ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

In re: University of Massachusetts Boston	)	NPDES 13 -_____
NPDES Permit No. MA 0040304	)	

PETITION FOR REVIEW OF A NPDES PERMIT ISSUED BY EPA REGION I

MINTZ, LEVIN, COHN, FERRIS,GLOVSKY and POPEO, P.C.
Ralph A. Child
Colin G. Van Dyke
One Financial Center
Boston, MA 02111
(617) 542-6000
(617) 542-2241 fax

Counsel for Petitioner University of Massachusetts Boston

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INTRODUCTION

Pursuant to 40 C.F.R. § 124.19(a), the University of Massachusetts Boston ("UMass Boston"), through its undersigned representatives, respectfully submits this petition for review of certain provisions in National Pollutant Discharge Elimination System permit No. MA 0040304 (the "NPDES permit") issued by the United States Environmental Protection Agency, Region I ("EPA"). Review of those provisions is warranted because they are based on clearly erroneous conclusions of fact and law and are not reasonably supported by information or data in the administrative record.

BACKGROUND

The UMass Boston campus is located at Columbia Point, a peninsula in Dorchester Bay that is owned by the Commonwealth of Massachusetts for the benefit of the University of Massachusetts. UMass Boston operates a non-contact cooling water system that withdraws salt water from Savin Hill Cove through a cooling water intake structure ("CWIS"), transports it to a pumphouse and through heat exchangers, and then discharges it to Dorchester Bay.

The system has operated since the campus was constructed in the 1970s and has been authorized under EPA's Non-contact Cooling Water General Permit MAG250004 since that permit was issued in 2000. When the General Permit was renewed in 2008, the 2008 General Permit was limited to facilities withdrawing flows smaller than UMass Boston's flows. UMass Boston accordingly filed a timely application for an individual NPDES permit. Later, UMass Boston supplemented its application with additional information, including information about upgrades to the facility associated with the issuance in 2009 of a 25-year master plan for the campus, and the results of biological monitoring of the system's intake in Savin Hill Cove and its outfall in Dorchester Bay. Pending EPA's issuance of an individual permit and that individual permit becoming effective, EPA has authorized the facility to operate pursuant to the 2000 General Permit.

On August 22, 2012, EPA Region 1 and the Massachusetts Department of Environmental Protection ("MassDEP") co-released a draft NPDES permit with an accompanying Fact Sheet for public comment. On October 25, 2012, UMass Boston submitted timely comments specifically addressing five (5) parts of the draft permit applicable to:

- unusual impingement events;
- operation of a traveling screen at the CWIS;
- a fish return system for impinged fish;
- performing a cooling tower feasibility study; and
- impingement monitoring required solely by MassDEP but included in the joint permit.

On February 7, 2013, EPA and MassDEP co-issued the final permit, along with the original Fact Sheet and their responses to UMass Boston's comments, which were the only public comments offered on the draft permit. The NPDES permit will become effective on May 1, 2013, excepting the provisions stayed by virtue of this appeal.

PARALLEL PROCEEDINGS

In addition to this petition, UMass Boston has separately appealed two state components of this permitting process. First, on February 27, 2013 UMass Boston requested an adjudicatory hearing at MassDEP's Office of Appeals and Dispute Resolution ("OADR) regarding the Water Quality Certificate ("WQC") issued by MassDEP to EPA on February 6, 2013. The WQC provided MassDEP's determinations under Section 401 of the Clean Water Act, 33 U.S.C. § 41, and 314 CMR 4 and 9. Second, today UMass Boston requested an adjudicatory hearing at

OADR regarding the NPDES permit to the extent that it also was co-issued by MassDEP as a Surface Water Discharge permit ("SWDP") pursuant to M.G.L. c. 21, § 43, et seq., and 314 CMR 2, 3, and 4.

TERMS AND PROVISIONS APPEALED

As set forth in more detail below, UMass Boston seeks review only of certain provisions of the NPDES permit. UMass Boston has identified each of those provisions in Attachment A and hereby incorporates that Attachment as part of this petition.

UMass Boston believes that all provisions of the NPDES permit which are not appealed by this petition or included in Attachment A are severable from the appealed provisions and should go into effect on May 1, 2013.

Intake Requirements

The NPDES permit conditions the operation of UMass Boston's cooling water intake after May 1, 2013 on compliance with a number of provisions that EPA acknowledges UMass Boston cannot possibly meet until substantial changes are made to its CWIS. This petition seeks review of those provisions to defer their effect until the changes can be implemented, as follows.

1. Variable Frequency Drives

UMass Boston's pumphouse currently uses four (4) single-speed pumps, three (3) capable of withdrawing 7,500 gallons per minute (gpm), and one (1) capable of withdrawing 3,750 gpm. Part I.D.1.a. of the NPDES permit requires that UMass Boston install and operate variable frequency drives ("VFDs") on at least two of the system's three larger pumps. As the record shows, UMass Boston is committed to installing VFDs in order to gain better control over the amount and timing of flows. In fact, UMass Boston has completed planning for the installation of VFDs on all four pumps which would surpass this requirement. Funding is authorized for this work as part of a larger utilities upgrade project associated with implementation of the 2009 Master Plan, and UMass Boston expects the VFDs to be in place by early 2014.

Nevertheless, UMass Boston appeals this provision because the NPDES permit conditions the authority of UMass Boston to operate the intake on having the VFDs in operation on May 1, 2013, on the effective date of the permit. The permit does not allow any time for the procurement or installation of the VFDs. Clearly, Part I.D.1.a, as written, imposes an impracticable and therefore unreasonable condition on UMass Boston. Accordingly, Part I.D.1.a should be stayed until the VFDs are installed and fully operational.

2. Other requirements to be stayed until the VFDs are operational

A number of permit provisions are tied to or dependent on installation of the VFDs and, for similar reasons, also should be stayed. They are:

a. Limits on rise in effluent temperature

Part I.a.1, including footnote 6, imposes limits on the rise in temperature between the system's influent and effluent. The permit limits are a calculated difference of 10° F at low tide, 11° F at mid-tide, and 12° F at high tide.[1/] Installation of the VFDs is a critical prerequisite to UMass Boston's meeting the temperature rise limits of the permit because installation of the VFDs and associated controls will modify flow rates based on tidal and temperature conditions. At certain times, UMass Boston will only be able to meet the temperature rise limits of the permit by adjusting the system's flows[2/]; for that reason, among others, UMass Boston plans to install VFDs on each of its four sea water pumps to ensure that it can meet the permit's

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1/ Fact Sheet p. 11 (These limitations on increases in effluent temperature are based on a Section 316(a) variance, pursuant to 33 U.S.C. §1326(a)).

2/ *See* Transmittal for EPA Permit Agency Review Team, p.3 (VHB) dated February 4, 2011and Sea Water Cooling System Summary of Expansion Request, p.2 (ARUP) dated July 14, 2011, both of which were attached to the UMass Boston Individual NPDES Permit Application (MA0040304) Foreword Letter, dated July 15, 2011 temperature rise limits even if one VFD is disabled. The temperature rise limits, therefore, should be stayed until the VFDs and their controls are installed, tested and fully operational.

b. Measuring rise in effluent temperature

Part I.a.1 also requires UMass Boston to measure the rise in temperature for each tidal height in a 24-hour period three times per day and to report the results. Once the VFDs and associated controls are operational, UMass Boston will have the capability of automating this measurement and scheduling it to coincide with the tides. But until then, these measurement and reporting obligations are impracticable and need to be stayed.

c. Limit on through-screen velocity

Part I.D.1.a(ii) requires UMass Boston to limit the through-screen velocity at the system's intake to .5 feet per second (fps). Again, VFDs are essential to UMass Boston's ability to satisfy this requirement. As with the provisions discussed above, UMass Boston does not object to this requirement as such, but only to the fact that the permit requires UMass Boston to meet the through-screen velocity limit on the day the permit becomes effective. Therefore, this provision should be stayed until the VFDs are installed, tested and fully operational.

d. Entrainment sampling

Part I.E.1 of the permit creates new entrainment sampling obligations for UMass Boston. Specifically, the permit requires UMass Boston to perform entrainment sampling three times per week between February 15 and July 30 of each year. The entrainment sampling requirements are consistent with the protocol UMass Boston used to collect data for its permit application between May and July of 2010.[3/] According to EPA, this additional entrainment sampling is needed to adequately characterize the levels of entrainment for the UMass Boston system and to determine

[3/] Fact Sheet p. 19.

whether the CWIS causes adverse impacts due to entrainment.[4/] According to EPA, this sampling is also necessary to determine whether the best technology available ("BTA") selected for UMass Boston reduces entrainment losses.[5/]

If the entrainment sampling commences on the effective date of the permit, however, nearly half the 2013 sampling season will have already passed. That means EPA would not receive a full set of 2013 data. Further, UMass Boston's installation of VFDs will lead to different and presumably reduced entrainment at the facility, so any data collected prior to installation of the VFDs will not help to characterize entrainment for the facility as modified.[6/] UMass Boston also is concerned that immediate commencement of entrainment sampling would reduce the likelihood that EPA might approve a reduced entrainment sampling regime after two years, as anticipated by Part I.E.4 of the permit.

For these reasons, the entrainment sampling required by Part I.E.1 should be stayed until the first February after the VFDs are installed, tested and fully operational, and then after two years, UMass Boston should be allowed to request termination of this sampling.

e. Entrainment sampling protocols

Parts I.E.1 and I.E.2 of the permit set forth entrainment sampling protocols that, while not being appealed by UMass Boston, would have no relevance until the entrainment sampling requirement takes effect.

f. Entrainment reporting

Finally, for the reasons described above, the entrainment reporting requirement in Part I.E.3 should be stayed until the entrainment sampling requirement takes effect.

4/ Fact Sheet p. 28.
5/ Fact Sheet p. 31.
6/ Because of the sampling UMass Boston performed in conjunction with its application, the agencies already have a baseline for comparison to data collected once the VFDs are installed and operational.

3. Fish Return Trough

Once it has been used for cooling, sea water in UMass Boston's system is discharged through a single, 42-inch pipe with an outfall that extends approximately two (2) meters into Dorchester Bay. Any organisms that were impinged by the traveling screen at the intake, whether live or not, are washed off to the outfall pipe and released into Dorchester Bay along with the cooling water discharge.

Part I.D.1.c of the permit requires UMass Boston to install and operate a new, separate fish return trough so as to reduce exposure of impinged organisms to the stress of the somewhat higher temperatures in the discharged cooling water. This provision also requires that the end of the new fish return trough be submerged below the water surface whenever the traveling screen is rotated.

a. Installation of a new fish return trough must be studied

This provision in the NPDES permit makes no allowance for the time required for UMass Boston to study, design and construct a new dedicated fish return trough. Nor, while EPA in the response to comments acknowledges that UMass Boston "may be presented with multiple challenges," does the permit recognize that installation of a useful new trough simply may not be feasible. EPA anticipates issuance, by EPA or MassDEP, of an administrative compliance order to set a schedule for compliance with the fish return requirement.[7/] The condition on authorization to discharge therefore should be formally stayed while UMass Boston investigates the feasibility, cost and effectiveness of constructing a new fish return.

UMass Boston appeals not only the timing of this requirement but the substance too, because a mandate for construction of a new, dedicated fish return finds no support in the record. EPA acknowledges that operation of the VFDs and maintenance of a .5 fps limit on through-

7/ Response to Comment 3.

screen velocity is "likely to allow most fish to avoid impingement."[8/] Given those expected reductions in impingement, EPA expects Dorchester Bay will experience an overall benefit even without a new fish return.[9/] Against that back drop, it is apparent that any basis for EPA's fish return requirement is lacking.

At most, EPA can point to MassDEP's determination that increased discharge temperatures "may be harmful" to fish.[10/] But that determination is belied by EPA's expectation that very few fish would ever end up in the facility's discharge. EPA expects UMass Boston to experience impingement rates greater than approximately 3.3 fish per hour rarely, even operating under current conditions.[11/] Furthermore, as the Agency is aware, UMass Boston's application included an evaluation of impingement impacts under worst case scenarios and, even then, determined that a very low number of marine organisms were recovered from the traveling screen.[12/] Assuming that further reductions are realized once the VFDs are operational and the facility is maintaining the permitted through-screen velocity, there may not be any impinged fish to benefit from the proposed new return trough.

While UMass Boston acknowledges that EPA exercises substantial discretion under the applicable standards for imposing conditions under § 316(b) of the Clean Water Act, still it must consider all relevant factors and has not done so here.[13/] For example, there is nothing in the

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8/ Fact Sheet p. 26 (Because the VFDs will reduce the overall amount of water withdrawn and because withdrawals can be tailored to actual cooling needs, EPA expects reduction in adverse impingement impacts); Fact Sheet p. 27.

9/ Fact Sheet p. 10.

10/ Response to Comment 1.

11/ Response to Comment 3.

12/ *See* Transmittal for EPA Permit Agency Review Team (VHB) dated February 4, 2011and Summary Report – Non-Contact Cooling Water Discharge Permit, p. 6 (VHB) dated July 15, 2011, both of which were attached to the UMass Boston Individual NPDES Permit Application (MA0040304) Foreword Letter, dated July 15, 2011.

13/ For every new NPDES permit or NPDES permit renewal, EPA must evaluate whether a facility's CWIS complies with Section 316(b) of the Clean Water Act, 33 U.S.C. §1326(b), specifically that the CWIS' location, design, construction and capacity reflect the best technology available for minimizing adverse environmental impact. Where, as here, no national, categorical standards apply to a CWIS, EPA uses its best professional judgment ("BPJ") on a site-specific basis while taking into account all relevant factors which may include, for record to indicate that EPA considered the cost of installation of a new fish return trough or the number of fish that might be helped, so there is no adequate basis for a determination whether that requirement is a reasonable conclusion of balancing all relevant factors.

These are very shaky foundations for a requirement that UMass Boston undertake the extensive and expensive design and installation of a new fish return trough. Instead, as UMass Boston has suggested, EPA should require only that UMass Boston investigate the feasibility, cost-effectiveness and potential benefit of installing a new fish return trough.[14/] EPA clearly lacks an adequate basis in the record for rejecting that suggestion and simply requiring the installation, especially because EPA recognizes that a technology might work at one facility but prove infeasible at another and, therefore, is required to evaluate whether each particular technology under consideration is in fact feasible at UMass Boston.[15/]

An investigation of a new, dedicated fish return should commence only after the VFDs are installed, tested and operational, so the Agency and UMass Boston can accurately assess the impingement potential of the upgraded CWIS. If, following that investigation, a new dedicated fish return is deemed feasible, cost-effective and beneficial – also taking into account the disruption to the resource area that would result from construction on the shoreline or in the mud flats – UMass Boston and the Agency would establish a timeline for permitting and construction of whatever fish return trough the parties agree to.

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example, the engineering aspects of various control techniques, process changes, cost, non-water quality environmental impacts (including energy issues), and a comparative assessment of an option's costs and benefits. *See* Fact Sheet p. 14-16; *Entergy Corp.* v. *Riverkeeper, Inc.*, 129 S. Ct. 1498, 1508-1510 (2009).

[14/] Comment 3.

[15/] Fact Sheet p. 15.

b. Locating the end of the fish return trough

Part I.D.1.c would also require that the outlet for the proposed fish return be submerged whenever the traveling screen is rotated. Even if UMass Boston were to build a new fish return trough, this requirement is likely to prove impracticable and should be studied.

The existing discharge pipe is exposed at low tide,[16] so to ensure that a new discharge point would be submerged whenever the traveling screen is rotated, it may need to be relocated. One option would be to install a shorter fish return leading to Savin Hill Cove rather than Dorchester Bay, but, as the Agency has acknowledged, Savin Hill Cove experiences build-up of silt that previously has required UMass Boston to perform dredging to allow the intake of water at low tide.[17] Thus, an outlet to Savin Hill Cove may not be feasible. Alternatively, the fish return outlet could be relocated farther off-shore in Dorchester Bay to ensure submergence at low tide. That would, of course, entail construction that would be highly disruptive to the resource area, very expensive, and would require significant permitting and time to implement – not to mention that the longer a fish travels through a fish return, the more likely it is to be harmed. Consequently, relocation of the fish return outlet to ensure submergence may not be feasible or beneficial.

Even if UMass Boston were to locate a new fish return outlet near the existing outfall, it would have to contend with the acknowledged low tide issues. The only apparent solution would be to prohibit rotation of the traveling screen during low tide, but given certain other requirements in the permit – which could require rotation of the traveling screen during low tide – this solution is not available. For example, both EPA's impingement monitoring requirement in Part I.C.1 and MassDEP's impingement monitoring requirement in Part I.G.4 obligate UMass

16/ The Agency acknowledges that, at least, the pipe is partially exposed at low tide. *See* Fact Sheet p. 8.
17/ Fact Sheet p. 23.

Boston to perform impingement sampling immediately after a screen rotation. And MassDEP's requirement that the impingement sampling target each of the three phases of the diurnal cycle means that some impingement sampling must occur at low tide. In addition, as UMass Boston has explained that the traveling screen is programmed to conduct cleaning every six hours or if a large amount of debris or impingement occurs; in the latter case, the screen rotation will occur automatically. If that were to occur at low tide, the discharge pipe may not be submerged.[18/] These potentially competing obligations could force UMass Boston to violate one provision of the permit in order to satisfy another.

Given the limitations of the campus layout and the geography of Columbia Point, as well as several competing obligations under the permit, whether the fish return outlet can be submerged whenever the screen is rotated should be studied rather than imposed as an inflexible condition of the permit.

4. Unusual Impingement Event

Part I.C.1 of the permit defines and imposes conditions relating to Unusual Impingement Events ("UIE"). A UIE is defined as any occasion on which 20 or more total fish are observed (or estimated based on time-limited observations) on the traveling screen within any six-hour period. Whenever a UIE is observed, UMass Boston will be required to rotate the traveling screen continuously until impingement is decreased to three or fewer fish per hour. In addition, UMass Boston would be subject to certain reporting requirements including enumeration and recording of all dead fish by species and size range.

UMass Boston objects to the UIE threshold in the permit, not to the permit's inclusion of a UIE standard as such. In its comments on the draft permit, UMass Boston requested

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18/ Comment 2.

clarification of the draft permit's UIE threshold. Rather than clarifying the standard proposed in the draft permit, EPA drastically reduced the threshold for a UIE from 150 fish in any six-hour period to 20 fish in any six-hour period.[19/] It made that change without any explanation other than that the agencies determined certain unidentified facilities with less than continuous screen rotation were subject to UIE thresholds of 15-40 fish per rotation.[20/] Neither EPA nor MassDEP has explained why a markedly lower threshold is necessary or why it selected a threshold of 20 rather than 15 or 40 fish per rotation fish.

The Agency highlighted its error by making another change to the permit's UIE provision: the final permit requires UMass Boston to continuously rotate the traveling screen during a UIE until impingement decreases to three or fewer fish per hour. UMass Boston does not object to this change, though it notes the only support offered for this new provision is that it is "consistent with other permits."[21/] Rather, this added provision illuminates the arbitrariness of EPA's UIE threshold, because EPA implies that impingement at a rate of three fish per hour is "usual." At that rate, the system would yield 18 impinged fish over six hours. That is only two fewer fish than what the Agency has defined as a UIE. To put it another way, the Agency would require UMass Boston to respond to 3.3 impinged fish per hour as a UIE, but treat 3 impinged fish per hour as consistent with normal conditions.

In so far as the Agency has not offered an adequate basis for its revision to the UIE definition or its requirement for continuous operation of the traveling screen until UMass Boston achieves a rate of three or fewer fish per hour, these requirements are unreasonable, arbitrary and capricious. UMass Boston does not contend, nor does EPA anticipate[22/], that UIEs will

19/ Draft Permit Part I.C.1; Response to Comment 1.
20/ Response to Comment 1.
21/ *Id.*
22/ *Id.*

frequently occur, but the fact remains that when they do occur UMass Boston will be required to operate its rotating screen continuously until impingement is reduced to three fish per hour. As UMass Boston has explained and as EPA has confirmed, the traveling screen manufacturer recommends that the screen be rotated no more than once every six hours; more frequent rotation would subject the screen to unnecessary wear and tear.[23/] EPA has not adequately justified this added burden on UMass Boston. The definition of a UIE should be changed to at least 40 fish per six hour period if that is in fact consistent with the standards applicable to other similar systems.

5. Impingement Monitoring (State Condition)

Part I.G.4 of the NPDES permit imposes an unduly extensive and expensive impingement monitoring program, including year-round sampling requiring the participation of a qualified biologist. Part I.G.4 is based on a condition included in the WQC that was issued for the NPDES permit by MassDEP on February 6, 2013. UMass Boston acknowledges and appreciates that in the final permit and WQC MassDEP modified its proposed impingement monitoring requirements, but even as reduced those requirements are overly burdensome and are unsupported by information or data in the administrative record. Accordingly, UMass Boston has filed claims for adjudicatory hearings on the WQC and SWDP at MassDEP's OADR.

In large part, UMass Boston's appeal of MassDEP's impingement monitoring requirements is based on MassDEP's failure to explain how those requirements are necessary to comply with any state requirements. That is partly because MassDEP's impingement monitoring program bears no rational relation to the demonstrated, much less to the anticipated, impacts of UMass Boston's CWIS. As the agencies are aware, the facility presents only a minimal

[23/] Response to Comment 2.

impingement potential as it currently operates.[24/] Installation of VFDs and maintenance of a .5 foot per second through-screen velocity will further decrease impingement potential.[25/] A less burdensome and costly monitoring and sampling regime, therefore, would be adequate and more appropriate, particularly in consideration of the relatively small size of UMass Boston's system and the financial burdens that the current permit requirements would impose on a public educational institution.

UMass Boston expects that the fate of MassDEP's impingement monitoring and sampling program will be determined by those state proceedings but nevertheless addresses those requirements in this petition to ensure that they do not take effect as a matter of federal law.

a. Year-round monitoring and sampling is excessive

In its comments on the draft permit, UMass specifically objected to the year-round impingement monitoring and sampling schedule proposed by MassDEP. UMass Boston explained that a reduced schedule aligned with EPA's prescribed entrainment monitoring program (February 15 through July 30) would generate important data while avoiding substantial and unnecessary costs that MassDEP's proposed program would otherwise impose on UMass Boston. As discussed above, MassDEP has not demonstrated a need for extensive year-round impingement monitoring and sampling.

That EPA and MassDEP understand the relative importance the proposed "first season" of sampling, and thus the relative unimportance of the proposed "second season," is evidenced by their request during the permit application process that UMass Boston conduct impingement

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24/ Summary Report – Non-Contact Cooling Water Discharge Permit, p. 6 (VHB), dated July 15, 2011, which was an attachment to the UMass Boston Individual NPDES Permit Application (MA0040304) Foreword Letter, dated July 15, 2011.

25/ Fact Sheet p. 27.

sampling in support of its permit application but only between April and July of 2010.[26] Even under those worst-case conditions, the impingement level at the facility was "relatively minor."[27] And more recently, MassDEP eliminated the requirement that a biologist be on site during impingement monitoring performed during the second season.[28] But rather than completely eliminate the second season, MassDEP elected to require impingement monitoring that would kill all of the impinged organisms so they can be inspected by biologists off site. There is simply no basis in the record for MassDEP to require a second season of impingement monitoring and sampling, especially where it would require destructive sampling.[29]

b. <u>No basis for requiring a trained biologist</u>

UMass Boston public comments also explained that it lacks the in-house staff to perform impingement monitoring and sampling as prescribed by MassDEP. In this respect, it is unlike many industrial and commercial permittees who employee staff biologists. Consequently, UMass Boston would be forced to hire outside consultants at a significant cost. UMass Boston estimated the annual cost of outside consultants would approach $150,000 if were required to perform year-round monitoring with an on-site biologist. While MassDEP's decision to eliminate the on-site biologist during the second season of monitoring would undoubtedly reduce the financial burden on UMass Boston, the remaining requirements still would impose substantial costs on UMass Boston. MassDEP has established no basis for imposing such a cost.

26/ Fact Sheet p. 19.

27/ Summary Report – Non-Contact Cooling Water Discharge Permit, p. 6 (VHB), dated July 15, 2011, which was an attachment to the UMass Boston Individual NPDES Permit Application (MA0040304) Foreword Letter, dated July 15, 2011.

28/ Response to Comment 6.

29/ Response to Comment 5.

c. Comparisons to dissimilar facilities

Clear evidence of just how outsized the MassDEP's impingement monitoring requirements are is found in the Response to Comments.[30/] UMass Boston requested information regarding similar impingement monitoring requirements that MassDEP had imposed elsewhere. In its response, MassDEP identified two facilities, the General Electric jet engine manufacturing facility in Lynn and the Wheelabrator waste-to-energy facility in Saugus.[31/] Even a superficial comparison of these facilities shows that UMass Boston's system is relatively small when compared to those facilities. According to MassDEP, the flow rates of those facilities are 45 and up to 60 million gallons per day (MGD), respectively, meaning that their flow rates are at least twice that authorized for UMass Boston under the final permit.[32/]

That MassDEP would impose impingement monitoring conditions on UMass Boston that are roughly equivalent to the regime's imposed on the much larger GE and Wheelabrator facilities finds no support in the record. What's more, the impingement monitoring requirements in the final permit actually are considerably more extensive than those for General Electric or Wheelabrator. For example, UMass Boston must conduct sampling year-round and three times per week while General Electric only performs sampling once per week when its system is operating. Wheelabrator only performs weekly sampling from March through October and twice-monthly sampling during the rest of the year.[33/] MassDEP has not adequately explained why UMass Boston should perform a program of impingement monitoring and sampling that is as or more extensive that those MassDEP has required at substantially larger facilities.

30/ Response to Comments 6.
31/ *Id.*
32/ *Id.*; UMass Boston's permitted flows are a limited to a 17.2 MGD monthly average, a 18.4 MGD daily maximum, and a 12.9 MGD annual average.
33/ *Id.*

<u>RELIEF SOUGHT</u>

UMass Boston respectfully seeks a full review by the EAB of the appealed terms and provisions of the final NPDES permit. After such review, UMass Boston seeks:

1. a remand to EPA with an order to issue an amended NPDES permit that conforms to EAB's findings on the terms and provisions appealed by UMass Boston, including those terms and provisions for which UMass Boston has only requested a stay; or,

2. a remand to EPA with an order to issue an amended NPDES permit that conforms to EAB's findings on the terms and provisions appealed by UMass Boston along with an order staying the terms and provisions for which UMass Boston has only requested a stay.

<u>CONCLUSION</u>

Thank you for your consideration.

Respectfully submitted,

UNIVERSITY OF MASSACHUSETTS BOSTON

By its attorneys,

Ralph A. Child
Colin G. Van Dyke
MINTZ, LEVIN, COHN, FERRIS, GLOVSKY AND POPEO, P.C.
One Financial Center
Boston, MA 02111
Tel: (617) 542-6000
Fax (617) 542-2241
Rchild@mintz.com
cgvandyke@mintz.com

March 11, 2013

ATTACHMENT A

Attachment A

Terms and Provisions from NPDES Permit No. MA 0040304 Appealed by UMass Boston

	Part	Page of Permit	Requirement
1.	I.A.1	2 of 12 (fn. 6)	Maximum temperature rise at low tide: 10° F
2.	I.A.1	2 of 12 (fn. 6)	Maximum temperature rise at mid-tide: 11° F
3.	I.A.1	2 of 12 (fn. 6)	Maximum temperature rise at high tide: 12° F
4.	I.A.1	2 of 12 (fn. 6)	Report maximum temperature rise for each height in 24-hour period; calculate temperature rise based on continuous measurement of influent and effluent temperatures
5.	I.A.1	2 of 12 (fn. 6)	Measure temperature rise 3 times per day
6.	I.C.1	5 of 12	Unusual Impingement Event (UIE) means 20 or more total fish per 6-hour period
7.	I.C.1	5 of 12	During UIE, rotate screens continuously until impingement decreases to 3 or fewer fish per hour
8.	I.D.1.a	6 of 12	Install variable frequency drives (VFDs) on at least two of the large salt water pumps and operate VFDs in conjunction with a supplemental cooling tower
9.	I.D.1.a(ii)	6 of 12	Limit through screen velocity to .5 foot per second
10.	I.D.1.c	7 of 12	Install and operate a new fish return for impinged fish; the end of fish return must be submerged whenever the traveling screen is rotated
11.	I.E.1	7 of 12	Entrainment monitoring - between 2/15 and 7/31, perform 3 times per week targeting 3 phases of the diurnal cycle
12.	I.E.1.a	7 of 12	Entrainment monitoring protocols
13.	I.E.1.b	7 of 12	Entrainment monitoring protocols
14.	I.E.2	8 of 12	Entrainment monitoring protocols
15.	I.E.3	8 of 12	Entrainment monitoring reporting

16.	I.G.4	11 of 12	Impingement monitoring, year-round, three times per week for 2 years; 2 sampling seasons with two different protocols; from 2/15-7/31, a qualified biologist must perform or supervise collection; from 8/1-2/14, transfer organisms weekly to a qualified biologist; commence impingement monitoring after the earlier of VFD installation or 2 years after the permit issues, whichever is sooner; UMass Boston can request reduction in frequency after 2 years

APPENDIX

- Exhibit 1: NPDES Permit No. MA 0040304 (Feb. 7, 2013)

- Exhibit 2: UMass Boston Individual NPDES Permit Application (MA0040304) Foreword Letter, dated July 15, 2011 (Excerpts)

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33 U.S.C. §§1251 et seq.; the "CWA"), and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

University of Massachusetts Boston

is authorized to discharge from the facility located at

University of Massachusetts Boston
100 Morrissey Boulevard
Boston, MA 02125

to receiving water named

Dorchester Bay (MA70-03)

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on the first day of the calendar month following sixty (60) days after signature.

This permit and the authorization to discharge expire at midnight, five (5) years from the last day of the month preceding the effective date.

This permit supersedes the permit issued on April 25, 2000.

This permit consists of 12 pages in Part I including effluent limitations, monitoring requirements, and state permit conditions, and 25 pages in Part II Standard Conditions.

Signed this 7th day of February, 2013

/S/ SIGNATURE ON FILE

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

David Ferris, Director
Massachusetts Wastewater
Management Program
Department of Environmental
Protection
Commonwealth of Massachusetts
Boston, MA

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning the effective date and lasting through the expiration date, the permittee is authorized to discharge **non-contact cooling water** from **outfall 001** to Dorchester Bay. Such discharge shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Units	Discharge Limitation			Monitoring Requirement[1,2]	
		Average Monthly	Maximum Daily	Annual Average	Measurement Frequency	Sample Type
Flow Rate	MGD	17.2	18.4	12.9[3]	Continuous	Flow Meter
pH[4]	s.u.	6.5 - 8.5		--	1 / Week	Grab
Effluent Temperature	˚F	Report	80[5] 85[5]	--	Continuous	Meter
Influent Temperature	˚F	Report	Report	--	Continuous	Meter
Rise in Temperature	˚F	--	See Footnote 6	--	3 / day	Calculation

Footnotes

(1) Effluent samples taken in compliance with the monitoring requirements specified above shall be taken at a location that provides a representative sample of the effluent prior to discharge to the receiving water.

(2) All samples shall be tested using the analytical methods found in 40 CFR Section 136 or alternative methods approved by EPA in accordance with the procedures at 40 CFR Section 136.

(3) Annual average flow value shall be reported daily as a rolling annual average based on the previous 365 days.

(4) The pH of the effluent shall be in the range of 6.5 standard units (s.u.) to 8.5 s.u. and not more than 0.2 units outside the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this class.

(5) The maximum daily temperature limit of 80°F shall be based on the mean daily temperature over a twenty-four (24) hour period. The maximum daily temperature limit of 85°F is an instantaneous maximum not to be exceeded.

(6) The rise in temperature (calculated as the difference between the recorded instantaneous effluent temperature and influent temperature) shall not exceed 10°F at low tide, 11°F at mid-tide, and 12°F at high tide. The permittee shall report the maximum rise in temperature for each tidal height in a 24-hour period based on continuous measurement of influent and effluent temperatures. Low and high tide shall be defined by the daily tide prediction at NOAA Boston Station ID Number 8443970. Mid-tide shall be defined as the tidal height approximately three (3) hours after low or high tide.

Part I.A. (continued)

2. Any discharge that causes a violation of water quality standards of the receiving waters, or otherwise interferes with attainment of any designated use of Class SB waters and existing uses of Dorchester Bay, is prohibited.

3. Any discharge of floating solids, visible oil sheen or foam is prohibited.

4. The discharges shall not impart color, taste, turbidity, toxicity, radioactivity or other properties which cause those waters to be unsuitable for the designated uses and characteristics ascribed to their use.

5. The use of biocides or other chemical additives in non-contact cooling water is prohibited.

6. This permit shall be modified, or revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

   a. contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

   b. controls any pollutant not limited by this permit.

   If the permit is modified or reissued, it shall be revised to reflect all currently applicable requirements of the Act.

7. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe (40 CFR §122.42):

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

      (i) One hundred micrograms per liter (100 µg/l);

      (ii) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

      (iii) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and Massachusetts regulations.

   b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

      (i) Five hundred micrograms per liter (500 µg/l);

      (ii) One milligram per liter (1 mg/l) for antimony;

      (iii) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

      (iv) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and Massachusetts regulations.

c. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

8. Toxics Control

a. The permittee shall not discharge any pollutant or combination of pollutants in toxic amounts.

b. Any toxic components of the effluent shall not result in any demonstrable harm to aquatic life or violate any state or federal water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be revised or amended in accordance with such standards.

B. UNAUTHORIZED DISCHARGES

This permit authorizes the permittee to discharge only in accordance with the terms and conditions of this permit and only from the outfall listed in Part I.A.1. of this permit. Discharges of wastewater from any other point sources which are not authorized by this permit or other NPDES permits shall be reported in accordance with Section D.1.e.(1) of the Standard Conditions of this permit (Twenty-four hour reporting).

C. UNUSUAL IMPINGEMENT EVENT

1. The permittee shall visually inspect the traveling screen at the CWIS once every twenty-four (24) hours for dead and live fish when circulating pumps are in operation. The permittee shall begin the inspection at the start of screen rotation and continue for at least one full rotation of the screen. An "unusual impingement event" (UIE) is defined as any occasion on which the permittee observes on the traveling screen, or estimates based on time-limited observations, 20 or more total fish within any 6 hour period. During the UIE, the permittee shall rotate the traveling screen continuously until impingement decreases to three (3) or fewer fish per hour.

