metal finishing operation).

The following is a brief description of the treatment process (See Figure 2 Clinton Treatment Plant Flow Schematic): A mechanical bar screen and bar rack remove grit screenings and large floatables. Wastewater then flows into an aerated grit tank for grit removal. Collected grit is then transported to the MWRA owned landfill and covered. Grit removal is followed by primary settling and scum removal. These processes are accomplished in four primary settling tanks, where smaller floating and settleable solids are removed. Four trickling filters are available for use in initial secondary treatment. Wastewater then flows into three of six available aeration tanks where activated sludge biological treatment occurs. Nitrification also occurs in the aeration tanks. Soda ash (sodium carbonate) is used to regulate the alkalinity of the activated sludge. After biological treatment, wastewater flows to three clariflocculators, which remove biological solids. Polymers and coagulants (sodium aluminate) are added to the clariflocculators to enhance solids removal and achieve the required level of phosphorus removal. Secondary effluent is then disinfected with sodium hypochlorite, dechlorinated with sodium bisulfite, and the final effluent discharged over aeration steps into the South Nashua River.

Sludge from the primary and secondary tanks is co-thickened in a gravity thickener. The sludge then is pumped to an anaerobic digester, which provides pathogen and volume reduction. The methane gas produced in this process is recovered and used to heat the digesters and dewatering/ maintenance building. Sludge is dewatered on one of two a belt filter presses then transported to an MWRA-owned landfill where it is further processed by mixing with a clean fill bulking agent and applied to the banks of the landfill and covered with a clean fill cover. The landfill was constructed with a double liner system to protect groundwater resources. It contains two separate leachate collection systems to collect and pump the leachate back to the sewer system for treatment at the plant.

B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Overview of Federal and State Regulations

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. Secondary treatment requirements are set forth at 40 C.F.R. Part 133.102. In addition, Section 301(b)(1)(C) of the CWA requires that effluent limitations based on water quality considerations be established for point source discharges when such limitations are necessary to achieve 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.

2. Water Quality Standards; Designated Use; Outfall 001

The South Nashua River in the vicinity of the discharges 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, and for primary and secondary contact recreation. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses and should have consistently good aesthetic value.

A warm water fishery is defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.02) as waters in which the maximum mean monthly temperature generally exceeds 20□ Celsius (68□Fahrenheit) during the summer months and are not capable of supporting 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). The segment of the South Nashua River from the Clinton WWTP to its confluence with the North Nashua River in Lancaster (MA81-09) is listed on the Massachusetts 2008 Integrated List of Waters (303d) as impaired and requiring the development of a TMDL. The listed impairments for this segment are nutrients and pathogens. Immediately upstream of the Clinton WWTP (MA81-08), the listed impairments for the river segment are unknown toxicity and pathogens. The specific cause(s) of these impairments are unknown.

The MassDEP 2003 Water Quality Assessment Report for the Nashua River, which is the basis for the 303(d) list, notes that the receiving water segment (MA81-09) does not support primary contact recreational use due to *E. coli* and is on alert status for high phosphorus concentrations.

3. Available Dilution

Water quality criteria in the receiving water must be met after accounting for dilution under low flow conditions. The Massachusetts Water Quality Standards (MA WQS) (310 CMR 4.00) dictate how available dilution is determined for receiving waters.

A comparison between the total dam release, which includes the daily variable release, a release to Lancaster Mills, and dam seepage; and the USGS gage shows that the watershed between the dam and the Clinton WWTP adds no additional flow to the Nashua River.

The flow of the South Nashua River at the Clinton WWTP is controlled by the Wachusett Dam, which is located 3.2 miles upstream of the treatment plant. 314 CMR 4.03(3)(b) requires that:

> *In waters where flows are regulated by dams or similar structures, the lowest flow condition at which aquatic life criteria must be applied is the flow equaled or exceeded 99% of the time on a yearly basis, or another equivalent flow agreed upon by the Department and the federal, state or private entity controlling the flow. The minimum flow established in such an agreement will become the critical low flow for those waters covered by the agreement.*

In a letter dated June 5, 2009, MWRA requested a revision in the critical low flow for the Nashua River from 2.785 cfs (cubic feet per second) to 4.27 cfs based on flow measurements at a US Geological Survey (USGS) gage upstream of the Clinton WWTP. However, a comparison of data from the USGS gage upstream of the WWTP to the water released from the dam shows that there is no significant streamflow addition (i.e. from baseflow or tributaries) between the dam and the WWTP discharge. On some dry weather days, the river flow is actually lower than MWRA's stated dam releases, perhaps due to evaporative losses or absorption into the river banks. EPA is not granting the request to increase the receiving water critical low flow, based on lack of evidence that the Nashua River flow is consistently greater than the minimum flow released from the Wachusett Dam.

The dilution has been calculated using the minimum dam release. MWRA is obligated by state law to release at least 12 million gallons per week from the Wachusett Dam (though it often releases higher volumes to manage water levels in the Wachusett Reservoir). This number can be converted to MGD as follows:

$$\text{Flow (MGD)} = \frac{\text{12 million gallons}}{\text{1 week}} \times \frac{\text{1 week}}{\text{7 days}} = 1.7 \text{ MGD}$$

The draft permit uses the 1.7 MGD as the critical low flow in accordance with the above excerpt from the Massachusetts MA WQS. This corrects the previous permit, which used 1.8 MGD as the critical low flow.

The dilution factor can then be calculated as follows:

$$\frac{\text{River flow (release from Wachusett Dam)} + \text{Daily permitted flow}}{} = \text{Dilution factor}$$

Daily permitted flow

WWTP Permitted Flow = 3.01 MGD
Nashua River Critical Low Flow = 1.7 MGD

$$\text{Dilution factor} = \frac{3.01\ \text{MGD} + 1.7\ \text{MGD}}{3.01\ \text{MGD}} = 1.56, \text{ or } 1.6$$

Therefore, the dilution factor is 1.6.

EPA notes that although the Clinton WWTP has a relatively low dilution factor, this factor is within MWRA's control. The minimum release from the Wachusett Reservoir to the Nashua River could be raised by increasing the flow through the fountain or by releasing more water over the spillway.

In communications with EPA, MWRA has indicated that it is considering releasing more flow into the Nashua River from the Wachusett Dam. EPA encourages MWRA to continue these deliberations, as it will confer the positive effects mentioned above. If a formal agreement is reached, and it significantly changes the dilution factor, EPA will consider this new information, for purposes of either revising the draft permit (if the information is received prior to the final permit decision), or modifying the permit (if the information is received after the final permit decision).

4. Effluent Flow

Due to excessive I/I (infiltration/inflow – See Section VI of this document) in the Clinton collection system, the Clinton WWTP has regularly (i.e. 29 of the last 36 months) exceeded its permitted flow rate of 3.01 MGD, calculated as a 12-month rolling average. In 2000, MWRA relined its sewer interceptor and manholes to eliminate I/I in its portion of the collection system. However, there continues to be a large quantity of I/I in the Clinton collection system as shown by a comparison of average daily influent flows[1] for a dry month and a wet month in 2008. In April 2008, average daily influent flow was 3.68 million gallons, while in August 2008, during the dry season, average daily influent flow was 2.69 million gallons. Even this lower number includes some inflow/infiltration, as MWRA estimates that daily sanitary sewage flow from Clinton and Lancaster is only 1.6 million gallons.[2] MassDEP issued an Administrative Consent Order (ACO) on July 3, 1985 establishing a Sewer Bank for Clinton and Lancaster. Every gallon per day of new sewer construction must be offset by 2 gallons per day of I/I removal. Clinton increased this ratio in 2006 to 3 gallons I/I removed for every gallon of increased flow. Unfortunately, it does not appear that this arrangement has been effective for reducing high wet weather flows to Clinton WWTP.

In a letter dated June 5, 2009, MWRA requested a revision in the permitted flow for the Clinton WWTP from 3.01 MGD to 3.65 MGD. EPA is not granting the request at this time, because it

[1] Average daily influent flow, as reported in Clinton MWRA's Monthly Operations Report submitted to MassDEP and EPA, should be distinguished from the 12-month rolling average flow reported in Clinton MWRA's Discharge Monitoring Reports.
[2] From MWRA I/I report dated January 30, 2009

appears that the current flow limit could be achieved by a serious effort to control I/I. Furthermore, the treatment plant flow represents a significant percentage of the receiving water dry weather flow as evidenced by the low dilution factor. An effluent flow limit increase would raise serious issues relative to consistency with water quality standards, including antidegradation provisions.

The draft permit carries forward the limit in the current permit, which is 3.01 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 flows shall also be reported on the federal DMR.

5. Conventional Pollutants

A) Biochemical Oxygen Demand (BOD5)/ Carbonaceous Biochemical Oxygen Demand (CBOD5)

The draft permit carries forward the BOD_5 limits in the current permit. The water quality-based limits were developed by MassDEP in August 1987 using a steady state water quality model, and were verified by EPA in October 1987. The mass limitations for BOD_5 are based on a 3.01 MGD permitted flow. The monitoring frequency continues to be three times per week.

Mass Limitation (lbs/day) = C x PF x 8.34

Where

C = Concentration Limit
PF = Permitted Flow
8.34 = Factor to convert concentration limit in mg/l and permitted flow in MGD to pounds per day.

Average Monthly Mass Limit = 20 mg/l x 3.01 MGD x 8.34 = 502 lbs/day or 500 lbs/day.
Average Weekly Mass Limit = 20 mg/l x 3.01 MGD x 8.34 = 502 lbs/day or 500 lbs/day.

In accordance with the provisions set forth at 40 CFR § 133.102(b)(3), the draft permit requires that the 30-day average percent removal of BOD_5 be no less than 85%.

B) Total Suspended Solids (TSS)

The draft permit carries forward the TSS limits in the current permit. The average monthly limit is 20 mg/l and the average weekly limit is 20 mg/l. The mass limitations for TSS are based on a 3.01 MGD permitted flow. The draft permit requires the permittee to report the maximum TSS value each month, but does not establish an effluent limit. The monitoring frequency continues to be three times per week.

Mass Limitation (lbs/day) = C x PF x 8.34

Where

C = Concentration Limit
PF = Permitted Flow
8.34 = Factor to convert concentration limit in mg/l and permitted flow in MGD to pounds per day.

Average Monthly Mass Limit = 20 mg/l x 3.01 MGD x 8.34 = 502 lbs/day or 500 lbs/day.
Average Weekly Mass Limit = 20 mg/l x 3.01 MGD x 8.34 = 502 lbs/day or 500 lbs/day.

In accordance with the provisions set forth at 40 CFR § 133.102(b)(3), the draft permit requires that the 30-day average percent removal of TSS be no less than 85%.

C) pH

The draft permit includes pH limitations that 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.

