EXHIBIT H

CONSERVATION LAW FOUNDATION

September 7, 2006

Hand Delivered

Mr. Roger A. Janson, Director
Municipal Permits Branch
U.S. Environmental Protection Agency
Once Congress Street, Suite 1100
Boston, MA 02114-2023

Re: Tentative Section 301(h) Decision of the Regional Administrator and Draft NPDES Permit No. 0100234 for City of Portsmouth, New Hampshire Peirce Island Wastewater Treatment Facility

Dear Mr. Janson:

The Conservation Law Foundation (CLF) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA) tentative decision denying a Section 301(h) waiver for the City of Portsmouth's Peirce Island Wastewater Treatment Facility and the accompanying draft NPDES permit. CLF is a non-profit, member-supported organization that works to solve environmental problems that threaten the people, natural resources and communities of New Hampshire and the New England region. CLF is actively engaged in efforts to protect the Great Bay estuary – a critically important natural resource facing multiple threats from growth and development – of which the Piscataqua River is an essential part.

The Tentative 301(h) Decision:

CLF strongly supports the EPA's tentative decision to deny a Section 301(h) waiver from the secondary-treatment requirements of the Clean Water Act, and we commend the EPA for reaching this important decision. As stated in the tentative decision, Congress's 1987 amendments to Section 301(h), coupled with the Section 303(d) impairment-listings of the "lower" Piscataqua River, and other estuarine assessment units in the vicinity of the Peirce Island discharge, prohibit the waiver of secondary treatment requirements. In addition to these impairments, other indicators of stress to the estuary discussed in CLF's prior comments of March 15, 2005 and May 9, 2005 (which CLF hereby repeats and incorporates into these comments by reference) also prohibit the issuance of such a waiver. Finally, while the EPA is to be commended for reversing its previous tentative decision to *grant* a Section 301 waiver, CLF is greatly concerned with the significant time that has elapsed since the facility's NPDES permit and waiver expired more than 15 years ago, in 1990. As further discussed below, CLF urges a

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prompt and aggressive schedule to ensure full and prompt compliance with the strictures of the Clean Water Act, and the draft NPDES permit.

The Draft NPDES Permit:

Again, CLF fully supports, and commends EPA for including, the draft permit's requirement of secondary treatment technology for the Peirce Island wastewater treatment facility. In addition, we offer the following comments:

- On page 6 of the draft permit, paragraph 2 states: "The discharge shall not cause a violation of the water quality standards of the receiving water." This language is an inaccurate statement of the applicable standard under the Clean Water Act and applicable regulations, which require that discharges not "cause *or contribute to*" a violation of water quality standards. (Emphasis added). The EPA's own fact sheet for the draft permit acknowledges this legal standard,[1] as does a subsequent provision of the draft permit itself.[2] The above-referenced language should be amended to include the words "or contribute to" following the word "cause."

- The draft permit imposes no effluent limitation for Ammonia Nitrogen as Nitrogen, merely imposing instead a "report only" requirement. As set forth in CLF's prior comments, increasing nutrient levels in the Great Bay estuary has become a matter of significant, growing concern. Accordingly, the EPA should establish a specific effluent limitation for Ammonia Nitrogen as Nitrogen, as well as total nitrogen. To ensure adequate safeguards in light of increasing nitrogen levels in the estuary, and to ensure maintenance of water quality standards, we urge the adoption of a 5 mg/l limit for total nitrogen.[3] Such stringent limits are needed not only to minimize the impacts of nutrients alone, but also their impacts in combination with possible warming trends, which are leading to hypoxic conditions in Rhode Island and which merit close consideration. *See* Attachment B ("Bay bottom is oxygen starved; fish won't survive," The Providence Journal, Aug. 5, 2006).

- The draft permit addresses enterococci bacteria with a "report only" requirement, rather than imposing a numerical effluent limitation. It does so based on the nature of the

[1] *See* Fact Sheet at p. 5 ("The permit must limit any pollutant or pollutant parameter (conventional, non-conventional, toxic and whole effluent toxicity) that is or may be discharged at a level that causes or has 'reasonable potential' to cause *or contribute* to an excursion above any water quality standard, including narrative water quality criteria.") (citing 40 C.F.R. § 122.44(d)(1)) (emphasis added).