2. UIEs will be reported to the Regional Administrator and Commissioner no later than twenty-four (24) hours after the permittee is aware of or has reason to believe an UIE has occurred as required in Part II.D.1.e. of this Permit. If the UIE is observed during weekend, holiday or evening periods, the permittee shall notify the EPA and MassDEP on the next business day.

3. The permittee shall prepare and submit a written report regarding such UIE within five (5) business days to EPA and MassDEP at the addresses found in Part I.F.1.c. of this permit. The oral and written reports shall include the following information:

a. An enumeration and recording of all dead fish by species. Report the species, size ranges (maximum and minimum length), and approximate number of organisms involved in the incident. In addition, a representative sample of 25% of fish specimens from each species, up to a maximum of 50 total fish specimens, shall be measured to the nearest centimeter total length.

b. The date and time of occurrence.

c. The determination or opinion of the permittee as to the reason the incident occurred.

4. In addition to EPA and MassDEP, the permittee shall report UIEs to the Massachusetts Division of Marine Fisheries at the following address:

Division of Marine Fisheries
Annisquam Marine Fisheries Station
Attn: Dr. Jack P. Schwartz
30 Emerson Avenue
Gloucester, MA 01930
(978) 282-0308

D. BEST TECHNOLOGY AVAILABLE

1. The location, design, construction, and capacity of the permittee's non-contact cooling water intake structure (CWIS) shall reflect the best technology available (BTA) for minimizing the adverse environmental impacts from impingement of aquatic organisms and entrainment of eggs and larvae. In order to satisfy this BTA requirement, the permittee shall:

a. Operate variable frequency drives (VFDs) on at least two of the large salt water pumps and operate the VFDs in conjunction with a supplemental cooling tower to:

(i) Limit the maximum daily intake flow to 18.4 MGD, maximum monthly average flow to 17.2 MGD, and annual average daily flow to 12.9 MGD.

(ii) Limit the maximum through-screen velocity to no more than 0.5 feet per second.

b. Rotate the traveling screen at the maximum rotation frequency recommended by the manufacturer, but not less than once per day, in order to minimize impingement duration. The manufacturer's recommended maximum screen rotation frequency shall be cited in the **CWIS Biological Monitoring Report** detailed in Part I.E.3. This requirement shall not apply to any period that the traveling screen is not in working order due to required maintenance.

c. Install and operate a new fish return trough that transports impinged fish and other aquatic organisms to Dorchester Bay in a separate trough from the non-contact cooling water discharge pipe. The new fish return trough shall avoid vertical drops and sharp turns or angles. The end of the new fish return trough shall be submerged at all times when the traveling screen is rotated at a location that minimizes the potential for re-impingement.

2. The permittee shall evaluate the feasibility of operating the supplemental cooling tower year-round. Within three (3) years after initiating full operation of the supplemental cooling tower, the permittee shall submit to EPA and MassDEP a **Cooling Tower Operational Study** that summarizes the results of the evaluation and estimates flow reductions, energy use, and potable water use resulting from increased operation of the cooling tower.

3. Any change in the location, design, or capacity of the intake structure outside of the specifications of this Permit must be approved in advance in writing by the Regional Administrator and Director of the Wastewater Management Program of MassDEP.

4. The permittee shall notify EPA and MassDEP of any change in the location, design, or capacity of the intake structures outside of the specifications of this Permit, as such changes may require a permit modification. The design of the intake structures shall be reviewed for conformity to applicable regulations pursuant to Section 316(b) of the CWA when such regulations are promulgated.

E. BIOLOGICAL SAMPLING

1. The Permittee shall conduct entrainment sampling three (3) times per week between February 15 and July 31st each year. Three entrainment samples shall be collected each week targeting three separate periods of the diurnal cycle (for example, once on Monday morning at 8:00 am, once on Wednesday afternoon at 2:00 pm, and once on Friday night at 8:00 pm). At a minimum, the sampling program shall address the following:

a. Sampling shall be conducted or supervised on-site by a qualified biologist using a 0.333 millimeter mesh 60-centimeter plankton net. The volume of water sampled shall be measured and equal to approximately 100 cubic meters (m^3). A standard mesh of 0.202 mm shall be required during the period of highest abundance of early stage winter flounder (late March to late April). After each sample, the collection nets shall be washed down and the sample transferred from the net to a jar containing sufficient formalin to produce a 5 to 10% solution.

b. In the laboratory, all eggs and larvae shall be identified to the lowest practical taxon and counted. Subsampling with a plankton splitter may be used if the count of eggs and larvae in a sample is greater than 400 organisms so that at least 200 eggs and larvae will be present in any subsample.

2. Ichthyoplankton counts shall be converted to densities per 100 m^3 of water based on flow through the sampling net and the data shall be presented in the annual **CWIS Biological Monitoring Report** detailed in Part I.E.3 below. Estimates of total numbers of ichthyoplankton based on facility flow rates shall also be provided. Entrainment losses shall be converted from weekly estimates of density per unit volume, to monthly and annual loss estimates based on the permitted flow. In addition, loss estimates should be converted to adult equivalents for species for which regionally specific larval survival rates are available.

3. Results of the entrainment monitoring shall be reported annually in a **CWIS Biological Monitoring Report**, which shall include monitoring logs and raw data collected in the previous year and summarize the data both graphically, where appropriate, and in text. The monitoring report shall also include the results of all calculations conducted in accordance with Part I.E.2. The **CWIS Biological Monitoring Report** shall be submitted to EPA and MassDEP by December 1st.

4. After two years, the Permittee may submit a written request to the EPA and MassDEP requesting a reduction in the frequency of the required entrainment monitoring requirements. Until written notice is received by certified mail from the EPA indicating that the intake screen monitoring and cleaning frequency has been changed, the Permittee is required to continue monitoring and cleaning at the frequency specified in this permit.

F. MONITORING AND REPORTING

1. **For a period of 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, a web-based tool that allows permittees to electronically submit discharge monitoring reports (DMRs) and other required reports via a secure internet connection. **Beginning no later than one year after the effective date of the permit**, the permittee shall begin reporting using NetDMR, unless the facility is able to demonstrate a reasonable basis that precludes the use of NetDMR for submitting DMRs and reports. Specific requirements regarding submittal of data and reports in hard copy form and for submittal using NetDMR are described below:

   a. Submittal of Reports Using NetDMR

   NetDMR is accessed from: http://www.epa.gov/netdmr. **Within one year of the effective date of this permit**, the permittee shall begin submitting DMRs and reports required under this permit electronically to EPA using NetDMR, unless the facility 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").

DMRs shall be submitted electronically to EPA 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 shall continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP.

b. Submittal of NetDMR Opt-Out Requests

Opt-out requests must be submitted in writing to EPA for written approval at least sixty (60) days prior to the date a facility would be required under this permit to begin using NetDMR. This demonstration shall be valid for twelve (12) months from the date of EPA approval and shall thereupon expire. At such time, DMRs and reports shall be submitted electronically to EPA unless the permittee submits a renewed opt-out request and such request is approved by EPA. All opt-out requests should be sent to the following addresses:

Attn: NetDMR Coordinator
U.S. Environmental Protection Agency, Water Technical Unit
5 Post Office Square, Suite 100 (OES04-4)
Boston, MA 02109-3912

And

Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608

c. Submittal of Reports in Hard Copy Form

Monitoring results shall be summarized for each calendar month and reported on separate hard copy Discharge Monitoring Report Form(s) (DMRs) postmarked no later than the 15th day of the month following the completed reporting period. All reports required under this permit shall be submitted as an attachment to the DMRs. Signed and dated originals of the DMRs, and all other reports or notifications required herein or in Part II shall be submitted to the Director at the following address:

U.S. Environmental Protection Agency
Water Technical Unit (OES04-SMR)
5 Post Office Square - Suite 100
Boston, MA 02109-3912

Duplicate signed copies of all reports or notifications required above shall be submitted to the State at the following address:

MassDEP – Northeast Region
Bureau of Waste Prevention
205B Lowell Street
Wilmington, MA 01887

Any verbal reports, if required in **Parts I** and/or **II** of this permit, shall be made to both EPA and to MassDEP.

Hard copies of the CWIS Biological Monitoring Report required under Part I.E.3. of this permit and any written reports required under Part I.C. of this permit shall also be submitted to the State at the following address:

MassDEP
Watershed Planning Program
627 Main St, 2nd Floor
Worcester, MA 01608

G. STATE PERMIT CONDITIONS

1. This authorization to discharge includes two separate and independent permit authorizations. The two permit authorizations are (i) a federal National Pollutant Discharge Elimination System permit issued by the U.S. Environmental Protection Agency (EPA) pursuant to the Federal Clean Water Act, 33 U.S.C. §§1251 et seq.; and (ii) an identical state surface water discharge permit issued by the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP) pursuant to the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and 314 C.M.R. 3.00. All of the requirements contained in this authorization, as well as the standard conditions contained in 314 CMR 3.19, are hereby incorporated by reference into this state surface water discharge permit.

2. This authorization also incorporates the state water quality certification issued by MassDEP under § 401(a) of the Federal Clean Water Act, 40 C.F.R. 124.53, M.G.L. c. 21, § 27 and 314 CMR 3.07. All of the requirements (if any) contained in MassDEP's water quality certification for the permit are hereby incorporated by reference into this state surface water discharge permit as special conditions pursuant to 314 CMR 3.11.

3. Each agency shall have the independent right to enforce the terms and conditions of this permit. Any modification, suspension or revocation of this permit shall be effective only with respect to the agency taking such action, and shall not affect the validity or status of this permit as issued by the other agency, unless and until each agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this permit is declared invalid, illegal or otherwise issued in violation of state law such permit shall remain in full force and effect under federal law as a NPDES Permit issued by the U.S. Environmental Protection Agency. In the event this permit is declared invalid, illegal or otherwise issued in violation of federal law, this permit shall remain in full force and effect under state law as a permit issued by the Commonwealth of Massachusetts.

4. The permittee shall conduct year-round impingement monitoring three times per week for a minimum of two years, at which time the permittee can request a reduction in monitoring frequency from MassDEP. Sampling should be initiated after the variable-speed drives for the intake pumps have been installed, or two years after permit issuance, whichever occurs first. There shall be two impingement monitoring "seasons" with slightly different protocols for each:

   First Season (February 15-July 31):
   During the First Season impingement collections may take place on the same days that entrainment monitoring takes place. In any case, each of the three impingement samples collected in any week shall target a different period of the diurnal cycle (for example, sampling would be conducted once on Monday morning at 6:00 am, once on Wednesday afternoon at 2:00 pm, and once on Friday night at 8:00 pm). Each impingement sample shall be separated by a minimum of 24-hours. Each collection shall cover a period of at least six hours following an initial, cleansing screen-wash and the exact time period shall be recorded. All squid, lobsters, fish and other vertebrates impinged over the period between screen washes shall be collected and kept in an aerated, sea-water-filled container of a large-enough size such that any further harm to impinged organisms is not unduly increased. If any turtles are impinged, these should be photographed and released in an area safe from re-impingement (but not to the fish return trough). A qualified biologist, or individual supervised on-site by a qualified biologist, shall collect the impinged organisms, key them to species, estimate the length of each organism (to the nearest centimeter), record this information in a log book and release the impinged organisms to the fish-return trough or to the ocean in another location far away enough from the intake that they would be unlikely to be re-impinged. If any organisms are collected that are unfamiliar to the supervising biologist, one or two of these organisms shall be put aside and preserved in alcohol or formalin, and sent to a qualified taxonomist for identification. If an "unusual impingement event" is taking place, the protocols outlined in Section C of this permit shall be followed.

Second Season (August 1-February 14):
During the Second Season, impingement collections shall also be made three times per week, and each collection shall target a different period of the diurnal cycle as outlined above for the First Season. Unless an “unusual impingement event” (see above) is taking place, all organisms impinged over the period between screen washes shall be collected either by a qualified biologist, analyzed on site and released (as outlined above for the First Season), or by a trained technician if a qualified biologist is not available. If impinged lobster, squid, fish and other vertebrate samples are collected by a trained technician, the fish and squids shall be preserved in alcohol or formalin, at concentrations appropriate for specimen storage, and set aside for weekly transfer to a qualified biologist for identification to species, measurement to the nearest centimeter, record keeping and reporting as outlined for the First Season. Lobsters should be counted, measured to the nearest centimeter and released. Turtles should be treated as outlined for the first season. If an “unusual impingement event” is taking place, the protocols outlined in Section C of this permit shall be followed.

NPDES PART II STANDARD CONDITIONS
(January, 2007)

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PART II. A. GENERAL REQUIREMENTS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

a. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the sludge use or disposal established under Section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

b. The CWA provides that any person who violates Section 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any of such sections in a permit issued under Section 402, or any requirement imposed in a pretreatment program approved under Section 402 (a)(3) or 402 (b)(8) of the CWA is subject to a civil penalty not to exceed $25,000 per day for each violation. Any person who negligently violates such requirements is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both. Any person who knowingly violates such requirements is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both.

c. Any person may be assessed an administrative penalty by the Administrator for violating Section 301, 302, 306, 307, 308, 318, or 405 of the CWA, or any permit condition or limitation implementing any of such sections in a permit issued under Section 402 of the CWA. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

Note: See 40 CFR §122.41(a)(2) for complete "Duty to Comply" regulations.

2. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or notifications of planned changes or anticipated noncompliance does not stay any permit condition.

3. Duty to Provide Information

The permittee shall furnish to the Regional Administrator, within a reasonable time, any information which the Regional Administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Regional Administrator, upon request, copies of records required to be kept by this permit.

4. Reopener Clause

The Regional Administrator reserves the right to make appropriate revisions to this permit in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the CWA in order to bring all discharges into compliance with the CWA.

For any permit issued to a treatment works treating domestic sewage (including "sludge-only facilities"), the Regional Administrator or Director shall include a reopener clause to incorporate any applicable standard for sewage sludge use or disposal promulgated under Section 405 (d) of the CWA. The Regional Administrator or Director may promptly modify or revoke and reissue any permit containing the reopener clause required by this paragraph if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or contains a pollutant or practice not limited in the permit.

Federal regulations pertaining to permit modification, revocation and reissuance, and termination are found at 40 CFR §122.62, 122.63, 122.64, and 124.5.

5. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from responsibilities, liabilities or penalties to which the permittee is or may be subject under Section 311 of the CWA, or Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

6. Property Rights

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges.

7. Confidentiality of Information

a. In accordance with 40 CFR Part 2, any information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission in the manner prescribed on the application form or instructions or, in the case of other submissions, by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information).

b. Claims of confidentiality for the following information will be denied:

(1) The name and address of any permit applicant or permittee;
(2) Permit applications, permits, and effluent data as defined in 40 CFR §2.302(a)(2).

c. Information required by NPDES application forms provided by the Regional Administrator under 40 CFR §122.21 may not be claimed confidential. This includes information submitted on the forms themselves and any attachments used to supply information required by the forms.

8. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Regional Administrator. (The Regional Administrator shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)

9. State Authorities

Nothing in Part 122, 123, or 124 precludes more stringent State regulation of any activity covered by these regulations, whether or not under an approved State program.

10. Other Laws

The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, or local laws and regulations.

PART II. B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of storm water pollution prevention plans. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

4. Bypass

a. Definitions

(1) *Bypass* means the intentional diversion of waste streams from any portion of a treatment facility.

(2) *Severe property damage* means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can be reasonably expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provision of Paragraphs B.4.c. and 4.d. of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph D.1.e. of this part (Twenty-four hour reporting).

d. Prohibition of bypass

Bypass is prohibited, and the Regional Administrator may take enforcement action against a permittee for bypass, unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(3) i) The permittee submitted notices as required under Paragraph 4.c. of this section.
ii) The Regional Administrator may approve an anticipated bypass, after considering its adverse effects, if the Regional Administrator determines that it will meet the three conditions listed above in paragraph 4.d. of this section.

5. <u>Upset</u>

a. Definition. *Upset* means an exceptional incident in which there is an unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph B.5.c. of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;
(2) The permitted facility was at the time being properly operated;
(3) The permittee submitted notice of the upset as required in paragraphs D.1.a. and 1.e. (Twenty-four hour notice); and
(4) The permittee complied with any remedial measures required under B.3. above.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

PART II. C. MONITORING REQUIREMENTS

1. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

b. Except for records for monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application except for the information concerning storm water discharges which must be retained for a total of 6 years. This retention period may be extended by request of the Regional Administrator at any time.

c. Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;
(2) The individual(s) who performed the sampling or measurements;
(3) The date(s) analyses were performed;
(4) The individual(s) who performed the analyses;
(5) The analytical techniques or methods used; and
(6) The results of such analyses.

d. Monitoring results must be conducted according to test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, unless other test procedures have been specified in the permit.

e. The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

2. Inspection and Entry

The permittee shall allow the Regional Administrator or an authorized representative (including an authorized contractor acting as a representative of the Administrator), upon presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the CWA, any substances or parameters at any location.

PART II. D. REPORTING REQUIREMENTS

1. Reporting Requirements

a. Planned Changes. The permittee shall give notice to the Regional Administrator as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is only required when:

(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR§122.29(b); or
(2) The alteration or addition could significantly change the nature or increase the quantities of the pollutants discharged. This notification applies to pollutants which are subject neither to the effluent limitations in the permit, nor to the notification requirements at 40 CFR§122.42(a)(1).
(3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition or change may justify the application of permit conditions different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

b. Anticipated noncompliance. The permittee shall give advance notice to the Regional Administrator of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

c. Transfers. This permit is not transferable to any person except after notice to the Regional Administrator. The Regional Administrator may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the CWA. (See 40 CFR Part 122.61; in some cases, modification or revocation and reissuance is mandatory.)

d. Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by the Director for reporting results of monitoring of sludge use or disposal practices.

(2) If the permittee monitors any pollutant more frequently than required by the permit using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, or as specified in the permit, the results of the monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Director.

(3) Calculations for all limitations which require averaging or measurements shall utilize an arithmetic mean unless otherwise specified by the Director in the permit.

e. Twenty-four hour reporting.

(1) The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances.

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(2) The following shall be included as information which must be reported within 24 hours under this paragraph.

(a) Any unanticipated bypass which exceeds any effluent limitation in the permit. (See 40 CFR §122.41(g).)
(b) Any upset which exceeds any effluent limitation in the permit.
(c) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Regional Administrator in the permit to be reported within 24 hours. (See 40 CFR §122.44(g).)

(3) The Regional Administrator may waive the written report on a case-by-case basis for reports under Paragraph D.1.e. if the oral report has been received within 24 hours.

f. Compliance Schedules. Reports of compliance or noncompliance with, any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

g. Other noncompliance. The permittee shall report all instances of noncompliance not reported under Paragraphs D.1.d., D.1.e., and D.1.f. of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D.1.e. of this section.

h. Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Administrator, it shall promptly submit such facts or information.

2. Signatory Requirement

a. All applications, reports, or information submitted to the Regional Administrator shall be signed and certified. (See 40 CFR §122.22)

b. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 2 years per violation, or by both.

3. Availability of Reports.

Except for data determined to be confidential under Paragraph A.8. above, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the CWA, effluent data shall not be considered confidential. Knowingly making any false statements on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the CWA.

PART II. E. DEFINITIONS AND ABBREVIATIONS

1. Definitions for Individual NPDES Permits including Storm Water Requirements

Administrator means the Administrator of the United States Environmental Protection Agency, or an authorized representative.

Applicable standards and limitations means all, State, interstate, and Federal standards and limitations to which a “discharge”, a “sewage sludge use or disposal practice”, or a related activity is subject to, including “effluent limitations”, water quality standards, standards of performance, toxic effluent standards or prohibitions, “best management practices”, pretreatment standards, and “standards for sewage sludge use and disposal” under Sections 301, 302, 303, 304, 306, 307, 308, 403, and 405 of the CWA.

Application means the EPA standard national forms for applying for a permit, including any additions, revisions, or modifications to the forms; or forms approved by EPA for use in "approved States", including any approved modifications or revisions.

Average means the arithmetic mean of values taken at the frequency required for each parameter over the specified period. For total and/or fecal coliforms and Escherichia coli, the average shall be the geometric mean.

Average monthly discharge limitation means the highest allowable average of "daily discharges" over a calendar month calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

Average weekly discharge limitation means the highest allowable average of "daily discharges" measured during the calendar week divided by the number of "daily discharges" measured during the week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Best Professional Judgment (BPJ) means a case-by-case determination of Best Practicable Treatment (BPT), Best Available Treatment (BAT), or other appropriate technology-based standard based on an evaluation of the available technology to achieve a particular pollutant reduction and other factors set forth in 40 CFR §125.3 (d).

Coal Pile Runoff means the rainfall runoff from or through any coal storage pile.

Composite Sample means a sample consisting of a minimum of eight grab samples of equal volume collected at equal intervals during a 24-hour period (or lesser period as specified in the section on Monitoring and Reporting) and combined proportional to flow, or a sample consisting of the same number of grab samples, or greater, collected proportionally to flow over that same time period.

Construction Activities - The following definitions apply to construction activities:

(a) Commencement of Construction is the initial disturbance of soils associated with clearing, grading, or excavating activities or other construction activities.

(b) Dedicated portable asphalt plant is a portable asphalt plant located on or contiguous to a construction site and that provides asphalt only to the construction site that the plant is located on or adjacent to. The term dedicated portable asphalt plant does not include facilities that are subject to the asphalt emulsion effluent limitation guideline at 40 CFR Part 443.

(c) Dedicated portable concrete plant is a portable concrete plant located on or contiguous to a construction site and that provides concrete only to the construction site that the plant is located on or adjacent to.

(d) Final Stabilization means that all soil disturbing activities at the site have been complete, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

(e) Runoff coefficient means the fraction of total rainfall that will appear at the conveyance as runoff.

Contiguous zone means the entire zone established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

Continuous discharge means a "discharge" which occurs without interruption throughout the operating hours of the facility except for infrequent shutdowns for maintenance, process changes, or similar activities.

CWA means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, and Pub. L. 97-117; 33 USC §§1251 et seq.

Daily Discharge means the discharge of a pollutant measured during the calendar day or any other 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Director normally means the person authorized to sign NPDES permits by EPA or the State or an authorized representative. Conversely, it also could mean the Regional Administrator or the State Director as the context requires.

Discharge Monitoring Report Form (DMR) means the EPA standard national form, including any subsequent additions, revisions, or modifications for the reporting of self-monitoring results by permittees. DMRs must be used by "approved States" as well as by EPA. EPA will supply DMRs to any approved State upon request. The EPA national forms may be modified to substitute the State Agency name, address, logo, and other similar information, as appropriate, in place of EPA's.

Discharge of a pollutant means:

(a) Any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source", or

(b) Any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation (See "Point Source" definition).

This definition includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances leading into privately owned treatment works.

This term does not include an addition of pollutants by any “indirect discharger.”

Effluent limitation means any restriction imposed by the Regional Administrator on quantities, discharge rates, and concentrations of “pollutants” which are “discharged” from “point sources” into “waters of the United States”, the waters of the “contiguous zone”, or the ocean.

Effluent limitation guidelines means a regulation published by the Administrator under Section 304(b) of CWA to adopt or revise “effluent limitations”.

EPA means the United States “Environmental Protection Agency”.

Flow-weighted composite sample means a composite sample consisting of a mixture of aliquots where the volume of each aliquot is proportional to the flow rate of the discharge.

Grab Sample – An individual sample collected in a period of less than 15 minutes.

Hazardous Substance means any substance designated under 40 CFR Part 116 pursuant to Section 311 of the CWA.

Indirect Discharger means a non-domestic discharger introducing pollutants to a publicly owned treatment works.

Interference means a discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

(a) Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and

(b) Therefore is a cause of a violation of any requirement of the POTW’s NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act (CWA), the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resources Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of the SDWA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection Research and Sanctuaries Act.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile.

Land application unit means an area where wastes are applied onto or incorporated into the soil surface (excluding manure spreading operations) for treatment or disposal.

Large and Medium municipal separate storm sewer system means all municipal separate storm sewers that are either: (i) located in an incorporated place (city) with a population of 100,000 or more as determined by the latest Decennial Census by the Bureau of Census (these cities are listed in Appendices F and 40 CFR Part 122); or (ii) located in the counties with unincorporated urbanized populations of 100,000 or more, except municipal separate storm sewers that are located in the incorporated places, townships, or towns within such counties (these counties are listed in Appendices H and I of 40 CFR 122); or (iii) owned or operated by a municipality other than those described in Paragraph (i) or (ii) and that are designated by the Regional Administrator as part of the large or medium municipal separate storm sewer system.

Maximum daily discharge limitation means the highest allowable "daily discharge" concentration that occurs only during a normal day (24-hour duration).

Maximum daily discharge limitation (as defined for the Steam Electric Power Plants only) when applied to Total Residual Chlorine (TRC) or Total Residual Oxidant (TRO) is defined as "maximum concentration" or "Instantaneous Maximum Concentration" during the two hours of a chlorination cycle (or fraction thereof) prescribed in the Steam Electric Guidelines, 40 CFR Part 423. These three synonymous terms all mean "a value that shall not be exceeded" during the two-hour chlorination cycle. This interpretation differs from the specified NPDES Permit requirement, 40 CFR § 122.2, where the two terms of "Maximum Daily Discharge" and "Average Daily Discharge" concentrations are specifically limited to the daily (24-hour duration) values.

Municipality means a city, town, borough, county, parish, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribe organization, or a designated and approved management agency under Section 208 of the CWA.

National Pollutant Discharge Elimination System means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of the CWA. The term includes an "approved program".

New Discharger means any building, structure, facility, or installation:

(a) From which there is or may be a "discharge of pollutants";

(b) That did not commence the "discharge of pollutants" at a particular "site" prior to August 13, 1979;

(c) Which is not a "new source"; and

(d) Which has never received a finally effective NPDES permit for discharges at that "site".

This definition includes an "indirect discharger" which commences discharging into "waters of the United States" after August 13, 1979. It also includes any existing mobile point source (other than an offshore or coastal oil and gas exploratory drilling rig or a coastal oil and gas exploratory drilling rig or a coastal oil and gas developmental drilling rig) such as a seafood processing rig, seafood processing vessel, or aggregate plant, that begins discharging at a "site" for which it does not have a permit; and any offshore rig or coastal mobile oil and gas exploratory drilling rig or coastal mobile oil and gas developmental drilling rig that commences the discharge of pollutants after August 13, 1979, at a "site" under EPA's permitting jurisdiction for which it is not covered by an individual or general permit and which is located in an area determined by the Regional Administrator in the issuance of a final permit to be in an area of biological concern. In determining whether an area is an area of biological concern, the Regional Administrator shall consider the factors specified in 40 CFR §§125.122 (a) (1) through (10).

An offshore or coastal mobile exploratory drilling rig or coastal mobile developmental drilling rig will be considered a "new discharger" only for the duration of its discharge in an area of biological concern.

New source means any building, structure, facility, or installation from which there is or may be a "discharge of pollutants", the construction of which commenced:

(a) After promulgation of standards of performance under Section 306 of CWA which are applicable to such source, or

(b) After proposal of standards of performance in accordance with Section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal.

NPDES means "National Pollutant Discharge Elimination System".

Owner or operator means the owner or operator of any "facility or activity" subject to regulation under the NPDES programs.

Pass through means a Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

Permit means an authorization, license, or equivalent control document issued by EPA or an "approved" State.

Person means an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

Point Source means any discernible, confined, and discrete conveyance, including but not limited to any pipe ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff (see 40 CFR §122.2).

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. §§2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well is used either to facilitate production or for disposal purposes is approved by the authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

Primary industry category means any industry category listed in the NRDC settlement agreement (Natural Resources Defense Council et al. v. Train, 8 E.R.C. 2120 (D.D.C. 1976), modified 12 E.R.C. 1833 (D. D.C. 1979)); also listed in Appendix A of 40 CFR Part 122.

Privately owned treatment works means any device or system which is (a) used to treat wastes from any facility whose operation is not the operator of the treatment works or (b) not a "POTW".

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Publicly Owned Treatment Works (POTW) means any facility or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature which is owned by a "State" or "municipality".

This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Regional Administrator means the Regional Administrator, EPA, Region I, Boston, Massachusetts.

Secondary Industry Category means any industry which is not a "primary industry category".

Section 313 water priority chemical means a chemical or chemical category which:

(1) is listed at 40 CFR §372.65 pursuant to Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) (also known as Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986);

(2) is present at or above threshold levels at a facility subject to EPCRA Section 313 reporting requirements; and

(3) satisfies at least one of the following criteria:

(i) are listed in Appendix D of 40 CFR Part 122 on either Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols), or Table V (certain toxic pollutants and hazardous substances);
(ii) are listed as a hazardous substance pursuant to Section 311(b)(2)(A) of the CWA at 40 CFR §116.4; or
(iii) are pollutants for which EPA has published acute or chronic water quality criteria.

Septage means the liquid and solid material pumped from a septic tank, cesspool, or similar domestic sewage treatment system, or a holding tank when the system is cleaned or maintained.

Sewage Sludge means any solid, semisolid, or liquid residue removed during the treatment of municipal wastewater or domestic sewage. Sewage sludge includes, but is not limited to, solids removed during primary, secondary, or advanced wastewater treatment, scum, septage, portable toilet pumpings, Type III Marine Sanitation Device pumpings (33 CFR Part 159), and sewage sludge products. Sewage sludge does not include grit or screenings, or ash generated during the incineration of sewage sludge.

Sewage sludge use or disposal practice means the collection, storage, treatment, transportation, processing, monitoring, use, or disposal of sewage sludge.

Significant materials includes, but is not limited to: raw materials, fuels, materials such as solvents, detergents, and plastic pellets, raw materials used in food processing or production, hazardous substance designated under section 101(14) of CERCLA, any chemical the facility is required to report pursuant to EPCRA Section 313, fertilizers, pesticides, and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills includes, but is not limited to, releases of oil or hazardous substances in excess of reportable quantities under Section 311 of the CWA (see 40 CFR §110.10 and §117.21) or Section 102 of CERCLA (see 40 CFR § 302.4).

Sludge-only facility means any "treatment works treating domestic sewage" whose methods of sewage sludge use or disposal are subject to regulations promulgated pursuant to Section 405(d) of the CWA, and is required to obtain a permit under 40 CFR §122.1(b)(3).

State means any of the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands.

Storm Water means storm water runoff, snow melt runoff, and surface runoff and drainage.

Storm water discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. (See 40 CFR §122.26 (b)(14) for specifics of this definition.

Time-weighted composite means a composite sample consisting of a mixture of equal volume aliquots collected at a constant time interval.

Toxic pollutants means any pollutant listed as toxic under Section 307 (a)(1) or, in the case of "sludge use or disposal practices" any pollutant identified in regulations implementing Section 405(d) of the CWA.

Treatment works treating domestic sewage means a POTW or any other sewage sludge or wastewater treatment devices or systems, regardless of ownership (including federal facilities), used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated for the disposal of sewage sludge. This definition does not include septic tanks or similar devices.

For purposes of this definition, "domestic sewage" includes waste and wastewater from humans or household operations that are discharged to or otherwise enter a treatment works. In States where there is no approved State sludge management program under Section 405(f) of the CWA, the Regional Administrator may designate any person subject to the standards for sewage sludge use and disposal in 40 CFR Part 503 as a "treatment works treating domestic sewage", where he or she finds that there is a potential for adverse effects on public health and the environment from poor sludge quality or poor sludge handling, use or disposal practices, or where he or she finds that such designation is necessary to ensure that such person is in compliance with 40 CFR Part 503.

Waste Pile means any non-containerized accumulation of solid, non-flowing waste that is used for treatment or storage.

Waters of the United States means:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide;

(b) All interstate waters, including interstate "wetlands";

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands", sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purpose;

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in Paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in Paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA (other than cooling ponds as defined in 40 CFR §423.11(m) which also meet the criteria of this definition) are not waters of the United States.

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole Effluent Toxicity (WET) means the aggregate toxic effect of an effluent measured directly by a toxicity test. (See Abbreviations Section, following, for additional information.)

2. <u>Definitions for NPDES Permit Sludge Use and Disposal Requirements</u>.

Active sewage sludge unit is a sewage sludge unit that has not closed.

Aerobic Digestion is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

Agricultural Land is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

Agronomic rate is the whole sludge application rate (dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

Air pollution control device is one or more processes used to treat the exit gas from a sewage sludge incinerator stack.

Anaerobic digestion is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

Annual pollutant loading rate is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

Annual whole sludge application rate is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

Apply sewage sludge or sewage sludge applied to the land means land application of sewage sludge.

Aquifer is a geologic formation, group of geologic formations, or a portion of a geologic formation capable of yielding ground water to wells or springs.

Auxiliary fuel is fuel used to augment the fuel value of sewage sludge. This includes, but is not limited to, natural gas, fuel oil, coal, gas generated during anaerobic digestion of sewage sludge, and municipal solid waste (not to exceed 30 percent of the dry weight of the sewage sludge and auxiliary fuel together). Hazardous wastes are not auxiliary fuel.

Base flood is a flood that has a one percent chance of occurring in any given year (i.e. a flood with a magnitude equaled once in 100 years).

Bulk sewage sludge is sewage sludge that is not sold or given away in a bag or other container for application to the land.

Contaminate an aquifer means to introduce a substance that causes the maximum contaminant level for nitrate in 40 CFR §141.11 to be exceeded in ground water or that causes the existing concentration of nitrate in the ground water to increase when the existing concentration of nitrate in the ground water exceeds the maximum contaminant level for nitrate in 40 CFR §141.11.

Class I sludge management facility is any publicly owned treatment works (POTW), as defined in 40 CFR §501.2, required to have an approved pretreatment program under 40 CFR §403.8 (a) (including any POTW located in a state that has elected to assume local program responsibilities pursuant to 40 CFR §403.10 (e) and any treatment works treating domestic sewage, as defined in 40 CFR § 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved state programs, the Regional Administrator in conjunction with the State Director, because of the potential for sewage sludge use or disposal practice to affect public health and the environment adversely.