D) Escherichia coli (*E. coli*)

The *Escherichia coli* (*E. coli*) limits for Outfall 001 are based on state water quality standards for Class B waters (314 CMR 4.05(b)(4)). The Commonwealth of Massachusetts promulgated *E. coli* criteria in the Surface Water Quality Standards (314 CMR § 4.00) on December 29, 2006, replacing fecal coliform bacteria criteria. These new criteria were approved by EPA on September 19, 2007.

The *E. coli* limits proposed in the draft permit for Outfall 001 are 126 colony forming units per 100 ml (cfu/100 ml) geometric monthly mean and 409 cfu/100 ml maximum daily value (this is the 90% distribution of the geometric mean of 126 cfu/100 ml). These limits are seasonal, and the season has been extended from April 1st - October 15th to April 1st - October 31st to fully encompass the contact recreation period. The proposed *E. coli* monitoring frequency in the draft permit is daily. The draft permit requires that *E. coli* samples be collected at the same time as one of the total residual chlorine samples.

E) Dissolved Oxygen

The draft permit includes a limitation of not less than 6.0 mg/l for dissolved oxygen (DO) which is the same as the previous permit and is therefore consistent with the anti-backsliding provision of the CWA § 402(o).

6. Non-Conventional Pollutants

A) Total Residual Chlorine

Chlorine is a toxic chemical, and chlorine compounds produced from the disinfection of wastewater can be extremely toxic to aquatic life. Data reported on the facility's discharge monitoring reports (DMRs) shows total chlorine residual levels below the minimum detection level for the past 24 months. The draft permit carries forward the current total residual chlorine (TRC) limitations, which are based on state water quality standards [Title 314 CMR 4.05(5)(e)].

The acute and chronic water quality criteria for chlorine defined in the 2002 EPA National Recommended Water Quality Criteria for freshwater are 19 µg/l and 11 µg/l, respectively. Given the dilution factor of 1.6, total residual chlorine limits have been calculated as 30 µg/l maximum daily and 18 µg/l average monthly. This limit is in effect year round. Sampling will be required twice (2) per day.

Total Residual Chlorine Limitations:

(acute criteria * dilution factor) = Acute limit (Maximum Daily)
(19 µg/l x 1.6) = 30.4 µg/l

(chronic criteria * dilution factor) = Chronic limit (Monthly Average)
(11 µg/l x 1.6) = 17.6 µg/l

B) Total Phosphorus

The Massachusetts Surface Water Quality Standards (314 CMR 4.00) do not contain numerical criteria for total phosphorus. The narrative criteria for nutrients is found at 314 CMR 4.05(5)(c), which states that nutrients Ashall not exceed the site specific limits necessary to control accelerated or cultural eutrophication@. The Standards also require that Aany existing point source discharges containing nutrients in concentrations which encourage eutrophication or the growth of weeds or algae shall be provided with the highest and best practicable treatment to remove such nutrients (314 CMR 4.04). MassDEP has established that a monthly average total phosphorus limit of 0.2 mg/l (200 µg/l) represents highest and best practical treatment for POTWs.

EPA has produced several guidance documents that contain recommended total phosphorus criteria for receiving waters. The 1986 Quality Criteria of Water ("the Gold Book") recommends in-stream phosphorus concentrations of 0.05 mg/l in any stream entering a lake or reservoir, 0.1 mg/l for any stream not discharging directly to lakes or impoundments, and 0.025 mg/l within a lake or reservoir.

More recently, EPA has released AEcoregional 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 criteria represent conditions in waters in each specific ecoregion which are minimally impacted by human activities, and thus representative of waters without cultural eutrophication. Clinton is within Ecoregion XIV, Eastern Coastal Plains. The recommended

total phosphorus criteria for this Ecoregion XIV is 24 µg/l (0.024 mg/l) and can be found in the Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion XIV, published in December 2000.

In the summer of 2003, the Clinton WWTP effluent phosphorus concentration hovered near 200 µg/l, which is much lower than the current limit (1,000 µg/l) and slightly higher than the proposed effluent limit (150 µg/l), for much of the season (see **Table 2**). Data collected for the 2003 Nashua River Water Quality Assessment (WQA) Report in the South Nashua River less than one mile downstream of the Clinton discharge at Station NS19 (Atherton Bridge in Lancaster) are presented below in **Table 3**. Although the Clinton WWTP's effluent phosphorus was well below its permit limit, all downstream ambient values exceed the Ecoregional criteria, 24 µg/l, although the lowest flow of the season was 10 times the 7Q10. Presumably, if 7Q10 conditions had occurred in 2003, downstream phosphorus levels would have been higher due to less dilution by the receiving water. This evidence indicates that a more stringent phosphorus limit is necessary to protect the receiving water from eutrophication during critical conditions.

Table 2. Reported Effluent Phosphorus Concentration, Summer 2003

Date	TP (µg/l)
May-03	399
June-03	260
July-03	210
August-03	420
September-03	189
October-03	190

(TP is Total Phosphorus)

Table 3. Downstream Concentration at NS19, Summer 2003*

Date	TP (µg/l)
4/9/2003	53
5/7/2003	64
6/11/2003	44
7/16/2003	32
8/13/2003	33
10/8/2003	37

*Data are from the Nashua River Watershed 2003 Water Quality Assessment Report.

MassDEP included the segment of the Nashua River immediately downstream of the Clinton WWTP (MA81-09) on the 2008 303(d) list for nutrients. The 2003 WQA noted moderate coverage of filamentous algae at the site on one occasion, and evidence of periphyton on another. Furthermore, the State has also documented the eutrophication of the Pepperell Impoundment, located on the North Nashua River approximately 20 miles downstream of the Clinton WWTP. The Impoundment is the downstream point of accumulation for any biomass produced upstream as the result of Clinton phosphorus inputs. The 2003 WQA reported floating algal mats at Pepperell Pond, indicating high phosphorus concentrations in the water column.

Discharge Monitoring Reports (DMRs) submitted by the permittee over the last 24 months report average monthly total phosphorus values between 170 µg/l and 600 µg/l with a maximum daily value of 960 µg/l. The calculated instream contribution at the current monthly average limit of 1,000 µg/l (1,000 µg/l divided by the dilution factor of 1.6) would be 600 µg/l, which is higher than both the ecoregion criteria and the "Gold Book" criteria.

In June 2007, MassDEP submitted a Draft Phosphorus Total Maximum Daily Load (TMDL) study for the Nashua River watershed to EPA for approval. EPA has not approved the TMDL.

Based on the downstream impairments (e.g. 303(d) listing of the South Nashua River segment MA81-09, and the documented eutrophication of the Pepperell Impoundment), the ambient total phosphorus levels, and the current nutrient criteria, EPA determined that a more stringent total phosphorus limit than that in the current permit is necessary. A limit was calculated that would result in the attainment of the Gold Book-recommended criteria of 100µg/l under 7Q10 conditions. The effluent limitation is calculated as follows:

$$C_d = \frac{(Q_r C_r - Q_s C_s)}{Q_d}$$

Where

C_d	=	Discharge concentration	=	?
C_r	=	Concentration below outfall	=	100 µg/l (Gold Book value)
Q_d	=	Discharge flow	=	3.01 MGD
Q_s	=	Upstream flow	=	1.71 MGD
C_s	=	Upstream concentration	=	12 µg/l
Q_r	=	Streamflow below outfall (effluent + upstream)	=	4.71 MGD

$$C_d = \frac{(4.71 \text{ MGD})(100 \text{ µg/l}) - (1.7 \text{ MGD})(12 \text{ µg/l})}{3.01 \text{ MGD}}$$

$$= 150 \text{ µg/l}$$

The draft permit therefore includes a water quality-based total phosphorus limit of 150 µg/l. This will be a monthly average limit and will be in effect from April 1 through October 31 of each year. In addition, the maximum daily value for each month must be reported.

The permit contains a compliance schedule for meeting the total phosphorus limits (see Section I.B. of the permit.) The schedule contains several interim milestones relative to the steps necessary to complete the design and construction of facilities necessary to meet the final limits. Final compliance with the total phosphorus limits must be achieved by the fourth anniversary of the effective date of the permit.

EPA has also included a winter effluent limitation for total phosphorus. Phosphorus discharged during the winter months could settle in downstream impoundments, particularly Pepperell Pond, and be available to support plant growth during the growing season. The permit establishes a one-year compliance schedule for meeting the November through March seasonal total phosphorus limit of 1,000 ug/l. The permit also includes a reporting requirement for dissolved orthophosphate for the winter period to confirm that the potential for phosphorus accumulation is minimized.

C) Aluminum

Aluminum, in the form of alum or other compounds, is a commonly used chemical additive in wastewater treatment to remove phosphorus. The release of metals such as aluminum into the environment can result in levels that are highly toxic to aquatic life. Therefore, it is necessary to evaluate the downstream effects of discharges of aluminum from wastewater treatment plants. Water quality-based effluent limitations are imposed on dischargers when it is determined that limitations more stringent than technology-based limitations are necessary to achieve or maintain the water quality standards in the receiving water (40 CFR § 122.44(d)(1)). Such determinations are made when EPA finds that there is reasonable potential for the discharge to cause or contribute to an instream excursion above a water quality criterion contained within applicable state water quality standards (40 CFR § 122.44(d)(1)(i)).

In determining reasonable potential, EPA considers existing controls on point and nonpoint sources of pollution, pollutant concentration and variability in the effluent and receiving water as determined from the permittee's reissuance application, DMRs, state and federal water quality reports; and, where appropriate, the dilution of the effluent in the receiving water (see 40 CFR §122.44(d)(1)(ii)). If EPA concludes, after using the procedures found at 40 CFR § 122.44(d)(1)(ii), toxicity testing data, or other available information, that a discharge causes or has the reasonable potential to cause or contribute to an in-stream excursion above a numeric criterion within an applicable state water quality standard, effluent limitations must be included in NPDES discharge permits to ensure that water quality standards in the receiving water are met (40 CFR § 122.44(d)(1)(v)).

The Massachusetts Surface Water Quality Standards include requirements for the regulation and control of toxic constituents and also require that EPA-recommended criteria established pursuant to Section 304(a) of the CWA be used unless site-specific criteria are established (314 CMR § 4.05(5)(e)). Massachusetts has not adopted site-specific criteria for aluminum. Therefore, the freshwater criteria for aluminum found in the *National Recommended Water Quality Criteria*: *2002* (US EPA 2002 [EPA-822-R-02-047]), which are an acute concentration of 750 µg/l and a chronic concentration of 87 µg/l, apply in Massachusetts.

The potential for discharges of aluminum from the Clinton WWTP to cause or contribute to an excursion above water quality criteria was determined by statistically projecting the maximum concentration of the pollutant in the receiving water downstream from the discharge. Only values for June and September WET tests were used, because that is when Clinton WWTF currently uses alum for nutrient removal, which will likely occur year-round under the new permit. EPA projected the maximum concentration as 960 ug/l by calculating the 99th percentile measurement of the existing effluent data set, shown in Table 4. The 95th percentile concentration, 468 ug/l, was calculated for comparison with the chronic WQC (see Appendix B).