[2] *See* Draft NPDES Permit at p. 9, ¶C,1,a(1) ("The [CSO] discharges may not cause *or contribute to* violations of Federal or State water-quality standards.") (emphasis added).

[3] Achieving this limit is feasible, especially considering that technology exists to achieve an effluent limit of 3 mg/l for total nitrogen. In fact, in the context of the Seacoast Region Wastewater Management Feasibility Study, in comments submitted by Mr. George Berlandi, the N.H. Department of Environmental Services (NHDES) made the initial recommendation that, "[b]ased on the State of Connecticut's Long Island Sound's TMDL," a 5 mg/l nitrogen limit should be used for wastewater treatment plants discharging to an estuary. Attachment A. With specific regard to Peirce Island, NHDES recommended 8 mg/l. *Id.*

outfall location and the assumption that the location "is not ordinarily used for recreational swimming," as well as "the lack of site specific data needed in order to access (*sic.*) the reasonable potential from the plant to contribute to a bacteria violation of the receiving water, which is on the State's list of impaired waters for enterococci bacteria." *See* Fact Sheet at p. 12. As stated in CLF's prior comments, it is important to note that primary contact recreation does in fact occur (a) in Little Harbor, where children engage in a sailing school and sometimes enter the water, and (b) on New Castle Island and in Kittery, in the vicinity of Portsmouth Harbor. Moreover, the Piscataqua River is classified as a Class B waterbody, and "swimming and other recreational purposes" are among its designated uses. *See* Fact Sheet at p. 7. These facts require the inclusion of specific effluent limitations for enterrococci bacteria, as does the receiving water's status as being impaired for such bacteria. The above-mentioned "lack of [existing] site specific data" is hardly a basis for *not* imposing such limitations. Rather, such data should be collected and should be a substantive basis for amending the draft permit to include specific limitations.

- The draft permit fails to include a time line for eliminating combined sewer overflows (CSOs). It is essential that these CSOs be addressed in the near term, and we urge an aggressive timeframe for their elimination as a term of the final permit.

- The draft permit provides that the frequency of toxicity testing can be reduced to not less than once per year, under certain circumstances, and by written request of the City. CLF urges the EPA to amend this language to require a minimum toxicity testing frequency of at least twice per year. We also urge the inclusion of language stating that if the frequency of testing is reduced, it can later be increased if warranted by testing results. Finally, CLF specifically requests that EPA provide CLF specific notice of any written request to reduce testing frequency.

- The draft permit should include a general re-opener clause to preserve all rights of re-opener pursuant to 40 CFR 122.62.

Implementation of Permit Requirements:

Though CLF commends EPA for reversing its initial, tentative decision to *grant* a Section 301(h) waiver for the Peirce Island plant, we are gravely concerned with the substantial time period (15+ years) that has elapsed during the administrative extension of the City's 1985 NPDES permit and 301(h) waiver. We are equally concerned with the prospect of future delay – which the EPA should in no way tolerate – as the City now grapples with potential alternatives to the Peirce Island plant and/or upgrades of the existing facility.

The Clean Water Act established critically important goals, and aggressive timetables for achieving those goals, that have been greatly undermined by the 15+ year administrative extension of the City's 1985 waiver and NPDES permit. As set forth in Section 301(b) of the Clean Water Act, Congress established a rigorous timetable to achieve the Act's objective "to

restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. §§ 1311(b), 1251. Pursuant to that timetable, Congress specifically provided in Section 301(b)(1)(B) that publicly owned treatment works in existence on July 1, 1977 shall, at that time, operate with effluent limitations premised on secondary treatment technologies. 33 U.S.C. § 1311(b)(1)(B). It further provided that "there shall be achieved . . . not later than July 1, 1977, any more stringent limitation, including those necessary to meet water quality standards, treatment standards, or schedules of compliance, established pursuant to any State law or regulations . . . or any other Federal law or regulation, or required to implement any applicable water quality standard established pursuant to this chapter." 33 U.S.C. § 1311(b)(1)(C). This regulatory scheme has been described as follows:

