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Reducing Nitrogen Pollution on Long Island Sound: Is There a Place for Pollutant Trading?

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I. INTRODUCTION

Long Island Sound is a magnificent estuary,[1] stretching over 110 miles from the windy eastern stretches of water and sand at its junction with the Atlantic Ocean, to its western end where it meets Manhattan's East River amidst one of the nation's most urbanized areas.[2] Draining a watershed of 16,000 square miles reaching

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1. An estuary is a semi-enclosed body of water where fresh and saltwater mix. *See* JOHN A. KNAUSS, INTRODUCTION TO PHYSICAL OCEANOGRAPHY 38 (1978). "Estuary" and "estuarine zone" are also defined specifically in the Clean Water Act. *See* Clean Water Act § 104(n)(4), 33 U.S.C. 1254(n)(4) ("'estuary' means all or part of . . . the connection with open sea and within which the sea water is measurably diluted with fresh water derived from land drainage"); Clean Water Act § 320(k), 33 U.S.C. § 1330(k) ('estuarine zone' includes "associated aquatic ecosystems and those portions of tributaries draining into the estuary up to the historic height of migration of anadromous fish or the historic head of tidal influence, whichever is higher").

2. *See* LONG ISLAND SOUND STUDY [hereinafter LISS], COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN 1 (1994) [hereinafter CCMP]. Long Island Sound is bordered by Connecticut and New York, but its watershed encompasses all of Connecticut, those parts of New York lying near the Sound, as well as substantial portions of Massachusetts, New Hampshire and Vermont. It reaches into Canada, where the headwaters of the Connecticut River lie. For practical and managerial reasons, efforts to restore Long Island Sound focus on the watershed within Connecticut and New York. *See id.* at 1.

northward to Canada, with a population of almost eight and a half million people,[3] it is home to a great diversity of plants, animals and fish.[4] With an estimated annual value exceeding $5 billion from commercial and recreational fishing, beach swimming and boating,[5] the Sound provides jobs and recreation, and solace to the soul.[6] Beneath the surface beauty, however, troubles abound. Fish catches are down, species diversity continues to decline and the waters are often unappealing, and occasionally unsafe.[7]

Of the numerous pollution problems facing Long Island Sound, the most prominent is over-enrichment of its waters by excess nitrogen. That nitrogen derives from numerous sources, but primarily from sewage treatment plants which dot the Sound's shores and tributaries. The cost of improved sewage treatment is dauntingly high for many of the localities, faced as they are with competing needs for scarce tax dollars. Those costs may vary with the age and condition of the individual treatment plant, and the benefits to be gained in improved water quality in the Sound as a whole may shift according to the location of the particular plant. These factors have led to the suggestion that pollutant trading among plants might potentially achieve water quality goals in a more cost efficient manner than a traditional regulatory program alone. That has, in turn, engendered interest in establishing some type of market based nitrogen trading program, focusing either on the Sound as a whole or on one of the states bordering it.

Although some of the earliest literature directed at managing water bodies and their watersheds[8] explored market type trading,[9] the

3. CCMP, *supra* note 2, at 3.

4. *See* CCMP, *supra* note 2, at 101-02; Elsa Brenner, *L.I. Sound Still Shy a Clean Bill of Health*, The N.Y. Times, July 7, 1996, §13 (Westchester Weekly), at 1.

5. CCMP, *supra* note 2, at 2.

6. Economists speak more prosaically of the benefits of protecting and preserving a resource such as the Sound, evaluating such elements as recreation, commercial fishing, "option value", and "existence value." The option value is the value to an individual of preserving the option of using the resource in the future. The "existence value" encompasses all nonuse-related values; it is the amount a person would be willing to pay for water quality improvements even though the person does not anticipate ever using the resource. *See* Alan J. Krupnick, *Reducing Bay Nutrients: An Economic Perspective*, 47 MD. L. REV. 452, 457 (1988).

