United States Court of Appeals
For the First Circuit

No. 11-1474

UPPER BLACKSTONE WATER POLLUTION ABATEMENT DISTRICT,

Petitioner,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Respondent.

No. 11-1610

CONSERVATION LAW FOUNDATION, INC.

Petitioner,

v.

UPPER BLACKSTONE WATER POLLUTION ABATEMENT DISTRICT,

Intervenor,

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Respondent.

PETITIONS FOR REVIEW OF A FINAL PERMIT DECISION BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Before

Lynch, Chief Judge,
Souter, Associate Justice,[*]
and Stahl, Circuit Judge.

[*] The Hon. David H. Souter, Associate Justice (Ret.) of the Supreme Court of the United States, sitting by designation.

Robert D. Cox, Jr., with whom Douglas T. Radigan, Bowditch & Dewey, LLP, Fredric P. Andes, and Barnes & Thornburg LLP, were on brief, for petitioner Upper Blackstone Water Pollution Abatement District.

Christopher M. Kilian, with whom Anthony N.L. Iarrapino was on brief, for petitioner Conservation Law Foundation.

Madeline Fleisher, with whom Ignacia S. Moreno, Assistant Attorney General, U.S. Department of Justice, Environment and Natural Resources Division, and Samir Bukhari, Ira W. Leighton, Karen A. McGuire, U.S. Environmental Protection Agency, were on brief, for respondent.

Donald L. Anglehart on brief for City of Marlborough, amicus curiae.

David M. Moore, City Solicitor, and Jennifer H. Beaton, Assistant City Solicitor, on brief for City of Worcester, amicus curiae.

Karma B. Brown, Brooks M. Smith, Hunton & Williams LLP, and Nathan Gardner-Andrews on brief for National Association of Clean Water Agencies, amicus curiae.

August 3, 2012

LYNCH, Chief Judge. These petitions seek review of certain effluent limitations imposed by the Environmental Protection Agency (EPA) in a National Pollutant Discharge Elimination System (NPDES) permit on the discharges of Upper Blackstone Water Pollution Abatement District, a sewage treatment plant located in central Massachusetts.

The District's discharges are into the headwaters of a polluted river which, in due course, flows into other rivers, and ultimately empties into Narragansett Bay. The states of Massachusetts and Rhode Island each have strong interests in the health of these waters and generally have supported the EPA's decisions during the permitting process. The District, supported by its member towns, has an interest in avoiding compliance costs associated with the permit and has challenged the effluent limitations as premature and unsupported by the scientific record.

We have stayed enforcement of the permit during this appeal and while the parties were engaged in settlement negotiations in a court-sponsored settlement program. We now lift the stay, deny the petitions, and find no error in the EPA's final permit decision.

I.

The Blackstone River is a major, interstate freshwater river which runs south from Worcester, Massachusetts, crosses the border into Rhode Island, and continues on to Pawtucket Falls.

There, it reaches sea level, becomes tidal, and changes its name to the Seekonk River, which, in turn, flows into the Providence River,[1] and ultimately empties into Narragansett Bay. The Blackstone River provides a significant source of freshwater to the Bay.

At the peak of the industrial revolution, water-powered textile mills lined the Blackstone River; dams, millponds, and canals altered its natural course and halted its flow at points. Toxic sediments of heavy metals and other industrial waste products released into the River accumulated behind its many impoundments and damaged its ecology. Today, industry has moved on; its legacy remains in leftover dams and the toxic sediments held in place behind them.

With the discontinuation of industrial river dumping, the River's health has dramatically improved. Massachusetts and Rhode Island now seek to put the River to new economic and recreational uses including tourism, recreation, and commercial fishing. The new limiting factor, and the subject of dispute in this case, is not the River's industrial legacy, but sewage treatment. As population has increased along the River, sewage processing has not kept apace. An influx of nitrogen and phosphorus from sewage

[1] We will refer to the Blackstone River as "the River" on occasion; the Seekonk and Providence Rivers, by their full names only; and all three together as "the three rivers."

treatment plants is causing serious problems for the River's waters and those downstream.

The Blackstone, Seekonk, and Providence Rivers, and Narragansett Bay, all suffer from severe cultural eutrophication, a process fueled by unnaturally high concentrations of nitrogen and phosphorus. When excessive levels of these chemical nutrients are introduced into a water system, algae populations rapidly multiply to nuisance levels. As populations "bloom" and die-off in quick succession, dead algae accumulate and decompose -- their nutrient-laden remains further enriching the immediate environment, thereby perpetuating the eutrophication cycle. Increased rates of respiration and decomposition deplete the available dissolved oxygen in the water, threatening other plant and animal life in the system. When oxygen saturation levels drop below what is needed by fish and invertebrates to breathe, the waters become host to fish kills, red tides, and shellfish poisonings, events which can pose threats to human health as well.

Phosphorus drives cultural eutrophication in freshwater systems and nitrogen drives the same process in marine waters. The Blackstone River currently suffers from severe phosphorus-driven cultural eutrophication. Algae blooms, thick, cloudy waters, putrid smells, and sudden fish kills periodically contaminate its waters. The numerous dams and impoundments along the River create areas of stagnant water where nutrients collect and cultural

eutrophication flourishes. The toxicity build-up behind the dams and serious concerns about resuspension of the contaminated sediments rule out an easy solution to this problem.

Narragansett Bay and the Seekonk and Providence Rivers, in turn, are each affected by the Blackstone's degraded waters. Narragansett Bay, the ultimate depository for all the nutrients carried by the Blackstone, suffers from severe nitrogen-driven cultural eutrophication. The Seekonk River, which forms the uppermost part of the Bay, is the most seriously impaired by the Blackstone's nitrogen loadings.

Conditions in the three rivers and the Bay have been deteriorating for many years. Increased domestic waste inputs into the rivers are worsening their nutrient-related problems. Among the numerous events documented in the record, severely hypoxic (waters characterized by levels of dissolved oxygen below what is needed by aquatic organisms to breathe) to nearly anoxic (waters completely depleted of dissolved oxygen) conditions, along with associated fish kills, were observed in upper Narragansett Bay, including the Providence River, in the summers of 2001 and 2002. August 2003 witnessed one of the Bay's largest fish kills in history, when more than one million fish died in anoxic water conditions near East Greenwich, Rhode Island.

The Rhode Island Department of Environmental Management (RIDEM) has set up response teams which monitor the Bay

continuously and publish public notices when bacterial or pollution conditions pose a threat to public health and commercial fishing.[2] In recent years, the state has been forced to close down some of the Bay's beaches and commercial fishing grounds entirely, measures which damage state tourism and recreation businesses, and which place the state's commercial fishing and shellfishing industries in jeopardy.

Recognizing the watershed's growing problems, and motivated by the desire to improve its resource value, Massachusetts and Rhode Island have begun implementing comprehensive plans to rehabilitate the three rivers and the Bay. These efforts build on decades of work by both government actors and private groups to study and address nutrient-related problems in the watershed.

Congress designated the Blackstone River Valley as a National Heritage Corridor in 1986 for the purpose of recognizing the historical significance of the River and restoring its watershed. The EPA formed the Narragansett Bay Project in the 1980s and the Blackstone River Initiative in the 1990s, to study,

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[2] See Bay Assessment & Response Team, RIDEM, http://www.dem.ri.gov/bart/index.htm (information regarding monitoring and closure of Narragansett Bay beaches and fisheries when bacterial or pollution levels threaten public health) (last visited Aug. 2, 2012); Office of Water Res., RIDEM, http://www.dem.ri.gov/programs/benviron/water/shellfsh/index.htm (information regarding monitoring and closure of shellfishing grounds) (last visited Aug. 2, 2012).

among other issues, the impacts of cultural eutrophication on the water systems. The Governors of Massachusetts and Rhode Island first signed a Memorandum of Understanding in 1992 to underscore the two states' commitments to studying and restoring the watershed. In 1998, President Clinton designated the Blackstone River an American Heritage River. Bills "[t]o establish the John H. Chafee Blackstone River Valley National Historic Park" are currently before both houses of Congress. S. 1708, 112th Cong. (2011); H.R. 3191, 112th Cong. (2011).

Federal, state, and local governments, businesses, and an array of outside groups and coalitions have funded and conducted numerous scientific studies on nutrient-related problems in the three rivers and the Bay. The EPA considered many of these studies in setting the 2008 permit limits; just a few of those included in full in the administrative record in this case are studies

conducted by Massachusetts[3] and Rhode Island,[4] as well as the U.S. Army Corps of Engineers[5] and the EPA.[6]

Although nitrogen and phosphorus end up in the rivers and the Bay from diverse sources, including storm run-off, agricultural

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[3] See Fiorentino, Div. of Watershed Mgmt., Mass. Dep't of Envtl. Prot., Blackstone River Watershed 2003 Biological Assessment (2006) (comprehensive report on Blackstone River water quality incorporating historical perspectives and previous studies, including 2003 biomonitoring survey); Tamul, Div. of Watershed Mgmt., Mass. Dep't of Envtl. Prot., Blackstone River Watershed 2003 DWM Water Quality Monitoring Data (2005) (biomonitoring survey of water quality including nitrogen and phosphorus inputs and related effects); Weinstein et al., Div. of Watershed Mgmt., Mass. Dep't of Envtl. Prot., Blackstone River Basin 1998 Water Quality Assessment (2001) (comprehensive evaluation of water quality in Blackstone River and related tributaries, and specific recommendations for managing nitrogen- and phosphorus-related water quality problems).