> The statute calls for a two phase program for application of effluent limitations. In Phase I, publicly-owned treatment works must provide, by July 1, 1977, secondary treatment (33 U.S.C.A § 1311(b)(1)(B)) or higher levels of treatment required to implement water quality standards (33 U.S.C.A. § 1311(b)(1)(C)), whichever is more stringent. The failure to provide secondary treatment to effluent discharge within the statutorily imposed period renders that publicly-owned treatment plant ineligible for a discharge permit, and hence in violation of the law. Phase II increases the standard of regulation by requiring public plants to utilize the best practicable waste treatment technology in order to qualify for a discharge permit. 33 U.S.C.A. § 1311(b)(2)(B). The duty of enforcement of these limitations and deadlines is imposed upon the EPA and the right to require such enforcement is granted to private citizens. 33 U.S.C.A. §§ 1319, 1365.

State Water Control Bd. v. Train, 424 F.Supp. 146, 147-48 (E.D. Va. 1976).

Under Section 301(i) of the Act, Congress specifically provided the opportunity for "municipal time extensions." 33 U.S.C.A. § 1311(i). Specifically, Congress provided that where construction is required to comply with the above requirements of subsection (b)(1)(B) or (b)(1)(C) of Section 301, "but (A) construction cannot be completed within the time required in such subsection, or (B) the United States has failed to make financial assistance under this chapter available in time to achieve such limitations by the time specified in such subsection," the plant owner may request a time extension to come into compliance. *Id.* The Act requires that such a request be filed with the EPA "within 180 days after February 4, 1987." *Id.* Of particular significance, Section 301(i) goes on to state in pertinent part:

> The [EPA Regional] Administrator . . . may grant such request and issue or modify such a permit, which shall contain a schedule of compliance for the publicly owned treatment works based on the earliest date by which . . . financial assistance will be available from the United States and construction can be completed, *but in no event later than July 1, 1988. . . .*

33 U.S.C. § 1311(i) (emphasis added).[4]

As the above statutory provisions demonstrate, the Clean Water Act created an aggressive schedule by which municipalities were required to implement secondary treatment and satisfy water quality standards. Together, these provisions establish that EPA has no authority to extend the Act's secondary-treatment standard deadlines beyond July 1, 1988. *See United States v. City of Hoboken*, 675 F.Supp. 189, 194 (D.N.J. 1987).[5] In *Hawaii's Thousand Friends v. City and County of Honolulu*, 821 F.Supp. 1368 (D. Has. 1993), for example, it was held that EPA lacked authority to allow, through an administrative consent order, the discharge of primary-treated effluent after July 1, 1988. There, Hawaii's Department of Health (DOH) had entered a 1985 consent order which contained interim effluent limitations and a construction schedule developed with approval and direction from the EPA. Thereafter, on July 1, 1985, DOH granted the subject plant an NPDES permit prohibiting the discharge of primary or advanced primary sewage effluent, and establishing effluent limitations "pegged to the *secondary treatment* requirements of the Clean Water Act." *Id.* at 1377 (emphasis in original). Despite this permit, the EPA apparently intended and believed (as did DOH and the discharger) that the interim effluent limits set forth in the consent order would remain effective after July 1, 1988. *Id.* In a decision invalidating this approach, the *Hawaii's Thousand Friends* court ruled:

> Neither EPA nor its state agent, DOH, has authority to extend secondary treatment deadlines or grant permits to discharge at less than secondary levels beyond July 1, 1988. Accordingly, the provisions in the 1985 consent order between the city and DOH purportedly lowering the effluent limitations for the plant are of no effect after the statutory municipal compliance deadline of July 1, 1988.

Id. at 1393.

Here, the Peirce Island facility will be in violation of its NPDES permit immediately upon such permit becoming effective. According to the EPA's Fact Sheet:

> EPA intends to develop a schedule for the construction of secondary treatment facility(s). EPA plans to work with the City and the United States Department of Justice to modify the existing judicial Consent Decree that the City of Portsmouth entered into with the United States to include an implementation schedule. The modified Consent Decree will contain the key milestones and implementation dates. EPA also expects to set interim limits and conditions that the City will need to meet until the secondary treatment facility is operational.