7. For example, a series of sewage spills in June 1997 led health officials to close twenty six beaches in Westchester County, NY, as well as beaches in the Bronx and Connecticut. *Spilled Sewage Closes Beaches in Westchester*, N.Y. TIMES, June 18, 1997, at B2; John T. McQuiston, *More Beaches are Closed by Sewage*, N.Y. TIMES, June 19, 1997, at B4; Michael Cooper, *Sewage Spill Bars Swimming at 27 Beaches*, N.Y. TIMES, June 29, 1997, at 1/23.

8. A watershed or drainage basin is the land mass which drains into a stream, river, lake, estuary or other body of water. For a discussion of the various terms see Robert W. Adler,

device has been primarily employed in dealing with air pollution under the federal Clean Air Act, most notably the sulfur dioxide trading program mandated by the Clean Air Act to reduce acid deposition.[10] However, not all observers are supportive of such market experiments.

Scholars, advocates and agencies have for some time debated the efficacy and utility of market based incentives for pollution control.[11] In one corner are those, often economists, who contend that market instruments, rather than regulation, are the most efficient way to prevent environmental damage and restore degraded resources.[12] They point particularly to the acid deposition program as a model for employing pollution trading to achieve environmental ends in a cost effective manner. In the other corner are those, including many environmentalists, who believe that market solutions, particularly pollution trading, achieve little, are overly complex to administer and enforce, and fail to reduce pollution where most needed; they often view the monetization of the right to pollute as an abdication of environmental principles.[13] They

Addressing Barriers to Watershed Protection, 25 ENVTL. L. 973, 976 & n.7 (1995), and references cited therein.

9. *See* MARC J. ROBERTS, *River Basin Authorities: A National Solution to Water Pollution*, 83 HARV. L. REV. 1527 (1970).

10. *See* Clean Air Act §§ 410-416, 42 U.S.C. §§ 7651i-7651o (1994). The acid deposition program is discussed in Part II, C, 5, *infra*.

11. Market based environmental policies are those which depend on financial incentives, or disincentives, to achieve desired environmental goals. They may include such mechanisms as fees, subsidies, and marketable rights. *See* OFFICE OF POLICY, PLANNING, AND EVALUATION, U.S. ENVIRONMENTAL PROTECTION AGENCY, 21P-2001, ECONOMIC INCENTIVES: OPTIONS FOR ENVIRONMENTAL PROTECTION, 1-2—1-4 (1991). For a general discussion of regulatory and market mechanisms from which policy makers can choose for implementing environmental policies, *see* ROBERT W. HAHN, A PRIMER ON ENVIRONMENTAL POLICY DESIGN 9-12 (1989); OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, ENVIRONMENTAL POLICY TOOLS (1995) [hereinafter ENVIRONMENTAL POLICY TOOLS].

12. *See, e.g.*, Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171 (1988) [hereinafter Ackerman & Stewart 1988]; Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333 (1985) [hereinafter Ackerman & Stewart 1985]. *See also infra* note 56.

13. There are clear philosophical differences which stem from divergent views of ecological resources and pollution. Stated in extreme terms, one view sees nature as a resource to be exploited, and to the extent it can be polluted without obvious harm then it is to man's economic advantage to do so. Trading rights to pollute is simply an extension of this view. *See* Robert W. Hahn, *Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders*, J. OF ECON. PERSPECTIVES 95, 110 (1989) [hereinafter Hahn, *Doctor's Orders*] (industry believes its claims on environmental resources represent property rights). The contrary view sees nature as good and pollution as bad. The suggestion that one might

criticize the trading programs, including the acid deposition program, arguing that the same degree of pollution reduction might have been achieved using traditional regulatory controls,[14] and that the trading system fails to protect the vulnerable populations and ecosystems and may delay full compliance with regulatory goals.[15]