[4] See Nixon et al., Anthropogenic Nutrient Inputs in Narragansett Bay, A Twenty-five Year Perspective: A Report to the Narragansett Bay Commission and Rhode Island Sea Grant (2005) (study of nitrogen and phosphorus sewage inputs into Narragansett Bay over a twenty-year period, with measurements taken in 1975, 1976, 1983, 1991, 1992, 2003, and 2004); Governor's Narragansett Bay Watershed Planing Comm'n, Nutrient and Bacteria Pollution Panel Initial Report (2004) (study and management plan for addressing the problems with cultural eutrophication in the Bay); RIDEM, Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers (2004) (reporting results of Rhode Island's TMDL efforts and a management plan for addressing cultural eutrophication in the Bay).

[5] See Wright et al., Dry Weather Water Quality Sampling and Modeling, Blackstone River Feasibility Study (2004) (for U.S. Army Corps of Engineers) (study of water quality conditions in Massachusetts segment of the Blackstone River for future use in developing a TMDL).

[6] See Wright et al., Blackstone River Initiative, Water Quality Analysis of the Blackstone River Under Wet and Dry weather Conditions (2001) (for EPA New England) (integrated water quality study and report on both Massachusetts and Rhode Island segments of the River and Narragansett Bay).

fields, and construction sites, sewage treatment facilities are the primary source of anthropogenic nutrient inputs into the Seekonk and Providence Rivers and the Bay. Thus, a critical component of both states' rehabilitation plans has been to impose tighter limits, under the Clean Water Act (CWA or the "Act"), on the amounts of nitrogen and phosphorus that sewage treatment facilities may discharge into the rivers and the Bay.

The CWA was enacted by Congress to address the serious threats water pollution poses to public health, economic activity, and the long-term viability of the Nation's water resources. 33 U.S.C. §§ 1252(a), 1313(c)(2)(A). The Act's primary goal is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Id. § 1251(a). States and the federal government share responsibility for achieving this goal. Id. § 1251(g); Arkansas v. Oklahoma, 503 U.S. 91, 101 (1992).

States have primary responsibility for designating the ambient water quality of the waters within their territory. 33 U.S.C. § 1313(c)(1), (2)(A). These "water quality standards" are expressed as "designated uses" of water bodies (such as propagation of aquatic life, recreation, aesthetics, and use as public water supply), and as numeric or narrative "criteria," which specify the amounts of pollutants that may be present in these water bodies without impairing their designated uses. Id. § 1313(c)(2)(A). In addition to incorporating state water quality standards, the Act

also employs federal, technology-based effluent limitations on individual discharges of pollution into navigable waters. Id. §§ 1311, 1314(b). State water quality standards generally supplement these effluent limitations, so that where one or more point source dischargers, otherwise compliant with federal conditions, are nonetheless causing a violation of state water quality standards, they may be further regulated to alleviate the water quality violation. Id. § 1311(b)(1)(C) ("[T]here shall be achieved . . . any more stringent limitation, including those necessary to meet water quality standards . . . established pursuant to any State law or regulations . . . ."); see also id. §§ 1311(e), 1312(a), 1313(d)(1)(A), (d)(2), (e)(3)(A).

"[A]ny person" who wishes to discharge "any pollutant" from a "point source" into the navigable waters must obtain an NPDES permit. Id. §§ 1311(a), 1342. NPDES permits bring both state ambient water quality standards and technology-based effluent limitations to bear on individual discharges of pollution, id. § 1342(a)(3), (b)(1)(A), and tailor these to the discharger through procedures laid out in the Act and in EPA regulations, id. § 1342. NPDES permits may be administered by the EPA or by an authorized state or Indian tribe. Id. §§ 1342(b), 1377(e); 40 C.F.R. § 123.31. To date, the EPA has authorized forty-six states to administer their own NPDES permit programs, including Rhode

Island.[7] Massachusetts has not received authorization, and so the EPA administers NPDES permits in that state.

The CWA also requires states to identify the waters within their boundaries that fail to meet their designated water quality standards and rank these in order of priority, taking into account "the severity of the pollution and the uses to be made of such waters." 33 U.S.C. § 1313(d)(1)(A). States must then begin the planning process for bringing these waters into compliance with water quality standards.[8] Id. § 1313(d), (e); 40 C.F.R. § 122.44(d)(1).

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[7] See EPA, NPDES Specific State Program Status, http://cfpub.epa.gov/npdes/statestats.cfm?view=specific (last visited Aug. 2, 2012); see also 49 Fed. Reg. 39,063 (Oct. 3, 1984) (approving Rhode Island's NPDES program).

[8] Part of this process requires the development of Total Maximum Daily Loads (TMDLs) for each pollutant that is responsible for a violation of water quality standards. 33 U.S.C. § 1313(d)(1)(C). A TMDL is a calculation of the maximum quantity of a pollutant that may be added to a water body from all sources without exceeding applicable water quality standards including "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." Id. TMDLs take time and resources to develop and have proven to be difficult to get just right; thus, under EPA regulations, permitting authorities must adopt interim measures to bring water bodies into compliance with water quality standards. Id. § 1313(e)(3); 40 C.F.R. § 122.44(d); see also, e.g., 43 Fed. Reg. 60,662, 60,665 (Dec. 28, 1978) ("EPA recognizes that State development of TMDL's and wasteload allocations for all water quality limited segments will be a lengthy process. Water quality standards will continue to be enforced during this process. Development of TMDL's . . . is not a necessary prerequisite to adoption or enforcement of water quality standards . . . .").

In some circumstances, discharge into the waters of one state may cause a violation of water quality standards in a downstream state. The CWA anticipates conflicts over pollution discharges between upstream and downstream states. See Milwaukee v. Illinois, 451 U.S. 304, 325-26 (1981). When an application is made for a discharge which may affect the water quality of a downstream state, the EPA is required to notify both the origin state and the downstream state. 33 U.S.C. § 1341(a)(2). If the downstream state then determines that the discharge will violate its water quality standards, it may submit its objections and request a public hearing. Id.

The Supreme Court has held that the CWA grants the EPA authority to require in NPDES permits conditions which ensure compliance with the water quality requirements of downstream states. Arkansas, 503 U.S. at 105; see 33 U.S.C. § 1341(a)(2) ("[The permitting agency] shall condition such license or permit in such manner as may be necessary to insure compliance with applicable water quality requirements. If the imposition of conditions cannot insure such compliance such agency shall not issue such license or permit."). EPA regulations have so required since 1973. See 40 C.F.R. § 122.4(d) ("No permit may be issued . . . [w]hen the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States . . . .").

In this case, both Massachusetts and Rhode Island have listed the Blackstone River as "impaired" under Section 1313(d) of the CWA; Rhode Island has also listed the Seekonk and Providence Rivers and Narragansett Bay as impaired.

Massachusetts has designated the Blackstone River for primary and secondary contact uses, including swimming, fishing, and boating, and as habitat for fish and other wildlife. 314 Mass. Code Regs. 4.05(3)(b).[9] Under Massachusetts' narrative water quality standards, the Blackstone River must be "free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life;" "free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the [river's] bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms;" "free from pollutants in concentrations that are toxic to humans, aquatic life or wildlife," and "free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses," id. at 4.05(3)(b), at all times, even under low flow conditions, id. at 4.03(3).

[9] See Massachusetts Water Quality Designations, available at http://www.mass.gov/dep/water/laws/regulati.htm#wqual (last visited Aug. 2, 2012).

Massachusetts has determined that the Blackstone River fails to meet state water quality standards. In its testing and analysis of the contaminants in the River, the Massachusetts Department of Environmental Protection (MassDEP) has documented multiple impairments including unknown toxicity, priority organics, metals, ammonia, chlorine, nutrients, organic enrichment, low dissolved oxygen, flow and other habitat alterations, pathogens, suspended solids, turbidity, objectionable deposits, and taste, odor, and color objections. Watershed Planning Program, Office of Watershed Mgmt., Massachusetts Year 2006 Integrated List of Waters 81-82 (2006).