The projected pollutant level was then inserted into a steady-state mixing equation to determine if it could cause or contribute to an excursion from water quality standards under critical conditions. Background concentrations of aluminum in the Nashua River were determined from the WET Chemistry dilution water samples from 2008 and 2009.

As shown in the box below, the projected maximum aluminum effluent of 960 ug/l results in a receiving water concentration of 604 µg/l during critical conditions, below the acute criterion of

750 µg/l. A concentration of 468 ug/l, the 95th percentile concentration, results in a receiving water concentration of 317 ug/l, above the chronic criterion of 87 µg/l. Therefore, there is reasonable potential for the discharge to cause or contribute to an excursion of the chronic water quality standard for aluminum.

Table 4. Aluminum Values in Clinton Wastewater Treatment Facility Effluent from Selected Toxicity Tests

Date	Aluminum, µg/l
June 2008	206, 205, 262
September 2008	199, 297, 696
June 2009	593, 435, 457
September 2009	126, 205, 295

Reasonable Potential Analysis for Aluminum

Where

C_r	=	Concentration below outfall		
Q_d	=	Discharge flow	=	3.01 MGD
C_d	=	Discharge concentration	=	468 µg/l
Q_s	=	Upstream flow	=	1.7 MGD
C_s	=	Upstream concentration	=	50 µg/l
Q_r	=	Streamflow below outfall (effluent + upstream)	=	4.71 MGD

Therefore,

$$Cr = \frac{(3.01\ MGD \times 468\ \mu g/l) + (1.7\ MGD \times 50\ \mu g/l)}{4.71\ MGD}$$

= **317 ug/l** > 87 µg/l (chronic criterion)

Therefore, there is **reasonable potential** for the discharge to cause or contribute to an excursion from the chronic water quality criterion for aluminum.

Reasonable Potential Analysis for Aluminum

Where

C_r	=	Concentration below outfall		
Q_d	=	Discharge flow	=	3.01 MGD
C_d	=	Discharge concentration	=	960 µg/l
Q_s	=	Upstream flow	=	1.7 MGD
C_s	=	Upstream concentration	=	50 µg/l
Q_r	=	Streamflow below outfall (effluent + upstream)	=	4.71 MGD

Therefore,

$$Cr = \frac{(3.01\ MGD \times 960\ \mu g/l) + (1.7\ MGD \times 50\ \mu g/l)}{4.71\ MGD}$$

$$= \mathbf{604\ ug/l} < 750\ \mu g/l \text{ (acute criterion)}$$

Therefore, there is **no reasonable potential** for the discharge to cause or contribute to an excursion from the acute water quality criterion for aluminum.

Given that the primary source of aluminum in the facility's discharge is alum used for phosphorus removal, and that the facility has a four-year compliance schedule to meet proposed phosphorus limits, the draft permit requires monitoring only for aluminum. This will give the facility the opportunity to re-evaluate use of alum in nutrient removal and will allow operational flexibility to minimize phosphorus concentrations until compliance with the new limit is possible. The permittee will report the average monthly maximum daily concentration in µg/l. Monitoring frequency will be twice per week.

D) Ammonia Nitrogen

Ammonia is unique among regulated pollutants in that it is naturally produced by fish as a waste product. High levels of ammonia in the water column make it more difficult for fish to excrete this chemical via passive diffusion from gill tissues. Ammonia toxicity also varies with pH and temperature. Since the date of the existing permit, EPA has revised water quality criteria to account for these relationships.

A review of the current seasonal effluent limitations for ammonia nitrogen indicates that they are protective of water quality and in accordance with the EPA 1999 Update of Ambient Water Quality Criteria for Ammonia. Effluent data from 2007-2009 indicate that the Clinton-MWRA WWTP has consistently met the limits in the current permit.

The draft permit includes seasonal effluent limitations for ammonia nitrogen. During the month of April, the average monthly limit for ammonia nitrogen is 10 mg/l, and the maximum daily discharge during each month must be reported. For the month of May, the average monthly effluent limit is reduced to 5 mg/l and the maximum daily discharge during each month must be reported. For the summer months, defined as June 1 through October 31, the draft permit includes an average monthly limit of 2 mg/l and a maximum daily limit of 3 mg/l. For the winter months, defined as November 1 through March 31, the average monthly limit is 10.0 with a maximum daily limit of 35.2. These limits are carried forward from the existing permit and are based on the 1981 waste load allocation. Monitoring frequency June 1 through October 31 continues to be three times per week. During the periods of November 1 through March 31, April 1 through April 30, and May 1 through May 31; monitoring frequency is once per week.

E) Copper

Certain metals, like copper, can be toxic to aquatic life. The current permit includes monthly average and daily maximum copper limits of 6.2 µg/l and 8.3 µg/l, respectively. These limits were calculated using the 1998 Water Quality criteria for copper calculated at a hardness of 35 mg/l as $CaCO_3$ and a dilution factor of 1.6. An examination of Clinton WWTP data from 2007-2009 indicates that effluent copper concentrations range from 4.23 – 13.1 µg/l (see Appendix A).

The Massachusetts Surface Water Quality Standards were revised in December 2006, and approved by EPA on March 26, 2007, to include a dissolved acute copper criterion of 25.7 µg/l and a dissolved chronic copper criterion of 18.1 µg/l for the Nashua River (314 CMR § 4.06, Table 28 (Site Specific Criteria)).

The new, less stringent, site specific copper criteria may allow an increase in the effluent copper limitations. However, EPA may only relax effluent limitations when consistent with anti-backsliding and antidegradation requirements. A chart from the USEPA NPDES Permit Writers Manual showing the anti-backsliding rules relating to water quality-based effluent limitations is attached (Figure 2 Anti-backsliding Flow Chart).

To determine whether a water quality-based limitation can be relaxed pursuant to anti-backsliding, it first must be determined whether a specific exception is met under 402(o). In this case, no specific exception has been met[3] . If there is no specific exception, water quality limits might still be relaxed, with the procedures being determined by whether the receiving water is in attainment of water quality standards for the pollutant in question. EPA therefore performed calculations to determine whether the receiving water is currently attaining the site-specific chronic copper criterion under critical conditions. Critical conditions include the treatment plant discharging at permitted flow, with an effluent copper concentration equal to the statistically-projected 99th percentile value (14.0 µg/l) and the flow in the receiving water upstream of the discharge at the minimum required flow release from the Wachusett Dam (1.71 MGD).

Under these conditions, the maximum daily instream dissolved copper concentration downstream from the discharge is projected to be 10.88 µg/l (see **Appendix C**). The projected

[3] The exception relating to new information does not apply. New regulations (in this case, new water quality criteria) are specifically excluded as new information.

instream copper concentrations downstream from the discharge are less than the site-specific acute and chronic criteria, meaning that the receiving water is currently in attainment of the site specific water quality standards with respect to copper. Therefore, it is permissible to relax the monthly average and daily maximum copper limits, provided antidegradation requirements are met.

First, EPA calculated limits that would result in the concentration of copper in the receiving water downstream from the discharge being equal to the site-specific criteria (i.e., limits based on the site-specific criteria); they are 40.4 µg/l (maximum daily) and 28.0 µg/l (average monthly). These values are less stringent than those contained in the prior permit.

EPA then evaluated the level of copper removal routinely achieved by the facility in accordance with requirements in the State's *Protocol for and Determination of Site-Specific Copper Criteria for Ambient Waters in Massachusetts* (the "site-specific protocol"; MassDEP 2007). This document provides that limits adjusted pursuant to the site-specific criteria will also reflect the level of copper control routinely achieved by the facility. A statistical analysis of the effluent concentration data from 2007 to 2009 (see **Appendix A**) shows that limits based solely on past performance would result in a monthly average limit of 9.5 µg/l and a daily maximum limit of 14.0 µg/l (see **Appendix C**). These limits are less stringent than the prior permit limits, but more stringent than limits based solely on the site-specific copper criteria referenced above.

A comparison of the limits in the prior permit, the limits based on the site-specific criteria being achieved in the downstream receiving water, and the limits based on the performance of the facility are presented in **Table 5**. Also shown are the downstream receiving water concentrations of copper that would be expected under each set of limitations (see **Table 5**).

Table 5.
Comparison of Effluent Limits and Resultant Downstream Receiving Water Concentrations of Copper*

	Average Monthly (Chronic) (Total Recoverable Copper)	Maximum Daily (Acute) (Total Recoverable Copper)	Resultant Downstream Receiving Water Concentration at Acute and Chronic Limits, respectively (Dissolved Copper)[4]
Limits in Prior Permit	6.2 µg/l	8.3 µg/l	6.1 µg/l and 7.4 µg/l
Limits to Achieve Criteria[5]	28 µg/l	40 µg/l	18.1 µg/l and 25.7 µg/l
Performance-Based Limits	9.5 µg/l	14.0 µg/l	8.1 µg/l and 10.9 µg/l

In light of the above calculations, EPA proposes to increase the monthly average limit from 6.2 µg/l (contained in the prior permit) to 9.5 µg/l, and to increase the daily maximum from 8.3 µg/l (contained in the prior permit) to 14.0 µg/l. This is consistent with the State's protocol, which allows an upward adjustment of limits based on site-specific criteria, but only to the extent necessary based on past demonstrated performance of the facility. Monitoring frequency will be once per week.

These limits are more stringent than the limits calculated to achieve the site specific criteria and to protect existing uses. The instream concentration will remain substantially below the applicable instream chronic criterion (8.1 µg/l vs. 18.1 µg/l), and the new limit reflects the past performance of the Permittee's facility.

F) Zinc

A Reasonable Potential Analysis was conducted to determine the necessity of permit limits for zinc. Similar to other metals, Water Quality Criteria for zinc are dependent on the hardness of the receiving water; increasing hardness reduces the toxicity of the metal. The downstream hardness value of 47.6 mg/l was calculated using a mass balance equation to account for the effect of the effluent on instream hardness. The value used for upstream concentration is the

[4] Criteria are expressed in terms of dissolved metals. However, permit limitations for metals are expressed in terms of total recoverable metals in accordance with the requirements of 40 CFR § 122.45(c). As such, conversion factors are used to develop total recoverable limits from dissolved criteria. The conversion factor reflects how the discharge of a particular metal partitions between the particulate and dissolved form after mixing with the receiving water. In the absence of site-specific data describing how a particular discharge partitions in the receiving water, a default assumption equivalent to the criteria conversion factor is used in accordance with the EPA Metal Translator Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criteria (EPA 1996 [EPA-823-B96-007]). Therefore, a conversion factor of 0.960 was applied to convert between total recoverable and dissolved copper concentrations.

[5] The limits to achieve criteria were calculated to result in the instream copper concentration downstream from the discharge being equal to the site-specific dissolved acute copper criterion of 25.7 µg/l and the site-specific dissolved chronic criterion of 18.1 µg/l. See Appendix C for the derivation of performance-based limits.

average of the instream hardness values of samples collected in the Nashua River upstream from the discharge for use as dilution water for the March 2008, June 2008, and September 2008 whole effluent toxicity (WET) tests[6]. The value used for discharge concentration is the measured hardness of the effluent in the same toxicity tests.