Control efficiency is the mass of a pollutant in the sewage sludge fed to an incinerator minus the mass of that pollutant in the exit gas from the incinerator stack divided by the mass of the pollutant in the sewage sludge fed to the incinerator.

Cover is soil or other material used to cover sewage sludge placed on an active sewage sludge unit.

Cover crop is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

Cumulative pollutant loading rate is the maximum amount of inorganic pollutant that can be applied to an area of land.

Density of microorganisms is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

Dispersion factor is the ratio of the increase in the ground level ambient air concentration for a pollutant at or beyond the property line of the site where the sewage sludge incinerator is located to the mass emission rate for the pollutant from the incinerator stack.

Displacement is the relative movement of any two sides of a fault measured in any direction.

Domestic septage is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

Domestic sewage is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

Dry weight basis means calculated on the basis of having been dried at 105 degrees Celsius (°C) until reaching a constant mass (i.e. essentially 100 percent solids content).

Fault is a fracture or zone of fractures in any materials along which strata on one side are displaced with respect to the strata on the other side.

Feed crops are crops produced primarily for consumption by animals.

Fiber crops are crops such as flax and cotton.

Final cover is the last layer of soil or other material placed on a sewage sludge unit at closure.

Fluidized bed incinerator is an enclosed device in which organic matter and inorganic matter in sewage sludge are combusted in a bed of particles suspended in the combustion chamber gas.

Food crops are crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

Forest is a tract of land thick with trees and underbrush.

Ground water is water below the land surface in the saturated zone.

Holocene time is the most recent epoch of the Quaternary period, extending from the end of the Pleistocene epoch to the present.

Hourly average is the arithmetic mean of all the measurements taken during an hour. At least two measurements must be taken during the hour.

Incineration is the combustion of organic matter and inorganic matter in sewage sludge by high temperatures in an enclosed device.

Industrial wastewater is wastewater generated in a commercial or industrial process.

Land application is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

Land with a high potential for public exposure is land that the public uses frequently. This includes, but is not limited to, a public contact site and reclamation site located in a populated area (e.g., a construction site located in a city).

Land with low potential for public exposure is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

Leachate collection system is a system or device installed immediately above a liner that is designed, constructed, maintained, and operated to collect and remove leachate from a sewage sludge unit.

Liner is soil or synthetic material that has a hydraulic conductivity of 1×10^{-7} centimeters per second or less.

Lower explosive limit for methane gas is the lowest percentage of methane gas in air, by volume, that propagates a flame at 25 degrees Celsius and atmospheric pressure.

Monthly average (Incineration) is the arithmetic mean of the hourly averages for the hours a sewage sludge incinerator operates during the month.

Monthly average (Land Application) is the arithmetic mean of all measurements taken during the month.

Municipality means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management agency under section 208 of the CWA, as amended. The definition includes a special district created under state law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201 (e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use or disposal of sewage sludge.

Other container is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

Pasture is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

Pathogenic organisms are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

Permitting authority is either EPA or a State with an EPA-approved sludge management program.

Person is an individual, association, partnership, corporation, municipality, State or Federal Agency, or an agent or employee thereof.

Person who prepares sewage sludge is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

pH means the logarithm of the reciprocal of the hydrogen ion concentration; a measure of the acidity or alkalinity of a liquid or solid material.

Place sewage sludge or sewage sludge placed means disposal of sewage sludge on a surface disposal site.

Pollutant (as defined in sludge disposal requirements) is an organic substance, an inorganic substance, a combination or organic and inorganic substances, or pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could on the basis on information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction) or physical deformations in either organisms or offspring of the organisms.

Pollutant limit (for sludge disposal requirements) is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of pollutant that can be applied to a unit of land (e.g., kilograms per hectare); or the volume of the material that can be applied to the land (e.g., gallons per acre).

Public contact site is a land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

Qualified ground water scientist is an individual with a baccalaureate or post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground water monitoring, pollutant fate and transport, and corrective action.

Range land is open land with indigenous vegetation.

Reclamation site is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

Risk specific concentration is the allowable increase in the average daily ground level ambient air concentration for a pollutant from the incineration of sewage sludge at or beyond the property line of a site where the sewage sludge incinerator is located.

Runoff is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off the land surface.

Seismic impact zone is an area that has 10 percent or greater probability that the horizontal ground level acceleration to the rock in the area exceeds 0.10 gravity once in 250 years.

Sewage sludge is a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to:, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in treatment works.

Sewage sludge feed rate is either the average daily amount of sewage sludge fired in all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located for the number of days in a 365 day period that each sewage sludge incinerator operates, or the average daily design capacity for all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located.

Sewage sludge incinerator is an enclosed device in which only sewage sludge and auxiliary fuel are fired.

Sewage sludge unit is land on which only sewage sludge is placed for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR §122.2.

Sewage sludge unit boundary is the outermost perimeter of an active sewage sludge unit.

Specific oxygen uptake rate (SOUR) is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in sewage sludge.

Stack height is the difference between the elevation of the top of a sewage sludge incinerator stack and the elevation of the ground at the base of the stack when the difference is equal to or less than 65 meters. When the difference is greater than 65 meters, stack height is the creditable stack height determined in accordance with 40 CFR §51.100 (ii).

State is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

Store or storage of sewage sludge is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

Surface disposal site is an area of land that contains one or more active sewage sludge units.

Total hydrocarbons means the organic compounds in the exit gas from a sewage sludge incinerator stack measured using a flame ionization detection instrument referenced to propane.

Total solids are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

Treat or treatment of sewage sludge is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

Treatment works is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature.

Unstable area is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

Unstabilized solids are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Vector attraction is the characteristic of sewage sludge that attracts rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents.

Volatile solids is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

Wet electrostatic precipitator is an air pollution control device that uses both electrical forces and water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

Wet scrubber is an air pollution control device that uses water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

3. Commonly Used Abbreviations

BOD	Five-day biochemical oxygen demand unless otherwise specified
CBOD	Carbonaceous BOD
CFS	Cubic feet per second
COD	Chemical oxygen demand
Chlorine	
Cl_2	Total residual chlorine
TRC	Total residual chlorine which is a combination of free available chlorine (FAC, see below) and combined chlorine (chloramines, etc.)

TRO	Total residual chlorine in marine waters where halogen compounds are present
FAC	Free available chlorine (aqueous molecular chlorine, hypochlorous acid, and hypochlorite ion)
Coliform	
Coliform, Fecal	Total fecal coliform bacteria
Coliform, Total	Total coliform bacteria
Cont. (Continuous)	Continuous recording of the parameter being monitored, i.e. flow, temperature, pH, etc.
Cu. M/day or M^3/day	Cubic meters per day
DO	Dissolved oxygen
kg/day	Kilograms per day
lbs/day	Pounds per day
mg/l	Milligram(s) per liter
ml/l	Milliliters per liter
MGD	Million gallons per day
Nitrogen	
Total N	Total nitrogen
NH_3-N	Ammonia nitrogen as nitrogen
NO_3-N	Nitrate as nitrogen
NO_2-N	Nitrite as nitrogen
NO_3-NO_2	Combined nitrate and nitrite nitrogen as nitrogen
TKN	Total Kjeldahl nitrogen as nitrogen
Oil & Grease	Freon extractable material
PCB	Polychlorinated biphenyl
pH	A measure of the hydrogen ion concentration. A measure of the acidity or alkalinity of a liquid or material
Surfactant	Surface-active agent

Temp. °C	Temperature in degrees Centigrade
Temp. °F	Temperature in degrees Fahrenheit
TOC	Total organic carbon
Total P	Total phosphorus
TSS or NFR	Total suspended solids or total nonfilterable residue
Turb. or Turbidity	Turbidity measured by the Nephelometric Method (NTU)
ug/l	Microgram(s) per liter
WET	"Whole effluent toxicity" is the total effect of an effluent measured directly with a toxicity test.
C-NOEC	"Chronic (Long-term Exposure Test) – No Observed Effect Concentration". The highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specified time of observation.
A-NOEC	"Acute (Short-term Exposure Test) – No Observed Effect Concentration" (see C-NOEC definition).
LC_{50}	LC_{50} is the concentration of a sample that causes mortality of 50% of the test population at a specific time of observation. The LC_{50} = 100% is defined as a sample of undiluted effluent.
ZID	Zone of Initial Dilution means the region of initial mixing surrounding or adjacent to the end of the outfall pipe or diffuser ports.

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

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES PURSUANT TO THE CLEAN WATER ACT (CWA)

NPDES PERMIT NUMBER: MA0040304

PUBLIC NOTICE START AND END DATES:

NAME AND MAILING ADDRESS OF APPLICANT:

University of Massachusetts Boston
100 Morrissey Boulevard
Boston, MA 02125

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

University of Massachusetts Boston
100 Morrissey Boulevard
Boston, MA 02125

RECEIVING WATER(S): **Dorchester Bay (MA70-03)**

RECEIVING WATER CLASSIFICATION(S): **SB, CSO**

SIC CODE: 8221

Table of Contents

I. Proposed Action, Type of Facility, and Discharge Location

The above named applicant has applied to the U.S. Environmental Protection Agency (EPA) for issuance of a National Pollutant Discharge Elimination System (NPDES) permit to discharge non-contact cooling water (NCCW) into the designated receiving water. NCCW is water that is used to reduce temperature and that does not come into direct contact with any raw material, intermediate product, waste product (other than heat), or finished product. The University of Massachusetts, Boston (UMB) is a public institute of education which incorporates the use of a non-contact cooling water system to cool campus buildings. Seawater is withdrawn from an intake structure located on the peninsula on Savin Hill Cove and discharged via a single outfall located on the east of the peninsula in Dorchester Bay (see site location in Attachment A). The discharge of NCCW from this facility was previously covered under NCCW General Permit MAG250004, which was issued on April 25, 2000. This General Permit expired on April 25, 2005 and a new NCCW General Permit was issued on July 31, 2008. UMB is not eligible for coverage under the 2008 NCCW General Permit because the permit is limited to facilities with cooling flows less than 1 MGD. UMB applied for an individual permit on October 28, 2008 and the discharge remains covered under the expired General Permit until an individual permit is issued.

II. Description of Discharge

UMB operates a non-contact cooling water system comprised of three separate piping systems using seawater, condenser water, and cooling water to meet the campus's cooling needs. A closed-loop condensing water system transports heat from the chillers in the Utility Plant to the Pump House. Four plate-and-frame heat exchangers located in the pump house use seawater to cool the condenser loop (see Attachment B). In 2007, UMB replaced or rebuilt the mechanical equipment in the Pump House, including the salt water pumps and traveling screen. The heated seawater effluent discharges through a single 42-inch pipe to Dorchester Bay. A quantitative description of the effluent parameters based on recent discharge monitoring reports (DMRs) is shown on Attachment C of this fact sheet.

III. Receiving Water Description

UMB is located on a 175-acre tract on Columbia Point peninsula in Dorchester Bay in Boston, MA (Attachment A). Dorchester Bay (MA70-03) is classified as Class SB, CSO under the Massachusetts Surface Water Quality Standards (WQSs). Title 314 Code of Massachusetts Regulations ("CMR") 4.05(4)(b) states that Class SB waters *"are designated as 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. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfish Areas). These waters shall have consistently good aesthetic value."*

The water in the vicinity of the facility is a tidal estuarine waterbody that is subject to semi-diurnal tidal flows with a mean tidal range of approximately 9.5 feet. The area in the vicinity of the intake and discharge consists of intertidal shoreline (mainly rip rap), intertidal to shallow subtidal flats, dredged channels, and subtidal substrate. The area provides suitable habitat for common shellfish species, including soft-shelled clam, blue mussel, periwinkle, razor clam, slipper shell, mud dog whelk, and hermit crab. According to Massachusetts Division of Marine Fisheries, shellfishing is currently prohibited in the vicinity of the discharge (Growing Area GBH3: Neponset River and Dorchester Bay).[1]

Section 303(d) of the Federal Clean Water Act (CWA) requires states to identify those waterbodies that are not expected to meet surface WQSs after the implementation of technology-based controls and, as such require the development of total maximum daily loads (TMDL). The Final 2010 303(d) Lists state that Dorchester Bay (MA70-03), from the mouth of the Neponset River to the line between Head Island and the north side of Thompson Island and the line between the south point of Thompson Island and Chapel Rocks (Boston/Quincy), is not attaining WQSs due to priority organics, pathogens, suspended solids, and turbidity. The discharge of NCCW from this facility is not expected to contribute to these impairments.

IV. Permit Basis and Explanation of Effluent Limit Derivations

The effluent limitations, monitoring requirements, and any implementation schedule, if required, may be found in Part 1 (Effluent Limitations and Monitoring Requirements) of the Draft Permit. The permit application and any supplemental information submissions are part of the administrative file.

A. General Requirements

The Clean Water Act (CWA) prohibits the discharge of pollutants to waters of the United States without a NPDES permit unless such a discharge is otherwise authorized by the CWA. The NPDES permit is the mechanism used to implement technology and water quality-based effluent limitations and other requirements including monitoring and reporting. This Draft Permit was developed in accordance with various statutory and regulatory requirements established pursuant to the CWA and applicable State regulations. During development, EPA considered the most recent technology-based treatment requirements, water quality-based requirements, and all limitations and requirements in the current permit. The regulations governing the EPA NPDES permit program are generally found at 40 CFR Parts 122, 124, 125, and 136. The standard conditions of the Draft Permit are based on 40 CFR §122.41 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(i) and §122.48.

B. Technology-Based Requirements

Subpart A of 40 CFR §125 establishes criteria and standards for the imposition of technology-based treatment requirements in permits under Section 301(b) of the CWA, including the

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1 Massachusetts Division of Marine Fisheries. Designated Shellfish Growing Area Map GHB3: Neponset River and Dorchester Bay. Updated on September 10, 2009. Accessed on November 10, 2011. http://www.mass.gov/dfwele/dmf/programsandprojects/shellfish/gbh/gbh3.pdf

application of EPA promulgated effluent limitations and case-by-case determinations of effluent limitations under Section 402(a)(1) of the CWA.

Technology-based treatment requirements represent the minimum level of control that must be imposed under Sections 301(b) and 402 of the CWA (See 40 CFR §125 Subpart A) to meet best practicable control technology currently available (BPT) for conventional pollutants and some metals, best conventional control technology (BCT) for conventional pollutants, and best available technology economically achievable (BAT) for toxic and non-conventional pollutants. In general, technology-based effluent guidelines for non-POTW facilities must be complied with as expeditiously as practicable but in no case later than three years after the date such limitations are established and in no case later than March 31, 1989 [See 40 CFR §125.3(a)(2)]. Compliance schedules and deadlines not in accordance with the statutory provisions of the CWA cannot be authorized by a NPDES permit.

EPA has not promulgated technology-based National Effluent Guidelines for the discharge of NCCW from colleges or universities (SIC 8221). In the absence of technology-based effluent guidelines, the permit writer is authorized under Section 402(a)(1)(B) of the CWA to establish effluent limitations on a case-by-case basis using Best Professional Judgment (BPJ).

C. Water Quality-Based Requirements

Water quality-based criteria are required in NPDES permits when EPA and the State determine that effluent limits more stringent than technology-based limits are necessary to maintain or achieve state or federal water-quality standards (See Section 301(b) (1)(C) of the CWA). Water quality-based criteria consist of three (3) parts: 1) beneficial designated uses for a water body or a segment of a water body; 2) numeric and/or narrative water quality criteria sufficient to protect the assigned designated use(s) of the water body; and 3) anti-degradation requirements to ensure that once a use is attained it will not be degraded. The Massachusetts State Water Quality Standards, found at 314 CMR 4.00, include these elements. The State Water Quality Regulations limit or prohibit discharges of pollutants to surface waters and thereby assure that the surface water quality standards of the receiving water are protected, maintained, and/or attained. These standards also include requirements for the regulation and control of toxic constituents and require that EPA criteria, established pursuant to Section 304(a) of the CWA, be used unless site-specific criteria are established. EPA regulations pertaining to permit limits based upon water quality standards and state requirements are contained in 40 CFR §122.44(d).

Section 101(a)(3) of the CWA specifically prohibits the discharge of toxic pollutants in toxic amounts. The State of Massachusetts has a similar narrative criteria in their water quality regulations that prohibits such discharges [See Massachusetts 314 CMR 4.05(5)(e)]. The effluent limits established in the Draft Permit assure that the surface water quality standards of the receiving water are protected, maintained, and/or attained.

D. Antibacksliding

EPA's antibacksliding provision as identified in Section 402(o) of the CWA and at 40 CFR §122.44(l) prohibits the relaxation of permit limits, standards, and conditions unless the circumstances on which the previous permit was based have materially and substantially changed since the time the permit was issued. Antibacksliding provisions apply to effluent limits based on technology, water quality, best professional judgment (BPJ), and State Certification requirements. Relief from antibacksliding provisions can only be granted under one of the defined exceptions [See 40 CFR §122.44(l)(i)].

In this case, UMB was previously covered under the NCCW General Permit issued April 25, 2000 (MAG250004). The pH and mean daily temperature limits in the Draft Permit is as stringent as or more stringent than the 2000 NCCW General Permit. The flow limits in the Draft Permit are less stringent that the NCCW General Permit. EPA considers the increase in flow in the Draft Permit, which is a result of the addition of campus expansion, an exception to antibacksliding because it is based on material and substantial alterations or additions to the permitted facility since permit issuance which would have justified the application of a less stringent effluent limitation (See 40 CFR § 122.44(l)(2)(i)(A)). In addition, the Draft Permit contains a new limitation on the rise in effluent temperature based on a 316(a) variance, which is an allowable exception to antibacksliding at 40 CFR § 122.44(l)(2)(i)(D).

E. Antidegradation

Federal regulations found at 40 CFR § 131.12 require states to develop and adopt a statewide antidegradation policy which maintains and protects existing instream water uses and the level of water quality necessary to protect the existing uses, and maintains the quality of waters which exceed levels necessary to support propagation of fish, shellfish, and wildlife and to support recreation in and on the water. The Massachusetts Antidegradation Regulations are found at 314 CMR § 4.04.

This Draft Permit is being issued with allowable effluent limits established to protect the existing and designated uses of Dorchester Bay. EPA anticipates that MassDEP shall make a determination that there shall be no significant adverse impacts to the receiving waters and no loss of existing uses as a result of the discharge authorized by this permit.

F. CWA § 316(a)

Heat is defined as a pollutant under Section 502(6) of the CWA. 33 U.S.C. § 1362(6). As with other pollutants, discharges of heat (or "thermal discharges") generally must satisfy both technology-based standards (specifically, the BAT standard) and any more stringent water quality-based requirements that may apply. State WQS may include numeric temperature criteria, as well as narrative criteria and designated uses, that apply to particular water body classifications and may necessitate restrictions on thermal discharges.

Section 316(a) of the CWA, 33 U.S.C. § 1326(a), provides, however, that thermal discharge limits less stringent than technology-based and/or water quality-based requirements may be authorized if the biological criteria of Section 316(a) are satisfied. The approval of less stringent thermal discharge limits under CWA § 316(a) is referred to as a "Section 316(a) variance." In addition, Massachusetts WQS provide that "any determinations concerning thermal discharge limitations in accordance with 33 U.S.C. 1251 § 316(a) will be considered site-specific limitations in compliance with 314 CMR 4.00." *See* 4.05(4)(b)(2)(c).

Thermal discharge variances, and the demonstration that an applicant must make to obtain one, are addressed in CWA§ 316(a) and EPA regulations, including those promulgated at 40 CFR § 125, Subpart H. In essence, the applicant must demonstrate that the alternative, less stringent effluent limitations it desires, considering the cumulative impact of its thermal discharge together with all other significant impacts on the species affected, will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the water body receiving the thermal discharge (BIP). See 33 USC § 1326(a); 40 CFR § 125.73(a) and (c)(1)(i). An existing thermal discharger can perform either a predictive or retrospective analysis in an effort to demonstrate that the protection and propagation of the BIP will be assured despite its proposed thermal discharge variance. If the applicant makes this demonstration to the satisfaction of EPA (or, if appropriate, the State), then the permitting authority may issue the permit with the requested alternative, variance-based thermal discharge limits. Conversely, if the demonstration does not adequately support the requested variance-based thermal discharge limits, the permitting authority shall deny the requested variance. In that case, the permitting authority shall either impose limits based on the otherwise applicable technology-based and water quality-based requirements or, at its discretion, impose alternative variance-based limits that the permit record demonstrates will assure the protection and propagation of the BIP.

G. CWA § 316(b)

Technology-based NPDES permit requirements for cooling water intake structures (CWISs) are based on CWA § 316(b), 33 USC § 1326(b), which requires that "the location, design, construction, and capacity of the facility's cooling water intake structure(s) (CWIS) reflect the Best Technology Available (BTA) for minimizing adverse environmental impact." As with effluent discharge limits, CWIS requirements must also comply with any more stringent conditions that might be necessary to achieve compliance with any applicable State WQS. See 40 CFR § 125.84(e).

The operation of CWISs can cause or contribute to a variety of adverse environmental effects, such as (a) killing or injuring tiny aquatic organisms, including but not limited to fish larvae and eggs, by entraining them in the water withdrawn from a waterbody and sent through the cooling system and (b) killing or injuring larger organisms, including but not limited to juvenile and adult fish, by impinging them against the intake structure's screens, racks, or other structures. Section 316(b) applies to discharge permits seeking to withdraw cooling water from a water of the United States.

In this case, CWA § 316(b) applies due to the withdrawal of seawater from Savin Hill Cove for use in UMB's NCCW system. At this time there are no national categorical standards in effect that apply § 316(b) to UMB's CWIS. As a result, EPA developed technology-based requirements for UMB by applying § 316(b) on a site-specific basis using BPJ. A detailed discussion of the requirements pertaining to this regulation is presented in Section VI of this Fact Sheet.

V. Explanation of the Permit's Effluent Limitation(s)

A. Facility Information

Since opening in 1974, UMB has used seawater from Savin Hill Cove to cool its campus buildings via a network of cooling water pipes. The pump house and cooling water intake structure (CWIS) are located on the southern side of Columbia Point peninsula in Savin Hill Cove. The NCCW outfall is a single, 42-inch discharge pipe located on the eastern side of the peninsula in the open water of Dorchester Bay. The pipe is oriented perpendicular to the shoreline and is nearly exposed at low tide.

NCCW is used at UMB to provide climate control in campus buildings. Heat from campus cooling is exchanged between the closed cooling and condenser loops in the utility building. Heat in the closed condenser loop is exchanged with the once-through seawater loop in the pumphouse (See Attachment B).

B. Permitted Outfalls

The permittee discharges heated NCCW from the cooling system to Dorchester Bay via Outfall 001 (See Attachment A). The discharge system consists of a single, 42-inch pipe approximately two meters from the shore in Dorchester Bay. The pipe runs underground from the heat exchangers along the sidewalk at Columbia Point to the discharge location.

C. Derivation of Effluent Limits under the Federal CWA and/or the Commonwealth of Massachusetts' Water Quality Standards

1. Flow

The Draft Permit contains a maximum (instantaneous) daily limit of 18.4 million gallons per day (MGD), a maximum monthly average limit of 17.2 MGD, and an annual average of 12.9 MGD calculated as a rolling average for the previous 365 days. These limits are based upon the projected installation and operation of variable frequency drive (VFD) pumps by the facility at the seawater intake (see Part VI.D of this Fact Sheet).

2. pH

Massachusetts Surface WQSs require the pH of Class SB waters to be within the range of 6.5 to 8.5 standard units (s.u.) and not more than 0.2 s.u. outside of the natural background range. The Draft Permit identifies a pH permit limit range of 6.5 to 8.5 in accordance with the WQSs. The discharge shall not exceed this pH range unless due to natural causes. In addition, there shall be no change from background conditions that would impair any use assigned to the receiving water class.

3. Temperature

In developing temperature limits for the discharge of NCCW from Outfall 001, EPA considered applicable water quality-based requirements, technology-based requirements, and the permittee's request for a CWA § 316(a) variance.

Water-Quality Based Limits

The state classification for Dorchester Bay is Class SB. The water quality standards (WQS) at 314 CMR § 4.05(4)(b)(2)(a) require that the instream water temperature shall not exceed a maximum of 85ºF (29.4°C) or a daily mean of 80ºF (26.7°C). In addition, the rise in temperature due to discharge shall not exceed 1.5ºF (0.8°C) during the summer months (July through September) nor 4ºF (2.2°C) during the winter months (October through June). At UMB, temperature is continuously monitored at the intake and discharge by sensors installed during spring 2010. Based on the historical data presented in Attachment B, the thermal discharge from the facility has exceeded the maximum instantaneous daily instream water quality criteria (85°F) on one occasion in September 2010. The Draft Permit includes a water quality-based maximum daily mean temperature limit of 80°F (i.e., a 24-hr. mean of 80°F) and instantaneous maximum daily temperature of 85°F.

CWA Section 316(a) Variance

As part of the requirements of the Draft Permit under Section 316(b) of the CWA, the permittee must reduce the intake volume at the CWIS (see Section VI.E. of this Fact Sheet). The maximum temperature differential (the difference between effluent and influent temperature) due to UMB's operations will increase at lower flows for the same heat load compared to current conditions. UMB has indicated that due to the higher delta T across the heat exchangers, the permittee will not meet the 1.5°F rise in temperature WQS in areas close to the point of discharge. According to CWA Section 316(a), as codified at 40 CFR 125 subpart H, thermal discharge effluent limitations in permits may be less stringent than those required by applicable standards and limitations if the discharger demonstrates that such effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the water body receiving the thermal discharge (BIP). This demonstration must show that the alternative effluent limitation desired by the discharger, considering the cumulative impact of its thermal discharge together with all other significant impacts on the species affected, will assure the protection and propagation of the BIP in and on the body of water into which the discharge is made. UMB requested a 316(a) variance from the 1.5°F rise in temperature (summer months) WQS (Letter from Bethany Eisenberg, April 29, 2011 included at Attachment 14 to the July 2011 permit application). UMB submitted an analysis of the extent of the thermal plume under the proposed conditions using CORMIX.

The habitat at the outfall is intertidal to shallow subtidal mud and sand/shell flat that can be exposed during low tide. The organisms that reside here, including shellfish, polychaete worms, and crustaceans, must be able to withstand periodic exposure to thermal extremes (e.g., when mudflats are exposed or at very shallow water depths). As a result, the resident organisms at the location of the outfall are likely to survive moderate temperature increases (10°F to 12°F) where the daily average temperature remains protective (80°F). EPA is satisfied that the temperature limits in the draft permit will protect the BIP because the mean daily temperature must meet WQS, which will avoid chronic exposure to high temperatures, resident invertebrate species are biologically capable of withstanding temperature extremes, and the rise in temperature will result in thermal plumes that are sufficiently small to allow fish species to avoid exposure. In addition, the rise in temperature limits in the Draft Permit are accompanied by lower limits on maximum daily and annual average daily flows, which will reduce impingement and entrainment losses at the cooling water intake structure. The aquatic community in Dorchester Bay is likely to experience an overall benefit as a result of the flow reduction at the intake, despite any nominal thermal impacts resulting from the discharge of heated effluent.

The permittee used CORMIX to estimate the size of the thermal plume at the estimated temperature differential under worst-case conditions (maximum tide-variable pump rate) and average case conditions (average tide-variable pump rate) (see Table V-1). The model predicts that the thermal discharge at a maximum temperature differential (difference between influent and effluent temperature) will exceed the criteria for rise in temperature during summer over a limited area.

Table V-1. Predicted size of thermal plume at the point where the temperature is equal to a rise in temperature of 1.5°F and the near-field region (NFR) under worst-case and average pump rates.

Tide	Pump Rate (gpm)	Delta T(°F)	Plume Length when temperature = 1.5°F (ft)	Plume half- width when temperature = 1.5°F (ft)	NFR Length (ft)	NFR half-width (ft)
Worst-case Conditions						
High	19,756	12	50.0	6.3	57.3	7.4
Mid	15,656	11	189.0	22.9	1217.3	40.0
Low	11,547	10	842.5	76.6	670.2	20.1
Average-Case Conditions						
High	8,162	6.5	31.5*	7.1*	43.4	6.8
Mid	8,162	6.7	116.7	8.2	416.4	14.6
Low	7,621	7.1	306.0	10.8	370.0	11.9

*The discharge flow will experience instabilities with full vertical mixing in the near-field region. Plume dimensions when the temperature meets water quality standards cannot be accurately predicted.

At high and mid-tide, the predicted plume is expected to meet the 1.5°F rise in temperature within the near-field region of the outfall at both worst- and average-case conditions (see Table V-1). According to CORMIX, the near-field region is a zone of the receiving water with strong initial mixing dominated by the initial jet characteristics of momentum flux, buoyancy flux, and outfall geometry. In this CORMIX simulation, the worst-case pump rates (19,756 gpm and 15,656 gpm at high and mid-tide, respectively) are higher than the maximum daily pump rates allowed in the Draft Permit (12,778 gpm). Therefore, the predicted size of thermal plumes under the modeled worst-case operating conditions is likely conservative compared to permitted operating conditions.

At low-tide, the predicted plume will meet the 1.5°F rise in temperature within the near-field region of the outfall under average-case conditions but not worst-case conditions (see Table V-

1). The worst-case plume dimensions at low-tide, at a maximum pumping rate and delta temperature (11,547 gpm and 10°F), are estimated at 842 ft in length and 153 ft in width. The outfall discharges into open water at the end of the peninsula at Columbia Point (see Attachment A). Because the nearest landmasses (Squantum Point and Thompson Island) are located more than 2,500 ft away, the relatively small plume from UMB is not expected to impair fish movements in the stretch of water between these land masses.

Based on these data, EPA is satisfied that during high, mid and low-tides, UMB has adequately demonstrated that its thermal plume is limited in size and will not impede fish movement or interfere with the designated or existing uses of Dorchester Bay.

At low slack spring tide (the time of the greatest range between high and low tide), the mudflats in front of the discharge southeast of Columbia Point become exposed, leaving a narrow, shallow channel (75 ft wide by 2 ft deep) between the exposed flats and the shoreline. According to the CORMIX simulation, the thermal plume contacts the mudflats before the WQS of a 1.5°F rise in temperature is met. The temperature in the shallow channel is likely to exceed the WQS over the limited slack tide period (approximately 30 minutes). The low slack spring tide scenario likely represents the worst case conditions for the thermal plume. However, the duration of slack tide is short, the spatial extent of the plume is limited to the channel, and the spring tide occurs only twice per lunar cycle (following the new and full moons). Given that the worst-case spring tide conditions are infrequent and last only a short period, the resulting thermal plume is not likely to interfere with the designated or existing uses of Dorchester Bay.

Based on CORMIX modeling and considering the location of the outfall, EPA concludes that the predicted thermal plumes under a range of tides and operating conditions are unlikely to interfere with the migration or movement of aquatic life or create nuisance conditions or otherwise interfere with the designated or existing uses of Dorchester Bay. The Draft Permit limits the rise in temperature at UMB (the difference between the effluent and influent temperature) to 10°F at low tide, 11°F at mid tide, and 12°F at high tide. The relatively small thermal plumes (compared to the size of Dorchester Bay) ensure that fish are able to escape thermal impacts from the heated effluent. In addition, resident invertebrates unable to escape the plume are likely to have high thermal tolerance or otherwise be able to adapt to periodic temperature extremes (e.g., by burrowing), given that the mudflats in the discharge area are generally shallow or exposed during low tides. EPA concludes that the temperature limits in the Draft Permit will assure the protection and propagation of the BIP. In order to ensure compliance with this temperature limit when ambient air temperatures are high, the permittee proposes to install and operate a supplemental closed-cycle cooling system. The permittee estimates that without the supplemental cooling system, the temperature differential could be exceeded about 205 hours per year (ARUP Sea Water Cooling System Summary of Expansion Options, April 13, 2011).

EPA is satisfied that the discharge of NCCW, under the rise in temperature and discharge rate limitations of the Draft Permit (10° to 12°F dependent on tide), will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in Dorchester Bay. Therefore, UMB has been granted a variance from the water quality standards for rise in temperature at the discharge point under Section 316(a) of the CWA. These limits are also consistent with state regulations at 314 CMR § 4.05(4)(b)(2)(c), which state "alternative effluent limitations established in connection with a variance for a thermal discharge issued under 33 USC § 1251 (FWPCA, § 316(a)) and 314 CMR 3.00 are in compliance with 314 CMR 4.00."

Technology-Based Limits

As discussed in Section IV.B of this Fact Sheet, EPA has not promulgated technology-based National Effluent Guidelines for the discharge of NCCW from colleges or universities as of this time. In the absence of applicable ELGs, the permit writer is authorized under Section 402(a)(1)(B) of the CWA and 40 CFR 125.3 to establish technology-based temperature limits by applying the BAT standard on a case-by-case, BPJ basis in consideration of (i) the appropriate technology for the category or class of point sources of which the applicant is a member, based upon all available information; and (ii) any unique factors relating to the applicant (see 40 CFR 125.3(c)(2)).

In this case, replacing the existing seawater cooling system in its entirety with a closed-cycle cooling system would likely eliminate the discharge of NCCW (because the closed-cycle system would operate using fresh water) and, therefore, any potential thermal impacts. However, EPA has concluded, based on CORMIX analysis provided by the permittee and considering the aquatic community present at the discharge location, that the discharge of NCCW at the permitted limits will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in Dorchester Bay. Technology-based temperature limits based on the installation and operation of a full scale closed-cycle cooling system at UMB would be more stringent than necessary for the protection of aquatic life. EPA, therefore, has granted a variance from technology-based temperature limits under Section 316(a) of the CWA. The Draft Permit includes a daily mean temperature limit of 80°F and a maximum daily rise in temperature limit of 10°F to 12°F (dependent on tide) based on a Section 316(a) variance.