Rhode Island has designated the Blackstone, Seekonk, and Providence Rivers and Narragansett Bay for primary and secondary contact recreational uses and as habitat for wildlife.[10] Rhode Island's narrative water quality criteria require that all three rivers and the Bay be free of pollutants in concentrations that adversely affect the composition of fish and wildlife; adversely affect the physical, chemical, or biological integrity of the habitat; interfere with the propagation of fish and wildlife; or adversely alter the life cycle functions, uses, processes, and activities of fish and wildlife. With respect to nutrient pollution, Rhode Island requires that the three rivers and the Bay

[10] See Rhode Island Water Quality Regulations, available at http://www.dem.ri.gov/pubs/regs/regs/water/h2oq10.pdf (last visited Aug. 2, 2012).

be free of nutrients "in such concentration that would impair any [designated uses] . . . or cause undesirable or nuisance aquatic species associated with cultural eutrophication."

Rhode Island has determined that all three rivers and the Bay fail to meet its water quality standards. RIDEM has documented numerous impairments in the Rhode Island segment of the Blackstone River including ammonia, copper, lead, pathogens, nutrients, low dissolved oxygen, and biodiversity impacts. Rhode Island monitors Narragansett Bay and its extensions particularly closely due to their importance to state industries. It has documented numerous impairments to the Seekonk and Providence Rivers, including nutrient pollution, low dissolved oxygen, and excessive algae growth, and similar impairments to the Bay, including nutrients, low dissolved oxygen, and pathogens.

In order to address these impairments, Rhode Island has issued several Rhode Island Pollutant Discharge Elimination System permits (RIPDES permits) to the major sewage treatment facilities along the rivers and Bay, which tighten nitrogen effluent limitations. The two largest treatment facilities, both on the Providence River, Narragansett Bay Commission Fields Point and Narragansett Bay Commission Bucklin Point, are designed to discharge 65 million gallons per day (mgd), and 31 mgd, respectively. As part of its major nitrogen removal initiative, RIDEM has issued both facilities nitrogen effluent limitations of

5.0 mg/L. RIDEM has also set a 5.0 mg/L nitrogen limit for East Greenwich, a much smaller facility, with an average daily flow of approximately 1.7 mgd, but which is located on a particularly impaired portion of Narragansett Bay. The Woonsocket facility, which, behind the petitioner District in this case, is the second-largest sewage treatment plant discharging into the Blackstone River, has been given a 3.0 mg/L nitrogen limit as part of a consent agreement. Five other much smaller facilities have been given nitrogen limits of 8.0 mg/L.

As part of this process, in an effort to reduce the incoming nitrogen into the Bay, Rhode Island also requested and recommended to the EPA that the nitrogen limits on Massachusetts dischargers into the Blackstone River be tightened as well. While nitrogen discharge does not cause cultural eutrophication in the Blackstone River's fresh-waters, the discharge is swiftly carried downstream to Rhode Island's saltwater rivers and the Bay, where it produces severe cultural eutrophication and resulting violations of Rhode Island's water quality standards.

II.

Against this complex backdrop, the present dispute arises. The petitioner in this case, Upper Blackstone Water Pollution Abatement District (the "District"), is the largest sewage treatment plant along the Blackstone River. It is located in Millbury, Massachusetts, very near the Blackstone River's

headwaters. It discharges approximately 34 to 43 mgd of treated domestic and industrial sewage[11] into the River.[12]

The District's discharge represents approximately seventy percent of the total municipal wastewater flow into the Blackstone River, making it the dominant discharger of both nitrogen and phosphorus into the River's waters.

The District's plant came online in 1976, and only recently went through its first major upgrade. This comprehensive upgrade was completed pursuant to an administrative consent order issued to the District by the EPA after the District had violated its September 30, 1999, NPDES permit, as modified by an August 3, 2001, Settlement Agreement (the "2001 permit"). The upgrade involved extensive plant renovations implemented over an eight-year period, through which the District adapted its facilities to comply with the 2001 permit's 0.75 mg/L limit on phosphorus, and, although the permit did not limit nitrogen discharge, a 8.0 - 10.0 mg/L limit on nitrogen in anticipation of future nitrogen controls.[13]

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[11] More than 200 industrial users contribute wastewater to the District's facilities, thirty-three of which currently qualify for the "pre-treatment" program under 40 C.F.R. § 403.3(v).

[12] This is somewhat below its design flow capacity of 56 mgd. The next largest sewage treatment plant on the Blackstone River is located in Woonsocket, Rhode Island, and has a design flow of 16 mgd, and an actual average discharge of 7 mgd.

[13] These needed upgrades to the District's aging facility cost $180 million and resulted in rate increases for the District's customers. However, even with these upgrades, and as was noted in the administrative record, relative to other Massachusetts

On November 8, 2005, while the upgrade was still ongoing, the District submitted a timely application to the EPA for renewal of the 2001 permit.[14] As part of the permit reissuance process, the EPA evaluated a variety of factors, including the District's expected future discharge -- accounting for the upgrade -- and the state of the receiving waters. The EPA found that all three rivers and the Bay exhibited severe nitrogen- and phosphorus-driven cultural eutrophication, and that the District's discharge was the predominant point source of both phosphorus and nitrogen in the Blackstone River.

Applying Massachusetts and Rhode Island water quality requirements, the EPA determined that the District's nitrogen and phosphorus discharges "will cause, have the reasonable potential to cause, or contribute to an excursion above" applicable state water quality standards. 40 C.F.R. § 122.44(d)(1)(i). Based on its comprehensive analysis of these and the other required factors, the EPA concluded that lower limits on the District's nitrogen and phosphorus discharge were necessary to achieve compliance with

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residents, the District's ratepayers pay significantly less than the average sewage rate. For 2011 figures, see Mass. Water Res. Auth. Advisory Bd., Annual Water and Sewer Retail Rate Survey (2011), available at http://mwraadvisoryboard.com/wp-content/uploads/2012/01/0-COMBINED-MASTER2.pdf (last visited Aug. 2, 2012).

[14] Although it expired in 2006, during the permit reissuance process that followed, the 2001 permit was administratively continued, and remained in effect after this court granted the District's motion to stay the 2008 permit on April 29, 2011.

state water quality standards. See id. § 122.44(d)(1)(vi). Because both Massachusetts and Rhode Island employ narrative water quality criteria for the relevant pollutants, the EPA translated these into numeric limits under its procedures set out in 40 C.F.R. § 122.44(d)(1)(vi).

On March 23, 2007, the EPA published a draft permit that limited total phosphorus discharge to 0.1 mg/L from April 1 through October 31, and 1.0 mg/L from November through March, and limited total nitrogen to 5.0 mg/L from May 1 through October 31, and imposed a narrative criteria for nitrogen during the remaining months.

As part of the lengthy, public permitting process that followed, the EPA published the draft permit and its accompanying rationale in full, accepted public comments -- extending the time for these from thirty to sixty-four days -- and held a public hearing on the permit. See 40 C.F.R. § 124.10. The EPA received and considered thirty-four sets of written comments from a variety of stakeholders, interested parties, individuals, and researchers, including the District, the states of Massachusetts and Rhode Island, several municipalities, and numerous other organizations. The EPA responded to each set of comments at length.

On August 22, 2008, the EPA issued the final permit, which contained the same limits on phosphorus and nitrogen proposed in the draft permit. In addition, on April 15, 2009, the EPA

issued a draft permit modification proposing an effluent limitation for aluminum discharge in order to comply with Massachusetts' aluminum criterion. After public comment, the EPA issued a final permit modification adopting this limitation into the final permit.

On September 15, 2008, the District filed a petition for review of the permit with the EPA's highest adjudicative body, the Environmental Appeals Board (the "EAB" or "Board"), see 40 C.F.R. § 1.25(e), appealing, among other provisions, the permit's phosphorus, nitrogen, and aluminum[15] discharge limits. Seven other parties also filed petitions for review with the Board: MassDEP, the Massachusetts towns of Holden, Millbury, and Worcester, the Conservation Law Foundation (CLF), the Northern Rhode Island Chapter of Trout Unlimited, and Cherry Valley Sewer District. MassDEP raised several objections to the methodology employed by the EPA in setting the nitrogen limit. RIDEM filed an amicus curiae brief in support of the permit's nitrogen limit, citing the comparable nitrogen limits it had imposed on similarly situated Rhode Island facilities. CLF contended that both the nitrogen and phosphorus limits were too high.

The District challenged multiple aspects of the permit, re-raising many of the points it had made in its comments on the draft permit. In particular, the District challenged: (1) the

[15] The District filed a separate petition for review of the aluminum limit, which the Board consolidated with the District's original petition.

EPA's decision to tighten the nitrogen and phosphorus limits before the District had fully completed its facility upgrades and without more data on nutrient impairment in the Bay; (2) the EPA's refusal to delay issuance of the permit until a new computer model of the Blackstone River, then under development by the District, could be completed, and (3) the EPA's conclusion that the District's aluminum discharge had a reasonable potential to cause or contribute to a violation of Massachusetts' water quality criterion for aluminum.