Hardness Analysis for Zinc

Where

C_r	=	Concentration below outfall		
Q_d	=	Discharge flow	=	3.01 MGD
C_d	=	Discharge concentration	=	57 mg/l
Q_s	=	Upstream flow	=	1.7 MGD
C_s	=	Upstream concentration	=	30 mg/l
Q_r	=	Streamflow below outfall (effluent + upstream)	=	4.71 MGD

Therefore,

$$Cr = \frac{(3.01\ MGD \times 57\ mg/l) + (1.7\ MGD \times 30\ mg/l)}{4.71\ MGD}$$

$$= 47.6\ mg/l$$

Equations from the EPA 2002 National Recommended Water Quality Criteria were used to determine acute and chronic zinc criteria for the receiving water. (Note: Values for the pollutant-specific coefficients and conversion factors were taken from Appendix B of the EPA 2002 National Recommended Water Quality Criteria).

1. Acute Criteria (Total Recoverable) = $\exp\{m_a [\ln(h)] + b_a) = 63.9\ \mu g/l$

Where:

m_a = Pollutant-specific coefficient = 0.8473
b_a = Pollutant-specific coefficient = 0.884
ln = Natural logarithm
h = hardness of the receiving water = 47.6 mg/l

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2. Chronic Criteria (Total Recoverable) = $\exp\{m_c [\ln(h)] + b_c) = 63.8\ \mu g/l$

Where:

m_c = Pollutant-specific coefficient = 0.8473
b_c = Pollutant-specific coefficient = 0.884

[6] MWRA began analysis of upstream dilution water in March 2008.

ln = Natural logarithm
h = hardness of the receiving water = 47.6 mg/l

The potential for discharges of zinc from the Clinton WWTP to cause or contribute to an excursion above water quality criteria was determined by statistically projecting the maximum concentration of the pollutant in the receiving water downstream from the discharge (similar to the analysis used for aluminum) . The following steps from the Technical Support Document (referred to as "the TSD") led to the finding of **no reasonable potential** to cause or contribute to exceedance of water quality criteria for zinc:

Zinc effluent data from March 2007 through December 2009 quarterly toxicity testing were analyzed using the delta-lognormal statistical distribution. The 99th percentile, 95% confidence level concentration projected for effluent zinc concentrations was 43.8 µg/L.

The projected pollutant level derived in Step 1 were modeled using a steady-state mixing equation to determine if it could cause or contribute to an excursion from water quality standards under critical conditions. Upstream samples taken for control WET Test renewals from the same period were averaged to determine the upstream concentration. As shown below, under critical conditions, the projected 99th percentile zinc effluent concentration results in a receiving water concentration of 30.7 µg/l, below both the acute criterion of 62.5 µg/l and the chronic criterion of 63.0 µg/l. Therefore, there is **no reasonable potential** for the discharge to cause or contribute to an excursion of water quality standards. No further analysis is needed.

Effluent limitations for zinc are not proposed in the draft permit. The permittee shall continue to monitor for zinc as part of their whole effluent toxicity (WET) testing.

Reasonable Potential Analysis for Zinc

Where

C_r	=	Concentration below outfall		
Q_d	=	Discharge flow	=	3.01 MGD
C_d	=	Discharge concentration	=	43.8 µg/l
Q_s	=	Upstream flow	=	1.7 MGD
C_s	=	Upstream concentration	=	8.8 µg/l
Q_r	=	Streamflow below outfall (effluent + upstream)	=	4.71 MGD

Therefore,

$$C_r = \frac{(3.01\text{MGD} \times 43.8\ \mu\text{g/l}) + (1.7\ \text{MGD} \times 8.8\ \mu\text{g/l})}{4.71\ \text{MGD}}$$

= 30.7 µg/l < 63.8 ug/l (chronic criterion)
30.7 ug/l < 63.9 ug/l (acute criterion)

Therefore, there is **no reasonable potential** for the discharge to cause or contribute to an excursion from either the acute or chronic water quality criterion for zinc.

G) Outfall 001 – Whole Effluent Toxicity

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 sources, the state narrative water quality criterion, the limited dilution at the discharge location, and in accordance with EPA national and regional policy and 40 C.F.R. ' 122.44(d), the draft permit includes a whole effluent chronic and acute toxicity limitations (C-NOEC = 62.5% and LC50 =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", September, 1991.)

The draft permit carries forward the requirements for quarterly Chronic and Acute toxicity tests using the species Ceriodaphnia dubia, only. The tests must be performed in accordance with the

test procedures and protocols specified in **Permit Attachment A**. The tests will be conducted four times a year, during the following months: March, June, September and December.

The LC_{50} limit of 100% is established by EPA/MassDEP policy for facilities with less than 10:1 dilution (See MassDEP's "Implementation Policy for the Control of Toxic Pollutants in Surface Waters, February 23, 1990). The C-NOEC is established at the receiving water concentration (1/Dilution Factor = 1/1.6), which is 62.5%.

VI. OPERATION AND MAINTENANCE OF THE COLLECTION SYSTEM

The current permit includes requirement regarding the operation and maintenance of the collection system. Among other things, the permit requires the permittee, and the Town of Clinton and the Lancaster Sewer District, as limited co-permittees, to each develop and implement an inflow/infiltration control program for the portion of the collection system it owns and operates and to report unauthorized discharges from its portion of the collection system.

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, can reduce 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 (SSOs) in separate sewer systems. I/I in the collection system has also caused significant increase in flow to the Clinton WWTP during wet weather.

The Town of Clinton was issued an Administrative Order (AO) by MassDEP on July 3, 1985, requiring any new sewer connections to be offset through the reduction of I/I. Specific tasks required by the ACO and to be completed by the Town of Clinton, according to MassDEP, are listed below:

- Sewer moratorium;
- Construction of two manholes;
- Adoption of a User Charge System and a Sewer Use Ordinance;
- Implementation of an Inflow Detection and Elimination Program;
- Submittal of an annual plan for sewer inspection and maintenance for approval by MassDEP.
- Submittal of a semi-annual report to MassDEP summarizing inspections and repairs, including the estimated quantity of I/I removed.

The current permit requires the permittee and each co-permittee to submit an annual report to EPA and MassDEP addressing I/I removal efforts. MWRA has submitted annual reports addressing I/I reduction in its portion of the sewer system and analysis of influent flows. However, it does not appear that the Towns of Clinton or the Lancaster Sewer District submitted I/I reports to EPA or MassDEP. While the MWRA reports contain useful information in regards to I/I quantities, they do not, and are not expected to, address Clinton's or Lancaster's I/I reduction efforts.

The draft permit continues the current permit's requirements regarding operation and maintenance of the collection system. Specifically, the permit includes the Towns of Clinton and Lancaster as limited co-permittees for conditions pertaining to operation and maintenance of the portion of the collection system each Town owns and operates, and includes the continuation of I/I control programs, and reporting of overflows.

VII. SLUDGE INFORMATION AND REQUIREMENTS

Section 405(d) of the Clean Water Act (CWA) requires that EPA develop technical standards regulating the use and disposal of sewage sludge. These regulations, found at 40 CFR Part 503, regulate the use and disposal of domestic sludge that is land applied, disposed in a surface disposal unit, or fired in a sewage sludge incinerator. Part 503 regulations have a self-implementing provision; however, the CWA requires implementation through permits.

The draft permit has been conditioned to ensure that sewage sludge use and disposal practices meet the CWA Section 405(d) Technical Standards and the 40 CFR Part 503 regulations. In addition, EPA Region I has included with the draft permit a 72-page document entitled "EPA Region I NPDES Permit Sludge Compliance Guidance, November 1999" (see **Attachment B** of the draft permit) for use by the permittee in determining the appropriate sludge conditions for the chosen method of sewage sludge use or disposal practices.

The permittee is required to submit an annual report to EPA and MassDEP by **February 19th** of each year, containing the information for the permittee's chosen method of sludge disposal, as required by the Part 503 regulations. The Sludge Compliance Guidance Document may be used for guidance in determining the appropriate reporting requirements.

VIII. PRETREATMENT

The facility accepts industrial wastewater from two (2) non-categorical Significant Industrial Users (SIUs). Industrial discharges to the Clinton WWTP comprise approximately 41,000 gallons per day, or 1% of the influent.

The permittee is required to administer a pretreatment program based on the authority granted under 40 CFR '122.44(j), 40 CFR Part 403 and Section 307 of the Act. The permittee's pretreatment program received EPA approval on September 28, 1990 and, as a result, appropriate pretreatment program requirements were incorporated into the previous permit, which were consistent with that approval and federal pretreatment regulations in effect when the permit was issued.

Upon reissuance of this NPDES permit, the permittee is required to review its pretreatment program and modify it as necessary to ensure that it is consistent with current Federal Regulations. Those activities that the permittee must address include, but are not limited to, the following: (1) develop and enforce EPA approved specific effluent limits (technically-based local limits); (2) revise the local sewer-use ordinance or regulation, as appropriate, to be consistent with Federal Regulations; (3) develop an enforcement response plan; (4) implement a

slug control evaluation program; (5) track significant noncompliance for industrial users; and (6) establish a definition of and track significant industrial users.

These requirements are necessary to ensure continued compliance with the POTW's NPDES permit and its sludge use or disposal practices.

Lastly, the permittee must continue to submit an annual report describing the permittee's pretreatment program activities for the twelve (12) month period ending 60 days before the due date in accordance with 403.12(i). The annual report shall be submitted **no later than October 31 of each year**.

IX. 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 Service (NMFS) if EPA=s action or proposed actions that it funds, permits, or undertakes, Amay adversely impact any essential fish habitat,@ 16 U.S.C. ' 1855(b). The Amendments broadly define Aessential fish habitat@ (EFH) as: Awaters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity,@ 16 U.S.C. ' 1802(10). AAdverse impact@ means any impact which reduces the quality and/or quantity of EFH, 50 C.F.R. ' 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 of actions. Id.

Essential fish habitat is only designated for fish species for which federal Fisheries Management Plans exist. 16 U.S.C. ' 1855(b)(1)(A). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

Only Atlantic Salmon is believed to be present during one or more life stage within the EFH Area, which encompasses the existing discharge site. No "habitat area of particular concern" as defined under '600.815(a)(9) of the Magnuson-Stevens Act, has been designated for this site. Although EFH has been designated for this general location, EPA has concluded that this activity is not likely to affect EFH or its associated species for the following reasons:

- The quantity of the discharge from the WWTP is 3.01 MGD and the effluent receives advanced secondary treatment;
- The facility withdraws no water from the South Nashua River, so no life stages of Atlantic salmon are vulnerable to impingement or entrainment from this facility;
- Limits specifically protective of aquatic organisms have been established for phosphorus, aluminum, chlorine and copper based on EPA water quality criteria;
- Acute and chronic toxicity testing on *Ceriodaphnia dubia* is required four (4) times per year and the recent toxicity results are in compliance with permit limits;
- The permit prohibits any violation of state water quality standards.