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[4] A prior version of Section 301(i) contained a deadline of July 1, 1983. The section was subsequently amended to provide the current deadline of July 1, 1988.

[5] The *City of Hoboken* case was decided under previous language of Section 301(i) and, therefore, states that it is "clear that EPA had no authority to extend secondary-treatment standard deadlines beyond July 1, 1983," as opposed to July 1, 1988.

Fact Sheet at p. 16. As in the *Hawaii's Thousand Friends* case, EPA intends to allow a period of time during which the Peirce Island plant's wastewater discharges will not satisfy the secondary-treatment requirements of the Clean Water Act and the yet-to-be-issued NPDES permit. The Act makes clear, however, that ever since July 1, 1988, the EPA has lacked statutory authority to sanction such discharges. *See* 33 U.S.C. § 1311(i); *City of Hoboken*, 675 F.Supp. at 194 ; *Hawaii's Thousands Friends*, 821 F.Supp. at 1393.[6] Thus, the EPA is without statutory authority to pursue its intended course of action.

Without in any way waiving concerns regarding the legality of EPA's intended course of action, CLF comments as follows:

- Any interim limits and conditions developed by the EPA should be subject to public review and comment.

- We strongly question whether the re-opening and modification of the existing judicial consent decree – which was executed in 1990, and which in no way addresses the significantly new standards now at issue as a result of the imminent 301(h) waiver denial – is proper. Rather, should the EPA use a judicial consent decree as a vehicle for achieving compliance and establishing an enforceable implementation schedule, we urge it to initiate a new and separate action such that the parties are afforded a meaningful opportunity to address the issues as they currently exist. CLF requests that it be provided specific notice of the public's right, pursuant to 28 C.F.R. § 50.7, to review and comment on any consent decree prior to its approval and entry by the U.S. District Court.

- Although we struggle to understand the legality of any approach that sanctions the Pierce Island facility's discharge with less than secondary treatment, under no circumstances should the EPA allow a period in excess of the NPDES permit term (i.e., 5 years) for the City to implement secondary treatment and meet the effluent limits of the permit. Allowing a period in excess of the permit term would amount to a *de facto* granting of the City's requested 301(h) waiver – a waiver the EPA admits cannot legally be issued. In light of the substantial time that has elapsed since the expiration of the 1985 waiver and NPDES permit – a time period that flies in the face of the clear intent of the Clean Water Act and the rigorous implementation timeframe set forth therein – the EPA must demand and obtain prompt implementation such as to ensure compliance with the yet-to-be issued NPDES permit during its five-year term.

[6] The *Hawaii's Thousand Friends* court noted that at the time the subject 1985 consent order was drafted, "it was EPA Region IX policy to issue these orders administratively rather than through judicial means." *Hawaii's Thousand Friends*, 821 F.Supp. at 1377. Nothing in the decision indicates that use of a judicial consent decree would have somehow rendered EPA's sanctioning of post-July 1, 1988 primary treatment legal.

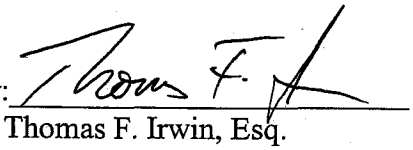
Request to extend deadline for closing the record:
CLF respectfully requests that the EPA keep the record for this public hearing open for an additional 14 days, to allow CLF to respond in writing to any comments submitted by the City, or others, warranting a reply.

* * * * * *

Again, CLF appreciates the opportunity to submit these comments. Should the EPA have any questions regarding these comments, please do not hesitate to contact undersigned counsel.