On May 28, 2010, the Board issued a 106-page decision upholding the permit, with the exception of a provision that made several other municipal entities "co-permittees," which the Board remanded to the EPA for further action. In re: Upper Blackstone Water Pollution, Abatement Dist., Nos. 08-11 et al., 2010 EPA App. LEXIS 17 (EAB May 28, 2010). After thorough review of the record materials, the Board considered and addressed each of the parties' various objections to the permit's nitrogen, phosphorus, and aluminum limits. Id. at *188. It found the that the available science and data concerning both the District's discharge as well as the quality of the affected waters supported the EPA's judgment to impose the tighter permit limits on the three chemical elements. Id. It rejected the argument that the EPA should have delayed the permit until the District's computer model was complete and declined to consider some very preliminary outputs from that model

because the "development and testing of the model ha[d] not been completed" and were "not utilized in setting [the limits] for this Permit."[16] Id. at *147. On the whole, it found the EPA's actions reasonable and supported by the record. Id. at *188. After the Board denied further review, the EPA provided the District with notice of its final permit decision on April 6, 2011.

On April 29, 2011, the District filed a petition for review with this court along with an emergency motion for a stay of the new permit during the pendency of the appeal. This court granted the stay that same day as to each permit condition cited by the District in its motion. On May 27, 2011, CLF filed a petition for review of the new permit, and on June 22, 2011, this court consolidated CLF's petition with the District's petition for purposes of briefing and oral argument.

The court received extensive briefing from the District, the EPA, CLF, and amici curiae[17] on the issues in this case. The District and amicus curiae, the City of Worcester, filed additional briefing on the HSPF water quality model the District was still in the process of completing. The District had raised the issue of

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[16] In 2004, the District began the lengthy process of developing a Hydrological Simulation Program--Fortran (HSPF) computer model of the Blackstone River watershed. The model remained incomplete through the permitting and EAB review process.

[17] The court acknowledges the assistance provided by the amici curiae in this case: City of Marlborough, City of Worcester, and National Association of Clean Water Agencies.

the then-unfinished model multiple times during the permitting process and on review before the EAB, arguing that, once completed, the model's results might justify a material change in the permit's conditions. See id. at *147. However, the District could not estimate when the model would be finished, and the EPA declined to delay the permit for an indefinite period until the District could complete its model. Instead, it instructed the District to file a permit modification request when the model was complete, and therein submit the model's results for consideration. See 40 C.F.R. §§ 122.62(a)(2), 124.5. The District represented that it would file such a request.[18]

III.

In its petition, the District challenges the 2008 permit's effluent limitations for nitrogen, phosphorus, and aluminum. It argues that key parts of the scientific record before the EPA were inadequate and unreliable, and that the agency irrationally based the permit's limitations on this flawed record.

[18] By the time of briefing in this case, the preliminary results of the District's model were available. After reviewing the parties' arguments as well as the permit modification mechanism, this court issued an order on January 24, 2012, directing the parties to participate in a court-sponsored Civil Appeals Management Program (CAMP). CAMP provided the parties with an opportunity to resolve the issues in this case more quickly and easily than proceeding with the appeal. Despite their good-faith efforts to do so, the parties were unable to resolve their differences and so informed the court on June 12, 2012. The court received additional filings from the parties on June 20 and 25, 2012.

It also argues that the EPA acted irrationally in refusing to delay the permit until the District could complete both its facility upgrade, then ongoing, and a new water quality model. CLF supports the science in the record, but takes issue with the EPA's interpretation of one report, arguing that a proper analysis of the report requires a more stringent nitrogen limitation.

The formulation of the 2008 permit's effluent limitations for the three chemical elements at issue required substantial scientific and technical expertise. Our review of the EPA's decision is deferential. See 33 U.S.C. § 1369(b)(1)(F); City of Pittsfield, Mass. v. EPA, 614 F.3d 7, 10 (1st Cir. 2010). Under the Administrative Procedure Act, we ask whether the EPA's actions were "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A).

We will not set aside those actions unless the agency "has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983). We will "uphold a decision of less than ideal clarity" where it finds support in the record and has a rational basis. FCC v. Fox Television Stations, Inc.,

556 U.S. 502, 513-14 (2009) (quoting Bowman Transp., Inc. v. Ark.-Best Freight Sys., Inc., 419 U.S. 281, 286 (1974)) (internal quotation mark omitted); Adams v. EPA, 38 F.3d 43, 49 (1st Cir. 1994).

This deference goes to the entire agency action, which here includes both the EPA's permitting decision and the EAB's review and affirmance of that decision. See 33 U.S.C. § 1369(b)(1); see also 5 U.S.C. §§ 551(13), 704.

Our scope of review is further modulated by the scientific and technical nature of the EPA's decisionmaking here. Adams, 38 F.3d at 49; P.R. Aqueduct & Sewer Auth. v. EPA, 35 F.3d 600, 604 (1st Cir. 1994); see also Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc., 462 U.S. 87, 103 (1983) ("[A] reviewing court must remember that [where the agency] is making predictions, within its area of special expertise, at the frontiers of science . . . . as opposed to simple findings of fact, a reviewing court must generally be at its most deferential."); Coal. for Responsible Regulation, Inc. v. EPA, Nos. 09-1322 et al., 2012 WL 2381955, at *7 (D.C. Cir. June 26, 2012) (to be published in F.3d) ("[W]e give an extreme degree of deference to the agency when it is evaluating scientific data within its technical expertise." (quoting Am. Farm Bureau Fed'n v. EPA, 559 F.3d 512, 519 (D.C. Cir. 2009)) (internal quotation marks omitted)).

We also defer to the EPA's reasonable interpretation of the CWA. Fed. Express Corp. v. Holowecki, 552 U.S. 389, 397 (2008). This deference increases where the EPA interprets its own regulations, Adams, 38 F.3d at 49; generally speaking, the agency's interpretation will be "controlling unless 'plainly erroneous or inconsistent with the regulation,'" Auer v. Robbins, 519 U.S. 452, 461 (1997) (quoting Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 359 (1989)).

Below we consider the petitioners' respective arguments, in turn, and affirm the EPA's decision as to each.

A. The EPA Did Not Commit Error by Issuing the 2008 Permit Without Waiting for Additional Information

The District argues that the EPA should have waited to issue the 2008 permit until after the District could complete both its facility upgrades and its new computer model of the Blackstone River. Instead of waiting for the "latest and best data," the District argues, the EPA "rush[ed] to issue the permit" in a "mechanical desire to reach a rapid conclusion without regard to whether the result is sound." Br. of Pet'r Upper Blackstone Water Pollution Abatement District, at 22 (quoting P.R. Sun Oil Co. v. EPA, 8 F.3d 73, 79 (1st Cir. 1993)) (internal quotation marks omitted). The District's arguments here fail.

The District first argues that the EPA should have waited to reissue the new permit until after the District had fully implemented its facility upgrades to comply with the 2001 permit

and 2002 administrative consent order. These upgrades reduced the District's nitrogen and phosphorus discharge down from prior levels to 8.0 - 10.0 mg/L and 0.75 mg/L, respectively, and the District argues that the EPA should have first assessed any water quality gains from these reductions before tightening the limits further still.

The 2002 consent order was issued under 33 U.S.C. § 1319 for the District's violation of the 2001 permit and established a schedule for construction of new facilities designed to achieve compliance with the 2001 permit. As sometimes happens when a permit requires new construction, the compliance schedule extended beyond the five-year expiration date of the actual permit. In its own words, the order provided "a schedule for compliance that the Director . . . has determined to be reasonable."

The order did not purport to alter the EPA's duties under the CWA to review and reissue permits every five years. See 33 U.S.C. § 1342(a)(3), (b)(1)(B) (permits "are for fixed terms not exceeding five years"). EPA regulations provide that no permit's term may be extended beyond this five-year statutory deadline except where administratively continued by the EPA during the permit reissuance process. See 40 C.F.R. § 122.46(a)-(b) ("NPDES permits shall be effective for a fixed term not to exceed 5 years . . . . Except as provided in § 122.6, the term of a permit shall not be extended by modification beyond the maximum duration

specified in this section."); id. § 122.6(a) ("[T]he conditions of an expired permit continue in force under 5 U.S.C. § 558(c) until the effective date of a new permit . . . ."); see also Natural Res. Def. Council, Inc. v. EPA, 859 F.2d 156, 212-14 (D.C. Cir. 1988) (per curiam) (upholding continuation provision). Here, neither the CWA nor EPA regulations allow the District's requested delay.

In addition, the record reflects that in formulating the 2008 permit limits, the EPA found that even with the fully completed facility upgrades, the District's discharge would still "cause, have the reasonable potential to cause, or contribute to" a violation of water quality standards.[19] 40 C.F.R. § 122.44(d)(1)(i). As to nitrogen, the EPA determined that "a seasonal reduction to no more than 5.0 mg/l is required . . . to achieve water quality standards," and that "[t]here is no realistic likelihood . . . that water quality standards could be met with a less stringent nitrogen limit." As to phosphorus, the EPA found that the 2001 permit's 0.75 mg/L limit is "inadequate for ensuring the water quality standards related to the control of eutrophication."