Still, the acid deposition trading program has encouraged market advocates to explore the applicability of pollution trading programs to water pollution, land use and even climate change problems.[16] Trading programs already have been undertaken to control

purchase rights to pollute raises serious moral concerns. *See* RICHARD A. LIROFF, REFORMING AIR POLLUTION REGULATION: THE TOIL AND TROUBLE OF EPA'S BUBBLE 9-10 (1986) [hereinafter LIROFF, TOIL & TROUBLE]; Michael J. Sandel, *It's Immoral to Buy the Right to Pollute*, N.Y TIMES, Dec. 15, 1997, at A23; James T.B. Tripp & Daniel J. Dudek, *Institutional Guidelines for Designing Successful Transferable Rights Programs*, 6 YALE J. ON REG. 369, 370 & n.4 (1989); Adam J. Rosenberg, *Emissions Credit Futures Contracts on the Chicago Board of Trade: Regional and Rational Challenges to the Right to Pollute*, 13 VA. ENVTL. L.J. 501, 525-26 & n.158 (1994); Michael P. Vandenbergh, *An Alternative to Ready, Fire, Aim: A New Framework to Link Environmental Targets in Environmental Law*, 85 KY. L.J. 803, 856-858 & nn.230-231 (1997). *See also* Jane B. Baron & Jeffrey L. Dunoff, *Against Market Rationality: Moral Critiques of Economic Analysis in Legal Theory*, 17 Cardozo L. Rev. 431, 436-437 (1996) (environmental ethics hostile to economic analysis); Hahn, *Doctor's Orders*, *supra* note 13, at 111 (environmentalists fear that market alternatives will give legitimacy to polluting). While most individuals' views fall somewhere in the middle of the spectrum, the moral overtones often enter into the debate. *See* Marshall J. Breger, Richard B. Stewart, E. Donald Elliott, David Hawkins, *Providing Economic Incentives in Environmental Regulation*, 8 YALE J. ON REG. 463, 469-70, 480 (1991) (speeches before the Administrative Conference of the U.S.) [hereinafter Breger *et al.*, *Providing Economic Incentives*] (dangerous to put in place any system that created legal rights to a given level of pollution; the issue does not revolve around rights to pollute, but temporary permission; D. Hawkins) (regulation is also a license to pollute, for free; R. Stewart).

14. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 WASH. & LEE L. REV. (forthcoming 1998) (manuscript on file with the author). Professor Driesen suggests that the term "economic incentive" is poorly defined, but often is contrasted with traditional regulatory measures, ignoring the fact that such measures themselves often create strong economic incentives. This leads critics to exaggerate the disadvantages of traditional regulation and minimize its advantages.

15. *See* James Dao, *A New, Unregulated Market: Selling the Right to Pollute*, N.Y. TIMES, Feb. 6, 1993, at A1. Opponents of trading may also point to the potential for uneven distribution of pollution impacts and the concomitant issue of environmental justice. *See EPA Weighs Environmental Justice Impacts of Emissions Trading Programs*, INSIDE EPA, Sept. 5, 1997, (Weekly Report), at 20 (community group contends trading program violates Civil Rights Act by disproportionately impacting disadvantaged communities); Eileen Gauna, *Federal Environmental Citizen Provisions: Obstacles and Incentives on the Road to Environmental Justice*, 22 ECOLOGY L.Q. 1, 72 (1995) (trading programs may lead to "hot spots" in poor and minority communities); Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 STAN. ENVTL. L.J. 300, 343 (1995) (distributional problems arise if pollution trading programs do not assure meaningful citizen participation). *See also* LIROFF, TOIL & TROUBLE, *supra* note 13, at 10.

16. Trading on a global scale currently is being suggested by the Administration as a mechanism for addressing carbon dioxide and other emissions which contribute to global

water pollution in specific water bodies,[17] both from point source dischargers and from overland runoff, or nonpoint sources.[18] These programs have sometimes been controversial, but interest in trading remains strong at the federal level, and in some localities. This interest is stimulated in part by the growing recognition that some water quality problems can be addressed only on a large geographic scale. A federal policy shift toward increasing emphasis on watershed management coincides with, and perhaps encourages, consideration of trading schemes.