Respectfully submitted,

Conservation Law Foundation

By: 

Thomas F. Irwin, Esq.
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ATTACHMENT A

METCALF & EDDY DRAFT METHODOLOGY MEMORANDUMS
LISTING OF COMMENTS RECEIVED as of July 18, 2005

1. SANDRINE THIBAULT, GB ESTUARY COMMISSION MEMBER, behalf of Office of Energy & Planning
2. GEORGE BERLANDI, GB ESTUARY COMMISSION MEMBER, behalf of Department of Environmental Services
3. KEN GALLAGER, behalf of Office of Energy & Planning
4. NEW HAMPSHIRE DEPARTMENT OF FISH & GAME AND GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE represented by: Peter Wellenberger, GB Estuary Commission Member; John Nelson, GB Estuary Commission Member; Steve Miller, Coastal Training Coordinator for NERR; and Brian Smith, Research Coordinator for NERR.
5. ELIZABETH GOLDMAN, Citizen, Town of Dover.
6. SKIP SEAVERNS, Planning Board Member, behalf of Town of Nottingham.
7. PETER RICE, GB ESTUARY COMMISSION MEMBER, behalf of City of Portsmouth.
8. CYNTHIA COPELAND, GB ESTUARY COMMISSION MEMBER, behalf of Strafford Regional Planning Commission.
9. JENNIFER HUNTER, behalf of New Hampshire Estuaries Project, and Rep. Thomas Gillick, GB Estuary Commission Member for Town of Hampton.
10. REP. JUDITH SPANG, New Hampshire House of Representatives, Town of Durham
11. CLIFF SINNOTT, GB ESTUARY COMMISSION MEMBER, Rockingham Planning Commission
12. MISCELLANEOUS RECEIPTS (4)

[snip] = no comments on particular area

COMMENTS RECEIVED FROM GEORGE BERLANDI, GB ESTUARY COMMISSION MEMBER

From: Formica, Matt
Sent: Thursday, June 23, 2005 9:26 AM

Hannah,

For your records, See attached for DES comments on the three memorandum. DES has confirmed that they did not have any comments on the Population Projection Methodology.

Matt

-----Original Message-----
From: Berlandi, George
Sent: Thursday, June 23, 2005 10:05 AM

Hi Matt,
Please find enclosed our comments relative to the technical memoranda. Any questions, let me know.. Thanks. Take care, Geo.B.

MEMORANDUM: DRAFT FUTURE SEWAGE AND SEPTAGE FLOW AND LOADING PROJECTION METHODOLOGY

[snip]

Study Area Background

A total of 17 WWTFs are located within 16 study area communities ***As a general comment, you may want to add Star Island and Wallis Sands wastewater treatment facilities to all appropriate areas.*** These 17 WWTFs serve their towns and in some instances serve the sewered populations in adjacent towns. In order to ensure consistency in evaluating each sewered community, a standard methodology was developed to apply to each community for the purpose of projecting the future wastewater and septage flows and loads.

[snip]

This memo summarizes the information available and the standard approach developed. One of the key assumptions of the future conditions projection methodology is that future sewered and unsewered development in the communities will occur in the same ratio as the existing development. In other words, if 50 percent of the current population is sewered, then it is assumed that 50 percent of the projected future population will also be sewered. ***Not sure this is appropriate. See comment below under Projection of Future Septage Flows...*** If any communities provide input that is contrary to this assumption, the projection methodology will be modified appropriately for those communities to incorporate specific information regarding the future ratio of sewered versus unsewered development.

[snip]

PROJECTION OF FUTURE WASTEWATER AND SEPTAGE FLOWS AND LOADINGS

12. For existing ocean discharges, assume current dilution factors as stated in Fact Sheets are correct. If flow increases assume dilution factor reduced by same percentage as permitted flow increase.
13. For new ocean discharges, project team will estimate dilution factor using a model part of the EPA PLUMES package. ***We presently use Cormix which we model under the worst case meteorological conditions-Will this model produce the same results?***
14. Metals and other Toxics limits to be estimated based on dilution factor and current New Hampshire Criteria and translator values. Assume lowest copper limit to be 20 ug/l (per current EPA Administrative Order interim value) and include cost of Administrative Order compliance in evaluation. ***(Shouldn't a diffuser be designed to avoid the need for a copper limit?*** Ambient metals/toxics levels assumed to be zero in receiving waters. ***This may not be a correct assumption as we have just found arsenic in ocean waters in the vicinity of the Seabrook POTW's discharge.***
15. pH limit between 6.5 to 8.0

Peirce Island WWTF Discharge Limit Methodology

[snip]