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[19] The argument has been raised in the briefing that water quality in the Blackstone River would be improved by modifying or removing the many industrial-era dams to allow the River's flow to move faster. No evidence has been presented to the EPA as to this proposal, so we may not address it. Moreover, it may be that since the build-up of toxic sediments behind the dams poses a serious toxic risk to water quality, this proposal may exacerbate the River's water quality problems and so should be studied carefully.

As to the District's computer model, neither the CWA nor EPA regulations permit the EPA to delay issuance of a new permit indefinitely until better science can be developed, even where there is some uncertainty in the existing data. The five-year term limit requires the EPA or state permitting authority to re-ensure compliance with the Act whenever a permit expires and is renewed. 33 U.S.C. § 1342(a)(3), (b)(1)(B); 40 C.F.R. § 122.46(a), (b). Thus, in regular intervals, the Act requires reevaluation of the relevant factors, and allows for the tightening of discharge conditions. The Act's goal of "eliminat[ing]" the discharge of pollutants by 1985 underscores the importance of making progress on the available data. 33 U.S.C. § 1251(a)(1).

In this case, the District overstates the availability of its data during the 2008 permit process. Although it was working on a computer model during the permitting process, the District did not present any data from the unfinished model during the sixty-four-day public comment period, and could not provide an estimated date for the model's completion. Indeed, it was uncertain during permitting whether the District would be able to successfully complete the model at all. Multiple previous attempts by state and federal actors to develop similar computer models had failed, leading RIDEM's experts to conclude that the Blackstone watershed "was too complicated to simulate with available mathematical models." The EPA took into account this prior experience as well

as the uncertainty surrounding the District's efforts to develop the model when it declined to delay issuance of the permit until some indefinite point in the future.

The EPA also concluded based on the extensive scientific record before it that even with the District's completed computer model, there was "no reasonable likelihood that a less stringent limit will meet [state water quality] standards." This determination is entitled to deference.

The EPA's decision entailed not only an evaluation of the sufficiency of the available scientific record, but also a risk analysis of the consequences of waiting. Nitrogen-based cultural eutrophication becomes more difficult to address the longer it is left unchecked. Nitrogen loadings accumulate and persist in water systems in a way that can exacerbate future water quality problems. The EPA found that both the severity of the existing water quality problems, and the potential for aggravated future problems, "counsel[ed] in favor of imposing a nitrogen limit . . . based on information currently available." This type of risk assessment is within the EPA's policymaking discretion, and its judgment here is entitled to respect. See Ethyl Corp. v. EPA, 541 F.2d 1, 28 (D.C. Cir. 1976) (en banc).

The District argues that delay was especially warranted here because the existing science was old and unreliable, and the District's new model could offer superior information. We

addressed and rejected a similar challenge in Sur Contra La Contaminación v. EPA, 202 F.3d 443 (1st Cir. 2000). A community organization, SURCCo, had challenged the EPA's issuance of a Prevention of Significant Deterioration permit under the Clean Air Act as arbitrary and capricious, on the grounds that the analysis relied upon by the EPA was faulty and the EPA should have required an alternative analysis to be conducted. We rejected SURCCo's argument, finding it was rational for the EPA "to prefer its own model, [and] to reject SURCCo's proposed alternative modeling." Id. at 448. We also rejected SURCCo's argument that the EPA had "relied on outdated -- and perhaps incorrect" data, and that the agency instead should have "relied on more recent data," available either from the state or from an analysis yet to be conducted when the permit was issued. Id. at 449. We credited the EPA's response that it had "no reason to question the continuing validity" of the data on which it relied. Id. (internal quotation mark omitted).[20]

[20] The District also relies on this court's decision in Puerto Rico Sun Oil Co. v. EPA, 8 F.3d 73 (1st Cir. 1993), for this point. However, at issue in that case was the EPA's rebuff of a state environmental quality board's request to delay the issuance of an NPDES permit until it could assess a possible mistake it had made in certifying the permit under 33 U.S.C. § 1341. However, the EPA ignored the state board's request and issued a final permit "with no explanation for its refusal to wait." 8 F.3d at 77. This court held that the EPA's failure to provide any justification for its actions was arbitrary and capricious. Id. at 78. In this instance, the EPA articulated its reasons for proceeding with issuance of the permit.

In almost every case, more data can be collected, models further calibrated to match real world conditions; the hope or anticipation that better science will materialize is always present, to some degree, in the context of science-based agency decisionmaking. Congress was aware of this when it nonetheless set a firm deadline for issuing new permits.

As in many science-based policymaking contexts, under the CWA the EPA is required to exercise its judgment even in the face of some scientific uncertainty. The Supreme Court has recognized this dimension of EPA decisionmaking in the context of the Clean Air Act. In Massachusetts v. EPA, 549 U.S. 497 (2007), the Court held that the EPA cannot "avoid its statutory obligation by noting the [presence of] uncertainty." Id. at 534. If "scientific uncertainty is so profound that it precludes EPA from making a reasoned judgment . . . EPA must say so. That EPA would prefer not to regulate greenhouse gases because of some residual uncertainty . . . is irrelevant. The statutory question is whether sufficient information exists to make an endangerment finding." Id.; see also Miami-Dade County v. EPA, 529 F.3d 1049, 1065 (11th Cir. 2008) (holding that the "EPA is compelled to exercise its judgment in the face of scientific uncertainty unless that uncertainty is so profound that it precludes any reasoned judgment"); Ethyl Corp., 541 F.2d at 28 ("[R]ecognizing . . . the developing nature of [the field] . . . . [t]he [EPA] Administrator may apply his expertise to

draw conclusions from suspected, but not completely substantiated, relationships between facts, from trends among facts, from theoretical projections from imperfect data, from probative preliminary data not yet certifiable as 'fact,' and the like."). The EPA did not act irrationally here by issuing the permit in the face of some scientific uncertainty.

Both the CWA and EPA regulations provide for the incorporation of new information into a permit once it has issued. The District will have multiple opportunities to submit new information to the EPA during the lengthy permit compliance process, which entails a period of close collaboration between the state, permittee, and EPA. The EPA noted during the permitting process that it intended "to establish a reasonable schedule for [the District] to come into compliance with the new nutrient limits." It has now drafted a compliance schedule, which provides the District with more than five years to implement the upgrades. A full twenty-one months are allocated to the District on the front end of this schedule for conducting testing and investigation into what measures should be implemented to comply with the permit's conditions. The District is required to submit its plans for implementing the new measures to the EPA one year later, and commence construction five months after that. The EPA has explained that "it may be appropriate to allow some period of time to operate the new plant before making a final decision on all

aspects of additional treatment facilities to enable [the District] and its consultants to determine the most cost-effective technologies for achieving the new limits."

In addition to this schedule for compliance, the CWA and EPA regulations provide procedures for the modification of issued permits where, in the EPA's view, change is warranted. 33 U.S.C. § 1342(a)(4), (b)(1)(C); 40 C.F.R. §§ 122.62(a)(2), 124.5. The EPA has stated that "if the model being developed for [the District], together with any other relevant evidence, makes it clear that alternative limits will result in attainment of water quality standards, EPA will modify the permit accordingly." The District has already submitted a permit modification request to the EPA based on its computer model and additional measurements it has conducted, and the EPA may consider that request in the normal course. The modification request is not before us, but both that procedure and the compliance process are relevant to our evaluation of the District's more extreme claims that it is being harmed by the EPA's decision not to delay the 2008 permit.

The EPA did not act arbitrarily here in deciding to issue the permit when it did.

B. The EPA Did Not Act Arbitrarily in Setting the 2008 Permit Limits

1. Nitrogen Limit

Both the District and CLF challenge the 5.0 mg/L seasonal nitrogen limit included in the 2008 permit. The District argues

that the EPA arbitrarily selected this limit based on an unreliable scientific model and without making the touchstone finding, under 33 U.S.C. § 1311(b)(1)(C), that the limit is "necessary to meet water quality standards." CLF argues that the EPA drew an unreasonable inference from the scientific record and, as a result, set a limit that is too lenient. We affirm the EPA's decision.

a. The District's Challenges

The District first attacks a scientific model the EPA incorporated into its analysis of the nitrogen-fueled cultural eutrophication in Narragansett Bay. The District argues that this model, which was created by the University of Rhode Island's Marine Ecosystems Research Laboratory (MERL) in the 1980s to simulate water quality conditions in the Bay,[21] is so unreliable and unrepresentative of actual Bay conditions as to entirely undermine the EPA's nitrogen analysis.