The purpose of this article is to examine the legal adequacy of proposals now under consideration for a nitrogen trading program on Long Island Sound, and to assess the likelihood of success in light of the experience with other trading programs, both for water and air pollution. Part I outlines the current environmental condition of Long Island Sound and explains the factors which have led proponents of trading to believe such a program could be effective. In Part II we consider the essential elements of a trading program, and the lessons to be learned from the Clean Air Act programs. Part III examines the federal policy framework within which water pollutant trading may take place, while Part IV analyzes the legal framework and explains the ways by which a trading program may be crafted to fit within it. Part V reviews existing water trading programs and the lessons to be learned from their successes and failures. Part VI undertakes a rigorous analysis of the specific proposal under consideration for Long Island Sound, evaluating both its legal adequacy and the likelihood that a sufficient market driver would be created to provide economically efficient environmental results. Part VII concludes that although a Long Island Sound pollutant trading program can be accommodated within the frame-

warming. *See* Peter Passell, *Global Warming Plan Would Make Emissions a Commodity*, N.Y. TIMES, Oct. 24, 1997, at D1; *see also* John H. Cushman, Jr., *Pollution Politics: Clinton's Choice*, N.Y. TIMES, JUNE 27, 1997, at A11; Peter Passell, *Wanted: A Global Warming Policy that Stands a Chance*, N.Y. TIMES, Oct. 2, 1997, at D2.

17. Water pollutant trading may be referred to as effluent trading, water quality trading, or nutrient trading if that is the pollutant to be traded. *See* Surface Water Quality Division, Michigan Department of Environmental Quality, *Introduction to Market-Based Programs* ¶ 3 (visited Dec. 20, 1997) <http://www.deq.state.mi.us/swq/trading/htm/intro.htm> [hereinafter *Introduction to Market-Based Programs*].

18. The term "point source" is generally used to indicate a facility which discharges its waste through a pipe. "Point source" is defined in Clean Water Act Section 502(14) as "any discernible, confined and discrete conveyance . . . ." 33 U.S.C. § 1362 (14) (1995) [hereinafter C.W.A.] The term "nonpoint source" is typically used when referring to uncontrolled runoff.

work of the Clean Water Act, the factual predicates for such a program have yet to be established, and practical and policy concerns make such a trading program problematic.

II. LONG ISLAND SOUND

A. The Hypoxia Problem

The Long Island Sound Study (LISS) was begun in 1985 to examine the water quality problems confronting the Sound.[19] It focused particularly on the low levels of dissolved oxygen (DO), a condition known as hypoxia, in parts of the Sound during the summer months. Its research identified excess nitrogen as the major cause of the low DO levels.[20] Nitrogen, an nutrient essential for plant growth and survival, can disrupt the natural balance of a water body when present at high levels. It fuels the growth of algae which eventually die, sink to the bottom, and decompose. The decomposition process consumes oxygen, thereby reducing the amount available generally in the ambient water, depriving fish and other aquatic life of the oxygen critical to sustain them.[21] One

19. The Long Island Sound Study got underway as the result of a congressional appropriation for EPA and the coastal states of Connecticut and New York to assess the water quality of the Sound. CCMP, *supra* note 2, at 5. Following enactment of the Clean Water Act Amendments of 1987, Long Island Sound was selected to participate in the National Estuary Program, and the Long Island Sound Study Management Conference, which included federal, state and local officials, representatives of industry, public interest groups, and academic institutions, Clean Water Act § 320 (c), 33 U.S.C. § 1330(c), was charged with gathering data and assessing the condition of the estuary, identifying the causes of environmental problems, and developing a Comprehensive Conservation and Management Plan to recommend priority corrective actions and compliance schedules to address those problems. Clean Water Act § 320 (b), 33 U.S.C. § 1330 (b).

20. LISS, HYPOXIA AND NUTRIENT ENRICHMENT—ASSESSMENT OF CONDITIONS AND MANAGEMENT RECOMMENDATIONS iii (1993) (hereinafter HYPOXIA STUDY). Hypoxia is generally considered to exist when dissolved oxygen levels dip below 3 mg/l, the level thought by biologists necessary to sustain healthy marine life. CCMP, *supra* note 2, at 11; LISS, *Hypoxia in Long Island Sound*, Table 1.