1. Two evaluation scenarios will be conducted for the Portsmouth Peirce Island WWTF: current primary standards and conventional secondary treatment standards.
2. Under the primary standard discharge, no increase of mass loadings of conventional pollutants (i.e. BOD/CBOD, TSS), necessitating lower concentration limits if future permitted flows are higher than current permitted flows.
3. Disinfection standards - 14 fecal coliform / 100 ml. ***Monitor for enterrocci until a water quality standard is adopted; then include that standard in coastal permits.***
4. ***We would recommend adding a total nitrogen limit of 8mg/l (50% removal). If possible, conduct analyses with and without nitrogen removal.***
5. ***Use the dilution factor to determine the total residual chlorine limit.***

Estuary Discharge Permit Limit Methodology (Hampton, Newfields, Newmarket, Durham, Newington, Pease Development Authority, Exeter, and Dover)

The following methodology for determining future permit limits will be used for future estuary discharges in this study.

1. No increase of mass loadings of conventional pollutants (i.e. BOD/CBOD, TSS), thereby necessitating lower concentration limits if future permitted flows are higher than current permitted flows. ***This may not be appropriate for facilities with zero dilution like Hampton-maybe we should assume advanced treatment for Hampton and maybe Durham?***
2. Maintain same end of pipe zero dilution concentration for bacteria standards. ***Assume enterrococci monitoring as well as the fecal. If a standard is adopted, then we should use it.***
3. Disinfection standards: 14 fecal coliform / 100 ml; ***Assume enterrococci monitoring as well as the fecal. If a standard is adopted, then we should use it.*** Effluent chlorine residual based on Dilution Factor but no greater than 0.45 mg/l - If not using UV disinfection, assume dechlorination facilities required if not already in place. ***How was the 0.45 mg/l limit determined?***
4. Sediment characteristics will not be included in future discharge limits.
5. Total nitrogen limits 10 mg/l. ***Based on the State of Connecticut's Long Island Sound's TMDL, we would recommend a limit of 5 mg/l for wastewater treatment plants discharging to an estuary.***

ATTACHMENT B

projo.com
The Providence Journal

Bay bottom is oxygen starved; fish won't survive

From north of Jamestown to Providence, bottom-dwelling fish and crabs can't survive under current conditions.

01:00 AM EDT on Saturday, August 5, 2006

BY GERALD M. CARBONE
Journal Staff Writer

Fishermen seeking bottom dwellers such as crab and summer flounder can rule out dropping a line in much of Narragansett Bay.

Teams of researchers measuring levels of dissolved oxygen in the Bay discovered Thursday that fish and crabs cannot currently live on the Bay bottom in all 53 places they tested from Providence down to just north of Jamestown because there was not enough oxygen.

In every place that they tested, scientists found that the water below 4 meters -- about 12 feet -- had less then 3 milliliters of dissolved oxygen per liter of water, a condition known as hypoxia.

All water below 12 feet was hypoxic, meaning that it did not have enough dissolved oxygen to support fish and crabs. Clams, particularly the hardy quahog, can withstand these types of conditions for a month or more, but bottom fish must move out of that entire region or die.

The state's director of Environmental Management, W. Michael Sullivan, said that global warming was one of many factors contributing to the Bay's depleted oxygen levels. Sullivan said the annual average temperature of the Bay had increased by 3 degrees in 50 years, which, combined with nitrogen from sewage and a cut in tidal flow due to sedimentation, had stimulated the growth of algae and plankton. When that plant growth dies and decays, it consumes oxygen.

Thursday's sampling found oxygen levels above four meters were generally healthful, so fishermen will still see striped bass and blue fish chasing bait near the surface.

Chris Deacutis, chief scientist for the Narragansett Bay Estuary Program, said, "There are probably pockets where it's not all that bad" along the bottom, but teams from the Estuary Program and from Brown University did not find any of those pockets in Thursday's sampling.

"If you were down around Jamestown, I still might try [bottom fishing], and the Quonset area, where there's some pretty good current, I might still try the bottom," Deacutis said. "Your fishing luck may be a lot lower in the upper third to upper half of the Bay to . . . down around Quonset. I wouldn't say Jamestown because Jamestown does have some pretty good water in the ship's passage.

"The upper Bay and the Providence River definitely have pretty bad water on the bottom, and Greenwich Bay does, too."