The MERL model was peer-reviewed and published in a scientific journal. Oviatt et al., Patterns of Productivity During

[21] MERL developed a physical, enrichment gradient model of the Bay through a series of tank experiments, which were designed to simulate the impact of nutrient loadings in lower Narragansett Bay and measure certain effects from these loadings, including dissolved oxygen impairments and chlorophyll *a* production. The experiment used multiple large tanks, each designed to model the temperature, mixing, turnover, and light conditions of Narragansett Bay; several tanks were used as controls, with conditions "similar to a relatively clean Northeast estuary with no major sewage inputs." Nutrients were added to the remaining tanks at varying levels designed to reflect a range of sewage-discharge scenarios in the Bay.

Eutrophication: A Mesocosm Experiment, 28 Marine Ecol. Progress Series 69 (1986). It has been used by the EPA, RIDEM, and other groups to better understand the causal relationship between nitrogen loadings and cultural eutrophication in Narragansett Bay. The EPA recently used the model in developing national guidance for nutrient reduction in water systems.[22]

RIDEM used the model to set nitrogen effluent limitations for Rhode Island sewage treatment plants situated along the Blackstone River and Narragansett Bay. As part of this process, RIDEM first conducted an extensive water quality study of the Blackstone, Seekonk, and Providence Rivers and the Bay, sampling and testing waters at various sites over a two-year period. It then compared the results of this study with the outputs of the MERL model, and concluded that both the study's results and the model showed that higher nitrogen levels led to increased cultural eutrophication and a less stable system in general. RIDEM published these results, as well as its rationale for imposing new nitrogen limits on Rhode Island sewage treatment facilities, in a 2004 Report. RIDEM, Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers (2004) ("RIDEM Report").

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[22] See EPA, Nutrient Criteria, Technical Guidance Manual: Estuarine and Coastal Waters, at 2-11, 2-16 (2001), available at http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/marine/index.cfm (last visited Aug. 2, 2012).

The EPA consulted both the RIDEM Report and the Nutrient Criteria Technical Guidance Manual in setting the nitrogen limit for the District's 2008 permit. The record demonstrates that the EPA carefully analyzed the MERL model during the permitting process and compared its results with the outputs of water quality measurements taken from the three rivers and the Bay. The EPA found that "[b]oth the MERL tank experiments and the data from the Providence/Seekonk River system confirm a clear correlation between nitrogen loadings, dissolved oxygen impairment, and chlorophyll *a* levels" in those water bodies. Both the MERL model and the field measurements demonstrated that as nitrogen loadings increase, dissolved oxygen decreases and chlorophyll *a* increases, with both becoming less stable and subject to greater swings at higher levels of nitrogen. The EPA concluded that the basic causal relationship demonstrated in the MERL experiments "corresponds to what is actually occurring in the Providence/Seekonk River system."

All of the parties agree that MERL's physical model did not perfectly capture Bay conditions. The EPA recognized that the model's flushing rate was lower than the Bay's natural flushing rate, which may have caused the model to overestimate the impacts of nitrogen loadings, while the model's mixing rate was higher than that in the Bay, which may, on the other hand, have caused the model to underestimate the impacts of nitrogen loadings. The model did not generate the precise maximum level of nitrogen loading at

which Rhode Island's water quality standards would be maintained. It did, however, generate a range of nitrogen loading scenarios which the EPA used in calculating the numeric limit in the permit.

The District argues that the discrepancies between the Bay's actual conditions and the conditions under which the experiments were conducted are so great as to render the model wholly unreliable. It argues that based on these "material[]" differences, and based on the fact that the model cannot predict the level of nitrogen control needed to meet state standards, it was irrational for the EPA to consider the model in setting the 2008 permit's nitrogen limit.

The EPA responds that the model provided one source of "useful information" in a multi-factored analysis and that to the extent it did rely on the model, it fully accounted for the model's shortcomings, and ultimately selected a nitrogen limit based on a less stringent nitrogen loading scenario than the model, considered alone, would warrant.

Our task is not to engage in a "de novo" evaluation of what scientific evidence was before the EPA, but to look instead for whether the EPA engaged in the proper decisionmaking process, and whether its decision finds support in the record. Motor Vehicle Mfrs. Ass'n, 463 U.S. at 43; Kennecott v. EPA, 780 F.2d 445, 449 (4th Cir. 1985) (Wilkinson, J.) ("The court best acts as a check on agency decisionmaking by scrutinizing process and by

determining whether 'the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment.'" (quoting Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 416 (1971))).

Where the agency follows the proper procedures and acts with a reasonable basis, both its choice of scientific data and interpretation and application of that data to real world conditions are entitled to deference. Sur Contra La Contaminacion, 202 F.3d at 448; P.R. Aqueduct & Sewer Auth., 35 F.3d at 604; see also Coal. for Responsible Regulation, 2012 WL 2381955, at *7.

Although the District singles out the EPA's reliance on the MERL model, the EPA used many sources of information in formulating the nitrogen limits, including both Massachusetts and Rhode Island reports on nitrogen loadings in the Bay, water quality studies evaluating nitrogen levels and response variables in the Bay, and national nitrogen guidance.[23] One significant source of

[23] The EPA consulted multiple sources, including: Deacutis et al., Hypoxia in the Upper Half of Narragansett Bay, RI, During August 2001 and 2002, 13 Ne. Naturalist (Special Issue 4) 173 (2006); RIDEM, Plan for Managing Nutrient Loadings to Rhode Island Waters (2005); Governor's Narragansett Bay Watershed Planing Comm'n, Nutrient and Bacteria Pollution Panel Initial Report (2004); RIDEM, Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers (2004); Howes et al., Massachusetts Estuaries Project: Site-Specific Nitrogen Thresholds for Southeastern Massachusetts Embayments: Critical Indicators, Interim Report (2003) (submitted to MassDEP). The EPA argues, and the record reflects, that the MERL model provided one source of "useful information" in an analysis that incorporated a wide variety of information.

information the EPA examined was Rhode Island's own in-state limits for nitrogen discharge into the relevant waters. As noted above, Rhode Island has imposed nitrogen limits equivalent to or stricter than the District's 5.0 mg/L limit on similarly situated sewage treatment facilities discharging into the three rivers and the Bay.

Where the EPA did rely on the MERL model, the record reflects that it fully accounted for the model's shortcomings. The EPA delved into "the assumptions and methodology used in preparing the model," Sierra Club v. Costle, 657 F.2d 298, 333 (D.C. Cir. 1981), and, far from ignoring the differences between the model and real world conditions, it highlighted and responded to these during the permitting process. Specifically, the EPA found that the difference in flushing rates tended to overestimate the effects of nutrient loadings, while the different stratification levels tended to underestimate those effects. It did not blindly follow RIDEM's conclusion, based on the model, that a 3.0 mg/L nitrogen limit might be needed, but, "conscious[] of the limits of its model," id. at 334, the EPA "chos[e] a nitrogen limit based on a less stringent loading scenario." See Am. Coke & Coal Chems. Inst. v. EPA, 452 F.3d 930, 943 (D.C. Cir. 2006) (holding that EPA's use of the challenged model was not arbitrary or capricious in part based on EPA's extensive efforts to compare model assumptions against real-world data).

The District's argument that the MERL model should have been excluded from consideration entirely is without merit. The EPA is not limited to models which perfectly replicate real world conditions. A model does not have to precisely predict the actual or an average future to increase understanding of a particular process or the role that different elements play in that process. The District's objection that the MERL model does not predict the level of nitrogen control needed misstates and misunderstands the different roles that scientific models may play in informing science-based decisions. Here, the EPA states, and the record reflects, that the MERL model demonstrated the relationship between nitrogen loading, dissolved oxygen, and chlorophyll *a* production for a range of loading scenarios in a water environment similar to the Bay's.

The EPA also followed the proper procedures for ensuring that the model received scrutiny not only from the permittee, but from the scientific community and the public. The EPA highlighted the model's potential shortcomings in the draft permit documents it published for public comment. Numerous stakeholders, organizations, and individuals submitted support for and criticism of the model. In its detailed and extensive responses to these comments, the EPA carefully reviewed and responded to each criticism raised. The EAB further reviewed the EPA Region's analysis of the model, and found no reason to fault that analysis.

"[A]dmission of uncertainties where they exist," "public exposure of the assumptions and data incorporated into the analysis," "the acceptance and consideration of public comment," and, ultimately, a decision that reflects the rule of reason, are the structural features of reasoned, publicly accountable science-based agency decisionmaking. Sierra Club, 657 F.2d at 334 & n.130; see also Nat'l Mar. Safety Ass'n v. Occupational Safety & Health Admin., 649 F.3d 743, 752 (D.C. Cir. 2011), cert. denied, 134 S. Ct. 1960 (2012). The EPA incorporated these structural safeguards into its decisionmaking process.

The EPA's determination, based on its analysis of the evidence before it as a whole, that a nitrogen limit of 5.0 mg/L was necessary to achieve Rhode Island's water quality standards was not a "hunch[] or wild guess[]" but a rational exercise of judgment. Ethyl Corp., 541 F.2d at 28.