21. In general, the maximum amount of dissolved oxygen which water can hold at typical summer water temperatures is 7.5 mg/l. HYPOXIA STUDY, *supra* note 20, at 1. The states have set water quality standards for dissolved oxygen at levels which are intended to protect aquatic organisms. Those standards are 5 mg/l in New York and 5 to 6 mg/l in Connecticut, depending on the type of waters involved. *Id.* at 13. *See* N.Y. COMP. CODES R. & REGS. tit. 6, § 703.3 (1991); CONN. AGENCIES REGS. § III (1996). Annual monitoring has shown levels as low as 0 mg/l (anoxia). In 1989 nearly 60% (over 500 square miles) of Sound bottom waters contained less than 3 mg/l. HYPOXIA STUDY, *supra* note 20, at 2. As recently as 1994, 25 percent of the Sound had unhealthy levels of oxygen during the late summer. LISS, PROPOSAL FOR PHASE III ACTIONS FOR HYPOXIA MANAGEMENT [hereinafter PHASE III

obvious manifestation of this problem is the fish kills which are not uncommon in some of the bays and harbors surrounding the Sound,[22] but hypoxia can have more subtle effects on the development of marine organisms and on species composition.[23]

Hypoxic conditions do not occur uniformly throughout the Sound, and tend to be most severe during the summer months in the western end of the Sound, which, not surprisingly, is the area of highest population concentration and sewage treatment plant loadings.[24] While hypoxia has been recorded in the Sound over the decades, the evidence suggests that it is becoming more common and more severe.[25]

The nitrogen flowing into the Sound comes from numerous sources, including fertilizer used on farm fields and urban lawns, septic tanks, animal wastes, and even air pollution.[26] However the primary contribution is from the more than one billion gallons a

PROPOSAL] 5 & Fig. 3 (Aug. 1997). The Long Island Sound Comprehensive Conservation and Management Plan sets interim targets, with a minimum of 3 mg/l under certain conditions. CCMP, *supra* note 2, at 26.

22. CCMP, *supra* note 2, at 15.

23. HYPOXIA STUDY, *supra* note 20, at 10. Hypoxia can be especially damaging for organisms, such as oysters, which cannot move to more oxygen enriched waters. *Id.* Hypoxia can also alter the ecological makeup of a waterbody, wiping out organisms sensitive to low oxygen levels, while allowing those types of organisms which can sustain themselves in such conditions to survive. *Id.* In addition to hypoxic conditions resulting from their decay, algae cloud the water, depriving submerged aquatic vegetation, so important to many species for food and habitat, of the light necessary for growth. Alliance for the Chesapeake, *New Air Rules Expected to Help Reduce Bay Nutrients*, BAY JOURNAL, July-Aug., 1997, at 10.

24. The hypoxia problem caused by excessive discharges of nitrogen is exacerbated by the natural tendency of the waterbody to stratify during the warmer summer months. The fresher water on the surface is warmer but contains more oxygen than the lower layer, which is denser and saltier. This phenomenon creates a density difference called a pycnocline, which prevents mixing of the surface and bottom layers which would otherwise occur and bring oxygen to the lower level. CCMP, *supra* note 2, at 16-18; *see infra* note 313 and accompanying text.

25. CCMP, *supra* note 2, at 11.

26. CCMP, *supra* note 2, at 20. Nitrogen compounds in the air result from emissions by a variety of sources, and are deposited to water bodies directly either as dry deposition, or acid precipitation. They reach waters indirectly through runoff. Estimates on the amount of nitrogen reaching the Sound through these mechanisms vary. The LISS estimates the figure at 11 percent. Phase III Proposal, *supra* note 21, at 5. A report released by the National Oceanic and Atmospheric Administration (NOAA) in June 1996 contains an estimate of 20 percent. R. VALIGURA, W. LUKE, R. ARTZ, B. HICKS, COASTAL OCEAN PROGRAM, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DECISION ANALYSIS SERIES NO. 9, ATMOSPHERIC NUTRIENT INPUT TO COASTAL AREAS: REDUCING THE UNCERTAINTIES 17 (1996). *See also* Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, EPA-453/R-97-011, Deposition of Air Pollutants to the Great Waters: Second Report to Congress, 168, 173-74 (1997) (total load from atmospheric deposition is 20 percent).