VI. Cooling Water Intake Structure, CWA Section 316(b)

With any NPDES permit issuance or reissuance, EPA is required to evaluate or re-evaluate compliance with applicable standards, including the technology standard specified in Section 316(b) of the CWA for cooling water intake structures (CWIS). Section 316(b) requires that:

> [a]ny standard established pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

33 U.S.C. § 1326(b). The operation of CWISs can cause or contribute to a variety of adverse environmental effects, such as killing or injuring fish larvae and eggs entrained in the water withdrawn from a water body and sent through the facility's cooling system, or by killing or injuring fish and other organisms by impinging them against the intake structure's screens. CWA § 316(b) applies if a point source discharger seeks to withdraw cooling water from a water of the United States through a CWIS. CWA § 316(b) applies to this permit due to the presence and operation of a CWIS at UMB.

A. Introduction and Regulatory Background

In the absence of applicable regulations, EPA has made § 316(b) determinations on a case-by-case basis using best professional judgment (BPJ), for both new and existing facilities with regulated CWISs. In December 2001, EPA promulgated new, final § 316(b) regulations that provide specific technology-based requirements for *new* facilities of any kind with a CWIS with an intake flow greater than two (2) MGD. 66 FR 65255 (Dec. 18, 2001) (Phase I rule). The Phase I rule is in effect but does not apply to this permit because UMB is not a new facility.

In July 2004, EPA published final regulations applying § 316(b) to large, *existing* power plants (Phase II rule), defined in 40 CFR § 125.91 as existing point sources employing CWISs that withdraw at least 50 MGD and generate and transmit electric power as their primary activity. Following litigation that resulted in the remand to EPA of many of the rule's provisions, *see Riverkeeper, Inc. v. U.S. EPA*, 475F.3d 83 (2d Cir. 2007); *rev'd in part, Entergy Corp. v. Riverkeeper, Inc.*, ___ U.S. ___, 129 S.Ct. 1498, 1510 (2009), the Agency suspended the Phase II rule in July 2007. 72 FR 37107 (July 9, 2007). The suspension left only 40 CFR § 125.90(b) in effect, which provides that in the absence of applicable categorical standards, BTA determinations are to be made on a case-by-case, BPJ basis.

On June 16, 2006, EPA published the Phase III Rule, which established categorical requirements for new offshore oil and gas extraction facilities that have a design intake flow threshold of greater than 2 MGD, but dictated that the BTA would be determined on a case-by-case, BPJ basis for existing electrical generation facilities with a design intake flow less than 50 MGD and existing manufacturing facilities. 71 FR 35006 (June 16, 2006). In 2009, EPA petitioned the 5th Circuit to remand those provisions of the Phase III Rule that established 316(b) requirements for existing electrical generators with a design intake flow less than 50 MGD and at existing manufacturing facilities on a case-by-case basis using best professional judgment. On July 23, 2010, the United States Court of Appeals for the 5th Circuit issued a decision upholding EPA's rule for new offshore oil and gas extraction facilities. Further, the Court granted the request by EPA and environmental petitioners to remand the existing facility portion of the rule back to the Agency for further rulemaking. *ConocoPhillips Co. v. U.S. Envtl. Prot. Agency*, 612 F.3d 822, 842 (5th Cir. 2010).

On April 20, 2011, EPA published proposed regulations to apply CWA § 316(b) to CWISs at existing power plants and manufacturers, and new units at existing facilities. 76 FR 22174-22288 (April 20, 2011). The proposed rule combines the remanded portions of the Phase II and Phase III rules. This proposed rule, if it were effective, would not apply to this permit because UMB is not a power plant or manufacturing facility.

There are no effective national categorical standards applying § 316(b) to the CWISs at UMB. As a result, EPA has developed technology-based requirements for the facility's CWISs by applying CWA § 316(b) on a BPJ, site-specific basis.

1. Methodology for the BPJ Application of CWA § 316(b)

Neither the CWA nor EPA regulations dictate a specific methodology for developing BPJ-based limits under § 316(b). In the preamble to the proposed regulations for CWISs at existing facilities, EPA indicates that the Agency has broad discretion in determining the "best" available technology for minimizing adverse environmental impact (See 76 FR 22196). EPA has read CWA § 316(b) to intend that entrainment and impingement be regarded as "adverse impacts" that must be minimized by application of the BTA.

EPA has looked by analogy to factors considered in the development of effluent limitations under the CWA and EPA regulations for guidance concerning additional factors to consider in making a BTA determination under CWA § 316(b). In setting effluent limitations on a site-specific BPJ basis, EPA considers a number of factors specified in the statute and regulations. *See, e.g.*, 33 U.S.C. §§ 1311(b)(2)(A) and 1314(b)(2); 40 C.F.R. § 125.3(d)(3).[2] These factors include: (1) the age of the equipment and facilities involved, (2) the process employed, (3) the engineering aspects of applying various control techniques, (4) process changes, (5) cost, and (6) non-water quality environmental impacts (including energy issues). The CWA sets up a loose framework for assessing these statutory factors in setting BAT limits.[3] It does not require their comparison, merely their consideration.[4] [I]n enacting the CWA, Congress did not mandate any particular structure or weight for the many consideration factors. Rather, it left EPA with discretion to decide how to account for the consideration factors, and how much weight to give each factor.[5] In sum, when EPA considers the statutory factors in setting BAT limits, it is governed by a standard of reasonableness.[6] It has "considerable discretion" in evaluating the relevant factors and determining the weight to be accorded to each in reaching its ultimate BAT

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[2] *See also NRDC v. EPA*, 863 F.2d at 1425 ("in issuing permits on a case-by-case basis using its "Best Professional Judgment," EPA does not have unlimited discretion in establishing permit limitations. EPA's own regulations implementing [CWA § 402(a)(1)] enumerate the statutory factors that must be considered in writing permits.").

[3] *BP Exploration & Oil, Inc.*, 66 F.3d at 796; *Weyerhauser v. Costle*, 590 F.2d 1011, 1045 (D.C. Cir. 1978) (citing Senator Muskie's remarks on CWA § 304(b)(1) factors during debate on CWA). *See also EPA v. Nat'l Crushed Stone Ass'n*, 449 U.S. 64, 74, 101 S.Ct. 295, 300, 66 L.Ed.2d 268 (1980) (noting with regard to BPT that "[s]imilar directions are given the Administrator for determining effluent reductions attainable from the BAT except that in assessing BAT total cost is no longer to be considered in comparison to effluent reduction benefits").

[4] *Weyerhauser*, 590 F.2d at 1045 (explaining that CWA § 304(b)(2) lists factors for EPA "consideration" in setting BAT limits, while CWA § 304(b)(1) lists both factors for EPA consideration and factors for EPA "comparison" -- *e.g.*, "total cost versus effluent reduction benefits" -- in setting BPT limits).

[5] *BP Exploration & Oil, Inc.*, 66 F.3d at 796; *Weyerhauser v. Costle*, 590 F.2d at 1045.

[6] *BP Exploration & Oil*, 66 F.3d at 796; *Am. Iron & Steel Inst. v. EPA*, 526 F.2d 1027, 1051 (1975), *modified in other part*, 560 F.2d 589 (3d Cir. 1977), *cert. denied*, 435 U.S. 914 (1978).

determination.[7] One court has succinctly summarized the standard for judging EPA's consideration of the statutory factors in setting BAT effluent limits: [s]o long as the required technology reduces the discharge of pollutants, our inquiry will be limited to whether the Agency considered the cost of technology, along with other statutory factors, and whether its conclusion is reasonable.[8]

Thus, in determining the BTA for this permit, EPA has the discretion to consider the above-listed factors and to decide how to consider and weigh them in making its decision. Again, the factors from the effluent limitation development process are not strictly applicable as a matter of law to a BTA determination under § 316(b) because they are not specified in § 316(b). Nevertheless, EPA has looked to the effluent limitation development process for guidance and will consider these factors, and perhaps other factors, to the extent the Agency deems them relevant to its determination of the BTA. Ultimately, EPA's determination of the BTA must be reasonable.

According to 40 C.F.R. § 125.3(c)(2), a BPJ-based BAT analysis also should consider the "appropriate technology for the category of point sources of which the applicant is a member, based on all available information," and "any unique factors relating to the applicant." UMB is unique in that does not employ a cooling water intake system associated with power generating like a steam electric power plant or a manufacturing plant, which are the most common types of regulated individual facilities with case-by-case determination of 316(b) requirements in Region 1. UMB has no capacity for electrical generation, but rather utilizes seawater water to satisfy the cooling needs of the campus chiller system. As such, the appropriate technology for this facility may not be comparable to the operation of CWISs at steam electric power plants and manufacturing facilities.

Because a BPJ-based application of CWA § 316(b)'s BTA standard is conducted on a case-by-case, site-specific basis, EPA must evaluate whether the technologies under consideration are practicable (or feasible) for use at UMB. In other words, although a technology works at one facility, it might not actually be feasible at another due to site-specific issues (*e.g.,* space limitations). Thus, a technology that works at another facility but is not feasible at UMB would not be the BTA for this permit. Conversely, a feasible technology for UMB might not be feasible for another facility.

Finally, as also indicated above, the United States Supreme Court recently held that EPA is

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[7] *Texas Oil & Gas Ass'n*, 161 F.3d at 928; *NRDC v. EPA*, 863 F.2d at 1426. *See also Weyerhauser*, 590 F.2d at 1045 (discussing EPA's discretion in assessing BAT factors, court noted that "[s]o long as EPA pays some attention to the congressionally specified factors, the section [304(b)(2)] on its face lets EPA relate the various factors as it deems necessary").

[8] *Assn of Pacific Fisheries v. EPA*, 615 F.2d 794, 818 (9th Cir. 1980) (industry challenge to BAT limitations for seafood processing industry). *See also Chemical Manufacturers Assn (CMA) v. EPA*, 870 F.2d 177, 250 n.320 (5th Cir. 1989), *citing* Congressional Research Service, *A Legislative History of the Water Pollution Control Act Amendments of 1972* at 170 (1973) (hereinafter "*1972 Legislative History*") (in determining BAT, "[t]he Administrator will be bound by a test of reasonableness."); *NRDC v. EPA*, 863 F.2d at 1426 (same); *American Iron & Steel Inst.*, 526 F.2d at 1051 (same).

authorized, though not statutorily required, to consider a comparative assessment of an option's costs and benefits in determining the BTA under CWA § 316(b). *Entergy*, 129 S.Ct. 1498, 1508-1510, *rev'g in part, Riverkeeper*, 475F.3d 83. As the Supreme Court explained, in its determination, "EPA sought only to avoid extreme disparities between costs and benefits." *Entergy*, 129 S.Ct. at 1509. As the Court also explained, EPA had for decades engaged in this type of cost/benefit comparison using a "wholly disproportionate test" to ensure that costs were not unreasonable when considered in light of environmental benefits.[9] *Id.* at 1509 (citing *In re Public Service Co. of New Hampshire*, 1 E. A. D. 332, 340 (1977); *In re Central Hudson Gas and Electric Corp.*, EPA Decision of the General Counsel, NPDES Permits, No. 63, pp. 371, 381 (July 29, 1977)). In *Public Service*, EPA's Administrator stated that "I do not believe that it is reasonable to interpret Section 316(b) as requiring the use of technology whose cost is wholly disproportionate to the environmental benefit to be gained." In *Central Hudson, id.*, EPA's then General Counsel stated that:

> ... EPA must ultimately demonstrate that the present value of the cumulative annual cost of modifications to cooling water intake structures is not wholly out of proportion to the magnitude of the estimated environmental gains (including attainment of the objectives of the Act and § 316(b)) to be derived from the modifications.

The relevant "objectives of the Act and § 316(b)" include the minimization of adverse environmental impacts from cooling water intake structures, restoring and maintaining the physical and biological integrity of the Nation's waters, and achieving, wherever attainable, water quality providing for the protection and propagation of fish, shellfish and wildlife, and providing for recreation, in and on the water. 33 U.S.C. §§ 1251(a)(1) and (2), 1326(b).

2. State Water Quality Standards

In addition to satisfying technology-based requirements, NPDES permit limits for CWISs must also satisfy any more stringent provisions of state water quality standards (WQS) or other state legal requirements that may apply, as well as any applicable conditions of a state certification under CWA § 401. *See* CWA §§ 301(b)(1)(C), 401(a)(1), 401(d), 510; 40 C.F.R. §§ 122.4(d), 122.44(d). *See also* 40 C.F.R. § 125.84(e). This means that permit conditions for CWISs must satisfy numeric and narrative water quality criteria and protect designated uses that may apply from the state's WQS.

The CWA authorizes states to apply their WQS to the effects of CWISs and to impose more stringent water pollution control standards than those dictated by federal technology standards.[10]

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[9] As the Court described, in developing the Phase II Rule, EPA had (for the first time) used a "significantly greater than test." The Court also indicated that either test was permissible under the statute. 129 S.Ct. at 1509.

[10] The regulation governing the development of WQS notes that "[a]s recognized by section 510 of the Clean Water Act, States may develop water quality standards more stringent than required by this regulation." 40 C.F.R. § 131.4(a). The Supreme Court has cited this regulation in support of the view that states could adopt water quality requirements more stringent than federal requirements. *PUD No. 1*

The United States Supreme Court has held that once the CWA § 401 state certification process has been triggered by the existence of a discharge, then the certification may impose conditions and limitations on the activity as a whole – not merely on the discharge – to the extent that such conditions are needed to ensure compliance with state WQS or other applicable requirements of state law.[11]

With respect to cooling water withdrawals, both sections 301(b)(1)(C) and 401 authorize the Region to ensure that such withdrawals are consistent with state WQS, because the permit must assure that the overall "activity" associated with a discharge will not violate applicable WQS. *See PUD No. 1*, 511 U.S. at 711-12 (Section 401 certification); *Riverkeeper I*, 358 F.3d at 200-202; *In re Dominion Energy Brayton Point, LLC*, 12 E.A.D. 490, 619-41 (EAB 2006). Therefore, in EPA-issued NPDES permits, limits addressing CWISs must satisfy: (1) the BTA standard of CWA § 316(b); (2) applicable state water quality requirements; and (3) any applicable conditions of a state certification under CWA § 401. The standards that are most stringent ultimately determine the Final Permit limits.

The Massachusetts Department of Environmental Protection (MassDEP) has designated Dorchester Bay a Class SB Water. Though the standard for Class SB waters does not include any specific numeric criteria that apply to cooling water intakes, it is nevertheless clear that MassDEP must impose the conditions it concludes are necessary to protect the designated uses of the channel, including that it provide good quality habitat for fish and other aquatic life and a recreational fishing resource. See 314 CMR 4.05(4)(b). In addition, 314 CMR 4.05(1) of the Massachusetts WQS provides that each water classification "is identified by the most sensitive, and therefore governing, water uses to be achieved and protected." This means that where a classification lists several uses, permit requirements must be sufficient to protect the most sensitive use. Finally, 314 CMR 4.05(4)(b)(2)(d) for Class SB waters states "in the case of a cooling water intake structure (CWIS) regulated by EPA under 33 USC § 1251 (FWPCA, §316(b)), the Department has the authority under 33 USC § 1251 (FWPCA, §401), M.G.L. c. 21, §§ 26 through 53 and 314 CMR 3.00 to condition the CWIS to assure compliance of the withdrawal activity with 314 CMR 4.00, including, but not limited to, compliance with narrative and numerical criteria and protection of existing and designated uses."

In summary, the Massachusetts WQSs apply to CWISs and UMB's permit requirements must be sufficient to ensure that the facility's CWIS neither causes nor contributes to violations of the

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of Jefferson County v. Wash. Dep't of Ecology, 511 U.S. 700, 705 (1994). *See also* 33 U.S.C. § 1370; 40 C.F.R. § 125.80(d). *See also* 40 C.F.R. § 125.80(d); *Riverkeeper, Inc. v. U.S. Environmental Protection Agency*, 358 F.3d 174, 200-201 (2d Cir. 2004) ("*Riverkeeper I"*).

[11] *PUD No. 1*, 511 U.S. at 711-12. holds that "in setting discharge conditions to achieve WQS, a state can and should take account of the effects of other aspects of the activity that may affect the discharge conditions that will be needed to attain WQS. The text [of CWA § 401d)] refers to the compliance of the applicant, not the discharge. Section 401(d) thus allows the State to impose "other limitations" on the project in general to assure compliance with various provisions of the Clean Water Act and with "any other appropriate requirement of State law." For example, a state could impose certification conditions related to CWISs on a permit for a facility with a discharge, if those conditions were necessary to assure compliance with a requirement of state law, such as to protect a designated use under state WQS. *See id.* at 713 (holding that § 401 certification may impose conditions necessary to comply with designated uses).

WQS and satisfy the terms of the state's water quality certification under CWA § 401. EPA anticipates that the MassDEP will provide this certification before the issuance of the Final Permit.

B. Effects of Cooling Water Intake Structures

Section 316(b) of the CWA addresses the adverse environmental impact of cooling water intake structures (CWIS) at facilities requiring NPDES permits. The principal adverse environmental impacts typically associated with CWISs evaluated by EPA are the *entrainment* of fish eggs, larvae, and other small forms of aquatic life through the plant's cooling system, and the *impingement* of fish and other larger forms of aquatic life on the intake screens.

Entrainment of organisms occurs when a facility withdraws water into the CWIS from an adjacent water body. Fish eggs, larvae, and other planktonic organisms in the water are typically small enough to pass through intake screens and become entrained along with the cooling water within the facility (See 76 FR 22197). As a result, the organisms are subjected to death or damage due to high velocity and pressure, increased temperature, and chemical anti-biofouling agents.[12] The number of organisms entrained is dependent upon the volume and velocity of cooling water flow through the plant and the concentration of organisms in the source water body that are small enough to pass through the screens of CWIS. The extent of entrainment can be affected by the intake structure's location, the biological community in the water body, the characteristics of any intake screening system or other entrainment reduction equipment used by the facility, and by season.

Impingement of organisms occurs when a facility draws water through its CWIS and organisms too large to pass through the screens, and unable to swim away, become trapped against the screens and other parts of the intake structure (See 76 FR 22197). Impinged organisms may be killed, injured or weakened, depending on the nature and capacity of the plant's filter screen configuration, cleaning and backwashing operations, and fish return system used to return organisms back to the source water.[12] In some cases, contact with screens or other equipment can cause an organism to lose its protective slime and/or scales, or suffer other injuries, which may result in delayed mortality. The quantity of organisms impinged is a function of the intake structure's location and depth, the velocity of water drawn to the entrance of the intake structure (approach velocity) and through the screens (through-screen velocity), the seasonal abundance of various species of fish, and the size of various fish relative to the size of the mesh in any intake barrier system (e.g., screens). For resident fish in Savin Cove, the CWISs pose multiple threats to single populations in that organisms are exposed to entrainment mortality as eggs and larvae and impingement mortality as juveniles and adults. It should be noted that this discussion focuses on fish because more information is available on CWIS impacts to fish, but CWISs can also harm other types of organisms (*e.g.*, shellfish).

The most direct impact of impingement and entrainment mortality is the loss of large numbers of aquatic organisms, including fish, benthic invertebrates, phytoplankton, fish eggs and larvae, and other susceptible organisms. EPA believes that reducing impingement and entrainment mortality

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[12] EPA 2011. Environmental and Economic Benefits Analysis of the Proposed Section 316(b) Existing Facilities Regulation: Section 2.3 CWIS Impacts to Aquatic Ecosystems. EPA. March 28, 2011.

will contribute to the health and sustainability of fish populations by lowering the total mortality rate for these populations. For many species, these losses may not lead to measurable reductions in adult populations; however, these losses can contribute to impacts to threatened and endangered species, indigenous populations, and a reduction in ecologically critical aquatic organisms, including important elements of an ecosystem's food chain. For instance, because predation rates are often linked to concentration of prey, reductions in a prey fish from impingement and entrainment mortality may indirectly result in reductions to predator species or increases to species in apparent competition. In addition, impingement and entrainment mortality can diminish a population's compensatory reserve, which is the capacity of a species to increase survival, growth, or reproduction rates in response to environmental variability, including temperature extremes, heavy predation, disease, or years of low recruitment.[13]

For commercially and recreationally important stocks, impingement and entrainment mortality represent an additional source of mortality to populations being harvested at unsustainable levels. Although reductions in impingement and entrainment mortality may be small in magnitude compared to fishing pressure and often difficult to measure due to the low statistical power of fisheries surveys, a reduction in mortality rates on overfished populations is likely to increase the rate of stock recovery. Thus, reducing impingement and entrainment mortality may lead to more rapid stock recovery, a long-term increase in commercial fish catches, increased population stability following periods of poor recruitment, and, as a consequence of increased resource utilization, an increased ability to minimize the invasion of exotic species. Finally, fish and other species affected directly and indirectly by CWISs can provide other valuable ecosystem goods and services, including nutrient cycling and ecosystem stability. [13]

C. Impingement and Entrainment at UMB

At the request of EPA and MassDEP, UMB conducted an impingement sampling study from April through July 2010. Impingement samples were collected from the traveling screen during a 15-minute screen rotation following an 8-hour cycle under varying tidal conditions. Sampling was conducted weekly during April, twice per week during May, and three times per week during June and July. UMB estimated that a total of 1,197 individuals of four species (Atlantic tomcod, cunner, longhorn sculpin, and winter flounder) were impinged during the study. Winter flounder were the most abundant individuals impinged (78% of total) and impingement was most frequent in July, with approximately 68% of total impingement occurring during this month.

As requested by EPA and MassDEP as part of the permit application, UMB also conducted a site-specific entrainment study from May through July of 2010. Entrainment samples were collected three times per week (non-consecutive samples) beginning on May 11 through July 30. Eggs and larvae were collected using a 0.333 mm plankton net to filter 100 m^3 samples of seawater pumped from the chamber of the pumphouse after passing through the traveling screen but prior to the heat exchangers.

During the 2010 entrainment study, UMB collected eggs from 9 taxa (in many cases eggs from several species were indistinguishable and grouped into a single taxa, for instance,

[13] EPA. Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule. March 28, 2011. EPA 821-R-11-002.

cunner/tautog) and larvae from 13 species. Of the estimated 15 million eggs and larvae entrained during the study period, eggs comprised 83.5% of the total sample compared to 16.4% larvae. The total sample was dominated by cunner-tautog eggs (nearly 76.7%), followed by silverside larvae (10.6%), wrasse eggs (2.7%), rockling-hake-butterfish eggs (2.5%), river herring-rainbow smelt larvae (1.8%), fourspot-windowpane eggs (1.2%), and stage 2 rainbow smelt larvae (1.1%).

In response to a request by MassDEP, UMB performed an adult equivalent analysis and foregone production analysis based on existing entrainment data for winter flounder, American lobster, rainbow smelt, and river herring (May 18, 2011 Memo: Biological Analysis Request Response). Adult equivalent analysis is a method for expressing entrainment (or impingement) losses as an equivalent number of individuals at one life stage, in this case, age-1 (Goodyear 1978).[14] During the 2010 entrainment study (actual daily pumping rates based on operation from May through July) the permittee estimates a loss of approximately 1,295 age-1 equivalents of the four requested species, including about 126 age-1 winter flounder and 1,168 age-1 rainbow smelt.

Production forgone is the expected total amount of biomass, in pounds, that would have been produced had individuals not been entrained (Rago 1984).[15] According to the May 18, 2011 Biological Analysis Request Response Memo, the permittee estimates total forgone production for winter flounder, rainbow smelt, and river herring under 2010 actual operating conditions was 1,007 pounds.

D. Assessment of Cooling Water Intake Structure Technologies

The design, location, construction and capacity of UMB’s CWIS must reflect BTA for minimizing adverse impacts from impingement and entrainment, as required by CWA § 316(b). The location of a CWIS in the waterbody is an important factor in minimizing its adverse environmental impacts. EPA evaluated the location of the CWIS in the waterbody, the type of waterbody, and the depth of the intake structure to determine how to best minimize adverse environmental impacts under CWA § 316(b). The design, construction, and operation of a CWIS are additional important factors in minimizing its adverse biological impacts. Fish protection technologies, including physical exclusion systems such as barrier nets or screens, may reduce impingement and entrainment impacts if properly designed, installed, and maintained. Capacity (the quantity of seawater being withdrawn) is another important factor that can minimize the adverse environmental impacts of a CWIS. Reducing capacity results in a corresponding reduction in the number of organisms entrained, thereby reducing entrainment mortality. A reduction in flow can be achieved through implementation of a closed-cycle cooling system (e.g., cooling towers), by using an alternative source of cooling water (e.g., storm water), or by using a variable frequency drive (VFD) to adjust pump capacity to meet cooling water demand. EPA assumes a reduction in flow is proportional to the reduction in entrainment mortality because fewer organisms are subject to CWIS impacts. In addition, a capacity reduction can minimize impingement if the maximum pumping volume results in a through-screen intake velocity (TSV)

[14] Goodyear, C. P. 1978. Entrainment impact estimates using the equivalent adult approach. United States Fish and Wildlife Service, FWS/OBS-78/65, Ann Arbor, MI.
[15] Rago, P. J. 1984. Production forgone: An alternative method for assessing the consequences of fish entrainment and impingement losses at power plants and other water intakes. Ecol. Model. 24:789−111.

no greater than 0.5 fps.

1. Existing Cooling Water Intake Structure Technology

The facility withdraws water from Savin Hill Cove to use as once-through NCCW in its cooling systems in campus buildings. The pumphouse and intake structure are located on the southern side of Columbia Point peninsula in Savin Hill Cove. A schematic of the intake structure is included in Attachment D. The intake structure chamber is approximately 10 feet deep and 7 feet-2 inches wide. The intake is fully submerged even at MLLW. According to the permittee, existing CWIS withdrawals range from approximately 0.34% of the volume of the tidal flow at a pumping rate of 3,750 gpm (typical of winter operations) to 1.34% at a pumping rate of 15,000 gpm (the 2010 maximum rate). At the design capacity, the intake withdraws 2.34% of the tidal volume. No chemicals are added to the seawater at any point in the process, and the seawater does not combine with any other process flows or potable water before being discharged to Dorchester Bay.

An intake tunnel approximately 87 ft long and 10 ft deep extends from a 5 ft fiberglass intake baffle to the traveling screen in the pumphouse basin chamber (see Attachment D). The intake baffle prevents larger, benthic organisms from entering the vault, while a 6-inch "stop log" trash rack prevents larger debris from entering the intake tunnel. The pumphouse basin is a rectangular chamber 32 feet deep oriented perpendicular to shore. A new, 7-ft wide, 3/8-inch mesh traveling screen, which encompasses the width and depth of the pumphouse basin chamber, was installed in 2007. A separate 1/8-inch strainer filters seawater prior to entering the pumphouse heat exchangers. The traveling screen is currently rotated for approximately 15 minutes once every 8 hours. During the 15-minute cleaning cycle, a pressurized spraywash rinses debris and any impinged organisms are transported to Dorchester Bay through a 10-inch fiberglass fish return pipe, which combines with heated NCCW before being discharged via Outfall 001.

The pumphouse is equipped with one small (3,750 gpm) and three large (7,500 gpm) single-speed pumps. The total design capacity of the system is 26,250 gpm, or 37.8 MGD. Each pump has a fixed rate, and operators change the combination of operating pumps to vary the pumping rate. The intake structure operates 24 hours a day, 365 days a year, with a typical operating range of 3,750 to 11,250 gpm (5.4 to 16.2 MGD). In winter, when cooling water needs are low, UMB only operates the small pump (5.4 MGD) and in spring and fall, UMB activates one of the large pumps (10.8 MGD). In summer, when cooling needs are greatest, UMB operates both the small pump and one of the large pumps (16.2 MGD). According to the permittee, the maximum pump rate (September 2000 to December 2010) was met by running two large pumps at a total capacity of 15,000 gpm (21.6 MGD).

The velocity of water entering a CWIS, or intake velocity, exerts a direct physical force against which fish and other organisms must act to avoid impingement. As intake velocity increases at a CWIS, so does the potential for impingement. EPA considers intake velocity to be one important factor that can be controlled to minimize adverse environmental impacts from impingement at CWISs. See 65 FR 49060, 49087 (Aug. 10, 2000). EPA has identified a "through screen" velocity (TSV) threshold of 0.5 feet per second (fps) as protective to minimize impingement of most species of adult and juvenile fish. This determination is fully discussed at 65 FR 49060, 49087-88. According to ERM's Best Technology Available Assessment Report (submitted with the permit application dated December 2010), the maximum TSV of the traveling screen at UMB between 2000 and 2010 (at 15,000 gpm) was 0.5 fps at mean low tide and 0.3 fps at mean high tide, which is consistent with the protective velocity for impingement. In the Sea Water Intake Velocity and Temperature Analysis submitted with the supplemental permit application material in July 2011, the permittee estimates that the TSV could exceed 0.5 fps approximately 19.8% of the year at current cooling water loads and pump technology.

The existing technology is not BTA for impingement based on infrequent screen rotation, an inadequate fish return system, and TSV. The screen is rotated once every 8 hours, which could lead to extended impingement duration (more than 7 hours) if an organism becomes impinged shortly after rotation completion. During laboratory studies, longer durations of impingement tended to result in higher mortality, injury, and scale loss (EPRI 2006).[16] Decreasing the impingement duration by rotating traveling screen continuously (or, at a minimum, as frequently as feasible based on manufacturer's recommendations) may improve survival of impinged organisms. In addition, the TSV exceeds the recommended level for avoidance of fish nearly 20% of the time on an annual basis, and the fish return system discharges live organisms and debris into the same pipe as the heated effluent from the heat exchangers. The existing technology is not BTA for entrainment because the traveling screen mesh size (3/8-inch) is too large to block small eggs and larvae from becoming entrained through the system.

As part of campus expansion under its 25-year Master Plan, UMB is proposing construction of an Integrated Science Complex and General Academic Building in the next 5 years, both of which UMB proposes connecting to the existing NCCW system. The additional buildings (minus the old Science Building) will nearly double cooling demand compared to current conditions. If this demand is fulfilled by the NCCW seawater system, the volume of seawater withdrawals would increase over existing levels. UMB projects that the additional load could be met by running three large single-speed pumps simultaneously with a total capacity of 22,500 gpm (7,500 gpm more than current cooling flow rates). At this pump rate, the TSV could increase to 0.82 fps at mean low tide, would exceed 0.5 fps more than 26% of the time on an annual basis, and the percent of tidal flow withdrawn would increase to 2%. The increase in water withdrawals and higher TSV would likely result in greater losses due to entrainment and impingement. Based on data collected in 2010, EPA estimates that entrainment under future cooling demands could result in the loss of an average of 35 million eggs and larvae during the peak entrainment season (May to July), with a potential for the loss of 52 million organisms in a season characterized by high densities of eggs and larvae in Savin Hill Cove (see Attachment E).

In summary, several components of the existing technology (frequency of screen rotation, fish return, and TSV) are not consistent with the BTA to minimize impingement and entrainment losses. Further, anticipated increases in future seawater withdrawals with the construction of two new academic buildings will likely increase entrainment and impingement compared to current levels. The following section discusses potentially available technological alternatives for ensuring that the location, design, construction, and capacity of UMB's CWIS reflect the BTA

[16] EPRI 2006. Laboratory Evaluation of Modified Ristroph Traveling Screens for Protecting Fish at Cooling Water Intakes. EPRI, Palo Alto, CA: 2006. 1013238.

for minimizing impingement and entrainment based on BPJ. EPA considered engineering, environmental, economic, and other issues for each technology to evaluate its availability and determine BTA to minimize adverse environmental impacts from the CWIS at UMB. For this analysis, EPA considered the permit applications from August 2009, December 2010, and July 2011 and supplemental information, including the Best Technology Available Assessment Report, Supplemental Impingement and Entrainment Study, and analysis of seawater cooling expansion, among others.

2. Location

The CWIS is located in Savin Hill Cove along the southern shoreline of the UMB peninsula approximately 3,500 feet across from the mouth of the Neponset River. The depth of water above the top of the seawater intake screen is dependent on tide condition and surface water elevation but the CWIS is fully submerged at all tide levels. At low low tide, the depth of water above the CWIS is 1.1 feet.

The cove in front of the intake structure has been dredged to allow clear passage of flows. Immediately adjacent to the intake, the channel is 19 feet deep at MLLW, but quickly rises to zero depth outside of the dredged portion. A 5-ft fiberglass baffle wall discourages benthic organisms from entering the intake tunnel. The depth of water in the channel at low low tide is 12.5 feet. The intake channel extends from the CWIS to a dredged navigational channel providing access to UMB and the Savin Hill Yacht Club. This channel was last dredged in 2006. With the exception of the dredged channels, the majority of Savin Hill Cove consists of intertidal to shallow subtidal mudflats that are exposed at low tide.

EPA has determined that no alternative CWIS location is available that would better minimize adverse impacts over the existing CWIS location. Savin Hill Cove is generally shallow, and constructing a new CWIS in another location would likely require extensive dredging and construction activities, which would result in substantial habitat disturbance.

3. Design

Physical Exclusion Systems

UMB evaluated the technical feasibility of several physical exclusion technologies for reducing entrainment mortality, including fine mesh wedgewire screens, aquatic filter barriers, and traveling screens (BAT Report ERM 2010). In principal, all of these technologies minimize entrainment by using mesh sizes small enough to exclude entrainable aquatic organisms (such as eggs and larvae). Wedgewire screens also engage hydrodynamic factors (such as the water velocity past the structure) to prevent organisms from being entrained. Physical exclusion systems can be designed to maintain a through-screen velocity (TSV) of 0.5 fps or less to minimize impingement.

The CWIS is located in an area of shallow mudflats that are exposed at low tide, except for a narrow channel dredged to a depth of 12.5 feet at low low tide. The CWIS is located across from the Savin Hill Yacht Club and near the Dorchester Yacht Club in an area that experiences heavy recreational boating use. The limited area and depth of the dredged intake channel is not adequate to accommodate a wedgewire screen or aquatic filter barrier large enough for the required cooling water volume at an appropriate TSV. In addition, both technologies could interfere with navigation of boats in Savin Hill Cove. Therefore, due to engineering aspects related to the limited width and depth of the intake channel, and non-water quality boat navigation impacts, neither wedgewire screens nor an aquatic filter barrier were considered available technologies at UMB to minimize entrainment.