EPA believes that the conditions and limitations contained within the draft permit adequately protect all aquatic life, including Atlantic salmon, the only species in the river with EFH designation. Impacts associated with this facility to the EFH species, its habitat and forage, have been minimized to the extent that no significant adverse impacts are expected. 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.

X. ENDANGERED SPECIES ACT

Section 7(a) of the Endangered Species Act of 1973, as amended (ESA) grants authority to and imposes requirements upon Federal agencies regarding endangered or threatened species of fish, wildlife, or plants ("listed species") and habitat of such species that has been designated as critical (a "critical habitat"). The ESA requires every Federal agency, in consultation with and with the assistance of the Secretary of Interior, to insure 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) typically administers Section 7 consultations for bird, terrestrial, and freshwater aquatic species. The National Marine Fisheries Service (NMFS) typically administers Section 7 consultations for marine species and anadromous fish.

EPA has reviewed the federal endangered or threatened species of fish and wildlife to determine if any listed species might potentially be impacted by the re-issuance of this NPDES permit. The review revealed that two federally protected species, the small whirled pogonia (*Isotria medeoloides*), an orchid, and the amphidromous fish species, the shortnose sturgeon (*Acipenser brevirostrum*), merited further discussion.

The small whirled pogonia orchid has been identified in Leominster, Massachusetts, which is two towns away from the Clinton WWTF. In addition, the small whorled pogonia is found in "forests with somewhat poorly drained soils and/or a seasonally high water table," according to the USFWS website. This species is not aquatic; therefore it is unlikely that it would come into contact with the facility discharge.

The Clinton WWTP discharges its effluent into the South Nashua River. This segment of the Nashua River is listed as a Class B warmwater fishery. The river system ultimately joins the Merrimack River at Nashua, New Hampshire. The lower Merrimack River has been identified as habitat for the federally protected shortnose sturgeon. However, it is unlikely that shortnose sturgeon would be able to navigate upstream, past the many anthropogenic obstacles to fish passage, leave the mainstem of the Merrimack River and travel approximately 50 river miles to reach the area of the South Nashua River influenced by the facility outfall. Based on this assessment, shortnose sturgeon are not considered to be present in the vicinity of the WWTP discharge. No other federally-listed species occur in Worcester County.

Based on the permit conditions and absence of listed species in the vicinity of the facility's discharge, EPA has determined that this permit action will have no effects on these species.

EPA is coordinating a review of this finding with USFWS and NMFS through the Draft Permit and Fact Sheet, and consultation under Section 7 of the ESA with USFWS and NMFS is not required.

XI. MONITORING AND REPORTING

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.

EPA currently conducts free training on the use of NetDMR, and anticipates that the availability of this training will continue to assist permittees with the transition to use of NetDMR. To participate in upcoming trainings, visit http://www.epa.gov/netdmr for contact information for Massachusetts.

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" request 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 sixty (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. Hard copies of DMRs must be postmarked no later than the 15th day of the month following the completed reporting period.

XII. 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.

XIII. 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.

XIV. 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.

XV. 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, 5 Post Office Square, Suite 100, 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.

XVI. EPA CONTACT

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:

Robin L. Johnson
EPA New England – Region 1
5 Post Office Square, Suite 100
Mail Code OEP06-1
Boston, MA 02109-3912
Telephone: (617) 918-1045
Johnson.Robin@epa.gov

_____
Date

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

Appendix A

Effluent Characteristics, 2007 – 2009

Appendix A
Effluent Characteristics, November 2

Month	Flow*	Dissolved Oxygen	BOD, monthly avg	BOD, weekly avg	BOD, daily max	BOD, avg monthly	pH min	pH max	TSS, avg monthly	TSS, avg weekly	TS
	MGD	mg/l	mg/l	mg/l	mg/l	lbs/day	s.u.	s.u.	mg/l	mg/l	
Jan-07	**3.29**	9.2	9.3	10	11.9	224	7	7.7	7.5	8.5	
Feb-07	**3.08**	10.0	10	11.2	12.8	197	7.2	7.8	6.7	8.0	
Mar-07	**3.12**	9.8	10.3	12.2	16.5	277	6.8	7.5	9.1	12.0	
Apr-07	**3.41**	8.5	6.9	12.8	14	334	6.9	7.4	5.6	9.7	
May-07	**3.45**	8.8	2.6	4.3	3.6	87	7	7.6	4.4	5.8	
Jun-07	**3.32**	6.7	2.8	3.3	4	68	6.7	7.4	5.3	6.2	
Jul-07	**3.24**	6.7	2.5	3.3	3.9	56	7	7.8	3.2	3.8	
Aug-07	**3.23**	6.7	2.3	2.6	3.3	46	7.1	7.4	2.7	3.0	
Sep-07	**3.18**	6.4	2.4	2.8	3.2	41	7	7.4	3.1	3.8	
Oct-07	**3.13**	6.5	2.7	3	3.6	46	7.1	7.7	3.9	3.7	
Nov-07	2.99	8.1	6.9	8.2	10.9	123	6.8	7.8	6.7	8.0	
Dec-07	2.92	6.6	10.5	16.3	23.4	198	6.6	7.5	9.2	12.0	
Jan-08	2.91	8.5	9.2	10.8	14.4	208	7.1	7.6	7.3	10.0	
Feb-08	**3.12**	8.8	8.3	10.4	13.6	345	7	7.5	6.2	8.3	
Mar-08	**3.28**	8.3	7.5	9.5	11.6	338	7	7.4	6.6	9.0	
Apr-08	**3.08**	7.6	4.8	5.7	8.5	151	6.9	7.5	3.8	4.0	
May-08	2.97	6.4	6.8	9.2	10	158	**6.2**	7.6	8.6	16.7	
Jun-08	2.93	6.5	3.7	7.1	8.5	74	7	7.7	4.9	7.8	
Jul-08	2.94	6.3	2.5	2.9	3.3	56	6.5	7.6	3.2	3.8	
Aug-08	3	6.9	2.4	2.6	2.9	65	6.9	7.5	3.1	3.7	
Sep-08	**3.08**	6.9	2.7	3.5	4.7	68	6.8	7.4	4.0	5.0	
Oct-08	**3.13**	8.2	3.4	4	4.2	71	7	7.5	5.6	7.5	
Nov-08	**3.16**	8.1	5.7	6.9	11.8	119	7.1	7.6	8.3	13.0	
Dec-08	**3.32**	9.0	3.9	4.2	5.4	135	7.1	7.7	3.6	4.6	
Jan-09	**3.39**	10.0	4.8	6	6.6	144	7.2	7.6	4.6	5.7	
Feb-09	**3.28**	9.9	6.7	7.8	11.5	191	7	7.7	6.9	8.2	
Mar-09	**3.13**	9.5	6.3	7.5	8.8	178	6.7	7.7	6.9	7.0	
Apr-09	**3.08**	9.2	5.9	6.7	8.6	154	7	7.6	7.4	9.8	
May-09	**3.1**	8.9	4.1	4.7	6	109	6.8	7.5	5.3	7.8	
Jun-09	**3.17**	9.6	3.7	4.9	5.2	101	7.1	7.6	4.7	5.7	
Jul-09	**3.36**	8.3	3.5	4.1	5.2	137	7.1	7.4	4.2	4.8	
Aug-09	**3.4**	7.5	2.7	3.8	4.1	88	6.8	7.5	3.2	4.3	
Sep-09	**3.39**	7.4	2.9	3.9	4.2	70	6.7	7.4	3.9	5.0	
Oct-09	**3.42**	8.7	3.4	6.3	12.2	82	6.8	7.4	4.0	7.3	
Nov-09	**3.46**	9.0	5.2	5.9	7.7	128	7	7.5	7.7	10.2	
Dec-09	**3.37**	9.7	8.2	9	11	212	7.2	7.6	8.6	12.2	
9/2000 Permit Limits	3.01	6	20	20	Report	500	6.5	8.3	20	20	
Minimum	2.91	6.3	2.3	2.6	2.9	41	6.2	7.4	2.7	3	
Average	3.1	7.7	5.5	7.1	8.8	146.8636	6.9	7.6	5.5	7.3	
Maximum	3.45	10	10.5	16.3	23.4	345	7.2	7.8	9.2	16.7	
Standard Deviation	0.2	1.2	3.1	4.1	5.6	103.5	0.2	0.1	2.0	3.5	
# measurements	36	36	36	36	36	36	36	36	36	36	
# exceed 2000 permit limit	29	0	0	0	N/A	0	1	0	0	0	

bold = exceeds 2000 permit limit
BOD = Biochemical Oxygen Demand
TSS = Total Suspended Solids
#/100 ml = number of bacterial colonies per 100 ml water
TRC = Total Residual Chlorine
*rolling average of preceding 12 months
**seasonal monitoring