day of treated effluent discharged by over 60 sewage treatment plants located on or close to the Sound.[27] Indeed, more than half of the total load of nitrogen delivered to Long Island Sound as a result of human activities is from these plants.[28] These discharges, as well as other point and nonpoint loadings of nitrogen have increased over the years, and will likely continue to do so.[29]

B. Addressing the Problem

Sewage treatment plants are required under the Clean Water Act to employ a specific level of treatment referred to as "secondary treatment,"[30] and even more stringent controls if necessary to prevent the impairment of local waters.[31] Although some incidental nitrogen removal occurs during normal operations, most plants are not designed to remove significant levels of this pollutant. Achieving high levels of nitrogen removal requires construction of new facilities or costly upgrades of old ones. Even with new technology based on biological processes,[32] the costs are substantial.[33]

The Long Island Sound Management Conference, a partnership

27. CCMP, *supra* note 2, at 4; LISS, SUMMARY OF THE COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN, at 6 (1994) [hereinafter CCMP SUMMARY].

28. CCMP, *supra* note 2, at 20. The most recent figures indicate that point sources, primarily sewage treatment plants, account for 37,000 tons of nitrogen a year. PHASE III PROPOSALS, *supra* note 21, at 5.

29. Nonpoint sources contribute substantially less nitrogen to the Sound than point sources, —roughly twenty percent. CCMP, *supra* note 2, at 20. Because of their diffuse nature it is often difficult to monitor, measure and control their pollutant load. Additionally, they are almost unregulated under the Clean Water Act. *See infra* note 172.

30. Clean Water Act § 301(b)(1)(B), 33 U.S.C. § 1311(b)(1)(B). *See infra* note 179.

31. Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C).

32. Nitrogen removal was traditionally achieved by using chemical additives. Biological methods for removing nutrients from wastewater (BNR) have improved the economic outlook, but still can be quite costly, and cannot always be employed. PHASE III PROPOSAL, *supra* note 21, at 6; *see* CCMP, *supra* note 2, at 29.

33. Preliminary estimates indicated that total maximum capital costs for a high level of nitrogen removal from point sources to the Sound could be as much as $8.1 billion, $6.4 billion for New York and $1.7 billion for Connecticut. CCMP, *supra* note 2, at 158. The most recent cost estimate for maximum nitrogen removal at the 70 treatment plants in New York and Connecticut is about $2.5 billion. PHASE III PROPOSAL, *supra* note 21, at 14. *See also* A.T. KEARNEY, INC., FRAMEWORK FOR INCORPORATING FLEXIBLE, MARKET-BASED INCENTIVES INTO GEOGRAPHIC TARGETING OF NITROGEN REDUCTION ACTIONS FOR LONG ISLAND SOUND, DRAFT FINAL 1-6 (August 27, 1996) [hereinafter A.T. KEARNEY, INC.], [prepared for U.S. Environmental Protection Agency, Region II] (estimates are in the $2 to 3 billion range). It should be noted, however, that these estimates reflect the total cost of plant upgrades, and not just the incremental costs of adding nitrogen removal. Incremental costs have recently been estimated at $300 million for New York and $350 million for Connecticut. PHASE III PROPOSAL, *supra* note 21, at 14.

of the federal government and the states of Connecticut and New York which was established by Congress to oversee the Long Island Sound Study and to develop a Comprehensive Management Plan[34], issued its Plan in 1994.[35] In it, the Conference chose both interim and long term goals for dissolved oxygen levels[36] and set forth a phased implementation plan to manage hypoxia, focusing on sewage treatment plants.[37] Phase I essentially called for a "freeze" on nitrogen loadings, setting 1990 as the baseline year. [38] Phase II consisted of a number of relatively low cost actions to achieve additional reductions below 1990 levels. The Plan recognized that these steps would not meet the interim targets, let alone the overall goal for dissolved oxygen and[39] accordingly, Phase III called for additional reductions, with targets to be based on sophisticated computer modeling work.