It is technically feasible to install and operate fine mesh traveling screens at UMB with a mesh size of 0.5 mm, which would be necessary to prevent entrainment of eggs and larvae present in Savin Hill Cove. However, in order to maintain a protective TSV, the surface area of the fine-mesh screens must be substantially increased. According to UMB, accommodating multiple fine mesh screens would require extensive expansion of the existing pump house and CWIS as well as the intake channel. The expansion of the associated structures would result in substantial disturbance to the aquatic environment during construction and possible habitat loss. Moreover, it is not clear if this technology will effectively reduce mortality of eggs and larvae. Eggs and larvae that would otherwise have become entrained will be excluded by the 0.5 mm mesh size, but are likely to become impinged on the screen, rinsed into a trough, and transported to the receiving water through the fish return system. To date, little research has been conducted on whether the fragile eggs and larvae that would have been lost to entrainment survive impingement on the screens. If survival is low, then the resulting loss of eggs and larvae due to the CWIS is not reduced. Due to the limitations associated with the size of the intake channel and the existing pump house, and the environmental impacts of expanding the channel and pump house, combined with uncertainty regarding the effectiveness of the technology to reduce mortality of eggs and larvae, EPA had determined that fine mesh traveling screens are not available UMB to minimize entrainment.

4. Capacity

Alternate Sources of Cooling Water

The use of alternative sources of water, such as storm water, for cooling purposes could reduce the volume of seawater needed for cooling and subsequently would reduce impingement and entrainment. According to UMB, approximately 50,000 gpd of grey water would be available to be collected and treated by 2035 (May 2010 Arup Energy and Utility Master Plan). This volume represents only 0.3% of current cooling water needs.

Based on the minimal volume of stormwater currently collected from facility, EPA has concluded that the existing stormwater collection system to supplement NCCW needs would be unlikely to contribute a substantial percentage of cooling water flow and is not required at this time. EPA has concluded that re-using alternative sources of water to supplement NCCW volume should be considered in the future if the opportunity arises, but alternative water sources are not available as the BTA at UMB at this time.

Closed-Cycle Cooling

Closed-cycle cooling (CCC) recirculates cooling water and can reduce cooling water intake volumes 94 percent or better, in turn directly reducing the number of organisms entrained in the CWIS (76 FR 22200). To date, CCC is one of the most effective means of reducing entrainment and impingement because it dramatically reduces the volume of cooling water required (76 FR 22207).

UMB evaluated the feasibility of retrofitting the NCCW system with a full-scale, 100% CCC system to reduce entrainment and impingement. A complete conversion of the existing open-cycle system would require 7 mechanical draft freshwater cooling tower cells with a footprint of 60 feet wide by 120 feet long by 28 feet tall. The existing chiller system uses freshwater in the condenser loop. Therefore, potable water would be used in the wet mechanical draft cooling towers, which would result in a 100% reduction in seawater withdrawals at the CWIS and would eliminate impingement and entrainment.

Converting to a CCC system would consume 13.4 million kilowatt hours of electricity and 45.4 million gallons of potable water per year (ARUP Sea Water Cooling System Summary of Expansion Request, July 2011). In comparison, the entire campus's current potable water consumption is 15.2 million gallons per year (based on 2010 data). Among the available options, CCC has the highest capital ($5.6 million) and annual operations and maintenance costs ($125,000). The cooling towers would be located near the chiller plant, in close proximity to the library and academic buildings. A 28-foot high industrial complex next to the HarborWalk is inapposite to the campus master plan, which emphasizes opening view corridors from the interior campus to the bay. The increased noise from cooling towers may be disruptive for the nearby library and surrounding academic buildings. According to analysis provided by ARUP (June 28, 2011, permit application attachment 19), at worst case octave band analysis, a conversion to CCC would result in noise levels outside the library between 70 and 75 dB(A), equivalent to a loud radio in a typical domestic room.

Installing and operating a CCC system is technically feasible from an engineering and process perspective. CCC will eliminate the need to withdraw seawater from Savin Hill Cove, and thus the impingement and entrainment of aquatic species associated with the CWIS. However, energy and water consumption and carbon emissions from CCC conflicts with a 2007 mandate (Executive Order 484) that directs state facilities to reduce "energy consumption derived from fossil fuels and emissions associated with such consumption" with goals of a 25% reduction in greenhouse gas emissions (from 2002 baseline), a 20% reduction in energy consumption (from 2004 baseline), and a 10% reduction in potable water consumption (from 2006 baseline) by 2012. While CCC is technically feasible to install and operate at UMB, converting to a freshwater CCC system is the most costly option, and will result in non-water quality impacts, including negative impacts to aesthetics, increased noise levels near the library, and substantial increases in energy use, water use, and carbon emissions.

Variable Frequency Drive

A variable frequency drive (VFD) will allow the permittee to adjust the pumping frequency of an existing single-speed pump. Currently UMB's pumping rate is controlled by running a combination of single-speed pumps. While this allows the permittee to pump less than the design capacity at any given time, the pump rate can only be adjusted on a coarse scale, with pumping rates at 3,750 gpm, 7,500 gpm, 11,250 gpm, 15,000 gpm, or 22,500 gpm. By installing and operating VFDs on some or all of the existing single-speed pumps, UMB would be able to finely adjust the pumping rate according to the actual cooling needs of the facility. By more finely controlling the volume of water being withdrawn to meet cooling needs, UMB can reduce the overall volume of water withdrawn, and therefore, reduce adverse impacts due to impingement and entrainment.

UMB has proposed retrofitting the existing sea water pumps with VFDs in order to better match water withdrawals with cooling water demand. The permittee estimated the cost of the retro fit would be $20,000 for the small pump and $40,000 for each large pump. UMB has proposed the use of VFDs to 1) reduce seawater withdrawals, and therefore, entrainment, from existing levels even as cooling demand increases following construction of the Integrated Science Complex and General Academic Building; and 2) maintain a maximum through-screen velocity (TSV) of 0.5 fps at the intake screen to minimize impingement. UMB estimated at a worst-case pump rate of 19,756 gpm at high tide the intake velocity, both through the intake screen and at the inlet to the intake tunnel (at the baffle wall), would be about 0.5 fps. UMB proposed operating VFDs at the existing sea water pumps at a maximum rate of 13,541 gpm (19.5 MGD) and an average daily rate of 9,097 gpm (13.1 MGD). Combining a supplemental cooling tower to offset heat loads on days with high ambient temperature (see discussion in Section V.C.3) would further reduce sea water withdrawals to a maximum daily rate of 12,778 gpm (18.4 MGD) and average daily rate of 8,958 gpm (12.9 MGD). EPA has determined that VFDs are an available technology to minimize entrainment at UMB.

5. Summary

Unlike traditional manufacturing or electrical generating facility subject to CWA 316(b) requirements, which use cooling water to extract heat generated in industrial processes, in the production of electricity, or to cool raw or processed material, UMB uses its cooling water to extract heat generated from its campus heating and air conditioning needs. EPA evaluated several potential technologies to minimize adverse environmental impacts resulting from entrainment and impingement at UMB, including physical exclusion technologies, alternative water sources, closed-cycle cooling (CCC), and variable frequency drives (VFDs). The resulting BTA determination was made on a case-by-case, BPJ basis in part informed by the six statutory factors used in setting BAT effluent limitations under 40 CFR §125.3(d)(3). In addition to these factors, EPA also considers whether a technology is feasible for a facility, a comparative assessment of costs and benefits, and unique factors related to applicant.

Regarding the location of the CWIS, its location in an estuary is not ideal due to the presence of early life stages of fish and other aquatic organisms. However, an alternative location that would minimize impingement and entrainment is not available at this time.

Physical exclusion systems such as fine mesh wedgewire screens, aquatic filter barriers, and traveling screens were determined to be unavailable at UMB due the limited size and depth of the intake canal and/or pump house and potential interference with navigation in Savin Hill Cove, which are related to engineering and non-water quality impacts of the technology. An alternative source of cooling water (e.g., stormwater) sufficient to meet existing and future demand is also unavailable at this time. There are two potentially available technological options to minimize adverse impacts from impingement and entrainment at UMB: CCC and VFDs.

Impingement

Installation and operation of either CCC or VFDs will likely reduce impingement of adult and juvenile fish at UMB. Converting to a freshwater CCC system will eliminate impingement by eliminating the intake of seawater. Alternatively, operating VFDs to maintain a TSV of 0.5 fps or less, which is consistent with the recommended TSV for protection of adult and juvenile fish from impingement, will likely allow most fish to avoid becoming impinged. In addition, combining the operation of VFDs with improvements to the existing traveling screen and fish return will further reduce impingement mortality. Rotating the screen more frequently to reduce impingement duration and establishing a new, dedicated fish return system to transport impinged organisms from the traveling screen back to the receiving water will also likely improve survival of impinged organisms.

Entrainment

Converting the existing NCCW system to a CCC system is feasible based on consideration of the cooling process, process changes, and engineering aspects involved in retrofitting mechanical draft cooling towers. On the other hand, CCC is the most expensive technology and would result in non-water quality impacts (in particular, increased noise), as well as greater carbon emissions, potable water consumption, and energy use. Compared to VFDs, CCC would increase carbon emissions and energy use by 44%, and nearly triple freshwater consumption compared to 2010 campus use. In determining if CCC is BTA for UMB, EPA considered whether the loss of eggs and larvae warrant the expenditure and increase in non-water quality impacts associated with CCC.

In 2010, UMB conducted a 12-week study to estimate entrainment losses due to the intake of seawater for cooling. Based on the data, UMB estimated a loss of 15 million eggs and larvae between May and July at actual pump rates. EPA analyzed the 2010 data using a bootstrap statistical method to approximate mean entrainment (as summarized in Attachment E). This analysis suggested that UMB likely entrained between 10.6 and 25.3 million (median of 16.8 million) eggs and larvae between May and July 2010. During the 2010 study, UMB entrained a number of rainbow smelt and river herring larvae. These two species are of particular concern because both are experiencing population declines (e.g., rainbow smelt was listed as a federal Species of Concern in 2004 and a petition to list river herring under the Endangered Species Act is currently being reviewed [76 Federal Register 67652, November 2, 2011]). However, the limited dataset precludes EPA from determining if the observed entrainment rates for these species are representative of CWIS impacts at UMB. While preliminary data suggests that UMB's CWIS may cause adverse impacts due to entrainment, additional biological monitoring is necessary to adequately characterize the levels of entrainment for this facility.

Ichthyoplankton density is highly variable over both short (hourly) and long (seasonally or annually) time periods and the limited duration of the available study is not sufficient to characterize the variability to make an accurate assessment of entrainment. The statistical bootstrap procedure EPA used to produce a mean and range for entrainment is useful for comparing entrainment under different pump scenarios for the study period, but is not sufficiently robust to precisely estimate entrainment losses. More than one year of data is preferred in a determination of BTA to minimize adverse impacts due to entrainment. Adverse impacts from heated effluent is sometimes considered in conjunction with entrainment and impingement losses when determining if CCC is warranted.[17] In this case, EPA has determined that UMB's thermal effluent is protective of the biological community in Dorchester Bay (see Section V.C.3 of this Fact Sheet). At this time, EPA concludes that, based on the current knowledge of entrainment impacts at UMB, the cumulative costs of CCC are not warranted (including consideration of capital, operation, and maintenance costs, in addition to the environmental costs of increased energy use, carbon emissions, and potable water consumption). Therefore, CCC is not required at this time; however, if UMB were to install CCC, the technology would eliminate the need for sea water withdrawal and, therefore, would satisfy Section 316(b) of the CWA.

Reducing entrainment mortality through the use of VFDs to minimize sea water withdrawal is an available BTA at UMB. The permittee has proposed to install and operate VFDs on the existing pumps to adjust sea water withdrawals to meet cooling water demands and to maintain a TSV no greater than 0.5 fps at the intake screen and inlet to the intake tunnel. Reducing the intake volume will cause the temperature of the effluent to increase moderately, but EPA and MassDEP concluded that the permitted rise in temperature (10°F to 12°F dependent on tide) will continue to provide for the protection and propagation of a balanced, indigenous population of fish, shellfish, and wildlife in Dorchester Bay (see Section V.C.3 of this Fact Sheet). UMB has also proposed operation of a supplemental cooling tower located on the roof of the new science complex in order to meet the rise in temperature limit in the draft permit and ensure that a TSV of less than 0.5 fps is maintained to minimize impingement. The supplemental cooling tower would be operated when ambient air temperature is high.

VFDs, plus a supplemental cooling tower (proposed BTA), will reduce seawater withdrawals compared to existing cooling demands, and will substantially reduce sea water withdrawals in the future after the science complex and academic building are added (Table VI-1). The proposed BTA will reduce annual average sea water withdrawal by 18% compared to existing conditions and 24% compared to projected future conditions. Corresponding reductions in entrainment may be proportionally greater than withdrawals suggest because the time period

[17] For example, see the analysis in the *Clean Water Act NPDES Permitting Determinations for Thermal Discharge and Cooling Water Intake Structures* for Brayton Point Station (MA0003654) (available at http://www.epa.gov/region1/braytonpoint/index.html) and Merrimack Station (NH0001465) available at http://www.epa.gov/region1/npdes/merrimackstation/pdfs/MerrimackStationAttachD.pdf.

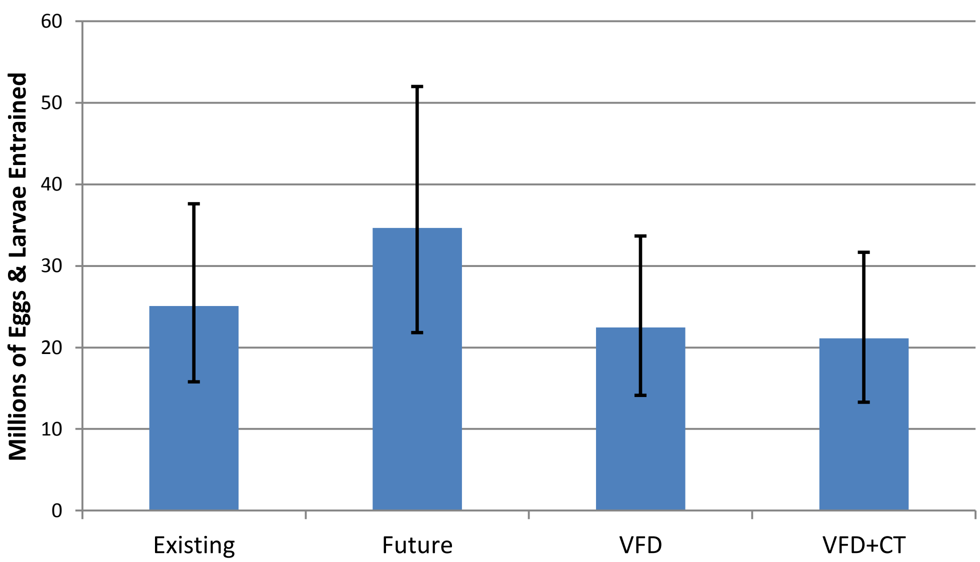
Table VI-1. Estimated annual withdrawal and pump rate under three operating scenarios.

	Existing Cooling Needs	Future Cooling Needs	VFDs + Suppl. Cooling Tower
Annual Volume (MG)	5,756	6,524	4,725
Max Pump Rate (MGD)	21.6	32.4	18.4
Annual Average Daily Pump Rate (MGD)	15.8	17.1	12.9

when densities of eggs and larvae tend to be greatest (spring), corresponds to the period when average and maximum daily pump rates are substantially lower with VFDs compared to the existing technology.

The proposed BTA will reduce entrainment compared to current levels even as future cooling demands increase with the addition of the science complex and academic building. EPA calculated a range for potential entrainment under proposed pump rates (ARUP Sea Water Intake Volume and Temperature, July 2011 Permit Application Attachment 20) at the CWIS for existing conditions, existing technology with future load, VFDs, and VFDs plus a supplemental cooling tower (Figure VI-1) (See Attachment E for explanation of bootstrap analysis).

Figure VI-1. Estimated entrainment (May through July) under four proposed pumping scenarios: existing, future, VFD, and VFD plus a supplemental cooling tower (VFD+CT). Error bars represent minimum and maximum mean value (mean range) of bootstrap sample estimates. (See Attachment E).



VFDs will enable UMB to reduce sea water withdrawals commensurate with cooling demand. Compared to the existing technology, withdrawal of sea water during the warmest period (May through September) will be substantially lower with VFDs. As cooling demand rises beyond the capacity of the existing small pump (5.4 MGD), UMB must currently operate a large pump (10.8 MGD), which automatically doubles the intake volume. With VFDs, the pump rate can be adjusted more finely between 5.4 MGD and 10.8 MGD. Control over pump speed becomes more significant as cooling demands increase with expansion of the campus and more pumps have to operate to meet demand. Based on analysis of estimated pump rates and 2010 entrainment data, VFDs will likely result in substantial reductions in entrainment with limited construction impacts and at a reasonable cost. Compared to estimated future pump rate, the proposed BTA (VFD+CT) would potentially reduce entrainment by 43%. During a year characterized by relatively high densities of eggs and larvae (based on 2010 data), the proposed BTA could save more than 20 million eggs and larvae between May and July. EPA has determined that, at this time, VFDs plus a supplemental cooling tower, as proposed by UMB, is BTA to reduce entrainment for this facility.

As illustrated in Figure VI-1, the cooling tower reduces entrainment more than VFDs alone, but because its operation is limited to the warmest days of the year, the resulting flow reductions are limited. As a supplement to the BTA requirements in the Draft Permit, EPA requires UMB to evaluate the feasibility of operating the cooling tower year-round and estimate the potential additional reductions in flow and entrainment that would result from increased operation of the cooling tower.

E. BTA Determination

Based on current CWIS operations, information available at this time, and the location, design, capacity and construction of the CWIS, EPA has determined that UMB's CWIS has the potential to cause adverse environmental impacts due to impingement and entrainment. In order to minimize adverse environmental impacts, EPA is requiring the following as BTA in Part I.D. of the Draft Permit:

(1) The permittee shall install variable frequency drives (VFDs) on at least two of the large salt water pumps and operate the VFDs in conjunction with a supplemental cooling tower to:

- Limit the maximum daily intake flow to 18.4 MGD, maximum monthly average flow to 17.2 MGD, and annual average daily flow to 12.9 MGD.

- Limit the maximum through-screen velocity to no more than 0.5 feet per second.

(2) The permittee shall rotate the traveling screen continuously, or the maximum rotation frequency recommended by the manufacturer if continuous rotation is not feasible, in order to minimize impingement duration.

(3) The permittee shall install and operate a new fish return trough that transports impinged fish and other aquatic organisms to Dorchester Bay in a separate trough from the non-contact cooling water discharge pipe. The new fish return trough shall avoid vertical drops and sharp turns or angles. The end of the new fish return trough shall be submerged at all stages of tide at a location that minimizes the potential for re-impingement.

EPA has determined that the anticipated environmental improvements to Savin Hill Cove and Dorchester Bay from these steps warrant the expenditure that would be required of the permittee. In addition, the Draft Permit requires that the permittee conduct entrainment sampling three times per week from February 15th to July 31st for the duration of the permit. EPA recognizes that intensive biological sampling can be costly. However, given the uncertainty of the magnitude of entrainment impacts and the status of several key species, EPA determined that a comprehensive biological monitoring program is necessary to characterize the entrainment impact and to determine if the BTA requirements in the Draft Permit successfully reduce entrainment losses. Finally, the Draft Permit requires the permittee to evaluate the feasibility of operating the proposed supplemental cooling tower year-round and to submit to EPA and MassDEP a *Cooling Tower Operational Study* that summarizes the results of the evaluation and estimates flow reductions, energy use, and potable water use resulting from increased operation of the cooling tower. If the permittee were to install and operate a freshwater CCC system, the need to withdraw seawater (and thus, entrainment) would be eliminated and no biological monitoring would be necessary.

VII. 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 such as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. § 1802 (10)). Adversely 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.

Essential fish habitat is only designated for 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. Table 2 includes a list of the EFH species and applicable life stage(s) for Dorchester Bay:

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod *(Gadus morhua)*	X	X	X	X
haddock *(Melanogrammus aeglefinus)*	X	X		
pollock *(Pollachius virens)*	X	X	X	X
whiting *(Merluccius bilinearis)*	X	X	X	X
red hake *(Urophycis chuss)*	X	X	X	X
white hake *(Urophycis tenuis)*	X	X	X	X

winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
yellowtail flounder *(Limanda ferruginea)*	X	X	X	X
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
American plaice *(Hippoglossoides platessoides)*	X	X	X	X
ocean pout *(Macrozoarces americanus)*	X	X	X	X
Atlantic halibut *(Hippoglossus hippoglossus)*	X	X	X	X
Atlantic sea scallop *(Placopecten magellanicus)*	X	X	X	X
Atlantic sea herring *(Clupea harengus)*		X	X	X
bluefish *(Pomatomus saltatrix)*			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a	X	X
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
summer flounder *(Paralichthys dentatus)*				X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
black sea bass *(Centropristis striata)*	n/a		X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
bluefin tuna *(Thunnus thynnus)*			X	X
Little skate (			X	X
Thorny skate			X	
Winter skate			X	

The once-through cooling system utilized by the facility has the potential to impact the EFH species and other aquatic resources in three major ways: (1) by entrainment of small organisms into and through the CWIS; (2) by impingement of juvenile and adult organisms on the intake screen; and (3) by discharging heated effluent to the receiving waters. A review of UMB's entrainment study indicates that, of the EFH species in Table 2, early life stages of hake, butterfish, yellowtail, and windowpane, as well as all stages of winter flounder are likely present in Savin Hill Cove. Additional species that are present in the vicinity of the facility, but not identified as EFH species, may be selected as prey by EFH species, such as cunner and bay anchovy. If these prey species are affected by UMB's CWIS or thermal discharge, it may indirectly affect EFH species through loss of prey. Therefore, EPA recognizes that this facility's operation has the potential to cause adverse effects to EFH species.

EPA has concluded that the limits and conditions in the Draft Permit minimize adverse effects to EFH for the following reasons:

- The Draft Permit prohibits the discharge from causing violations of the state water quality standards in the receiving water.
- The Draft Permit requires the permittee to meet the state water quality standard for mean daily temperature (80°F) and limits the rise in effluent temperature to 10°F to 12°F (dependent on tide). EPA and MassDEP are satisfied that the permitted rise in temperature will ensure the protection and propagation of a balanced, indigenous population of fish, shellfish, and wildlife in Dorchester Bay.
- As BTA for entrainment, the Draft Permit requires that the permittee install and operate variable frequency drives (VFDs) in conjunction with a supplemental cooling tower to reduce flows from existing levels to a the maximum daily limit to 18.4 MGD, maximum monthly average limit to 17.2 MGD, and an annual average to 12.9 MGD. This BTA will also minimize impingement by reducing the through-screen velocity at the intake to no greater than 0.5 fps.
- As BTA for impingement, the Draft Permit requires the permittee to make significant upgrades to the existing fish return system in order to minimize impingement mortality, including more frequent screen rotation and a new fish return trough.

Based on these requirements, EPA has determined that the Draft Permit ensures that the proposed discharge will not adversely impact EFH and that no consultation with NMFS is required. If adverse impacts to EFH do occur as a result of this permit action, or if new information becomes available that changes the basis for this determination, then NMFS will be notified and consultation will be promptly initiated. During the public comment period, EPA has provided a copy of the Draft Permit and Fact Sheet to NMFS.

VIII. 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) administers Section 7 consultations for freshwater species. The National Marine Fisheries Service (NMFS) administers Section 7 consultations for marine species and anadromous fish.

EPA has reviewed the federal endangered or threatened species of fish, wildlife, and plants to see if any such listed species might potentially be impacted by the re-issuance of this NPDES permit. Upon review of the current endangered and threatened species in the area, EPA has determined that, at this time, there are no federally threatened or endangered species present in the vicinity of the outfalls from this facility. Furthermore, effluent limitations and other permit conditions (e.g., CWIS BTA requirements) which are in place in this Draft Permit should preclude any adverse effects should there be any incidental contact with listed species either in Dorchester Bay or Savin Hill Cove.

EPA is coordinating a review of this finding with NMFS through the Draft Permit and Fact Sheet; however, further consultation under Section 7 of the ESA is not required. If adverse impacts to ESA do occur as a result of this permit action, or if new information becomes available that changes the basis for this determination, then NMFS will be notified and consultation will be promptly initiated. During the public comment period, EPA has provided a copy of the Draft Permit and Fact Sheet to both NMFS and USFWS.

IX. Monitoring

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.

X. State Certification Requirements

EPA may not issue a permit unless the MassDEP either certifies that the effluent limitations contained in this permit are stringent enough to assure that the discharge will not cause the receiving water to violate State Water Quality Standards or waives its right to such certification. EPA has requested that MassDEP certify the permit. Under Section 401 of the CWA, EPA is required to obtain certification from the state in which the discharge is located which determines that all water quality standards, in accordance with Section 301(b)(1)(C) of the CWA, will be satisfied. Regulations governing state certification are set forth in 40 CFR §124.53 and §124.55. EPA regulations pertaining to permit limits based upon water quality standards and state requirements are contained in 40 CFR §122.44(d). EPA expects that the permit will be certified.

XI. Comment Period, Hearing Requests, and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the Draft Permit is inappropriate, including the variance granted under Section 316(a) of the CWA for alternative effluent limitations for temperature, 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 Attn: Danielle Gaito, 5 Post Office Square, Suite 100 (OEP06-4), 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. A public meeting may be held if the criteria stated in 40 C.F.R. § 124.12 are satisfied. In reaching a final decision on the Draft Permit, the EPA 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 any public hearings, if such hearings are held, the EPA 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. Within 30 days following the notice of the Final Permit decision, any interested person may submit a petition for review of the permit to EPA's Environmental Appeals Board consistent with 40 C.F.R. § 124.19.

XII. EPA and MassDEP Contacts

Danielle Gaito
EPA Office of Ecosystem Protection
5 Post Office Square, Suite 100 (OEP06-4)
Boston, MA 02109-3912
Tel: (617) 918-1297 Fax: (617) 918-0297
email: gaito.danielle@epa.gov

Cathy Vakalopolous
MassDEP Division of Watershed Management
1 Winter Street, 5th Floor
Boston, MA 02108
Tel: (617) 348-4026 Fax: (617) 292-5696
email: catherine.vakalopolous@state.ma.us

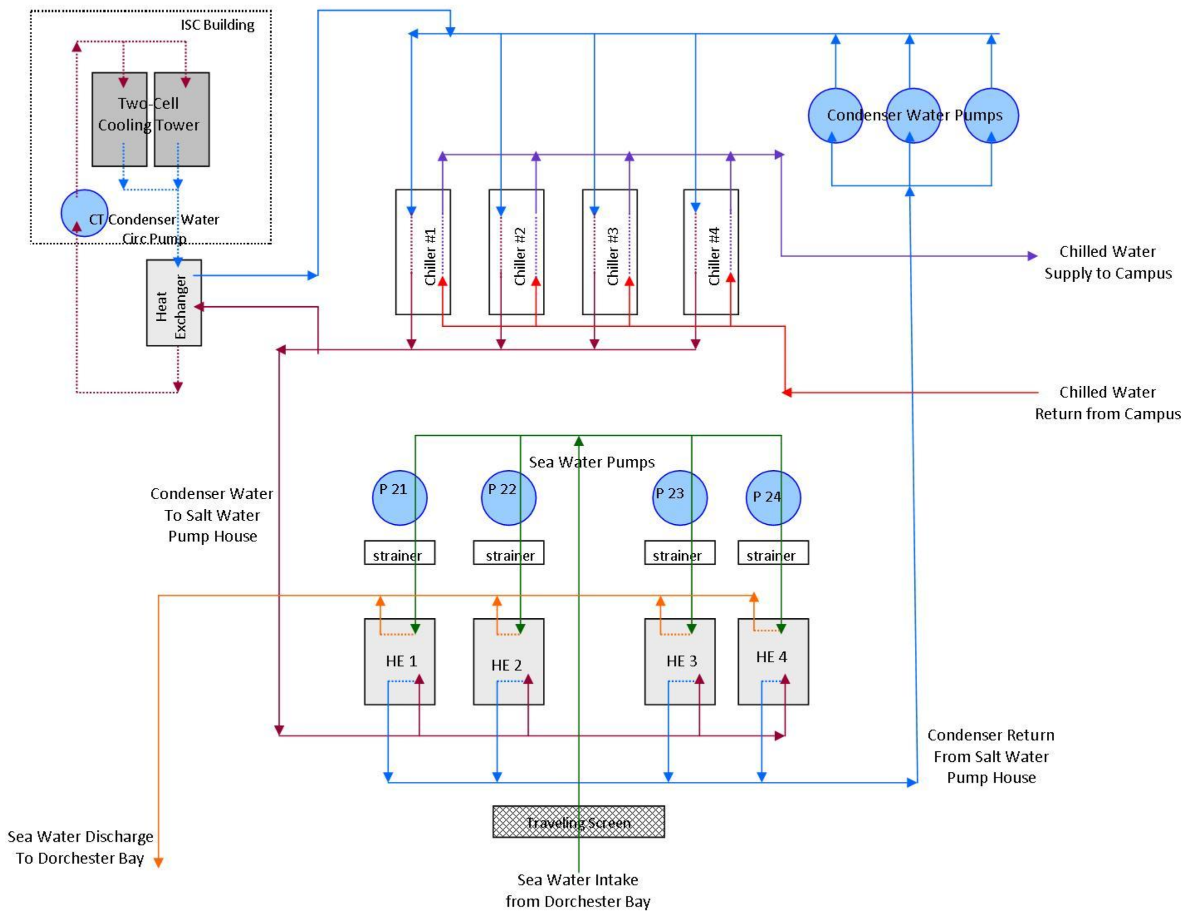
Date: ________________

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

Attachment A
Site Location

Source: MassGIS

Attachment B
Flow Diagram



Attachment C
Discharge Monitoring Report Summary
January 2002 through July 2011

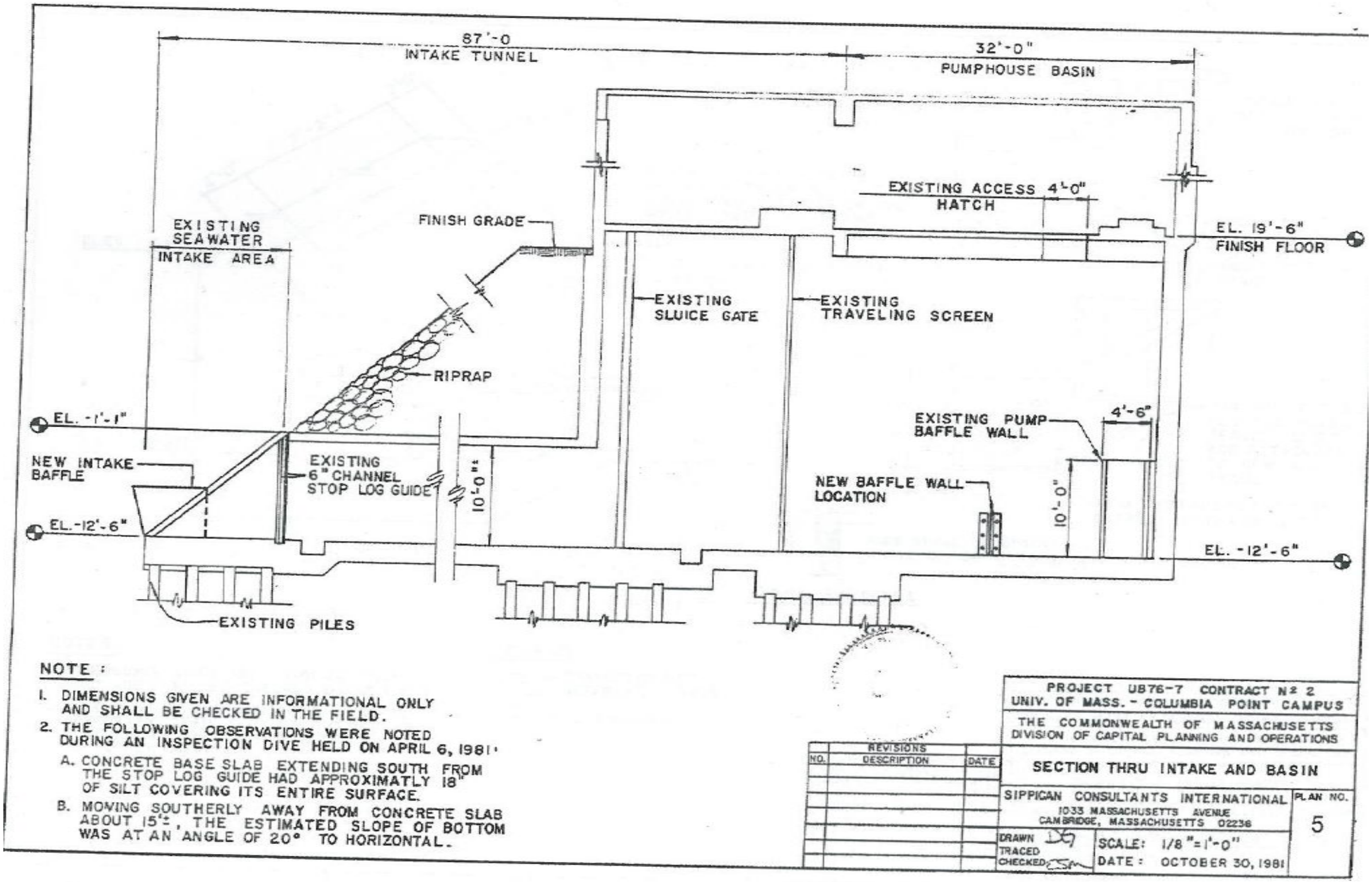
	Flow (MGD)	PH (s.u.)		Temperature (°F)	
	Daily Max	Daily Min	Daily Max	Avg Mo	Daily Max
01/31/2002	5.4	7.1	7.1	38.	41.
02/28/2002	5.4	7.1	7.2	41.	42.
03/31/2002	5.4	7.2	7.3	44.	46.
04/30/2002	10.8	7.3	7.4	46.	47.
05/31/2002	10.8	7.3	7.3	47.	50.
06/30/2002	10.8	7.3	7.3	50.	53.
07/31/2002	16.2	7.3	7.3	51.	53.
08/31/2002	16.2	7.3	7.3	52.	53.
09/30/2002	16.2	7.3	7.3	53.	56.
10/31/2002	10.8	7.3	7.3	49.	52.
11/30/2002	10.8	7.3	7.3	46.	50.
12/31/2002	10.8	7.3	7.3	44.	48.
01/31/2003	5.4	7.1	7.1	42.	44.
02/28/2003	5.4	7.1	7.2	42.	44.
03/31/2003	5.4	7.2	7.3	44.	48.
04/30/2003	10.8	7.3	7.4	46.	48.
05/31/2003	10.8	7.3	7.3	47.	50.
06/30/2003	10.8	7.3	7.3	49.	53.
07/31/2003	16.2	7.3	7.3	51.	56.
08/31/2003	16.2	7.2	7.3	52.	56.
09/30/2003	16.2	7.3	7.3	52.	55.
10/31/2003	10.8	7.3	7.3	49.	52.
11/30/2003	10.8	7.3	7.3	48.	50.
12/31/2003	10.8	7.3	7.3	44.	48.
01/31/2004	5.4	7.1	7.1	42.	45.
02/29/2004	5.4	7.1	7.2	42.	45.
03/31/2004	5.4	7.2	7.3	46.	48.
04/30/2004	10.8	7.3	7.4	46.	48.
05/31/2004	10.8	7.3	7.3	48.	51.
06/30/2004					
07/31/2004	16.2	7.3	7.3	51.	55.
08/31/2004	16.2	7.2	7.3	52.	58.
09/30/2004	16.2	7.3	7.3	52.	55.
10/31/2004	10.8	7.3	7.3	49.	53.
11/30/2004	10.8	7.3	7.3	46.	51.
12/31/2004	10.8	7.3	7.3	44.	46.
01/31/2005	5.4	7.1	7.1	40.	44.
02/28/2005	5.4	7.1	7.2	40.	42.
03/31/2005	5.4	7.2	7.3	45.	47.
04/30/2005	10.8	7.3	7.4	47.	49.
05/31/2005	10.8	7.3	7.3	47.	50.
06/30/2005	10.8	7.3	7.3	49.	52.