ix A
nber 2005 - November 2008

avg ekly	TSS, max daily	TSS, avg monthly	Ammonia, avg monthly	Ammonia, max daily	Total Phosphorus, avg monthly**	Total Phosphorus, max daily**	Copper, average monthly	TRC, monthly average	TRC, max daily	Fecal Coliform, geometric avg	Fecal Coliform, max daily
g/l	mg/l	lbs/day	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	#/100 ml	#/100 ml
5	9.0	243	0.5	0.5			8.9	0.0	0.0	7.3	37.8
0	9.0	320	0.5	0.5			11.6	0.0	0.0	9.37	22.89
.0	16.1	234	0.5	0.5			10.36	0.0	0.0	2.96	15.87
7	11.0	274	0.5	0.5			9.95	0.0	0.0	1.93	8.88
8	8.0	153	0.94	1.63	0.198	0.26	4.7	0.0	0.0	1.64	4.64
2	7.0	128	0.68	1.3	0.17	0.24	6.56	0.0	0.0	4.61	20.57
8	5.0	71	0.5	0.5	0.19	0.28	7.94	0.0	0.0	3.2	26.2
0	3.5	55	0.5	0.5	0.2	0.29	7.1	0.0	0.0	9.7	187.4
8	4.0	54	0.51	0.63	0.27	0.38	10.17	0.0	0.0	4.4	39.1
7	12.0	65	0.5	0.5	0.41	0.64	8.73	0.0	0.0	3.1	11.9
0	10.0	119	0.54	0.67			9.48	0.0	0.0	7.9	36.3
.0	13.0	170	1.19	3.1			9.83	0.0	0.0	27.4	**1475.2**
.0	11.0	234	0.78	1.9			9.29	0.0	0.0	23.5	224.3
3	10.5	255	2.1	3.6			5.9	0.0	0.0	3.3	34.9
0	10.0	303	1.8	2.2			6.1	0.0	0.0	2	9.7
0	7.0	118	3.82	4.62			5.95	0.0	0.0	1.7	19.1
.7	23.0	197	0.66	1.03	0.6	0.96	4.23	0.0	0.0	6.1	301.4
8	11.5	97	0.5	0.5	0.28	0.33	6.1	0.0	0.0	3.1	19.8
8	4.5	73	0.5	0.5	0.24	0.29	7.16	0.0	0.0	1.8	7
7	5.0	84	0.5	0.5	0.24	0.43	6.8	0.0	0.0	2.6	6.7
0	8.0	103	0.5	0.5	0.35	0.62	4.68	0.0	0.0	2.6	10.6
5	8.5	114	0.5	0.5	0.56	0.86	6.7	0.0	0.0	2.4	4.7
.0	23.0	168	0.5	0.5			13.1	0.0	0.0	3.7	9.4
6	6.3	123	0.5	0.5			7.95	0.0	0.0	3	8.6
7	6.0	138	0.5	0.5			6.84	0.0	0.0	2.2	7.6
2	11.0	197	0.5	0.5			12.8	0.0	0.0	2.5	4.9
0	13.0	191	0.65	2.43			5.6	0.0	0.0	2.1	4.9
8	13.0	189	0.11	0.16			4.97	0.0	0.0	1.9	13.4
8	6.0	140	0.1	0.1	0.71	0.83	6.5	0.0	0.0	1.6	6.5
7	7.0	127	0.1	0.1	0.51	0.76	5.43	0.0	0.0	1.5	3.4
8	6.5	162	0.1	0.1	0.46	0.56	7.84	0.0	0.0	1.8	11.9
3	5.0	106	0.1	0.1	0.22	0.33	6.27	0.0	0.0	2.5	5.9
0	5.0	93	0.1	0.1	0.21	0.28	6.85	0.0	0.0	2.7	11.6
3	13.0	97	0.1	0.1	0.19	0.23	6.52	0.0	0.0	3.2	7.8
.2	15.5	191	0.1	0.1			6.81	0.0	0.0	3	5.8
.2	16.0	223	0.1	0.1			7.83	0.0	0.0	2.5	19.3
0	Report	500	Varies	Varies	1	Report	20	17.6	30.4	200	400
3	3.5	54	0.5	0.5	0.17	0.24	4.23	0	0	1.64	4.64
3	9.4	157.5	0.9	1.2	0.3	0.5	7.6	0.0	0.0	6.0	114.8
.7	23	320	3.82	4.62	0.6	0.96	11.6	0	0	27.4	1475.2
5	4.4	85.5	0.8	1.2	0.1	0.2	2.1	0.0	0.0	6.8	314.1
6	36	36	36	36	18	18	36	36	36	36	36
0	N/A	0	0	0	0	0	0	0	0	0	1

Appendix B

Aluminum Calculations

Background Aluminum Concentration (from WET Chemistry data)

With non-detects, >10 samples, lognormal distribution

Al

Date	Al (ug/L)	lnAl (ug/l)	$(y_i - u_y)^2$
3/3/2008	<15		
3/5/2008	434	6.07	5.05529378
3/7/2008	23.5	3.16	0.44575127
6/9/2008	<15		
6/11/2008	18.9	2.94	0.78408291
6/13/2008	39.9	3.69	0.01911864
9/22/2008	15.2	2.72	1.21738356
9/24/2008	<15.0		
9/26/2008	<15.0		
12/8/2008	<15		
12/10/2008	<15		
12/12/2008	146	4.98	1.34318859
3/4/2009	24.8	3.21	0.37675392
3/6/2009	45.2	3.81	0.00018359
3/9/2009	55.7	4.02	0.03815524
6/8/2009	92.8	4.53	0.49815386
6/10/2009	34.3	3.54	0.08381091
6/12/2009	70	4.25	0.17964777
9/14/2009	36.7	3.60	0.04922618
9/16/2009	38.4	3.65	0.03118368
9/18/2009	72.7	4.29	0.21316218
12/7/2009	<15		
12/9/2009	29.1	3.37	0.20603276
12/11/2009	24.4	3.19	0.39697983

Al - (Delta Lognormal distribution, ND)

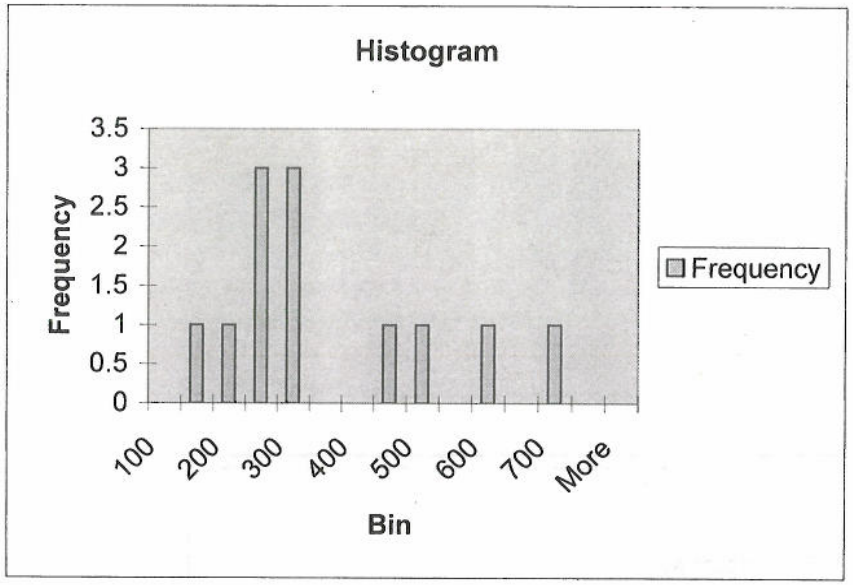
Daily Average Derivation (some measurements < detection limit)

D= Detection Limit** =	15.0
u_y = Avg of Nat. Log of daily Discharge (ug/L) =	3.82465
$\Sigma (y_i - u)^2$ =	10.93811
k = number of samples =	24
r = number of non-detects =	7
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-r-1)$ =	0.68363
δ = number of nondetect values/number of samples =	0.29167
Estimated CV = σ/μ =	

$E(x) =$ **Daily Average** $= \delta D + (1-\delta)\exp(u_y + 0.5\sigma_y^2)$

$=$ **50.05323363** ug/L (units)

Bin	*Frequency*
100	0
150	1
200	1
250	3
300	3
350	0
400	0
450	1
500	1
550	0
600	1
650	0
700	1
750	0
More	0



Histogram indicates that effluent data fit a lognormal distribution.

Aluminum Reasonable Potential Analysis

MWRA-Clinton WWTP

no non-detects, >10 samples, Lognormal distribution

Date	Al (ug/L)	Y_i lnAl (ug/L)	$(y_i - u_y)^2$
6/9/2008	206	5.3279	0.125351067
6/11/2008	205	5.3230	0.128820491
6/13/2008	262	5.5683	0.012900687
9/22/2008	199	5.2933	0.151026181
9/24/2008	297	5.6937	0.000139392
9/25/2008	696	6.5453	0.745500944
6/8/2009	593	6.3852	0.49458687
6/10/2009	435	6.0753	0.154779561
6/12/2009	457	6.1247	0.196034377
9/13/2009	126	4.8363	0.715113416
9/15/2009	205	5.3230	0.128820491
9/17/2009	295	5.6870	2.54991E-05

Aluminum - (Lognormal distribution, no ND)

Projected Maximum Daily Concentration

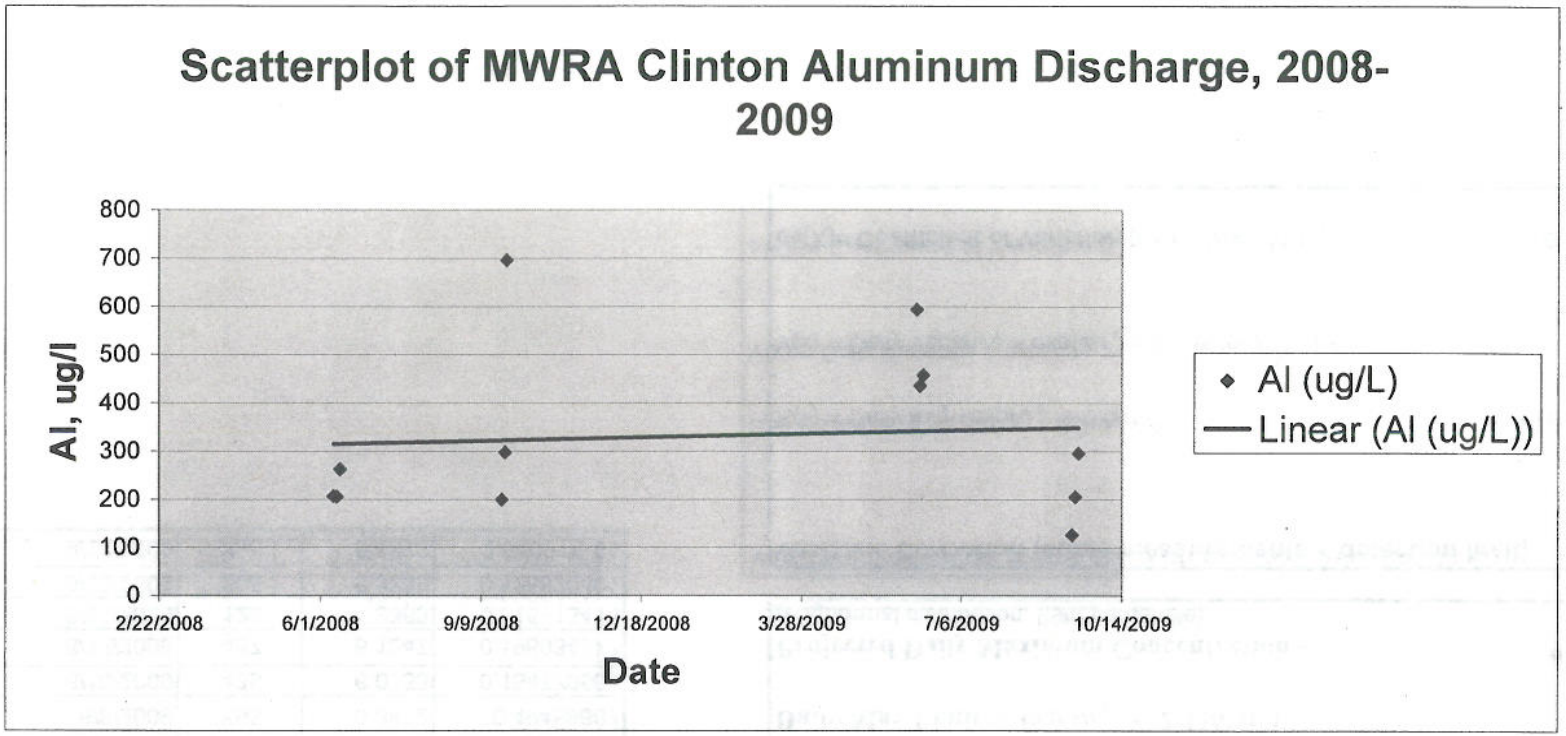
u_y = Avg of Nat. Log of daily Discharge (lbs/day) =	5.68193
σ_y = Std Dev. of Nat Log of daily discharge =	0.50929
$\Sigma (y_i - u_y)^2$ =	2.85310
k = number of daily samples =	12
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-1)$ =	0.25937

Daily Max Limit = $\exp(u_y + 2.326*\sigma_y)$

Projected Daily Maximum Concentration = **959.61 ug/L**
(Lognormal distribution, 99th percentile)

Variance Derivation (some measurements < detection limit)

E(x) = Daily Avg = $\exp(u_y + 0.5\,\sigma_y^2)$ =	334.15736
V(x) = Daily Variance = $\exp(2\mu_y + \sigma_y^2)[\exp(\sigma_y^2)-1]$ =	33064.72729
cv(X)= Coefficient of Variation (CV) = $V(x)^{1/2}/E(x)$	0.54417



Scatterplot data and trendline indicate that aluminum effluent concentrations during nutrient removal periods have been stable over the past two years.