The District's second challenge to the 2008 permit's nitrogen limit is that the EPA failed to prove that the limit is either "necessary" or "sufficient" to attain Rhode Island water quality standards. The CWA requires the EPA to impose certain types of discharge limitations on point source dischargers, including publicly owned sewage treatment facilities, such as the District's, "including those necessary to meet water quality standards." 33 U.S.C. § 1311(b)(1)(C). The District argues that the EPA failed to make specific findings either that the nitrogen

limit is "necessary" to achieve Rhode Island water quality standards or that it will "in fact" do so.

We reject the first claim, since the EPA expressly found that the 5.0 mg/L limit was necessary to meet state standards, and that a higher limit would not achieve those standards. In the Fact Sheet that accompanied the original draft permit, the EPA found "[b]ased on the available evidence, including nitrogen loadings from [the District] and the discharge of the Blackstone River to the Seekonk River, where the greatest impacts have been measured, . . . [the] seasonal reduction of nitrogen to no more than 5.0 mg/l is required at [the District's facility] in order to achieve water quality standards." The EPA reiterated that this limit was "necessary" to attain water quality standards at multiple other points in the draft permit and during the permitting process.

As to the second objection, the District argues that the EPA never found the nitrogen limit "sufficient" to attain water quality standards and that a still lower effluent limit may be needed. The EPA noted in the draft permit's Fact Sheet the possibility that further monitoring "will demonstrate that additional pollutant reductions are ultimately needed to meet water quality standards." This review and potential tightening of the conditions in NPDES permits is a basic feature of the CWA that the

District does not dispute.[24] See 33 U.S.C. §§ 1251(a), 1313, 1342(b).

The District's argument seems to go to the precision of the permit's nitrogen limit. But where a complex administrative statute, like those the EPA is charged with administering, requires an agency to set a numerical standard, courts will not overturn the agency's choice of a precise figure where it falls within a "zone of reasonableness." See, e.g., Nat'l Mar. Safety Ass'n, 649 F.3d at 752; Solite Corp. v. EPA, 952 F.2d 473, 488 (D.C. Cir. 1991) (per curiam) (judicial deference is warranted where EPA chooses "a numerical standard . . . within a 'zone of reasonableness'" (omission in original) (quoting Small Refiner Lead Phase-Down Task Force v. EPA, 705 F.2d 506, 525 (D.C. Cir. 1983) (internal quotation marks omitted))); Kennecott, 780 F.2d at 450 (EPA's "conclusions with respect to data and analysis need only fall within a 'zone of reasonableness'" (quoting Reynolds Metals Co. v. EPA, 760 F.2d 549, 559 (4th Cir. 1985)) (internal quotation mark omitted)); Hercules, Inc. v. EPA, 598 F.2d 91, 117 (D.C. Cir. 1978) (holding that within the zone of reasonableness, "the choice of a

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[24] The District's "sufficiency" argument is actually directed toward a very different point. The District argues that in addition to determining whether specific effluent limits will attain state water quality standards, the EPA must make a companion determination that the state standards are in fact "attainable," and if not, the EPA should work with the state to revise the standard "to reflect what can be attained." However, the District does not argue that Rhode Island's water quality standards here are unattainable, so we reject this argument.

precise figure is left to EPA"). The nitrogen limit the EPA chose here is justified by the record and within the zone of reasonableness.[25] The District's challenges to the limit fail.

b. CLF's Challenges

CLF does not challenge the EPA's reliance on either the RIDEM Report or the MERL model, but attacks the inferences the agency drew from these sources. CLF argues that because RIDEM

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[25] The District makes a cursory argument that the EAB applied an excessively deferential standard in its review of the 2008 permit's nitrogen and phosphorus limits. Since 1980, EPA's regulations have provided that the EAB's review of NPDES permitting decisions at the regional level shall be deferential to the EPA Regions' determinations, see 40 C.F.R. § 124.19(a); see also 45 Fed. Reg. 33,290, 33,412 (May 19, 1980), particularly where these involve science-based and technical judgments, see In re: NE Hub Partners, L.P., 7 E.A.D. 561, 567-68 (EAB 1998), review denied sub nom. Penn Fuel Gas, Inc. v. EPA, 185 F.3d 862 (3d Cir. 1999). This deference is not unbounded, however; in its review of petitions, the Board carefully examines the permit decisionmaking process and the full record. See, e.g., In re: City of Marlborough, Mass. Easterly Wastewater Treatment Plant, 12 E.A.D. 235, 248-52 (EAB 2005) (remanding permit because "the Region [had] not sufficiently explained where or how [the compliance finding] is reflected in the record").

In this case, the EAB exhaustively reviewed the EPA Region's permitting decision in a thorough and exacting 106-page opinion. The EAB carefully addressed each of the arguments of the parties to this appeal, as well as those of seven other entities, including the states of Massachusetts and Rhode Island. The Board's opinion, upholding the permit in part, and remanding to the EPA for further proceedings in part, reviewed the analysis and methodology employed by the EPA Region in full. The Board's review of the permit decision on this record was reasonable. To the extent that amicus curiae, City of Marlborough, makes additional broader arguments about the EAB's standard of review in this case, amicus is not a party and we do not engage those arguments. Downing/Salt Pond Partners, L.P. v. Rhode Island, 643 F.3d 16, 28 (1st Cir. 2011), cert. denied 132 S. Ct. 502 (2011).

determined in its Report that a 5.0 mg/L nitrogen limit "would not be acceptable as [a] water quality goal[] for the area," and that instead, a limit of at least 3.0 mg/L was necessary to ensure compliance with Rhode Island water quality standards, the EPA acted irrationally choosing a 5.0 mg/L limit over a more stringent limit.

The EPA responds, and the record reflects, that RIDEM noted in its Report that "some uncertainty remains regarding predicted water quality improvements and loading reductions necessary to meet water quality standards. . . . For these reasons, evaluation of phased implementation is indicated." RIDEM, Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers at 27 (2004). RIDEM, in fact, set a limit of 5.0 mg/L for two sewage treatment facilities located along the Providence River, both of which are comparable in size to the District. The EPA took these factors, and many others, including the additional studies and data we have referenced above, into account in setting the nitrogen limit.

CLF's argument that the EPA should have interpreted RIDEM's Report to require a 3.0 mg/L limit amounts to an attack on the EPA's interpretation and application of the scientific data before it to real world conditions. We give the EPA substantial deference in this area. See Coal. for Responsible Regulation, 2012 WL 2381955, at *7; Adams, 38 F.3d at 49; P.R. Aqueduct & Sewer Auth., 35 F.3d at 604; Kennecott, 780 F.2d at 450. Here, the EPA

independently analyzed the model and data utilized in RIDEM's Report and reasonably concluded that certain aspects of each warranted a slightly higher limit than the Report recommended. This decision is entitled to deference.

CLF makes an additional argument that the EPA made the impermissible assumption in setting the nitrogen limit that the District's discharge will remain below its design flow of 56 mgd. See 40 C.F.R. § 122.45(b)(1) ("POTW[] [publicly owned treatment work] effluent limitations . . . shall be calculated based on design flow."). However, CLF has waived this argument by failing to present it either to the EPA Region during the permitting process or during the initial round of briefing before the EAB. 40 C.F.R. § 124.13 ("All persons . . . who believe any condition of a draft permit is inappropriate . . . must raise all reasonably ascertainable issues and submit all reasonably available arguments supporting their position by the close of the public comment period . . . ."). As a result, the EPA did not have the opportunity to assess or respond to CLF's objection on the record.

"Simple fairness to those who are engaged in the tasks of administration, and to litigants, requires as a general rule that courts should not topple over administrative decisions unless the administrative body not only has erred but has erred against objection made at the time appropriate under its practice." United States v. L. A. Tucker Truck Lines, Inc., 344 U.S. 33, 37 (1952);

see also Pepperell Assocs. v. EPA, 246 F.3d 15, 27 (1st Cir. 2001). The waiver rule serves particularly important purposes in the administrative review context, both in that it accords respect to the agency decisionmaking process by providing the agency with the "opportunity to address a party's objections, . . . apply its expertise, exercise its informed discretion, and create a more finely tuned record for judicial review," and in doing so, guards against a system in which regulated parties "simply turn to the courts as a tribunal of first resort." Mass. Dep't of Pub. Welfare v. Sec'y of Agric., 984 F.2d 514, 523-24 (1st Cir. 1993). Because CLF failed to abide by this rule, its argument is waived.