07/31/2005	16.2	7.3	7.3	51.	53.
08/31/2005	16.2	7.2	7.3	52.	55.
09/30/2005	16.2	7.3	7.3	54.	58.
10/31/2005					
11/30/2005	10.8	7.3	7.3	48.	50.
12/31/2005	10.8	7.3	7.3	44.	48.
01/31/2006	5.4	7.1	7.1	40.	41.
02/28/2006	5.4	7.2	7.2	41.	42.
03/31/2006	5.4	7.2	7.3	43.	47.
04/30/2006	10.8	7.3	7.4	45.	47.
05/31/2006	10.8	7.3	7.3	48.	53.
06/30/2006	10.8	7.3	7.3	53.	55.
07/31/2006	16.2	7.3	7.3	61.	65.
08/31/2006	16.2	7.2	7.3	52.	56.
09/30/2006	16.2	7.3	7.3	53.	55.
10/31/2006	10.8	7.3	7.3	48.	52.
11/30/2006	10.8	7.3	7.3	48.	50.
12/31/2006	10.8	7.3	7.3	44.	46.
01/31/2007					
02/28/2007					
03/31/2007					
04/30/2007					
05/31/2007					
06/30/2007					
07/31/2007					
08/31/2007					
09/30/2007					
10/31/2007					
11/30/2007					
12/31/2007					
01/31/2008					
02/29/2008					
03/31/2008					
04/30/2008					
05/31/2008	10.8	7.1	7.3	46.	50.
06/30/2008	10.8	7.	7.4	51.	59.
07/31/2008	16.2	7.3	7.3	55.	57.
08/31/2008	16.2	7.1	7.3	57.	60.
09/30/2008	16.2	7.	7.4	57.	62.
10/31/2008	10.8	7.2	7.4	55.	58.
11/30/2008	10.8	7.2	7.4	52.	55.
12/31/2008	10.8	7.4	7.4	47.	50.
01/31/2009	5.4	7.1	7.1	42.	45.
02/28/2009	5.4	7.1	7.2	42.	45.
03/31/2009	5.4	7.1	7.2	46.	48.
04/30/2009	10.8	7.3	7.4	46.	48.
05/31/2009	10.8	7.3	7.4	48.	51.
06/30/2009	10.8	7.3	7.3	49.	53.

07/31/2009	16.2	7.3	7.3	51.	51.
08/31/2009	16.2	7.5	7.8	55.	58.
09/30/2009	16.2	7.3	7.6	56.	61.
10/31/2009	10.8	7.	7.5	48.	54.
11/30/2009	10.8	7.	7.6	46.	49.
12/31/2009	10.8	6.8	7.5	44.	45.
01/31/2010	5.4	7.1	7.4	40.	41.
02/28/2010	5.4	7.1	7.2	40.	42.
03/31/2010	5.4	7.2	7.3	43.	45.
04/30/2010	5.4	7.2	7.3	48.	52.
05/31/2010	10.2	7.3	7.3	56.	61.
06/30/2010	21.6	7.3	7.3	60.	66.
07/31/2010	21.6	7.3	7.3	67.	79.
08/31/2010	16.2	7.2	7.3	73.	83.
09/30/2010	16.2	7.3	7.3	72.	91.
10/31/2010	16.2	7.3	7.3	62.	79.
11/30/2010	16.2	7.3	7.3	49.	59.
12/31/2010	10.8	7.3	7.3	42.	50.
01/31/2011	10.8	7.	7.3	36.	39.
02/28/2011	10.8	6.8	7.3	36.	40.
03/31/2011	10.8	6.8	7.5	41.	45.
04/30/2011	10.8	7.1	7.5	49.	58.
05/31/2011	10.8	6.9	7.6	58.	68.
Min	**5.4**	**6.8**	**7.1**	**36.0**	**39.0**
Max	**21.6**	**7.5**	**7.8**	**73.0**	**91.0**
Average	**11.2**	**7.2**	**7.3**	**48.5**	**52.3**

*Missing data indicates no data reported in DMR for that period.

Attachment D
Cooling Water Intake Structure



Attachment E
Bootstrap Analysis of UMB Entrainment Data

UMass Boston (UMB) estimated entrainment from the 2010 study data using a relatively straightforward method in which the number of organisms per taxonomic group per sample volume was extrapolated over the total seawater intake during the study period. This method assumes a constant catch rate between sampling events. For example, a single sampling event on May 28 entrained 27 stage 2 rainbow smelt larvae; UMB then assumed that 27 stage 2 rainbow smelt larvae were caught in every 100 m^3 volume withdrawn until the next sampling event on June 1. Then the June 1 sample density was extrapolated for the volume withdrawn until the next sample, and so on. Using this method, UMB estimated a total of 15,063,438 eggs and larvae were entrained during the 2010 study. While this method may be appropriate to calculate a coarse estimate for entrainment during the 2010 study, the method does not capture the variability that is inherent in this type of biological data. For example, entrainment is likely underestimated when no organisms are captured in a given sample and overestimated when a many organisms are captured. Additionally, a single year of 36 sampling events is not sufficient to accurately determine a mean and range representative of entrainment at UMB. For this dataset, the mean is 384.7 organisms per 100 m^3, but the standard deviation is 545.1 organisms. A high deviation is characteristic of skewed biological data with many low density samples and few high density samples.

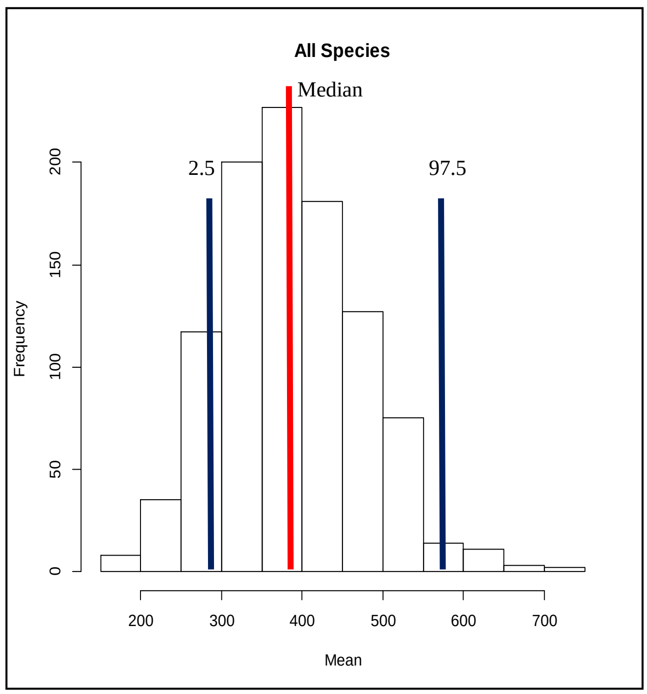


Figure 1. Frequency of n=1,000 bootstrap

If we could approximate a mean number of organisms captured per sampling volume for the study period and characterize the variability around that mean, we may establish a more accurate baseline. This baseline can then be used to compare entrainment among available entrainment technologies. Bootstrapping is a mathematical resampling method in which the variability of a statistic (here, the mean) can be estimated by measuring its properties when sampling from an approximate distribution. Using R (The R Foundation for Statistical Computing), EPA randomly resampled (with replacement) the empirical dataset of 36 sampling events for each taxonomic group 1,000 times and calculated the mean of each bootstrap sample. In this way, the 2010 study was essentially "repeated" 1,000 times using the data from 2010. "With replacement" describes the method of randomly choosing a value from the entire dataset (n=36) for each new event in a bootstrap sample.

EPA then examined the distribution of the means (n=1,000), which approximates a normal distribution (Figure 1). Considering the entire dataset of 1,000 bootstrap means, the median approximates an average year, the 25th value (i.e., 2.5%) represents a low year, and the 975th value (i.e., 97.5%) represents a high year (Table E-1). Mean values on either tail (less than 2.5% and greater than 97.5%) are considered rare events (probability of occurrence is 1:20). In comparison to UMB's estimate of 15.1 million organisms entrained during the 2010 study, values from the bootstrap analysis indicate that total entrainment was likely between 10.6 and 25.3 million organisms with a median of 16.8 million organisms.[1]

EPA used the median and 95% range to assess entrainment at proposed pump rates (existing pump rate, future pump rate, variable frequency drive, and variable frequency drive plus supplemental cooling tower) (Table E-2). The analysis and discussion of entrainment BTA is presented in Section VI of the Fact Sheet.

Table E-1. Median and range representing 95% of the dataset for bootstrap means.

	Organisms per 100 m^3
Median (of means)	378.6
2.5% Value (of means)	238.6
97.5% Value (of means)	568.4

Table E-2. Entrainment (May – July) for each proposed pump rate at median and 95% values.

	Existing	Future	VFD	VFD + CT
Median	25,071,786	34,649,827	22,440,053	21,107,968
2.5%	15,804,974	21,842,864	14,145,959	13,306,227
97.5%	37,644,105	52,025,083	33,692,682	31,692,618,

[1] Total entrainment in 2010 was calculated by multiplying median, 2.5%, and 97.5% bootstrap mean values by the actual 2010 daily pump volume and summing daily values over the study period. Similarly, total entrainment was calculated in Table E-2 using the estimated daily pump volumes under each of the four scenarios and summing over the study period. The values presented for 2010 entrainment and in Table E-2 are estimates of entrainment from May 11 to July 30 only, not annual estimates.

Response to Public Comments
University of Massachusetts, Boston
Draft National Pollutant Discharge Elimination System Permit MA0040304

In accordance with the provisions of 40 C.F.R. §124.17, this document presents responses of the Environmental Protection Agency (EPA) to comments received on the Draft NPDES Permit for the University of Massachusetts, Boston (MA0040304). The responses to comments explain and support the determinations that form the basis of the Final Permit. The Draft Permit public comment period began August 22, 2012 and ended on September 20, 2012. Upon request by the permittee, the public comment period was extended from September 27, 2012 to October 26, 2012. Comments were received from the permittee (UMass Boston).

The Final Permit is substantially identical to the Draft Permit that was available for public comment. Although EPA's decision-making process has benefitted from the comments submitted, the information and arguments presented did not raise any substantial new questions concerning the permit. EPA did, however, make certain clarifications in response to comments in addition to correcting minor typographical errors. These changes are detailed in this document and reflected in the Final Permit. A summary of the changes made in the Final Permit are listed below. The analyses underlying these changes are explained in the responses to individual comments that follow. Comments related to State Permit Conditions (Part I.G of the Draft Permit) were addressed by the Massachusetts Department of Environmental Protection (MassDEP) and included below.

Changes to Permit:

Page 1. Deleted language pertaining to effective date if no comments are received.

Page 5. Part I.C.1. Impingement rate triggering an Unusual Impingement Event was changed from 25 fish per hour to 20 fish per 6 hours and requirement to rotate screen continuously until impingement rate decreases to three or fewer fish per hour was added. (See Response to Comment 1).

Page 6. Part I.D.1.b. Requirement to rotate the screen continuously was deleted. Final Permit requires permittee to rotate screens at the maximum rotation frequency recommended by the manufacturer, but not less than once per day. (See Response to Comment 2.)

Page 6. Part I.D.1.c. Requirement for the end of the new fish return trough to be "submerged at all stages of tide" changed to "submerged at all times the traveling screen is rotated." (See Response to Comment 3).

Page 7. Part I.D.2. The timeline for the submission of the Cooling Tower Operational Study was changed from "within three years of the effective date of the permit" to "within three (3) years after initiating full operation of the supplemental cooling tower." (See Response to Comment 4).

Page 11. Part I.G.4. The state conditions pertaining to impingement monitoring were changed to better align with operation of the traveling screens as described by the permittee and to eliminate the requirement for a qualified biologist to be on site for impingement monitoring during the period when entrainment monitoring is not required. (See Response to Comments 5 and 6).

Response to Comments:

1. Unusual Impingement Event – (Part I.C.1)

UMass Boston requests that Part I.C. is clarified to better relate to the operation of UMass Boston's travelling screen system by adding the following language: "After a 6 hour cycle of UMass Boston's traveling screen, this would equate to 150 fish impinged or 600 fish in a twenty-four (24) hour period." The current configuration of the system would need to be modified to enable the collection of impinged fish. UMass Boston will undertake a study on the fish return trough to determine the feasibility of making modifications to accommodate this sampling.

Response: The impingement rate of 25 or more total fish per hour that defined an unusual impingement event in the Draft Permit was based on continuous rotation of the traveling screen. During the public comment period, UMass Boston clarified that the traveling screen rotates at a maximum frequency of once every 6 hours. Based on the impingement rate identified in the Draft Permit, 150 fish impinged during a 6-hour cycle (or 600 fish in 24-hours) would constitute an unusual impingement event. However, given the less frequent rotation of the traveling screen, the agencies have determined that fewer than 150 fish during a single rotation cycle (6 hours) could represent an unusual impingement event. As an example, unusual impingement events at other facilities that rotate traveling screens less than continuously are triggered at impingement rates of 15 to 40 fish per rotation, with most facilities operation on an 8 hour rotation schedule.

The agencies have concluded that an unusual impingement rate for the frequency of rotation at UMass Boston shall be triggered by impingement of 20 or more total fish per 6 hour cycle. This impingement rate may either be observed during normal screen operation (one rotation every 6 hours) or calculated based on actual rotation frequency in the event that automatic screen rotation is activated by a large amount of debris. In addition, consistent with other permits, the Final Permit requires that when an unusual impingement event is triggered, the permittee shall begin rotating the screens continuously until the impingement rate decreases to three or less fish per hour. EPA understands that while continuous operation of the screen is not recommended by the manufacturer (see Comment 2), continuous operation following an unusual impingement event should be limited in duration and occur only rarely, and, as such, should not interfere with maintenance of the traveling screen. The Final Permit at Part I.C.1 has been altered as follows to reflect this change:

> The permittee shall visually inspect the traveling screen at the CWIS once every twenty-four (24) hours for dead and live fish when circulating pumps are in operation. The permittee shall begin the inspection at the start of screen rotation and continue for at least one full rotation of the screen. An "unusual impingement event" (UIE) is defined as any occasion on which the permittee observes on the traveling screen, or estimates based on time-limited observations, 20 or more total fish within any 6 hour period. During the UIE, the permittee shall rotate the traveling screen continuously until impingement decreases to three (3) or fewer fish per hour.

2. Traveling Screen Operation - Best Technology Available (Part I. D.1.b.)

UMass Boston requests that the requirement to rotate the traveling screen "continuously, or at the maximum frequency recommended by the manufacturer if continuous rotation is not feasible, but no less than once per day, in order to minimize impingement duration" is removed. UMass Boston requests that the traveling screen system be permitted to continue to operate at the manufacturer recommended frequency with a cleaning every six hours, except when the screen is not operational due to required maintenance.

Currently, the traveling screen is programmed to conduct cleaning once every six hours for a 20-minute washout cycle, or four times in a 24 hour period. If a larger amount of debris or impingement occurs the screen has differential level control which will activate screen rotation. We have discussed increasing the screen rotation to continuous cycling with the manufacturer's representative and they have confirmed that continuous cycling would result in unnecessary wear, increased maintenance and potential damage to the equipment.

Response: According to the comment, UMass Boston has confirmed with the manufacturer that the maximum rotation frequency of the screen is once every 6 hours. The condition in the Draft Permit requires that the screen be rotated continuously *or* "at the maximum frequency recommended by the manufacturer if continuous rotation is not feasible, but not less than once per day." Therefore the permittee would meet the permit condition at Part I.D.1.b as written in the Draft Permit. However, given that the permittee has already confirmed that continuous rotation is not feasible, the Final Permit at Part I.D.1.b has been changed as follows:

> Rotate the traveling screen at the maximum rotation frequency recommended by the manufacturer, but not less than once per day, in order to minimize impingement duration. The manufacturer's recommended maximum screen rotation frequency shall be cited in the **CWIS Biological Monitoring Report** detailed in Part I.E.3. This requirement shall not apply to any period that the traveling screen is not in working order due to required maintenance.

3. Fish Return System Requirements - Best Technology Available (Part I.D.1.c)

UMass Boston requests that the wording of the requirement be refined to allow two (2) years for the completion of a fish return trough feasibility study. The study will provide the recommendations for design for the fish return trough and, if determined to be beneficial, will include a timetable for final design and construction. At minimum the fish return will be modified to allow monitoring for an Unusual Impingement Event as specified in Part I; Section C.

Design of the fish return trough will require considerable evaluation. The requirement for having a fully submerged outlet at all times (specifically, at low tide) does not appear to be physically possible if the pipe were to be placed in the inner bay. If the pipe outlet were recommended to be routed off shore to ensure full submergence, it is likely that considerable permitting efforts would be required, and careful cost analysis and evaluation of impacts of such an option would be warranted. Input from numerous agencies will likely be required to determine the design and location of the return trough outlet and to complete permitting for the selected location. UMASS Boston will work with the EPA and other regulatory agencies to evaluate an appropriate design, and to set up a timeline for permitting and construction of whatever fish return trough all parties agree to, based upon the feasibility study.

Response: EPA agrees that UMass Boston may be presented with multiple challenges in meeting the fish return system requirements at Part I.D.1.c. Under the Final Permit, the use of variable frequency drives will result in a higher rise in discharge temperature, at times as high as 12°F. Although this rise in temperature is not likely to impact the balanced, indigenous population of Dorchester Bay upon discharge, the sudden rise in temperature may be harmful to a fish transported from the traveling screen to the receiving water via the discharge pipe. EPA continues to believe that a dedicated fish return that maximizes the potential for safe return of fish to the receiving water is a necessary component of best technology available for this facility.

The Draft Permit at Part I.D.1.c requires that the end of the new fish return trough “shall be submerged at all stages of tide.” The traveling screen typically rotates once every 6 hours unless automatically triggered by a change in pressure. The Final Permit has been changed to require that the end of the new fish return trough “shall be submerged at all times when the traveling screen is rotated.”

EPA understands that not all permit conditions may be met on the date that the permit becomes effective. EPA anticipates that upon issuance of the final permit, an administrative compliance order will be issued by EPA or MassDEP which contains a reasonable schedule of compliance for the planning, design, and construction of a fish return system necessary to achieve compliance with the permit conditions. The permit condition at Part I.D.1.c has not been changed to reference any compliance schedule that may be agreed upon after the permit becomes final.

4. Cooling Tower Feasibility Study - Best Technology Available (Part I.D.2.)

UMass Boston requests that the requirement be modified to state that the Cooling Tower Operational Study be provided to the EPA three (3) years after the entire cooling system loop is in full operation, instead of three (3) years from the effective date of the permit. The supplemental cooling towers will be installed before the entire loop is completed and interim operation will not be representative of long - term, full system operation.

Response: It is feasible that operation of the supplemental cooling towers prior to their completion would not be representative of full system operation and that certain aspects of the Cooling Tower Operational Study would not be available for study until after the towers are installed and fully operational. In response to this comment, EPA has changed the Final Permit as follows:

> The permittee shall evaluate the feasibility of operating the supplemental cooling tower year-round. Within three (3) years after initiating full operation of the supplemental cooling tower, the permittee shall submit to EPA and MassDEP a **Cooling Tower Operational Study** that summarizes the results of the evaluation and estimates flow reductions, energy use, and potable water use resulting from increased operation of the cooling tower.

5. Impingement Monitoring – State Condition (Part I.G.4.)

UMass Boston requests:

- Reduction in the sampling requirement from year-round to coincide with the EPA sampling requirement (February 15 to July 31).
- Specification that the duration of the sampling period to be an eight (8) hour period (consistent with the EPA/MassDEP data collection requirements mandated for support of the Draft permit data submittal) rather than the 11-hour sample period specified in the MassDEP condition.
- Sampling not be conducted until the Variable Frequency Drives (VFDs) for the salt water pumps are installed and fully operational.
- Requirement for a qualified biologist to be onsite is removed. A potential alternative may be to have a state biologist be the qualified biologist on the site during some of the sampling requirements.

As currently written, this condition will require a qualified biologist to be onsite a minimum of four hours a day, three days a week, year round. This requirement poses a significant financial burden for UMASS Boston. We currently do not have staffing in-house to support this effort and would have to hire consultants which would cost the University approximately $150,000. The adjustment of this requirement to align with the sampling requirements imposed by EPA will allow UMASS Boston to facilitate both the impingement and entrainment sampling simultaneously.

The current wording of the MassDEP requirement would require that the rotating screen be run for three (3) hours of sampling, following the standard six (6) hour sampling period currently in place. This would result in a sample size of 9 hours and incur significant wear and tear on the rotating screen. Reverting to the six (6) hour sampling period utilized during the permit data collection period would result in less stress on the traveling screen system and provide a sample size that represents the actual impingement that occurs during one third of a day of system operation.

Response (prepared by MassDEP): MassDEP conferred with staff biologists from the Massachusetts Division of Marine Fisheries and the Office of Coastal Zone Management regarding the need for impingement data from UMass Boston. There is agreement that two years of impingement monitoring are needed at this facility, primarily because impingement monitoring conducted in support of UMass Boston's application for an individual permit was not adequate to accurately characterize impacts. The sampling required in the Final Permit will provide a comprehensive characterization of impingement issues at this facility. The exact specifications for this sampling have been slightly modified to reduce costs incurred by UMass Boston while ensuring that the information needed will be generated. The change has only been made because of the size of this facility's intake, which is small compared to many others, and impacts from impingement are not expected to unduly affect the resource.

An eleven-hour sampling period was never specified. MassDEP has adjusted the wording of the biomonitoring requirements so that the timing of the sampling event is more consistent with the screen-wash cycle at the facility.

MassDEP agrees that sampling should not be initiated until the variable speed drives for the pumps are installed and operational. However, if this does not occur prior to the end of the second year of this permit cycle, MassDEP requires that sampling begin so it can be completed, the data analyzed, and a report on impingement can be available for the agencies to read and discuss in time for development of the next permit.

The requirement for a qualified biologist will stand for half the year. The sampling protocols for the second half of the year have been adjusted such that a trained technician could collect the impingement sample but afterwards turn it over to a qualified biologist for measurement and identification to species. MassDEP is somewhat concerned about this second change, because it means that the sampling in the second half of the year will be "destructive" sampling – similar to gill net or other sampling protocols that result in the death of the fish sampled. According to the permittee and based on discussions with the manufacturer, the traveling screen cannot be continuously rotated, although UMass Boston will be meeting a <0.5 ft./sec through screen velocity at the intake screen. This through screen velocity has been proposed as one option to meet best technology available for cooling water intake structures in the proposed federal rulemaking under CWA Section 316(b) for existing facilities (See 76 Federal Register 22203, April 20, 2011). However, MassDEP believes it will not preclude all impingement. Due to the intermittent screen wash, some fish could be impinged for up to the entire period between screen washes. Still, sampling in the second half of the year, for at least the two year period specified, will result in the loss of this, hopefully small, number of fish.

6. Impingement Monitoring - State Condition (Part I.G.4.)

UMass Boston requests that MassDEP and/or EPA provide the following information to substantiate and validate that the State Condition for sampling frequency and requirements are standards that are being required at all and/or most similarly sized facilities with similar pumping rates, or describe why the

UMASS Boston impingement sampling requirements in the draft permit are not consistent with other similarly sized facilities. In particular, the supporting information requested is as follows:

a) Please list all other facilities that have a non-contact cooling water discharge permit under these regulations and identify which of these are also required to implement this same or significantly similar impingement sampling schedule.

b) Please provide the impingement sampling schedule and sampling requirements for each of these facilities.

c) Please identify the permitted maximum flow rates for each of these facilities.

d) If other facilities are required to have a higher or lower frequency impingement sampling requirements, please indicate the reasoning for the difference in sampling requirement for UMass Boston.

Response (prepared by MassDEP): Please see the response to question 5 above. To demonstrate that the requirement for UMass Boston is not unusual, we provide monitoring requirements from the Wheelabrator Saugus Final Permit and the General Electric Aviation Draft Permit. Neither facility has intakes quite as small as UMass Boston's, but both are still in the small-medium range. Wheelabrator Saugus has a variable flow rate that ranges from 43.2 to 60 mgd. General Electric Aviation in Lynn has a number of discharges. The one for which requirements are listed below is an intermittent 45 mgd discharge. Please note that both facilities have already produced impingement data. The requirements are somewhat different for each. The need for impingement data, and the requirements outlined in NPDES permits related to impingement monitoring, are primarily based on the quantity and quality of data currently available for the site, the nature of the resource(s) being impacted, and the degree of concern that intake-related impacts could alter the aquatic community.

1. Final NPDES Permit for Wheelabrator, Saugus:

3. Finfish: Occurrence and Abundance of Species Impinged

a. Impingement monitoring shall be conducted weekly during the months of March through October, and twice per month during November, December, January, and February. Each weekly sampling event shall consist of three four (4) hour collections that represent three separate periods of the diurnal cycle (for example, once on Monday morning at 8:00 am, once on Wednesday afternoon at 2:00 pm, and once on Friday night at 8:00 pm). Samples shall not be taken during consecutive periods of the diurnal cycle or on consecutive days.

b. The permittee shall collect aquatic organisms passing through the fish return system. Each collection shall cover a period of at least two hours following an initial cleansing screenwash and the exact time period shall be recorded. The trash racks shall also be cleaned during each sampling period and their contents examined for any fish, mammals, reptiles or invertebrates and the specific quantity and type of such organisms shall be recorded.

c. All fish will be immediately examined for initial condition (live, dead, injured). A representative sample of 25% of each fish species, up to a maximum of 50 specimens per species, alive or injured at the time of collection shall be placed in a 20-gallon holding tank supplied with continuously running ambient seawater. For the first year of the permit only, latent survival shall be determined after 48 hours, after which any live fish shall be safely returned to the subtidal waters of the Saugus River.

d. All fish shall be identified to the lowest distinguishable taxonomic category, counted, and measured (to the nearest mm total length) and the data shall be presented in the annual BMR. In the event of a large impingement event of a school of equivalently sized forage (non-commercial) fish, a subsample of 50 fish can be taken for length measurements. Twenty-four hour and monthly totals shall be extrapolated and reported. For the purposes of this permit, a large impingement event shall be defined as one which includes at least 100 fish during any of the four (4) hour collection periods noted above.

e. Annual impingement rates shall be extrapolated from the observed counts of the weekly sampling events.

4. This biological monitoring shall be conducted for the first three years of this permit. Following a request by the permittee, authorization to discontinue or modify portions of the biological monitoring program may be granted by the Regional Administrator and the Commissioner.

See: http://www.epa.gov/region1/npdes/permits/2010/finalma0028193permit.pdf

<u>Draft NPDES Permit for General Electric Aviation, Lynn</u>

b. During the operation of the Test Cell CWIS, the permittee shall conduct impingement monitoring using the methods described below.

i. Impingement monitoring shall be conducted a minimum of once per week when the Test Cell CWIS is operating. To the maximum extent practicable, a sampling event shall consist of three, non-consecutive four (4) hour collections that represent morning, afternoon, and night (e.g. once on Monday morning at 8:00 am, once on Wednesday afternoon at 2:00 pm, and once on Friday night at 8:00 pm). The permittee may conduct fewer than three samples and/or consecutive
4-hour collections if the Test Cell CWIS does not operate long enough for three, non-consecutive collections to be sampled. In the event that fewer than three samples or in the event that consecutive samples are conducted, the permittee shall provide an explanation in the CWIS Biological Monitoring Report.

ii. Sampling shall be conducted using 3/8-inch (9.5 mm) stainless steel baskets placed in the screenwash return sluiceways. Each collection shall cover a period of at least four hours following an initial cleansing screenwash and the exact time period shall be recorded. To the extent practicable, the trash racks shall also be cleaned during each sampling period and its contents examined for any fish, mammals, reptiles or invertebrates.

iii. All fish will be immediately examined for initial condition (live, dead, injured). Any fish that is alive or injured at the time of collection shall be placed in a holding tank supplied with continuously running ambient seawater. Latent survival shall be determined after 48 hours.

iv. All fish shall be identified to the lowest distinguishable taxonomic category, counted, and measured (to the nearest mm total length) and the data shall be presented in the annual CWIS BMR. In the event of a large impingement event of a school of equivalently sized forage fish, a subsample of 50 fish can be taken for length measurements. Twenty-four hour and monthly totals shall be extrapolated and reported.

v. Annual impingement rates shall be extrapolated from the sampling events This CWIS biological monitoring shall be conducted for the duration of this permit to characterize impingement and entrainment before and after implementation of BTA at CWISs, unless authorization to discontinue or modify portions of the sampling program is granted by EPA and MassDEP.

See: http://www.epa.gov/region1/npdes/permits/draft/2011/draftma0003905permit.pdf

UMASS BOSTON
UNIVERSITY OF MASSACHUSETTS BOSTON

100 Morrissey Boulevard
Boston, MA 02125-3393
P: 617.287.5000
www.umb.edu

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Ref: 71914.14

Danielle Gaito

Environmental Scientist

USEPA REGION 1 - New England

5 Post Office Square

Mail Code: OEP06-4

Boston, MA 02109-3912

Re: UMASS Boston Individual NPDES Permit Application (MA0040304) Foreword Letter

Dear Ms. Gaito,

Please find attached to this letter the permit application for a non-contact cooling water permit for the UMass Boston facility. A transmittal describing the contents of the permit application follows this letter. This letter is provided as a foreword to the application with the intent of providing information to outline the larger picture related to the goals, priorities and requirements for an economically and environmentally sustainable campus as related to options for cooling needs. Pertinent information relative to the original campus plan development and current expansion plans that contributed to the proposal are included. Figures and attachments referenced specifically in this foreword, immediately follow this letter. Additional data and attachments are included with the permit application.

UMass Boston Needs Assessment for Non-Contact Cooling Water

Current estimates of the cooling requirements for the existing campus, the new Integrated Sciences Complex and General Academic Building No. 1 show that with the seawater system alone UMass Boston does not have enough capacity to cool the entire campus (Figure 1). Based on that, we are requesting expanded use for a portion of the capacity of the existing seawater system combined with a supplemental cooling tower to be located on the roof of the Integrated Sciences Complex.

The following paragraphs summarize the findings of more than two years of discussions and research and engineering planning in response to the questions from the EPA and DEP regarding the UMASS Boston Original Application for an NPDES permit to continue using the existing sea water pump station at the campus for a portion of the campus existing and future cooling needs. More detailed information included in the attachments associated with the complete permit application show that the seawater pump system is never to be used to its full pumping capacity, and that the maximum pumping rates and temperature deltas presented are for minimal periods of time, only during the summer months, with minimal impacts.

The final request in UMASS Boston's application is to utilize the existing sea water pumps and chiller configuration, with Best Technology Available (BTA) improvements as described in the application, and a supplemental cooling tower to be utilized only during the peak summer months. This mixed configuration allows the existing system to be used, with variable frequency drives to the best extent possible (never to the maximum that it is capable of) while maintaining the required maximum intake velocity and minimizing the volume of seawater pumped and the temperature differentials at the discharge. The use of the variable frequency drives and the supplemental cooling tower allow fine tuning of pumping needs during different tidal configurations and outside temperatures. This allows the use of the system with variable results while always holding the maximum velocity at the intake below 0.5 feet per second.

In summary, after extensive review of current and anticipated campus needs to begin implementation of our 25-year Master Plan we have determined that during the worst-case summer scenario, holding the intake velocity at 0.5 feet per second or less, we will need to intake a maximum seawater volume of 18.4 Million Gallons per Day (MGD) with a maximum ΔT of 12°F. The maximum pumping rate requested is less than ½ of the capacity of the existing pump house. The average daily seawater volume will be approximately 12.9 MGD with an average annual ΔT of approximately 7.0°F for the proposed condition with supplemental cooling tower. As shown in the detailed graphs and tables included with the application, the maximum values are for short durations (often only a few hours during the day, and not for the entire day).

UMass Boston NPDES Application

Since August 2000, UMass Boston has been covered under the Massachusetts General Permit for Non-Contact Cooling water discharge (See Attachment 1 for a permitting timeline). In 2008, EPA indicated that UMass Boston was no longer eligible for coverage under the General Permit and requested that a new Notice of Intent be filed. The original application was submitted in 2008. Since then, additional analyses have been done and data has been submitted.