Appendix C

Copper Calculations

Appendix C

Copper Performance-Based Limits

no ND, >10 samples, Lognormal distribution

Date	Cu (µg/l)	*Yi lnCu (µg/l)*	$(y_i - u_y)^2$
Jan-07	8.90	2.1861	0.0387711
Feb-07	11.60	2.4510	0.2133124
Mar-07	10.36	2.3380	0.1216647
Apr-07	9.95	2.2976	0.0951260
May-07	4.70	1.5476	0.1949973
Jun-07	6.56	1.8810	0.0116979
Jul-07	7.94	2.0719	0.0068502
Aug-07	7.10	1.9601	0.0008441
Sep-07	10.17	2.3194	0.1090946
Oct-07	8.73	2.1668	0.0315481
Nov-07	9.48	2.2492	0.0676191
Dec-07	9.83	2.2854	0.0877886
Jan-08	9.29	2.2289	0.0574997
Feb-08	5.90	1.7750	0.0458796
Mar-08	6.10	1.8083	0.0327099
Apr-08	5.95	1.7834	0.0423357
May-08	4.23	1.4422	0.2991494
Jun-08	6.10	1.8083	0.0327099
Jul-08	7.16	1.9685	0.0004259
Aug-08	6.80	1.9169	0.0052164
Sep-08	4.68	1.5433	0.1987817
Oct-08	6.70	1.9021	0.0075760
Nov-08	13.10	2.5726	0.3404311
Dec-08	7.95	2.0732	0.0070601
Jan-09	6.84	1.9228	0.0044036
Feb-09	12.80	2.5494	0.3139335
Mar-09	5.60	1.7228	0.0709588
Apr-09	4.97	1.6034	0.1487858
May-09	6.50	1.8718	0.0137699
Jun-09	5.43	1.6919	0.0883328
Jul-09	7.84	2.0592	0.0049128
Aug-09	6.27	1.8358	0.0235227
Sep-09	6.85	1.9242	0.0042119
Oct-09	6.52	1.8749	0.0130584
Nov-09	6.81	1.9184	0.0050063
Dec-09	7.83	2.0580	0.0047355

Copper - (Lognormal distribution, no non-detects)

Daily Maximum Limit Derivation

u_y = Avg of Nat. Log of daily Discharge (lbs/day) =	1.98915
σ_y = Std Dev. of Nat Log of daily discharge =	0.28004
$\Sigma (y_i - u_y)^2$ =	2.74472
k = number of daily samples =	36
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-1)$ =	0.07842

Daily Max Limit = $\exp(u_y + 2.326*\sigma_y)$

Daily Max Limit = **14.02 µg/l**
(Lognormal distribution, 99th percentile)

Average Monthly Limit Derivation

Number of samples per month, n =	4
E(x) = Daily Avg = $\exp(u_y + 0.5\,\sigma_y^2)$ =	7.60159
V(x) = Daily Variance = $\exp(2u_y + \sigma_y^2) * [\exp(\sigma_y^2) - 1]$ =	4.71389
σ_n^2 = Monthly Average variance = $\ln\{V(x) / (n[E(x)]^2) + 1\}$ =	0.02019
σ_n = Monthly Average standard deviation = σ_n^2^(0.5) =	0.14209
u_n = n-day monthly average = $\ln(E(x)) - 0.5\sigma_n^2$ =	2.01826

Monthly Average Limit = $\exp(u_n + 1.645*\sigma_n)$

Monthly Avg Limit* = **9.51 µg/l**
(Lognormal distribution, 95th percentile of average monthly values)

*Based on sampling frequency of 1 time per month

Receiving Water Concentration under Performance-Based Copper Limits

Receiving Water Concentration (RWC) = $(C_sQ_s + C_eQ_e)/(Q_e + Q_s)$

where					Units
C_s=	Concentration of pollutant upstream of discharge	6.6 ug/l (total recoverable)	*0.960		6.34 µg/l (total dissolved)
C_e=	Concentration of pollutant in effluent	14.02 ug/l (total recoverable)	*0.960		13.46 µg/l (total dissolved)
Q_s=	Critical (7Q10) flow of receiving water	1.71			MGD
Q_e=	Effluent flow during 7Q10	3.01			MGD

RWC= **10.88** µg/l (total dissolved)

Compare to Acute Criteria = 25.7 µg/l

If RWC > Acute Criteria, there is Reasonable Potential for excursions from the Criteria.
If RWC < Acute Criteria, there is not Reasonable Potential for excursions from the Criteria.

Receiving Water Concentration (RWC) = **(CsQs + CeQe)/(Qe + Qs)**

where					Units
C_s=	Concentration of pollutant upstream of discharge	6.6 µg/l (total recoverable)	*0.960	=	6.34 µg/l (total dissolved)
C_e=	Concentration of pollutant in effluent	9.51 µg/l (total recoverable)	*0.960	=	9.13 µg/l (total dissolved)
Q_s=	Critical (7Q10) flow of receiving water				1.71 MGD
Q_e=	Effluent flow during 7Q10				3.01 MGD

RWC= **8.12** µg/l (total dissolved)

Compare to Chronic Criteria = 18.1 µg/l

If RWC > Chronic Criteria, there is Reasonable Potential for excursions from the Criteria.
If RWC < Chronic Criteria, there is not Reasonable Potential for excursions from the Criteria.

Limits based on Site-Specific Criteria (hypothetical)

Acute Waste Load Allocation (based on Water Quality Criteria)

WLA_a = **$[WQC \times (Q_e + Q_s) - Q_s C_s]/Q_e$=** 38.80053 mg/L (total dissolved)

Convert to recoverable for permit limit WLA_a / 0.960 = **40.41722 total recoverable copper**

Units

Where

C_s=	background concentration	2.75 ug/l (total recoverable)	=	2.64 ug/l (total dissolved)
Q_s=	critical streamflow	1.71 MGD		
Q_e=	critical effluent flow	3.01 MGD		
WQC=	water quality criterion	25.7 ug/l (total dissolved)		

Chronic Waste Load Allocation (based on Water Quality Criteria)

WLA_c = **$[WQC \times (Q_e + Q_s) - Q_s C_s]/Q_e$=** 26.88292 mg/L (total dissolved)

Convert to recoverable for permit limit WLA_a / 0.960 = **28.00305 total recoverable copper**

Units

Where

C_s=	background concentration	2.75 ug/l (total recoverable)	=	2.64 ug/l (total dissolved)
Q_s=	critical streamflow	1.71 MGD		
Q_e=	critical effluent flow	3.01 MGD		
WQC=	water quality criterion	18.1 ug/L (total dissolved)		

Receiving Water Concentration under Prior Limits (6.2 and 8.3 ug/l)

Receiving Water Concentration (RWC) = $(C_sQ_s + C_eQ_e)/(Q_e + Q_s)$

where			Conversion Factor	Units
C_s=	Concentration of pollutant upstream of discharge	6.6 ug/L (total recoverable)	0.96 =	6.336 ug/L (total dissolved)
C_e=	Concentration of pollutant in effluent	8.3 ug/L (total recoverable)	0.96 =	7.968 ug/L (total dissolved)
Q_s=	Critical (7Q10) flow of receiving water			1.71 MGD
Q_e=	Effluent flow during 7Q10			3.01 MGD

RWC= 7.376746 ug/L (total dissolved)

Compare to Acute Criteria = 25.7 ug/L

If RWC > Acute Criteria, there is Reasonable Potential for excursions from the Criteria.
If RWC < Acute Criteria, there is not Reasonable Potential for excursions from the Criteria.

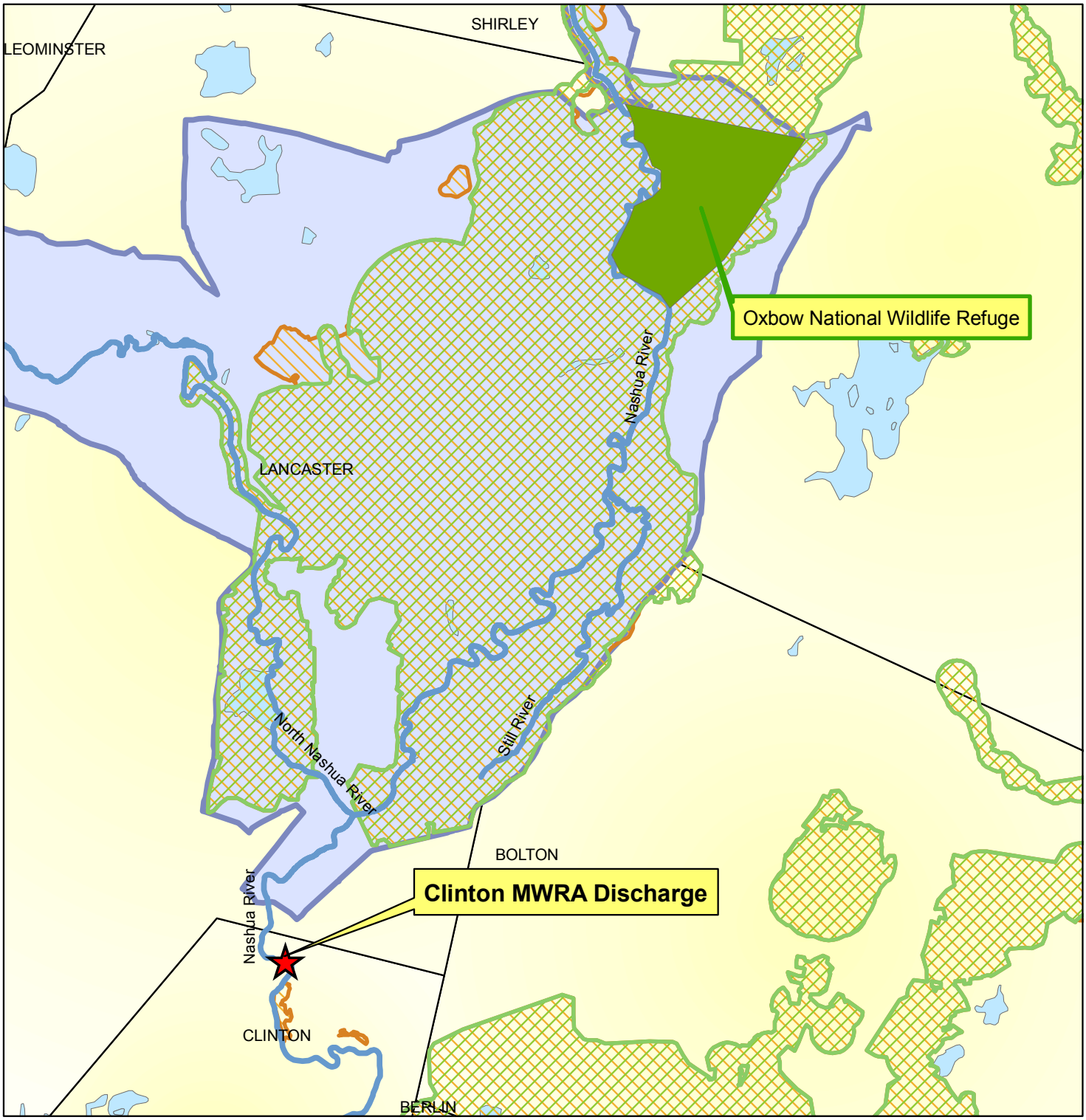
Receiving Water Concentration (RWC) = **(CsQs + CeQe)/(Qe + Qs)**