Deacutis said Greenwich Bay had "practically no oxygen" beyond 10 feet. Readings there were as bad or worse than the "dead zone" of the Gulf of Mexico, where oxygen levels are typically less than 2.

Although it may sound dramatic to say that much of Narragansett Bay's bottom cannot support fish, the current outbreak of hypoxia is not unusual. For at least the past few summers, a wide swath of the Bay bottom has become barren of fish.

"It's not unexpected," Deacutis said of Thursday's readings.

Tests taken July 6 also showed widespread hypoxia on the Bay bottom, although not as extensive as the current outbreak. And in August 2003, when schools of fish washed up dead in Greenwich Bay, scientists think the hypoxic area extended all the way to the Jamestown Bridge.

Scientists say these factors contribute to hypoxic conditions:

"Nutrient loading" from sewage flowing into the Bay through treatment plants, septic systems, and from lawn fertilizers. Nitrogen from these sources stimulates plankton and algae growth; when these organisms die, they decompose and suck up oxygen.

Scott Nixon, an oceanographer at the University of Rhode Island, cautions against blaming all of the Bay's low oxygen cycles on pollution. He has noted that Rhode Islanders have been dumping sewage into the Bay for more than a century without causing fish kills of the kind seen in 2003.

High water temperatures. Warm water stimulates plankton and algae growth. It also holds less dissolved oxygen than cold water. Sullivan, the DEM director, said global warming has driven average annual Bay temperatures 3 degrees above their 1950s levels. During the seven-day heat wave that broke yesterday, Bay temperatures jumped 5 degrees, to the high 70s. At midweek, John Torgan of Save The Bay recorded a temperature of 81 degrees in the shallows off Gaspee Point, where dead baby clams washed ashore ankle deep in places.

Calm winds. Wind infuses surface waters with oxygen and churns the water, mixing oxygen into the depths. The 2003 fish kill was preceded by several days of relatively calm weather.

Hard rains. Rain causes hypoxia by washing nutrients into the Bay, and by "stratifying" the water into surface waters of freshwater buoyed by bottom waters of denser saltwater. When water stratifies this way, it is more difficult for winds to infuse oxygen through mixing.

"Neap" tides. There are two types of tides, spring and neap. Spring tides have nothing to do with the season of the year; they take their name from the German verb "springen," meaning to move quickly. Spring tides occur during full and new moons, when the tidal pull is strongest, creating a greater variation between high and low tides. Spring tides result in greater mixing of the Bay waters, which brings oxygen to the lower layers.

Neap tides are the time of smallest variation between high and low tides, occurring every two weeks at the half moon. The 2003 fish kills took place during a neap tide.

When researchers tested the Bay on Thursday, it was during a time of neap tide. Warren Prell, Doherty professor of oceanography at Brown, said the timing was deliberate so researchers could see how extensive the hypoxia was. Teams will also test the Bay next Thursday during a spring tide.

Sullivan agreed with Nixon's argument that nutrients aren't solely responsible for recent outbreaks of hypoxia in Narragansett Bay. "That's one piece of it," Sullivan said. "But it's a complex biological and geological system. If the Bay stays cool, plants don't grow as much. But you have got to drive your car less to have an impact on global warming."

The DEM can't control global climate change, but it can reduce nutrients flowing into the Bay. The state recently took steps to do that through an agreement with the Narragansett Bay Commission, which runs the state's two largest sewage-treatment plants -- Fields Point and Bucklin Point. Together those plants treat an average of 62 million gallons of sewage a day.

The commission recently agreed to install $100 million worth of equipment to cut its summertime nitrogen discharges to less than 8 parts per million by 2008, a 50-percent reduction mandated by state law.

Sullivan termed this a "historic" agreement that should help the Bay's waters.

However, Sullivan said, Massachusetts has more sewage-treatment plants dumping into Bay waters than Rhode Island has, and unless that state also mandates nitrogen reductions, Rhode Island's efforts may be in vain.

"Why should Rhode Island continue to live with the flushing of Massachusetts toilets?" Sullivan said.

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Online at: http://www.projo.com/news/content/projo_20060805_bay5.1fcb4a8.html