NPDES – Supplemental Information

In response to EPA and DEP's requests in April 2011 for supplemental information (Attachment 2) on the UMass Boston Individual NPDES application, UMass Boston is pleased to provide the following information:

- Historical Information
- Chilled Water System
- The UMass Boston 25-Year Master Plan
- UMass Boston's Commitment to Environmental Protection and Sustainability
- Why Non-contact Cooling Water is Important to UMass Boston

Historical Information

In 1969, the Massachusetts Legislature enacted, and Acting Governor Francis W. Sargent signed, Chapter 898 of the Acts of 1969 (hereinafter Chapter 898) (Figure 2), which authorized the University to acquire and fill land on Columbia Point for the purpose of planning and developing a new campus for UMass Boston. Chapter 898 is a legislative program intended to advance the public mission of the University through a comprehensive and coordinated process for long-term campus-wide development. Section 1 of Chapter 898 specifically provides for "the acquisition and development of a site for a campus of the University of Massachusetts… in… Columbia Point…

and for the preparation of long-range plans for the development of said campus and of plans for the development of said site and buildings, utilities and other improvements of said purposes, for the construction of buildings, utilities and other improvements…" As to the review of these activities, Section 5 of Chapter 898 authorizes the fill and use of the land that comprises the UMass Boston Campus, subject to "written approval" of plans for such "fill or use" by the Department of Public Works (the Massachusetts Department of Environmental Protection [DEP] has succeeded to the role of the Department of Public Works). Section 7 of Chapter 898 further clarifies that no "general and special laws or parts thereof, which prohibit, restrict, limit or regulate the height, bulk, location or use of buildings" shall apply "to any building, structure, tunnel or facility constructed under this act."

The UMass Boston campus was designed and built in the early 1970s. The original campus design included three building phases (See Figure 3):

Phase I

110 Admin (Quinn Administration)
150 Service and Supply
090 Library (Healey Library)
080 Science Building
College 020 (McCormack Hall)
College 010 (Wheatley Hall)
160 Utility Plant (UP) and Salt Water Pump House (SWPH)

Phase II

Fine Arts
120 Physical Education
080 Science II
College 050 (Academic Building I)
College 060 (Academic Building II)

Phase III

College 030 (Academic Building III)
College 040 (Academic Building IV)

The first phase was opened in September 1973 (Figure 4). At the time, the Utility Plant (UP) was envisioned to support the entire campus build-out so its components were sized appropriately to support all three phases of planned development. Phases II and III were never started. Since 1973 there have only been two buildings added to the campus. An athletic center, including a gymnasium, ice rink, and pool facility, was added in 1978, and a Campus Center was added in 2004.

Chilled Water System

When the campus was constructed in the early 1970s, the campus's cooling needs were satisfied by the chillers located in the Utility Plant, the heat from which was rejected by pumping sea water through the chillers (direct contact). The sea water was brought in via pumps at the Salt Water

Pump House (SWPH), using seawater from Savin Hill Cove. This seawater was then returned to Dorchester Bay. In the nearly 40 years of its operation, two significant upgrades to the SWPH have occurred.

Upgrade No. 1 – Elimination of direct contact seawater circulation to the Utility Plant

Direct contact of saltwater with steel and copper based mechanical equipment led to corrosion of the chiller system and piping. In 1976, a study was completed by Francis Associates/SCI on the SWPH's operation and mechanical system. In response to the study's recommendations, a closed-loop condensing water system was installed between the Salt Water Pump House and the chillers located in the Utility Plant, therefore creating the non-contact system that exists today. To exchange heat from the chillers indirectly to the sea, four plate and frame heat exchangers were installed that isolate the sea water from the closed-loop condensing system for the chillers. This upgrade resulted in the elimination of seawater circulation to the Utility Plant.

Upgrade No. 2 – Replacement of mechanical equipment

In 2007, a second upgrade was made to the aging seawater cooling systems that had exceeded their life expectancy. The upgrade consisted of replacing or rebuilding nearly all of the mechanical equipment in the SWPH. Total renovation costs were approximately $3M + equipment pre-purchases. Upgrades to the traveling screens as a BTA method as documented in the permit application were completed during this 2007 upgrade.

Today

Currently, seawater is drawn into the SWPH from Savin Hill Cove and pumped through four plate and frame heat exchangers where it indirectly cools a separate condensing loop. In the winter months, the condensing water is circulated via the Utility Plant directly into the campus chilled water loop to all buildings. This is very efficient, as the sea provides "free cooling" to the campus during the months when water temperatures are low.

During the summer months, the chillers cool the chilled water loop by transferring heat to the condenser water loop. The sea water then removes the heat from the condenser water loop by cooling the plate and frame heat exchangers.

The SWPH contains four single-speed pumps which can be used in different combinations to vary the volume pumped seasonally. Pumping rates vary from 3,750 to 26,250 gallons per minute (gpm) which is equivalent to 5.4 – 37.8 MGD. The current typical winter pumping rate is 3,750 gpm (5.4 MGD). In the summer months the pumping rate is higher averaging 11, 250 gpm (16.2 MGD). Using seawater cooling provides the campus many benefits:

1. Reduced electrical consumption / carbon footprint (from not having to use cooling towers);

2. Reduced electrical consumption /carbon footprint (from free-cooling in the winter -not having to use chillers);

3. Savings on maintenance and operating costs (from not having to provide costly chemical treatment and maintenance of cooling towers);

4. Reduced use of fresh water (from not having to supply cooling towers with treated city water, cooling towers work by evaporating water to the atmosphere).

5. Reduced noise pollution (by limiting cooling tower use)

6. Reduced visual impairments on the campus (by limiting installation of cooling towers on the campus)

The UMass Boston 25-Year Master Plan

As mentioned, the UMass Boston campus was originally constructed in the early 1970's. The campus buildings constructed at the time and now referred to as Quinn Administration Building, Healey Library, McCormack Hall, Science Center, Service and Supply, and Wheatley Hall were designed to be interconnected by means of a Plaza Level, below which two substructure levels were constructed: an upper level located above grade and a lower level located at grade. These substructure levels were designed to accommodate parking.

Years of exposure to salt-laden water has caused severe and widespread corrosion damage to the two substructure levels used for parking. Failure of the waterproofing membrane throughout the plaza level has resulted in the plaza level's widespread deterioration. Mechanical, electrical, plumbing and architectural features have also become deteriorated as well. Over the years, the response to this on-going problem had been to selectively repair and patch deteriorated areas and install shoring supports under structural elements or utility pipes where the deterioration was particularly acute.

In 2005, concerns about the structural integrity of the campus buildings constructed upon the deteriorating substructure levels, prompted UMass Boston to request the assistance of the Division of Capital Asset Management (DCAM). In August of that year, DCAM commissioned the firm of Simpson Gumpertz and Heger, Inc. (SGH) to conduct a "Study for Structural Repair of Plaza and Upper and Lower Levels UMass Boston Harbor Campus" (Massachusetts State Project No. UMB0502). This study proposed a comprehensive Conceptual Long Term Repair solution, the estimated cost of construction of which was $136 million and the estimated total project cost was $160 million.

The university also faced issues as a result of having deferred maintenance of many of its building systems; yet, its academic programs were growing in regard, its research endeavors were drawing more external financial support, and the University needed to accommodate a growing enrollment as well. Thus key leaders of DCAM and UMass Boston made a decision in 2006 to focus efforts on development of a Campus Master Plan that would address the University's growth needs, long term development, indeed that would address the highest and best use of its physical resources. The decision was made to forgo the Conceptual Long Term Repair solution in favor of an interim structural stabilization project that would mitigate the effects of the deteriorated conditions, addressing the most pressing structural and repair issues. Completion of this interim stabilization project will provide 7 to 10 years of continued use to allow for thoughtful and evidence-based decisions to be made about the campus' earliest constructed buildings. Shortly after that June 2006 decision was made, UMass Boston leaders decided to cease using the substructure levels for parking. The prescient decision to close the garage was followed closely in time (20 days) by a collapse of cast iron piping from the garage's ceiling caused by a pipe support becoming dislodged from deteriorated concrete, the very hazard outlined in the SGH study.

Work on the interim stabilization project was confirmed essential and the need for a strategically-informed Master Plan that would acknowledge and reflect a critical awareness of a number of existing conditions and future needs was undertaken.

In 2009, UMass Boston, in collaboration with the DCAM, completed an extensive and inclusive planning process that resulted in the development of a 25-Year Master Plan (Figure 5). The plan, which is supported by the UMass Board of Trustees, provides flexible and living guidelines for the transformation of the physical campus to meet the strategic goals and priorities of the university. It calls for redeveloping and renovating the Columbia Point campus with new academic facilities, improvements to existing space, residence halls, green spaces, parking garages, new roadways, and pedestrian and bicycle pathways. The Master Plan guiding Principles are found in Figure 6.

Phase 1 of the Master Plan (approximately 2008-2017) calls for planning and implementing the following priority projects:

- Relocation of the campus utilities (which currently run through the two-level substructure that is under existing campus buildings) and relocation of the campus roadway network (referred to by the campus as the Utility Corridor and Roadway Relocation project)
- New construction:
  - Utility Plant Switchgear Building
  - Integrated Sciences Complex (Site A)
  - General Academic Building No. 1 (Site O)
  - General Academic Building No. 2
  - Residence Hall No. 1
  - Pool Facility
  - Trigeneration Utility Plant
- Renovations/Upgrades:
  - Utility Plant Upgrades
  - Wheatley Hall Renovations
  - McCormack Hall Renovations
- Demolition:
  - Science Center
  - Substructure
  - Pool Facility

The campus started construction on the Integrated Sciences Complex in June 2011 (pre-construction activities including test piles commenced in the spring of 2011). It is anticipated that construction on General Academic Building No. 1 will begin in June 2012. The Utility Corridor and Roadway Relocation Project is currently in schematic design. It is anticipated that construction on this important enabling project will begin in 2012.

A timeline for the first ten years of Master Plan implementation is included as Figure 7.

UMass Boston's Commitment to Environmental Protection and Sustainability

Since UMass Boston's founding, faculty, students, and staff, emphasize teaching, research, and service activities that promote environmental protection and nurture sustainability, strive for responsible stewardship and conservation of resources, and enhance the natural environment.

Many academic programs at UMass Boston focus on environmental sciences as a discipline or within course content and train students for entry into environmental careers in regulatory offices, consulting firms, academic institutions, and many other areas. In 1990, UMass Boston became the only public university in Massachusetts to sign the Talloires Declaration (Figure 8). Composed in 1990 at an international conference in Talloires, France, this is the first official statement made by university presidents, chancellors, and rectors of a commitment to environmental sustainability in higher education. The Talloires Declaration (TD) is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities.

In 2007, UMass Boston signed on and became part of the Leadership Circle of the American College and University Presidents' Climate Commitment (Figure 9). Through the Commitment, UMass Boston joins a national effort to address global warming by garnering institutional commitments to neutralize greenhouse gas emissions, and to accelerate the research and educational efforts of higher education to equip society to re-stabilize the earth's climate. To date, more than 600 institutions have signed the commitment.

The institutions which have signed the Commitment have vowed to take specific steps in pursuit of climate neutrality such as creation of institutional structure to develop and implement plans, completion of a comprehensive greenhouse gas inventory, and development of a Climate Action Plan with specific reduction targets and timelines. Our Climate Action Plan is attached (Figure 10). It is important to note that there are targets for reductions in greenhouse gas emissions, energy consumption, reductions in potable water usage as well as other measures.

Concurrent with UMass Boston's efforts with the President's Climate Commitment, the State of Massachusetts also released a new Executive Order – No. 484 entitled "Leading by Example – Clean Energy and Efficient Buildings" in April 2007 (Figure 11). The order mandates that "state agencies shall prioritize practices and programs that address resource use at state facilities, including a reduction in energy consumption derived from fossil fuels and emissions associated with such consumption." The order also specifically notes that "all UMass campuses and all state and community colleges reduce their environmental impact. Such efforts shall include but not be limited to, the provisions of this Order to promote energy conservation and clean energy practices, as well as waste reduction and recycling, environmentally preferable procurement, toxics use reduction, water conservation, sustainable transportation, open space and natural resource protection, and improved compliance practices."

Some of the specific recommendations within Executive Order 484 as it relates to UMass Boston are included below:

Executive Order 484 Goals		**ISC (in construction)**	**GAB No. 1 (in programming)**	**UMass Boston Climate Action Plan**
Reduction in greenhouse gas emissions (25% by 2012, 40% by 2020, 80% by 2050) from 2002 baseline with no adjustment for growth, load, weather, etc.		Energy modeling predicts 20% or more-better than code-compliant building.		25% reduction by 2012 40% reduction by 2020 80% reduction by 2050
Reduce energy consumption from 2004 baseline (20% by 2012, 35% by 2020).		Energy modeling predicts 20% or more-better than code-compliant building which will qualify for NStar utility rebates		20% reduction by 2012 35% reduction by 2020
Procure 15% energy by renewable sources by 2012 and 30% by 2020.				Using clean renewable energy bonds, UMass Boston is currently doing a project to install a photovoltaic array on the Wheatley Hall roof.
Utilize bio-heat products (3%-10% by 2012).				3% bio-based for all #2 fuel oil by 2008 10% bioheat blend for all #2 fuel oil by 2012
New construction to meet Massachusetts Leadership in Energy and Environmental Design (LEED) Plus Standard	**LEED Certification** Third party commissioning Energy performance 20% better than MA Energy code Reductions in water use (50% outdoor, 20% indoor) relative to standard baseline projections. Conformance with at least ¼ identified smart growth criteria.	• Will meet MA LEED Plus std. • Will be LEED certified (anticipated Silver) • Commissioning agent – WSP, Flack & Kurtz	• Will meet MA LEED Plus std. • Will be LEED certified • Commissioning agent is being selected.	• MA LEED Plus std. • LEED certified

Executive Order 484 Goals (continued from previous page)	ISC (in construction)	GAB No. 1 (in programming)	UMass Boston Climate Action Plan
Reduce potable water consumption from 2006 baseline (10% by 2012, 15% by 2020).	All fixtures will be low flow.		10% reduction by 2012 15% reduction by 2020

The Leading by Example (LBE) Program encompasses all of Massachusetts' executive agencies and public institutions of higher education. These agencies and institutions own 70 million square feet of buildings and 8,000 vehicles, employ over 65,000 people, and include 29 college campuses. Through various initiatives, LBE works to reduce the overall environmental impacts of state government operations, particularly climate and energy impacts. Executive Order 484 establishes higher energy efficiency standards in the operation of state buildings, setting short- and long-term targets and goals to advance clean energy and efficiency, and reduce greenhouse gas emissions that contribute to global warming. In addition, the LBE Program promotes sustainability activities within state government including waste reduction, water conservation, green buildings, alternative fuels, efficient transportation, and recycling. The Program includes annual reporting and tracking of each institution's efforts.

Why Non-contact cooling water is important to UMass Boston.

UMass Boston, first and foremost is an academic institution. The University of Massachusetts Boston, one of five campuses of the University of Massachusetts, is nationally recognized as a model of excellence for urban universities. A comprehensive, doctoral-granting campus, we provide challenging teaching, distinguished research, and extensive service which particularly respond to the academic and economic needs of the state's urban areas and their diverse populations.

Everything the university does needs to relate to its mission and the guiding principles of the campus. Our operations are no exception. For a number of reasons discussed below, right now we need to limit the use of cooling towers on campus as much as possible.

When we initially applied to a new NPDES permit in December 2010; we believed at that time, based on the best information we had about the existing campus and projecting the needs of planned future buildings, that we could utilize the seawater cooling system for the entire campus. As we have begun Master Plan implementation and have actually started to design some of those future buildings, it has been necessary to adjust our plans. Current estimates of the cooling requirements for the existing campus and the new Integrated Sciences Complex and General Academic Building No. 1 show that use of the seawater pumping system with the required limitations on its use to minimize environmental impacts will not have enough capacity to cool the entire campus (Figure 1). Based on that finding, the current proposal it to use both the seawater system to a limited extent with a very controlled pumping system based on tides/temperatures and cooling needs (that can be accommodated with the addition of variable frequency drives and automated controls) and a supplemental cooling tower to be located on the roof of the Integrated Sciences Complex.

Visual Pollution, Physical Footprint, Local Climate and Noise

As we begin implementation of the Master Plan, we are focused on opening up the campus. By that we mean removing impediments around the campus to allow clear, unobstructed views and pathways. We will accomplish this by strategically placing buildings, removing the substructure and creating at grade entrances to all of our remaining buildings. We will relocate the roadway to maximize our building sites and we will strategically locate two parking structures to capture vehicular traffic at campus entrances thereby creating a more pedestrian-friendly environment. We will also utilize landscaping to create physical connections to our surrounding waterfront.

It has been suggested that we could eliminate our use of seawater if we were to install a full-capacity (7,000 tons of refrigeration) cooling tower system. If only cooling towers were to be used for the estimated cooling needs, the configuration would include approximately seven (7) towers approximately 28 ft. tall each and would take up a land area of approximately 60 feet by 120 feet. These towers would be a visual impediment to the new UMass Boston Master Plan goal of opening up view corridors from the interior of the campus towards the waterfront. We have reviewed this option and have determined that for our campus this is not the best use of our open space. At grade, this physical footprint of cooling towers would take up valuable real estate that is otherwise planned for additional academic space. Utilizing existing roof space is not an option either, as the current configuration of the campus does not have existing buildings that could support cooling tower loads on their structure without significant investment of capital dollars. In addition, the added height is another impediment to the goal of increasing views of the waterfront.

We have looked at the most current projections for the two buildings that are being worked on at present, the Integrated Sciences Complex (ISC) and General Academic Building No. 1(GAB NO.1). The building site for GAB NO.1 is Site O on the Master Plan. It is situated in the Beacons Parking Lot next to the current Science Center and our running track/soccer field. In order to provide GAB NO.1 with utilities (electrical, water, gas) our Utility Relocation and Roadway Project must meet up with GAB NO.1 prior to its construction completion. There is no other way to feed the building with utilities. In addition, our engineering team (BVH Integrated Services) who is working on schematic level design of the new utility corridor has stated that if a cooling tower were necessary to supplement cooling for GAB NO.1 the most logical place to put it would be on top of the new ISC vs. GAB NO.1. Their strong opinion was that GAB NO.1 is too far away from our Utility Plant and chillers to be effective and the location of cooling towers on those buildings is therefore not an effective solution. In addition, we have to be mindful that GAB NO.1 is located in a prominent position on campus and will frame our future campus quad. In terms of other impacts, locally, the warm moist air ejected from the cooling towers can cause fogging of nearby building windows and potential icing on surfaces nearby in colder weather.

Finally, this is an academic setting. Noise pollution generated by the cooling towers will be an issue. Regulators have required cooling towers have been replaced in other areas of Boston with seawater pumping systems specifically to eliminate unacceptable noise pollution. One such location is a condominium complex on Union Wharf in Boston (Union Wharf Condominium Trust, LLC). Specific information relative to the noise generation that would be experienced if the UMass Boston Campus utilized cooling towers for 100% the cooling needs is included in the Permit Application attachments.

Sustainability

Given the aggressive goals of the campus with respect to the President's Climate Commitment and Massachusetts Executive Order 484, the campus must continue to use the seawater cooling system first and supplement with the smallest cooling tower possible. Cooling towers require additional pumping, and utilize electric fans and fresh water to expel heat to the atmosphere. Use of full capacity cooling towers, instead of the use of the existing sea water cooling, with proposed modifications and supplemental cooling tower, will increase pollution and resource consumption, specifically by:

- Increasing fresh water consumption by 44.5 million gallons of fresh water annually versus 0.9 million gallons for the seawater system with supplemental cooling. To put this figure in context, the campus currently only consumes just over 15.2 million gallons of water per year (based on 2010 data).
- Increasing electrical consumption by 4.1 million kWh annually
- In total, increased water and electric utility costs will be approximately $ 1.03 million per year
- Increasing carbon emissions by 2,458 tons annually.

Additionally, cooling towers are a very costly and disruptive option for the UMass Boston campus:

- The cost of implementing the 100% cooling tower solution will be about $5.6 million versus $3.5 million for the variable pumping solution with supplemental cooling towers.
- Annual maintenance costs for a full-capacity cooling tower system will increase maintenance costs by over $25,000 per year.
- A full-capacity cooling tower will quadruple the required chemical treatment, including oxidizing and non-oxidizing biocides, and organic scale and corrosion inhibitors.
- A full-capacity cooling tower system would create noise levels disruptive to the campus; acoustic analysis indicates the cooling towers would be audible in neighboring Healy Library.

Very truly yours,

Zehra Schneider Graham

Deputy Director of Health and Safety

Summary Report – Non-Contact Cooling Water Discharge Permit

UMASS Boston Individual NPDES Permit Application (MA0040304)

Boston
Massachusetts

Prepared for **University of Massachusetts-Boston**
Boston, Massachusetts

Prepared by: **VHB/Vanasse Hangen Brustlin, Inc.**
Watertown, Massachusetts

ERM Consulting & Engineering, Inc., Boston MA

ARUP Engineering, Cambridge, MA

July 15, 2011

Table of Contents

List of Attachments

Attachment No.	Description	Date Submitted to Agencies
1	Email from VHB: CZM Review of UMass Boston NPDES Non-Contact Cooling Water Discharge Permit Application	2/1/2011
2	Entrainment Collection Protocol from DEP	2/3/2011
3	Cover Letter to CZM and DMF for December 2010 Permit Application Materials	2/4/2011
4	Supplemental Biological Data Submission to EPA	2/17/2011 Revised 7/15/2011
5	Supplemental Biological Analysis Spreadsheets	2/17/2011 Revised 7/15/2011
6	March 7, 2011 EPA Teleconference Notes	3/7/2011
7	ARUP Powerpoint: Sea Water Cooling System Summary of Expansion Options	3/4/2011 Revised 7/14/2011
8	Pumphouse Flow Diagram	3/11/2011
9	Letter to DEP: Summary of key topics discussed during March 2, 2011 telephone conversation	3/11/2011
10	Dorchester Bay Tides & Currents Graphic	3/31/2011

Attachment No.	Description	Date Submitted to Agencies
11	Memorandum: UMass Boston NCCW System Information Requests Pursuant to March 7, 2011 Teleconference with Attachments	4/13/2011
12	Email from EPA: UMass Meeting 4/20/2011 (regarding 316(a) variance)	4/25/2011
13	Email from EPA: Teleconference Information Request Submittal 4/13/11 (comments on 4/13 submission)	4/27/2011
14	Letter to DEP: Thermal Discharge Conditions and Variance Request for Conditions of 316(a) of the Clean Water Act	4/29/2011
15	Technical Memorandum: Supplemental Low Tide Mixing Zone Analysis (date 4/6/2011)	4/29/2011
16	Email and attachments: additional data on UMass Boston (regarding tides)	5/6/2011
17	Memo: UMass Boston NPDES Individual Non-Contact Cooling Water Permit Application (response to Item 11 from April 20 Supplemental Information Requests)	5/10/2011
18	Memo: Biological Analysis Request	5/20/2011
19	Cooling Tower Noise Data	Not submitted
20	Sea Water Volume and Temperature Data	Not submitted
21	CORMIX analysis of Current Pump House System with Future Load	Not submitted
22	Salt Water Pump House – Technical Backup regarding Shell & Tube Heat Exchanger Technology, Seawater Intake Screen Options and Methodology for Calculating Sea Water Pumping Volumes	Not submitted

Introduction

The purpose of this report is to provide supplemental information to the Environmental Protection Agency (EPA) in association with a Permit Application for a University of Massachusetts Boston (UMass Boston) National Pollutant Discharge Elimination System (NPDES) Individual Permit for the discharge of non-contact cooling water. Since the original application was submitted in October of 2008, changes to the needs of future cooling at the campus occurred, and ongoing requests for additional information were issued by the EPA and DEP.

The information provided herein is in support of the request for a permit to allow the pumping of seawater for use as non-contact cooling water for the current campus configuration as well as during the first phase of the campus master plan expansion program, which includes the addition of two new buildings (The Integrated Science Complex and the General Academic Building 1). UMass Boston does not anticipate that subsequent phases of the campus master plan expansion program will impose additional demands to the existing seawater cooling system. This Permit Application is requesting coverage for pumping rates that vary depending on tidal conditions in order to achieve specific temperature differentials and inflow velocities that have been calculated to achieve compliance with limit goals. To meet these variable temperature limits, and set maximum intake velocity limit (0.5 feet per second), additional pump controls will be implemented. The maximum pumping rates and temperature differentials at the discharge location (not the end of the mixing zone) that could occur under the pumping regime requested in this permit application are included in Attachment 20.

The rates and temperature limits in the proposed conditions analysis represent what has been calculated to be needed during the worst-case scenario. The worst case scenario assumes that the cooling system is operating at maximum demand, which includes fully occupied buildings and clear and sunny skies requiring maximum cooling needs. These conditions do not occur throughout the year. The maximum total daily volume anticicpated with the proposed pumping controls in place is 18.4 million gallons (MG), with the average daily volume equal to 12.9 MG. Detailed supporting calculations, including monthly peak and average volumes, are included in Attachment 20.

Details of the pumping conditions, potential impacts, and mitigation/Best Technologies Available (BTA) proposed for any potential impacts are specifically described in the supporting documentation for this report. This report also provides a summary of responses to request for information that have occurred since submission of the December 2010 permit application. A history of the permitting process, details of existing conditions, and a summary of prior technical investigations that have taken place was included in the December 2010 permit application.

UMass Boston representatives with its Team of consultants met with EPA and DEP Staff on April 20, 2011 to review the progress made since the December 2010 submittal and March 7, 2011 teleconference to determine information needs. The supplemental information requests that were outlined in the April 20 meeting and agreed upon via email correspondence with EPA subsequent to the meeting included the following, described in more detail in the foreword letter and final section of this report.

1. Provide outstanding thermal modeling and biological data to DEP (Supporting response in Attachment 15 and 18, respectively)
2. Amend existing permit application to accurately reflect the updated sea water cooling system/cooling tower proposal (Supporting response in permit application forms)
3. Present a comprehensive argument as to why the proposed sea water pumping system/cooling tower scenario is the preferred alternative (Supporting response in Foreword letter)
4. Explore opportunities for entrainment minimization (Supporting response in Attachment 22)
5. Provide an outline of various cooling scenarios from environmental and monetary perspective (Supporting response in Attachment 7)
6. Submit request for 316(a) variance associated with a limited exceedance of water quality standards within the mixing zone (Supporting response in Attachment 14)
7. Provide projected entrainment and impingement totals for each of the proposed variable frequency drive (VFD) pumping rates, including 0.4, 0.45 and 0.5 fps intake velocity (Supporting response in Attachment 5)
8. Provide discussion of proposed intake volume (Supporting response in the System Description section of this report, detailed table in Attachment 20)
9. Provide analysis of proposed monthly pumping, including average volume, total volume and maximum daily volume (Supporting response in Attachment 20)
10. Demonstrate how annual volume of sea water pumped was calculated (Supporting response in Attachment 22)
11. Provide thermal mixing zone analysis for 0.4, 0.45 and 0.5 fps intake velocity (Supporting response in Attachment 17)

11a. Describe schedule for proposed building construction and decommissioning of existing science building (Supporting response in Foreword)

12. Clarify proposed pumping regime (Supporting response in System Description section of this report)

Detailed responses to the supplemental information requests are summarized in this report and described in detail in the supporting attachments. Prior to this submission, as data pursuant to these requests has become available, it has been submitted to the EPA and DEP. Superseded versions of submissions, submitted to

EPA and DEP in draft format, are not included herein. The dates of revisions to previously submitted information are provided.

Currently Proposed Seawater Cooling System

This section summarizes the currently proposed seawater cooling system, including a description of cooling capacity, best technologies available (BTA) proposed for implementation, and a discussion of the intake and discharge impacts.

System Description

A detailed description of the source waterbody is included in the December 2010 application.

The pump house and cooling water intake structure (CWIS) are located on the southern side of Columbia Point peninsula in Savin Hill Cove. The non-contact cooling water discharge pipe is located to the north of the pump house, on the eastern side of the peninsula in the more open water of Dorchester Bay. The cooling water system operations are described in greater detail in December 2010 application. The locations of the non-contact cooling water intake and discharge locations are shown on Figure 1. The details of the cooling system design and operation for proposed conditions are expanded on in the ARUP Report (Attachment 22).

The existing pumping system includes four single speed pumps in the pump house that can be used in different combinations to vary the volume pumped for specific needs. The pumping rates can vary based on the number of pumps running between a minimum of 3,750 to up to a maximum of 26,250 gallons per minute (gpm). This equates to a minimum of 5.4 and maximum of 37.8 million gallons per day (MGD) at any given time. The UMass Boston cooling water flow rate typically varies between 3,750 gpm and 11,250 gpm. The intake structure generally operates 24 hours a day, 365 days a year. Daily flow monitoring in 2010 recorded a total annual pumping volume of 3,795 MG.

This permit request is not for the fixed rates as outlined here, as variable speed pumps would allow for fine tuning of pumping needs based on cooling needs, tidal conditions and temperature and velocity limits.

Under conditions requested in this permit application, the sea water cooling system would be upgraded to include variable frequency drive pumps and controls linking pumping rate to tide and temperature differential. Controls would be set to limit pumping to 0.5 fps intake velocity under all tide conditions, and the maximum temperature differential would be set to vary between 10 degrees F at low tide, 11 degrees F at mid tide and 12 degrees F at high tide. Intake velocity and temperature limits will only be reached during warmer times of the year. When cooling demand exceeds the previously mentioned maximum limits, a supplemental cooling tower consisting of two cells and proposed to be located on the proposed Integrated Science Center roof will be activated to address additional demands.

For 88.1% of the year, temperature differential will be limited to 6.5 degrees F. Average annual temperature differential will be 7 degrees F. Average annual total pumping volume will be 4,725 million gallons, with an average intake velocity of 0.29 feet per second. Sea water cooling system analyses are included in Attachment 20 and supporting methodlogy is described in Attachment 22.

The analysis of the potential increase in temperatures to the discharge water for existing and future cooling utilized very conservative worst case conditions with low tide occurring at the same time as the maximum cooling requirements each day thus resulting in the highest potential temperature differential. It is noted in the detailed report that this potential situation does not practically exist consistently, as low tide will vary on a daily basis and will not coincide with peak daily cooling needs, but for modeling purposes this assumption had to be made to evaluate the worst possible conditions, and to determine the potential level of impact.

The cooling system at UMass Boston is described in detail in the December 2010 application and Foreword. The existing cooling system includes three 2,000-ton chillers. Under current operations, no more than two chiller units are in operation at any given time; the third chiller is for system redundancy. Under future operations, with increased cooling needs from the two new buildings, the third chiller will need to be used (with a fourth additional chiller proposed to be installed for redundancy).

The discharge system consists of a single 42-inch pipe approximately two meters from the shore in Dorchester Bay. The discharge pipe is oriented perpendicular to the shore and is nearly exposed at low tide.

Best Technology Available

The supplemental Best Technology Available (BTA) analysis included in this report describes the proposed technology required to allow tide and temperature dependent pumping as well as the proposed small cooling tower proposed to provide supplemental cooling during times of extreme cooling demand.

BTA measures currently employed at the campus, and described in the December 2010 application, include:

- Four existing pumps (two sizes) that allow for reduced flows and reduced impacts in winter when less cooling water is needed.
- A traveling screen filter with low-pressure spray nozzles that prevents marine life from being impinged in pumps that was updated in 2007.
- No chemical treatment of traveling screen spray water or cooling.

- The separation between intake and outlet structures that reduces possibility of recirculation, therefore reducing the impact on surrounding water and wildlife.
- A baffle that is in place at inlet, limiting sediment and benthic creature disturbance.
- The limited distance which seawater travels before being released which reduces the possibility of contamination or leaks.
- The limited distance from the pump house to source water which provides a better chance for return of viable fish/species to the source water.
- Video monitoring of pump house operations in place and regular inspections of equipment to ensure proper functioning.
- In order to further support the evaluation of potential improvements to these operations, UMass Boston implemented an impingement and entrainment monitoring program (conducted in 2009-2010).

The additional BTA proposed to meet cooling demands of the two new buildings are listed below. These technologies are intended to work in conjunction with the current technologies, and were selected for maximum efficiency and environmental protection.

- Closed-cycle cooling (cooling towers);
- Installation of variable speed pumps; and
- Use of operation controls and restrictions.

The analysis of potential BTAs included an evaluation of 100 percent sea water versus closed loop cooling and included the temperature differential impacts as well as an energy comparison, a carbon emissions comparison, and a cost comparison (See Attachment 7). The analysis concluded that the use of a 100 percent cooling tower system would result in a cost of $5.6 million and require 45.4 million gallons of make-up water per year. The use of 100 percent cooling towers would result in a 53 percent increase in carbon emissions and an annual increase of 53 percent in energy usage over the sea water cooling system. In comparison, the use of a supplemental cooling tower system results in a cost of $3.5 million and requires only 0.9 million gallons of make-up water per year. The supplemental cooling tower would result in a 6 percent increase in carbon emissions and an annual increase of 6 percent in energy usage over the sea water cooling system. In order to minimize impacts of the seawater cooling system on impingement, entrainment and temperature, a smaller cooling tower to meet the needs of the two additional buildings during peak summer hours is proposed.

In addition to the above-mentioned BTAs, it is recommended that monitoring of the system, with improvements as described, over a 2-year time period, prior to the new buildings coming on line be completed in order to evaluate if additional operational controls may be warranted and to evaluate how the system functions.

Intake Impacts

Intake impacts are discussed below in terms of impingement, entrainment, adult equivalency and foregone production.

At the EPA's request, VHB performed supplemental impingement and entrainment analysis in support of UMass Boston's NPDES permit application. VHB coordinated with DEP to develop an acceptable methodology to evaluate impingement and entrainment occurring at the UMass Boston facility. The sampling protocol utilized was provided by the DEP. Sampling program details were included in the December 2010 application.

Attachments 4 and 5 provide a full report of the impingement, entrainment results, analysis and supporting data.

Impingement

Impingement is a measure of the fish and other organisms that are drawn into the intake channel and become trapped on the travelling screen prior to passing through the seawater pumps and chillers.

Impingement analyses were conducted for existing and proposed conditions using the impingement data collected during 2010. Overall, impingement occurring at the site was determined to be relatively minor and the majority of the fish impinged were alive at the time of collection (a 9% mortality rate was observed). The largest single sampling event, in terms of fish collected, occurred on July 28, 2010, and resulted in the collection of 20 juvenile winter flounder.