where			Conversion Factor	Units
C_s=	Concentration of pollutant upstream of discharge	6.6 ug/L (total recoverable)	0.96 =	6.336 ug/L (total dissolved)
C_e=	Concentration of pollutant in effluent	6.2 ug/L (total recoverable)	0.96 =	5.952 ug/L (total dissolved)
Q_s=	Critical (7Q10) flow of receiving water			1.71 MGD
Q_e=	Effluent flow during 7Q10			3.01 MGD

RWC= 6.091119 ug/L (total dissolved)

Compare to Chronic Criteria = 18.1 ug/L

If RWC > Chronic Criteria, there is Reasonable Potential for excursions from the Criteria.
If RWC < Chronic Criteria, there is not Reasonable Potential for excursions from the Criteria.



Legend

- Rivers
- NHESP* Estimated Habitats of Rare Wildlife
- NHESP* Priority Habitats of Rare Species
- Areas of Critical Environmental Concern
- Town Lines

N

Figure 1
Clinton-MWRA WWTF Location Map

EPA

**NHESP = Massachusetts Natural Heritage and Endangered Species Program*

1 in = 1 mile

Clinton Treatment Plant
Flow Schematic

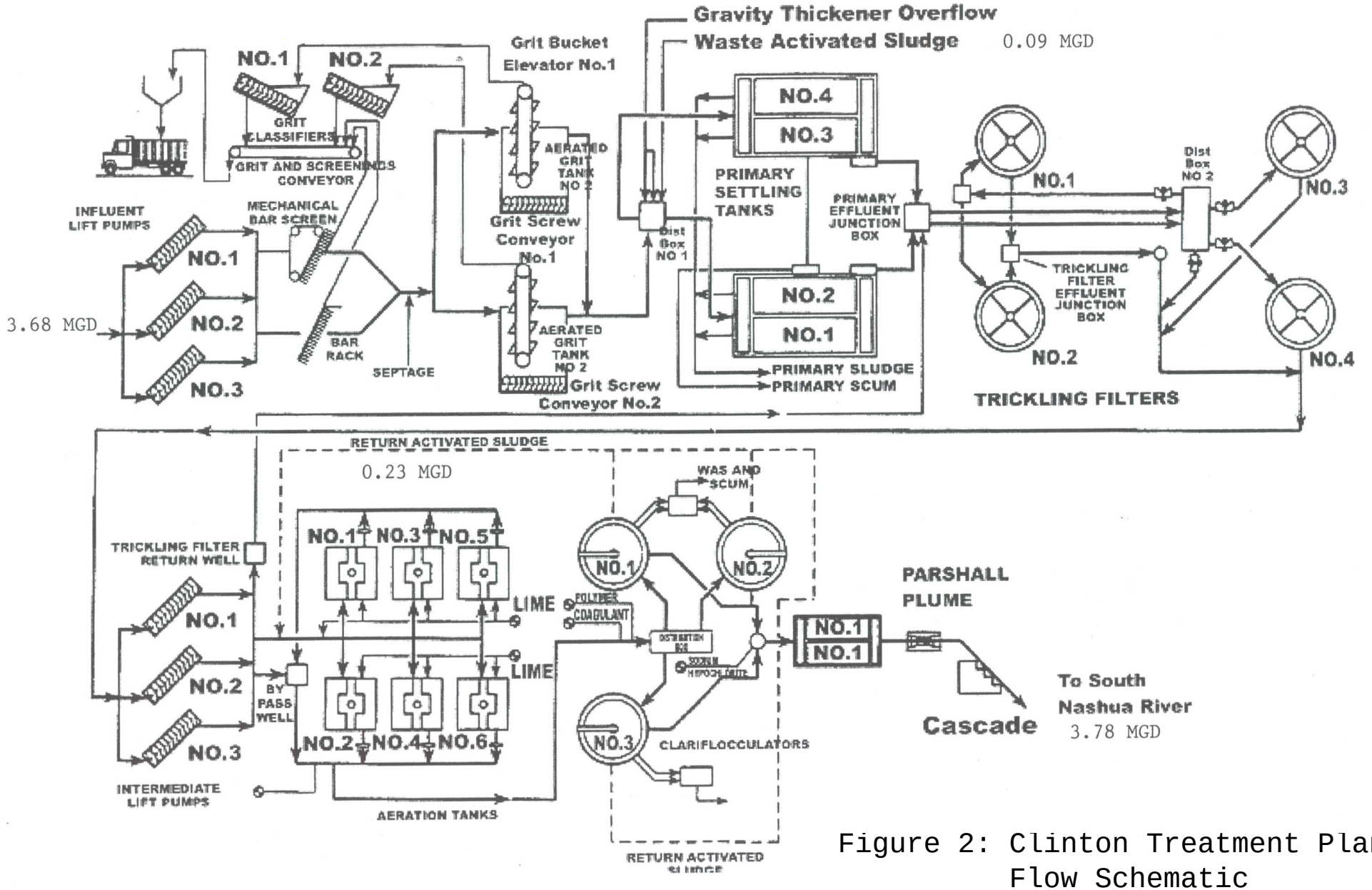


Figure 2: Clinton Treatment Plant Flow Schematic

http://www.mwra.com/03sewer/html/clinton/flowschematic.jpg

6/15/2010

EXHIBIT 10-1
Anti-Backsliding Rules Relating to Water Quality-Based Effluent Limitations

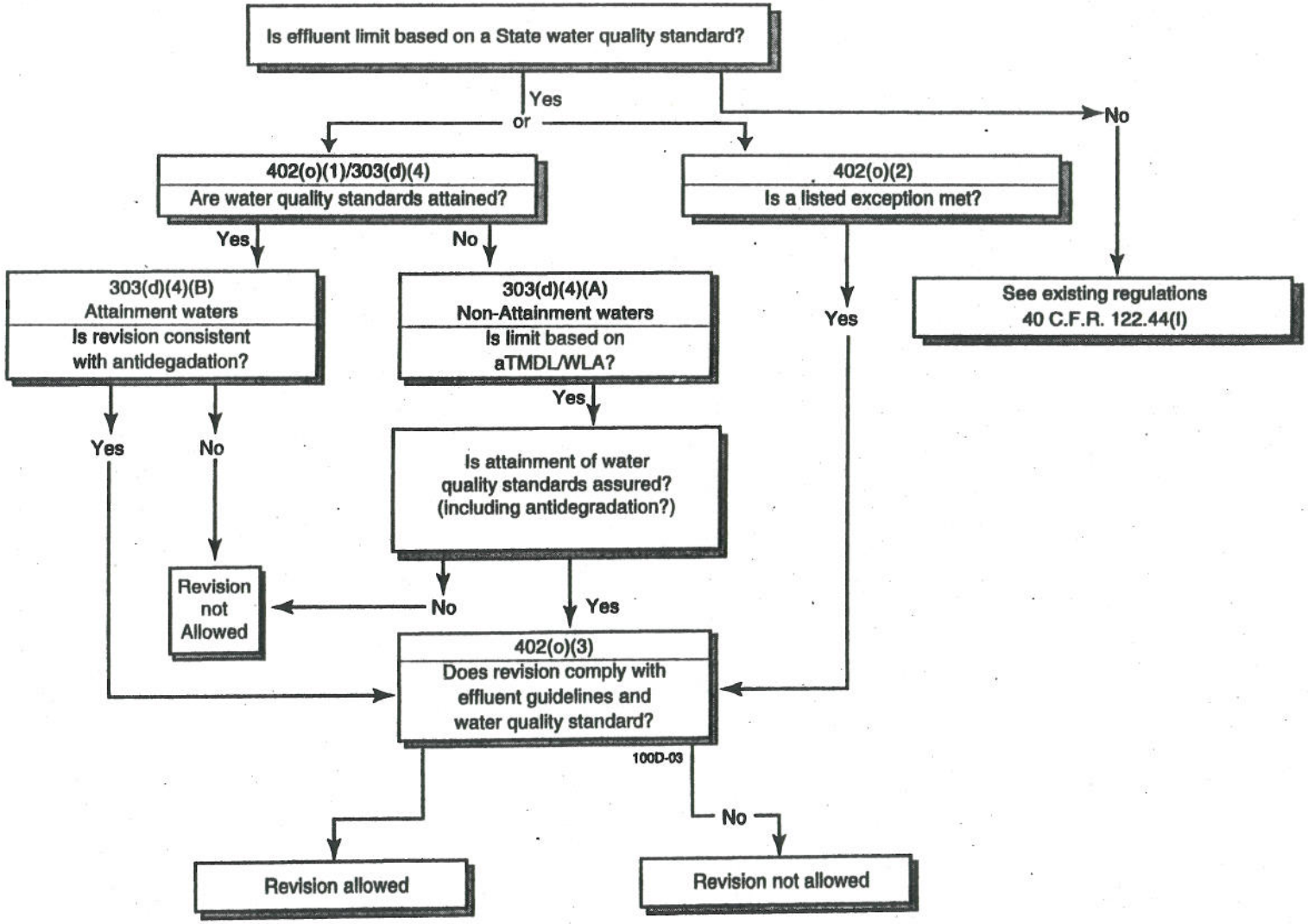


Figure 3: Anti-backsliding Flow Chart