2. Phosphorus Limit

The District objects to the 2008 permit's imposition of a 0.1 - 1.0 mg/L seasonal limit on its phosphorus discharge. In the way of brief background to this challenge, the District's 2001 permit limited phosphorus discharge to 0.75 mg/L in order to address low dissolved oxygen levels, but not cultural eutrophication, in the Blackstone River. Around the time the 2001 permit issued, the EPA was in the process of studying nutrient-related issues more closely in water systems across the country. In 2001, the EPA published a national action plan for the development and establishment of numeric nutrient criteria as well

as recommended numeric criteria for most water systems.[26] In conjunction with these ongoing efforts, the EPA specifically noted during the 2001 permitting process that more stringent phosphorus limits might be necessary in future permits to address cultural eutrophication impacts in the Blackstone River.

Subsequently, in order to address the severe and ongoing phosphorus-driven cultural eutrophication in the Blackstone River, the EPA incorporated a more stringent phosphorus limit into the 2008 permit. In formulating this limit, the EPA considered the national and regional guidance criteria and recommended values it had recently published. See, e.g., Buck et al., Office of Water, EPA, Nutrient Criteria Technical Guidance Manual: Rivers and Streams (2000); Office of Water, EPA, Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria: Rivers and Streams in Ecoregion XIV (2000) (guidance document on river watersheds in eastern coastal states, including Massachusetts); Barbour et al., Office of Water, EPA, Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish (2d ed. 1999). It also looked at older studies, see Office of Water Regulations & Standards, Quality Criteria for Water (1986)

[26] See Grubbs, Office of Sci. & Tech., Development and Adoption of Nutrient Criteria into Water Quality Standards (2001), available at, http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2009_01_21_criteria_nutrient_nutrientswqsmemo.pdf (last visited Aug. 2, 2012).

(the "Goldbook"), and considered site-specific data from studies conducted after the 2001 permit had issued.

The District argues that the 2008 permit's phosphorus limit is arbitrary because the EPA considered national guidance on phosphorus reduction, and other regional and area studies which, the District argues, have no proven connection to the Blackstone River.

The EPA did not act irrationally by considering its national and regional phosphorus guidance criteria in addition to site-specific data. The guidance documents helped inform the EPA's background understanding of phosphorus-driven eutrophication and recommended "a range of ambient phosphorus concentrations that [would be] sufficiently low to prevent cultural eutrophication" in river systems similar to the Blackstone. See 40 C.F.R. § 122.44(d)(1)(vi).

Of the documents the EPA considered which recommended specific numeric phosphorus limits, the Nutrient Criteria Technical Guidance Manual recommends an in-stream phosphorus concentration of 0.01 - 0.09 mg/L, the Ambient Water Quality Criteria Recommendations for Ecoregion XIV recommends an in-stream concentration of 0.024 mg/L, and the Goldbook recommends an in-stream concentration of 0.05 mg/L for any stream entering a lake or reservoir, and 0.1 mg/L for any stream not discharging into an impounded waterbody (the EPA noted that the Blackstone River is

characterized by multiple impoundments). The EPA did not blindly follow any of these recommended limits, but after examining additional site-specific data, including local water quality studies, selected a phosphorus limit designed to ensure an in-stream concentration of 0.1 mg/L.[27]

The EPA also analyzed various site-specific phosphorus load data produced after 2001, including studies conducted by MassDEP, EPA New England, and the U.S. Army Corps of Engineers.[28] To account for the District's phosphorus treatment upgrade, implemented as part of the 2001 permit and 2002 consent order, the EPA also examined data collected when the District's phosphorus discharge was comparable to what it would be with the upgrade. The EPA examined data collected by MassDEP under low flow conditions in August of 2003, when the District's average monthly discharge was 0.8 mg/L, very close to the 2001 permit's 0.75 mg/L limit. See Fiorentino, Div. of Watershed Mgmt., Mass. Dep't Envtl. Prot.,

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[27] In this instance, the EPA determined that a monthly average total phosphorus limit of 0.1 mg/L was necessary from April 1 through October 31 in order to ensure an in-stream concentration of not more than 0.1 mg/L due to the lack of any significant dilution in the River's waters downstream during these months.

[28] See Fiorentino, Div. of Watershed Mgmt., Mass. Dep't of Envtl. Prot., Blackstone River Watershed 2003 Biological Assessment (2006); Tamul, Div. of Watershed Mgmt., Mass. Dep't of Envtl. Prot., Blackstone River Watershed 2003 DWM Water Quality Monitoring Data (2005); Wright et al., Dry Weather Water Quality Sampling and Modeling, Blackstone River Feasibility Study (2004) (for U.S. Army Corps of Engineers); Wright et al., Blackstone River Initiative, Water Quality Analysis of the Blackstone River Under Wet and Dry weather Conditions (2001) (for EPA New England).

Blackstone River Watershed 2003 Biological Assessment (2006). MassDEP nonetheless observed a "luxuriant algal community" and measured levels of phytoplankton which were "extremely abundant, covering virtually the entire river bottom." The EPA reasonably determined, and the record reflects, that the 2001 permit's 0.75 mg/L phosphorus limit would thus be insufficient to reduce cultural eutrophication and bring the River into compliance with state water quality standards.

To the extent the District challenges the precision of the 2008 permit's numeric limit, we have already recognized that the EPA's choice of a precise numeric value will be affirmed where it is within the zone of reasonableness. See Nat'l Mar. Safety Ass'n, 649 F.3d at 752. The permit's phosphorus limit is within this zone of reasonableness.

The District also alleges that the EPA was required to demonstrate both that the phosphorus limit "would have a substantial impact on the cultural eutrophication of the Blackstone River" and that it will alleviate not merely cultural eutrophication but "a specific impairment in designated uses." In other words, the District argues that any effluent limitation imposed upon it must cure (or nearly so) the water quality problem.

The CWA quickly disposes of these arguments. The Act's TMDL and interim planning process both contemplate pollution control where multiple point sources cause or contribute to water

quality standard violations. 33 U.S.C. § 1313(d), (e). Under earlier legislation, including the 1965 Federal Water Pollution Control Act, when a water body failed to meet its state-designated water quality standards, pollution limits could not be strengthened against any one polluter unless it could be shown that the polluter's discharge had caused the violation of quality standards. See EPA v. California ex rel. State Water Res. Control Bd., 426 U.S. 200, 202-03 (1976). This standard was ill-suited to the multifarious nature of modern water pollution and prevented the imposition of effective controls. Id. In 1972, Congress declared that the system was "inadequate in every vital aspect," and had left the country's waterways "severely polluted" and "unfit for most purposes." S. Rep. No. 92-414, at 3674 (1971). The CWA rejected the earlier approach and, among other things, introduced individual pollution discharge limits for all point sources. 33 U.S.C. 1311(b). To maintain state water quality standards, the Act establishes the TMDL and continuing planning processes, which target pollution from multiple sources. Id. § 1313(d), (e).

EPA regulations require permitting authorities to include in NPDES permits conditions which "control all pollutants or pollutant parameters . . . [that] are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality." 40 C.F.R.

§ 122.44(d)(1)(i); see also 54 Fed. Reg. 23,868, 23,873 (June 2, 1989). We thus reject the notion that in order to strengthen the District's discharge limits, the EPA must show that the new limits, in and of themselves, will cure any water quality problems.

3. Aluminum Limit

Finally, the District challenges the limit placed on aluminum discharge, arguing that the EPA assembled and then relied upon an erroneous data set in deriving the limit. Specifically, the District argues that the EPA should have excluded an "outlier data point of 344 µg/L" in calculating the District's average daily aluminum discharge. The EPA responds that the atypical data point was properly included in its analysis of in-stream concentrations of aluminum since the District did not demonstrate that the conditions which led to the high discharge will not reoccur, and that, in any case, the District has waived its argument.

We find that the District has waived the argument by failing to raise it during the public comment period of the permitting process. See 40 C.F.R. § 124.13; L. A. Tucker Truck Lines, 344 U.S. at 37; Pepperell Assocs., 246 F.3d at 27; Mass. Dep't of Pub. Welfare, 984 F.2d at 523-24. In its February 27, 2009, comments on the draft modification for aluminum discharge, the District objected that the EPA "used and relied upon incomplete and incorrect data and as a result reached incorrect conclusions." However, this comment was directed at another argument, that the

EPA had failed to include data from certain years, and did not state or imply that the EPA should have excluded the 344 µg/L data point. By failing to give the EPA an opportunity to address the argument during the permitting process, the District has waived its claim.

IV.

The District's responsibility for serious pollution problems in the important waterways of two states is clear, and its challenge to the 2008 permit has no merit. As the District has recognized, cost considerations may not be considered by the EPA in the setting of permit limits to assure compliance with state water quality standards. 33 U.S.C. §§ 1311(b)(1)(C), 1342(a)(2); Defenders of Wildlife v. Browner, 191 F.3d 1159, 1163 (9th Cir. 1999); U.S. Steel Corp. v. Train, 556 F.2d 822, 838 (7th Cir. 1977). We trust that the District, as well as the EPA, will now act with expedition to address these problems.

The District and CLF's petitions are denied. The stay granted by this court on April 29, 2011, is lifted. No costs are awarded.

So ordered.