Entrainment

Entrainment is a measure of the organisims drawn into the intake channel that pass through the seawater pumps and chillers.

Entrainment analyses were conducted for existing, proposed and existing pump house plus future loads pumping conditions using the entrainment data collected during 2010. At the request of DEP, winter flounder entrainment data from the Mystic I, LLC facility was used to supplement the collected UMass data for the months of March, April and May.

An adult equivalency analysis, to determine the number of organisms that would have survived to adulthood had they not been entrained, and a foregone production analysis, to determine the number of pounds of fish that were not produced as a result of entrainment, were conducted at the request of the DEP to determine the entrainment impact on fish population. These analyses are included in Attachment 18.

Thermal Mixing Zone / CORMIX Modeling

The CORMIX mixing zone analysis was updated to describe the area/volume of water at the discharge location that is impacted by the increased temperature of the discharge water for several new scenarios, including:

1. Low tide analysis
2. Analysis of 0.4 fps and 0.45 fps intake velocity
3. Analysis of average intake velocity
4. Evaluation of current sea water pump house configuration with future loads for both peak and average conditions.

The hydraulic zone of influence calculations were not updated for this submission because the worst-case scenario (defined in the introduction to this report) hydraulic zone of influence calculated for the December 2010 application is unchanged. For a detailed description of worst-case hydraulic zone of influence calculations, see that application. The worst-case hydraulic zone of influence, defined as the percentage of the tidal zone used as cooling water, is 1.4 percent of the mean low water volume over the distance of one tidal excursion.

The mixing zone analysis of the UMass Boston cooling water discharge was updated using the CORMIX model to evaluate potential thermal impacts to the receiving water for an array of pumping and tidal conditions. The mixing zone analysis models the size of any temperature change zone as a result of increased discharge water temperature and the size of zone for which the water quality standard is exceeded. At the request of the DEP, the low tide analysis included in the August 2009 application has been revived, with the understanding that simplifying assumptions required for analysis of an extremely shallow mixing zone like that present at low tide render the results less accurate than the results for the mid and high tide analyses. The analysis performed resulted in the following conclusions:

- The thermal water quality limits are met within 77.2 feet of the centerline of the mixing zone under worst case conditions (half width of 77.2 feet). The thermal water quality limits are met within 10.8 feet of the centerline of the mixing zone under average conditions.
- The largest anticipated zone of initial dilution has a half width of 40.0 feet under worst-case conditions and 14.6 feet under average conditions.

This permit application is requesting a variance under 316(a) of the Clean Water Act for minor and infrequent exceedences of the 1.5 degree F temperature differential in the near field region. The official variance letter request, and detailed CORMIX modeling results, are described in more detail in Attachments 17 and 18 respectively.

Conclusion

The results of the technical team investigations indicate that with the existing and proposed BTA relative to the cooling water system, the intake and subsequent discharge of non-contact cooling water for the UMass Boston campus for existing conditions, and for the proposed conditions with the two new buildings on line have no significant impact on aquatic life or aesthetic quality of the harbor waters. Temperature differentials were deemed minimal even in the worst case conditions and actual conditions are to be monitored continually to confirm estimates and refine as necessary.

The installation of variable speed pumps with increased monitoring and a small closed-cycle cooling tower to provide backup cooling in extreme conditions were determined to be the most feasible technology improvements.

The proposed technological and management improvements for the operation of the seawater cooling water system will provide the necessary cooling for the campus under worst case conditions, while maximizing the protection of not only the aquatic environment, but the air quality, energy consumption, and aesthetics of the campus as well.

Attachment 3

Cover Letter to CZM and DMF for December 2010 Permit Application Materials

February 4, 2011

Vanasse Hangen Brustlin, Inc.

Ref: 71914.14

Re: **TRANSMITTAL for EPA Permit Agency Review Team**
EPA NPDES Non-Contact Cooling Water Discharge Permit Application for UMass Boston (Updated Permit Application for UMass Boston Individual NPDES Permit Issuance No. **MA 0040304**)

Included: Excerpts for Expedited Review of Proposed BTA Analysis and Final Proposal

Dear NPDES Permit Agency Review Team:

Thank you for your time, interest and willingness to expedite this preliminary review of The University of Massachusetts Boston's Individual NPDES Permit Application. As discussed with each of you, and, as requested by Mr. Gerald Szal at the Massachusetts Department of Environmental Protection, we have forwarded you via email and FEDEX, the full UMass Boston Individual NPDES Permit Application (as referenced above) for UMass Boston's noncontact cooling water (NCCW) intake and discharge.

At this time, UMass Boston is in a holding pattern in terms of finalizing its new building design plans and equipment specifications until the results of this permit application are known. The University is unable to provide a final direction to the design and engineering firms regarding the cooling system as they are waiting for direction as to whether or not the existing pump house with the improvements as presented can be used.

As a result of our discussions with EPA and DEP, we understand that it will take some time to determine the specific permit requirements and plan implementation details for the NCCW discharge and that these details cannot be completely ironed out in a short timeframe. EPA is however agreeable to working on an expedited process to make a decision whether or not to allow use of UMass Boston's existing pump house, with modifications as proposed in the application, or possibly amended pending the review. Your input is essential to this determination so we provide, by this letter, some background information relative to UMass Boston's plans and its NPDES Application.

As described, UMass Boston has undergone an extensive master planning process, culminating in a plan to transform the campus over the next 25 years. The first two projects of the Master Plan are two academic buildings, as follows:

1. An Integrated Sciences Complex (ISC), which will house the research labs of faculty in the following departments: Biology, Chemistry, Environmental, Earth and Ocean Sciences, Physics and Psychology. This building, for which Schematic Design has been completed by the design firm of Goody Clancy and Associates, will also house undergraduate Biology teaching labs, and an undergraduate "sandbox" research project

101 Walnut Street
Post Office Box 9151
Watertown, Massachusetts 02471-9151
617.924.1770 ▪ FAX 617.924.2286
email: info@vhb.com
www.vhb.com

lab, the Center for Personalized Cancer Therapy and the Developmental Sciences Research Center. Construction is projected to begin with the first test piles in April.

2. The second academic building, the General Academic Building, is in the Schematic Design phase, under William Wilson Architects. This building will house 60,000 square feet of new instructional spaces, undergraduate teaching labs, the Performing Arts Department, including a performance theater, the Art Department, including teaching studios, and the offices of the Honors College, and the Departments of Computer Science and Mathematics.

UMass Boston is requesting to use its existing pump house for cooling these two new buildings and the decision is especially critical now because the Integrated Sciences Complex design process has just entered the detailed design phase. UMass Boston's plan is to upgrade its existing pump house, which is used currently for cooling its existing campus-wide building inventory, in order to 1) improve the efficiency of their cooling system, 2) fully utilize the existing capacity to accommodate the cooling needs of the two new buildings, and, 3) implement system modifications and upgrades to comply with the requirements of the Clean Water Act and goals for minimum impacts on the habitat and environment. The results of the analysis completed over the past year, used to develop this plan, indicate that these goals can be met with the application of new Best Technologies Available (BTAs), as described in the full permit application and Appendices.

Some of the BTA improvements have already been put in place. Many of the modifications are a result of the extensive analyses that have been completed, and some of the improvements are to be provided once the plan is approved by EPA.

Some analyses and management upgrades already implemented include:

- Installation of additional temperature sensors for the intake and discharge water
- Completion of a thorough BTA Assessment for the entire system
- Completion of NPDES Stormwater MS4 Compliance Audit, Application, and update of practices with submittal of status report and current application to EPA.
- Completion of a second impingement monitoring and entrainment monitoring program during the spring and summer months of 2010 (in addition to previous monitoring data submitted) as coordinated with DEP and EPA staff and implemented as per agency specific requirements and requests for the biological/environmental assessment.
- Preparation of a plan for BTA improvements and recommended schedule for various components for improvements to the pumping/cooling system based on the findings of the BTA Assessment.
- Recommendations for campus-wide stormwater Best Management Practices (BMPs) that support sustainable stormwater management for all future construction and planning projects.
- Implementation of the campus-wide Stormwater Management Plan to improve the discharge quality of stormwater from the campus.

Many of the BTA measures that were recommended by the EPA to be evaluated are already being implemented at the campus under current operating conditions. These include:

- Four existing pumps (two sizes) that allow for reduced flows and reduced impacts in winter when less cooling water is needed.
- A traveling screen filter with low-pressure spray nozzles that prevents marine life from being impinged in pumps.
- No chemical treatment of traveling screen spray water or cooling.
- The separation between intake and outlet structures that reduces possibility of recirculation, thereby reducing the impact on surrounding water and wildlife.
- A baffle that is in place at inlet, limiting sediment and benthic creature disturbance.
- The limited distance which seawater travels before being released which reduces the possibility of contamination or leaks.
- The limited distance from the pump house to source water which provides a better chance for return of viable fish/species to the source water.
- Video monitoring of pump house operations in place and regular inspections of equipment to ensure proper functioning.

The impingement and entrainment monitoring program and mixing zone analysis were completed to provide site specific information and to evaluate the maximum efficiency of the system with minimum impacts under the absolute worst case scenarios. The results of the detailed analyses, with input from four (4) experienced engineering firms and the campus environmental, engineering and operations staff, show that the goals of compliance with EPA and DEP goals can be met with the application of system modifications and with some new BTAs. The final recommendations include:

- Installation of Variable Frequency Dives (VFDs) for existing intake pumps to maintain 0.5 fps maximum through screen velocity and to allow for variability for specific temperature and tide conditions,
- Possible modifications to the existing fish return system to return recovered marine organisms to receiving waters. While this is provided as an option, it should be noted that the actual numbers of marine organisms recovered was low, however the University is in support of furthering this proposed measure if deemed feasible and appropriate by EPA and DEP.
- Ongoing monitoring of the system to evaluate the opportunity for further refinements or improvements to the BTAs in place, and potentially some operational changes.

Included with this cover letter (sent via email on this date) is the Summary Report Section of the application and the Supplemental Impingement & Entrainment Study, (Appendix D). Although the entire report is provided, which includes detailed appendices describing the lengthy and complicated Best Technology Available analyses (Appendix B) and the Mixing Zone Analysis (Appendix C), that have been completed over the past year, Mr. Gerald Szal of DEP recommended that we provide the specific biological information as a pdf to the review team to support an expedited opinion as to the viability of the use of the existing pump house with the BTA modifications as described. Mr. Szal requested specifically that this information be provided to Mr. Jack Schwartz (Division of Marine Fisheries) and Mr. Todd Callaghan (Coastal Zone Management) as this would be critical for their expedited review. It is further requested that the results of your review be forwarded to Ms. Danielle Gaito at EPA as well as Mr. Szal.

We understand that the preparation of the Draft Permit takes time, and that the issuance of the final permit is down the line, however, it is critical that the University know at this time if the use of the existing pump house with the in-place BTA improvements and proposed additional BTA improvements is viable. We greatly appreciate your willingness to expedite this review and thank you for your help.

You may contact Kristin Kent, VHB Senior Biologist (kkent@vhb.com) 617-924-1614 with any specific questions regarding the Entrainment and Impingement study. Please also feel free contact me at (617) 924-1770 or Zehra Schneider Graham at UMass Boston (617) 287-5445 if you have questions regarding any other aspect of this submittal.

Very Truly Yours,

Karla Keeney for
Bethany Eisenberg
Director of Stormwater Services

Cc: via email
Jack Schwartz; Division of Marine Fisheries
Todd Callaghan; Department of Coastal Zone Management
Gerald Szal, DEP
Danielle Gaito; Environmental Protection Agency
Jeff Plante, Alicia Kabir; ERM
Michael Sweeney; ARUP
Zehra Schneider-Graham, Dorothy Renaghan, Michael McGerigle; UMASS Boston

Attachment 7

Arup Powerpoint: Sea Water Cooling System Summary of Expansion Options

Revised July 14, 2011

Sea Water Cooling System Summary of Expansion Request

July 14, 2011

University of Massachusetts, Boston

NOTE***: The analysis presented herein was prepared to be reflective of "Normal Case Scenario" proposed operations. It removes the Old Science Center from the "Worst Case Scenario" used in the December 10, 2010 permit submittal. The December 2010 analysis showed the "Worst Case Scenario" with the two new buildings (Integrated Science Complex and General Academic Building No.1) in place and with the Old Science Center not yet demolished. Note the worst case scenario is only anticipated to exist for a few months during construction.***

This version also includes updated cooling loads for the Integrated Science Building and the General Academic Building No.1 of 1,800 tons and 825 tons respectively. The new loads are a based on more up-to-date information from the architects and engineers, as a result of the buildings being further along in the design process versus the information available in December 2010.

This analysis is based on Typical Meteorological Year data from Boston Logan Airport with the 2 new buildings and the Old Science Center demolished.

ARUP

Proposed Variable Volume Pumping with Supplemental Cooling Tower

What will variable volume pumping control (BTA) do for the existing Sea Water Pumping System?

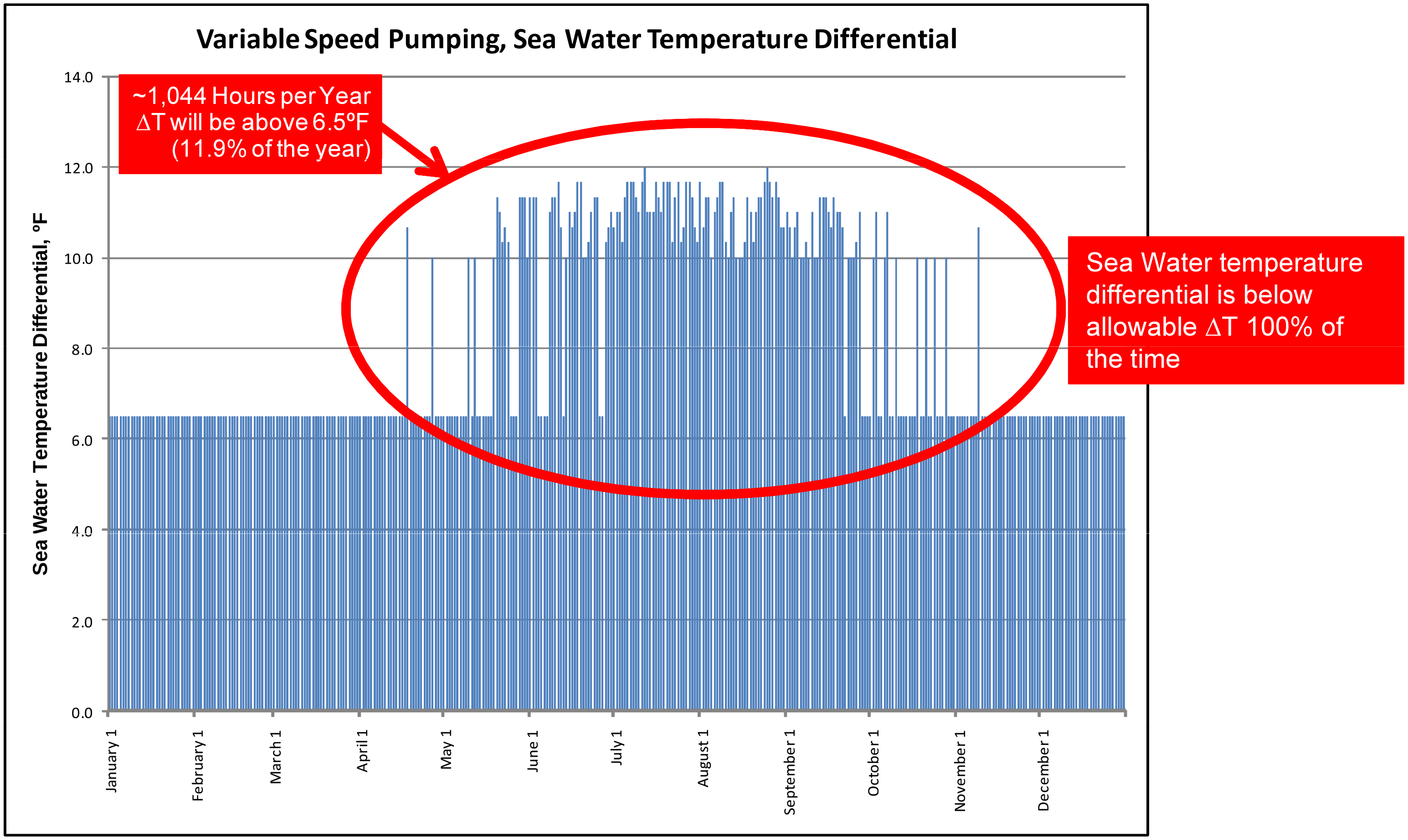
- **Impingement –** It is proposed that the existing pumping system will be controlled by variable speed drives such that intake water velocity does not exceed the **regulatory accepted and mandated maximum velocity of 0.5 foot per second at all times.**
- **Temperature Differential –** Per our best estimates, under the variable Volume pumping scheme (BTA proposed) + supplemental cooling tower the system will meet or be less than the allowable sea water discharge temperature differential 100% of the year. (Allowable sea water temperature differential is: low-tide = 10ºF max, mid-tide = 11ºF, high-tide = 12ºF.)
- **Entrainment –** The proposed system will significantly reduce the current annual volume, maximum daily volume, and average daily volume of sea water pumped. See table below.

	Millions of Gallons of Sea Water Pumped		
	Annual Total	Daily Maximum	Daily Average
Existing Pump House System: Without Future Loads (Current Condition)	5,756	21.6	15.8
Proposed Pump House Condition: Variable Intake Velocity / Variable Sea ΔT + Supplemental Cooling Tower	4,725	18.4	12.9
Proposed Reduction	1,030	3.2	2.8
Percent Reduction	18%	15%	18%

ARUP

Proposed Variable Volume Pumping with Supplemental Cooling Tower

Estimated Annual Temperature Differential Profile, Low to Peak Load Conditions



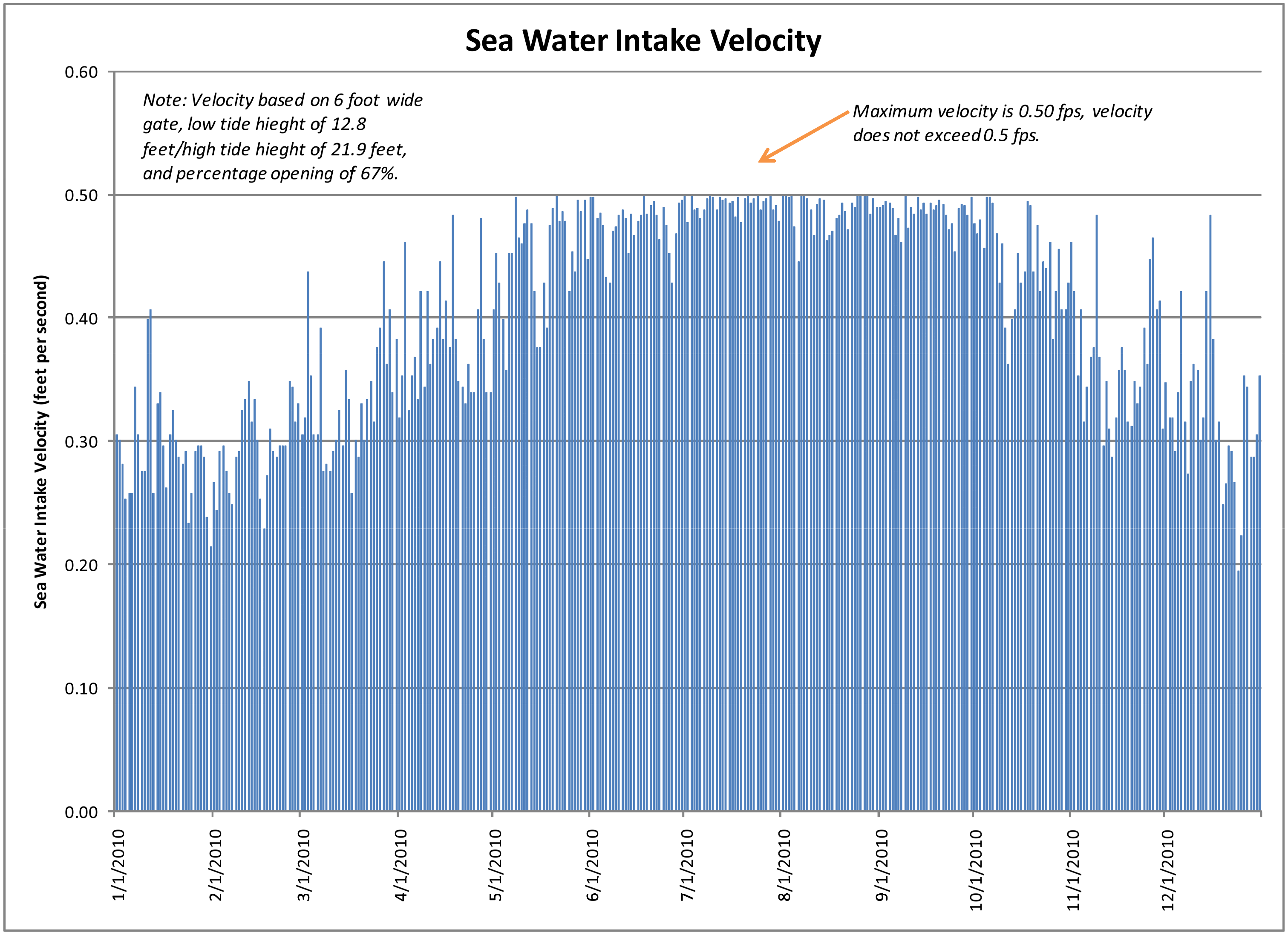
Data for Normal Case Scenario (Science Center demolished, allowable sea water temperature differential at low/mid/high tide = 10/11/12 ˚F

Note, each bar in the graph represents a temperature differential duration of 1 hour. Combined, all bars in the graph represents a full year of data (8,760 hours).

ARUP

Proposed Variable Volume Pumping with Supplemental Cooling Tower

Proposed Hourly Sea Water Flow Rate



ARUP

Comparison of Proposed Variable Volume Pumping + Supplemental Cooling Tower Option to 100% Cooling Tower System

- A 100% Cooling Tower System would eliminate cooling reliance on the sea water cooling system in entirety.
- A 100% Cooling Tower System is not recommended for several reasons that are outlined in the table below and on the following pages.
- The table below shows the environmental and cost impact of a 100% Cooling Tower System versus the Proposed Variable Volume Pumping + Supplemental Cooling Tower Option. Data for a 100% Sea Water Cooling system, while not proposed, is provided for additional context.

	Annual Energy Consumption (kWh)	Annual Water Consumption (Million Gallons)	Carbon Emmissions (tons of CO_2)	Capital Cost to Implement	Annual Utility Cost	Annual Maintenance and Operation Cost
100% Cooling Tower Cooling	13,422,319	45.4	8,006	$5,614,489	$2,438,111	$125,278
Sea Water Variable Volume + Supplemental CT Cooling	9,301,903	0.9	5,549	$3,532,793	$1,403,963	$99,384
100% Sea Water Cooling	8,784,593	0	5,240	$1,091,597	$1,317,689	$46,906

Percent Savings in comparison to 100% Cooling Tower	Energy	Water	Carbon	Capital	Utility Cost	O&M Cost
Sea Water Variable Volume + Supplemental CT Cooling	31%	98%	31%	37%	42%	21%
100% Sea Water Cooling	35%	100%	35%	81%	46%	63%

Comparison of Results, Values Show Increases in Consumption and Costs:

Variable Volume + Supplemental CT vs. 100% Cooling Tower	4,120,416	44.5	2,458	$2,081,696	$1,034,147	$25,894
100% Sea Water vs. 100% Cooling Tower	4,637,727	45.4	2,766	$4,522,892	$1,120,422	$78,372
100% Sea Water vs Variable Volume + Supplemental CT	517,310	0.9	309	$2,441,196	$86,274	$52,478

Comparison of 100% Cooling Tower System (elimination of sea water system) versus Proposed Variable Volume Pumping + Supplemental Cooling Tower

100% Cooling Tower Comparison (Slide 1)

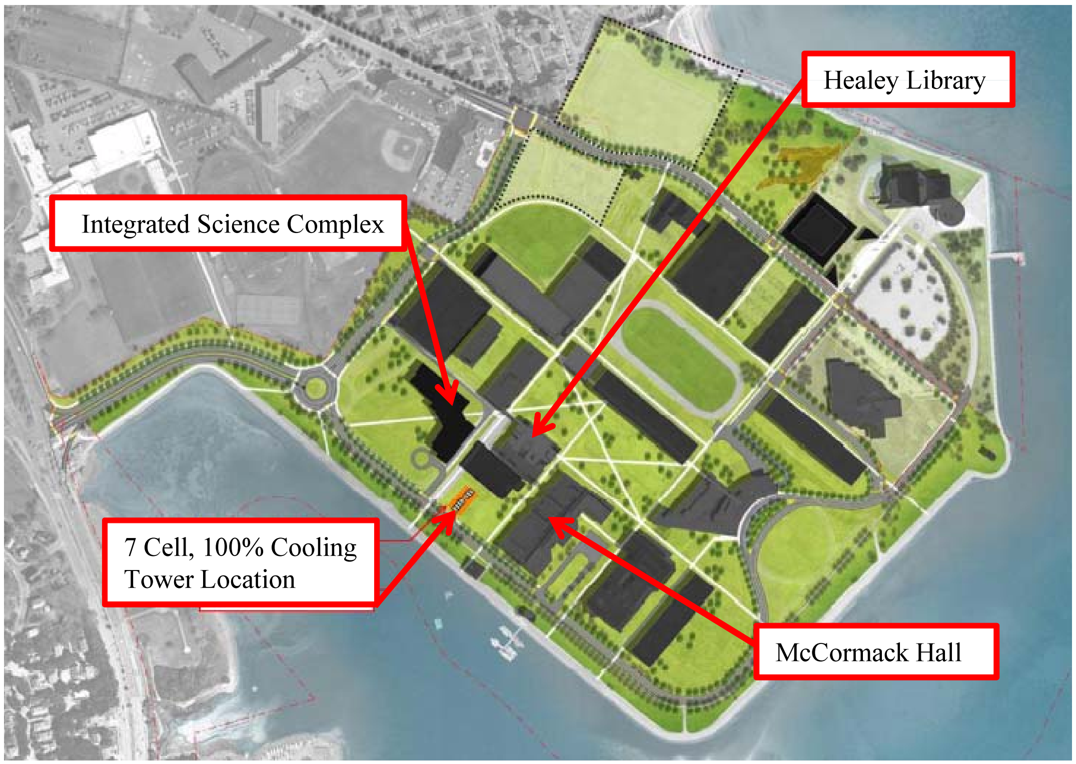
- 100% Cooling Towers (elimination of sea water system) would require more additional pumping, and utilize more fans and more fresh water to expel heat to the atmosphere; this will increase pollution and resource consumption over the proposed system:
  - Increase to UMass Boston fresh water consumption by 44.5 million gallons of fresh water annually.
  - Increase UMass Boston electrical consumption by 4,120,000 kWh annually
  - Increase UMass Boston carbon emissions by 2,458 tons annually.
- Maintenance and Utility costs will be negatively impacted in a significant manner:
  - Increased utility costs for electricity and water of about $1,034,000 annually.
  - Annual maintenance cost for the 100% cooling tower option will be about $125,000 per year, three times the current sea water cooling system budget.
  - Chemical Treatment: A 100% cooling tower system will require significantly more chemical treatment - including oxidizing and non-oxidizing biocides, and organic scale and corrosion inhibitors – then the supplemental cooling tower.

Comparison of 100% Cooling Tower System (elimination of sea water system) versus Proposed Variable Volume Pumping + Supplemental Cooling Tower

100% Cooling Tower Comparison (Slide 2)

- The capital cost of building a 100% cooling tower system is estimated to be $2,100,000 greater than the proposed system.
- A 100% cooling tower system would be significantly disruptive to the UMass Boston Campus:
  - **Noise pollution** generated by a 100% cooling tower system will be have be audible in Healy Library and surrounding academic buildings. The 100% cooling tower system will have a sound power level 15dB greater than the proposed option. This is significant and will be perceived as more than a double the loudness of the proposed option. Noise from the 100% cooling tower, 7 cell system, will be potentially problematic for Healey Library.
  - **Physical Footprint –** The towers have a large footprint of approximately 60 feet wide by 120 feet long by 28 feet tall, which would be a visual impediment to the new UMass Boston master plan that is trying to open-up view corridors from the interior of the campus to the sea. Valuable real estate would be taken up by this cooling tower system.
  - **Local Climate Impacts -** The warm moist air ejected from the cooling towers can cause fogging of nearby building windows.

Visual Impact of a 100% Cooling Tower System



The cooling towers need to sit in close proximity to the existing chiller plant. This graphic depicts the 100% cooling tower system (7 cell tower) sitting above the chiller plant. The towers will therefore be in very close proximity to Healey Library, McCormack Hall, and the new Integrated Science Complex. The tower's footprint of 120' x 60' and height of 28' would be a significant visual eyesore and block views to the sea that the new master plan is intending to recapture.

ARUP

Benefits of the Proposed Variable Volume Pumping + Supplemental Cooling Tower System

Proposed Option Benefits, Summary Slide

- The Permit Application is requesting to always pump below the full capacity of the pump station. Variable speed pumps allow the flow rate to stay significantly below existing pumping capacity at all times and to vary pump rate with tidal conditions to maintain intake velocity below 0.5 fps and to keep sea water temperature differential below the allowable maximum ΔT.
- Will provide monitoring of the existing sea water pumping system operations and allow for trending of impingement velocity and discharge temperature differential when in operation. This information can be used to propose additional operational controls, and/or verify the conditions moving forward.
- Versus other BTA's, Variable Speed Pumping + Supplemental Cooling Tower requires the smallest increase in energy consumption to support the expanded UMass Boston Campus.
- Versus other BTA's, the proposed condition will have the smallest impact on carbon footprint.
- Will require minimal fresh water consumption as compared the fresh water that would be required by a 100% cooling tower system.

Proposed Variable Volume Pumping + Supplemental Cooling Tower System Compared to a 100% Sea Water Cooling System

Proposed Option Issues, Summary Slide 1

- Cooling Towers require additional pumping, and utilize fans and fresh water to expel heat to the atmosphere; this will increase pollution and resource consumption:
  - Increase to UMass Boston fresh water consumption by 0.9 million gallons of fresh water annually.
  - Increase UMass Boston electrical consumption by 517,000 kWh annually
  - Increased utility costs for electricity and water of about $86,000 annually.
  - Increase UMass Boston carbon emissions by 309 tons annually.

Proposed Variable Volume Pumping + Supplemental Cooling Tower System Compared to a 100% Sea Water Cooling System

Proposed Option u2sues, Summary Slide 2

- The supplemental cooling tower is costly and disruptive to the UMass Boston Campus:
  - **Annual maintenance** cost for the cooling tower option will be about $100,000 per year, twice the current sea water cooling system budget, but less than the $125,000 per year cost of a 100% cooling tower system.
  - A supplemental cooling tower will require **chemical treatment**, but significantly less than a 100% cooling tower system.
  - **Noise –** The supplemental cooling towers will generate noise, but the noise is not predicted to have a significant impact on the surrounding buildings. Whereas the stronger noise level generated by a 100% cooling tower system will have a negative impact on surrounding buildings.
  - **Physical Footprint –** The towers have a large footprint of approximately 15 feet wide by 45 feet long by 15 feet tall, which would be a visual impediment to the new UMass Boston master plan that is trying to open-up view corridors from the interior of the campus to the sea. In order to keep from obscuring views and taking up valuable real estate, the towers are being included in the design of the new Integrated Science Complex (ISC). The towers will reside on the roof of the ISC, adding to construction costs.
  - **Local Climate Impacts -** The warm moist air ejected from the cooling towers can cause fogging of nearby building windows, although the roof top placement will partially help eliminate this issue.

Slide 11

u2 Not sure we want to use this slide in this way. We have to add the two towers at the ISC - so I don't think we want to say that they are disruptive - Maybe we should reverse the full replacement option with the supplemental and say these about the full replacement first then say that the two we have to add will be less disruptive than the full option? - or will be minimally disruptive?
user, 7/14/2011

BTA for Impingement /Entrainment - Existing

Similar to other nearby permitted facilities with similar pumping scenarios, UMass Boston has existing BTAs in place, including:

- Four existing pumps (two sizes) that allow for reduced flows and reduced impacts in winter when less cooling water is needed.
- A recently updated traveling screen filter with low-pressure spray nozzles that prevent marine life from being impinged in pumps.
- No chemical treatment of traveling screen spray water or cooling.
- The separation between intake and outlet structures that reduces possibility of recirculation, therefore reducing the impact on surrounding water and wildlife.
- A baffle that is in place at the inlet, limiting sediment and benthic creature disturbance.
- A limited distance from the pump house to source water which provides a better chance for return of viable fish/species to the source water.
- Video monitoring of pump house operations and regular inspections of equipment to ensure proper functioning.
- In order to further support the evaluation of potential improvements to these operations, UMass Boston implemented an impingement and entrainment monitoring program, as directed by DEP (conducted in 2009-2010).

Additional BTA for Impingement /Entrainment

Proposed BTA included in the permit to result in the least impingement and entrainment and to reduce other environmental/resource/energy consumption/sustainability concerns relative to cooling towers vs. cumulative existing and modified BTAs:

- Evaluation parameters included; compliance with EPA and DEP limits and guidelines, as well as feasibility and cost in terms of; construction, operation and maintenance, energy efficiency, noise and air quality impacts, as well as aesthetics of equipment within the campus landscape. The proposed BTA system components and/or improvements to the cooling water system that were recommended are summarized as follows:
- Installation of variable frequency drives (VFDs) for the existing intake pumps were identified as the most feasible technological improvement alternative to the existing cooling water system.
- It was determined that modifications to the existing fish return system may be warranted to return recovered marine organisms to receiving waters via a shorter route.
- It is recommended that monitoring of the system, with improvements as described, over a 2-year time period, prior to the new buildings coming on line to evaluate if additional operational controls may be warranted and to evaluate how the system functions.