To carry out the Phase III reductions, the near Sound watershed was divided into geographical management zones, based primarily on tributary watersheds.[40] Nitrogen loadings in each zone and their impacts on the Sound were to be assessed based on the model, and zone-by-zone plans would be fashioned to achieve nitrogen reduction targets,[41] using both point and nonpoint source

34. *See supra* note 19.

35. The Conference released the Management Plan in 1994; the principal problems it identified were (1) low levels of dissolved oxygen (hypoxia) in much of the Sound, due in large part to nitrogen from point sources, primarily sewage treatment plants; (2) toxic contamination; (3) contamination from pathogens; (4) floatable debris; (5) the impact of all these factors on living resources; (6) and the degradation of water quality and habitat due to land use and development. CCMP, *supra* note 2, at ES-1.

36. *Id.* at 25, 26 (Sidebar 5). The CCMP set interim DO targets both for the bottom waters of the Sound where the greatest problems occur, and for surface waters. The intent of the targets is to eliminate severe hypoxia. Bottom targets are to maintain existing DO levels in those waters currently meeting state water quality standards; and raise DO levels to meet state standards in those areas having current DO levels between 3.5mg/l and the state standards. For those areas which do not presently achieve a level of 3.5mg/l, the interim target is to increase levels to 3.5 mg/l, with an absolute floor of 1.5 mg/l at all times. Interim targets were also established for surface waters. The long term goal is to "[i]ncrease dissolved oxygen levels in the Sound to eliminate adverse impacts of hypoxia resulting from human activities." *Id.* at 25.

37. *Id.* at 27-45.

38. The states agreed to achieve this "freeze," through various permit modifications and facility retrofits. CCMP, *supra* note 2, at 27-29

39. *Id.* at 36.

40. The land area was classified into eleven "management" zones, corresponding largely to river system watersheds. The function and intent of these management zones and plans, and their significance to any proposed trading program, is discussed in Part VI, *infra.*

41. CCMP, *supra* note 2, at 37.

controls. But in light of the high point source loadings and the difficulties inherent in reducing runoff,[42] a substantial focus remained on limiting sewage plant discharges.

Subsequent to the issuance of the report a new computer model, known as LIS 3.0, was completed for use in managing nitrogen loadings to the Sound.[43] Based on modeling work, it appears that to achieve targeted dissolved oxygen levels overall inputs of nitrogen must be reduced 58.5 percent from 1990 levels. Accordingly, in February 1997 the LISS Management Conference's Policy Committee[44] released for public comment a "Proposal for Phase 3 Actions for Hypoxia Management", which included a commitment by Connecticut and New York to reduce nitrogen loads by 58.5 percent from 1990 levels by the year 2014.[45] The proposal contemplates a phased, enforceable schedule which is to achieve 40 percent progress toward the 58.5 percent goal in five years; 75 percent within ten years; and full attainment in 15 years.[46] Each of the eleven watershed-based management zones established by the LISS was allocated the same 58.5 percent reduction.[47] Within each management zone loadings may be allocated to both point and nonpoint sources.

42. According to the U.S. Environmental Protection Agency (EPA) nonpoint sources are today the largest cause of our Nation's water quality problems. OFFICE OF WATER, U.S. ENVIRONMENTAL PROTECTION AGENCY, EPA A841-F-96-004A, NONPOINT SOURCE POLLUTION: THE NATION'S LARGEST WATER QUALITY PROBLEM, Pointer No. 1, (visited Dec. 20, 1997) <http://www.epa.gov/OWOW/NPS/facts/point1.htm>. These sources are extremely diverse, *see id.*, and are harder to identify and control than point sources, depending as they do on localized features such as land uses, climate and geology. *See* David Letson, *Point/Nonpoint Source Pollution Reduction Trading: An Interpretive Survey*, 32 NAT. RESOURCES J. 219 (1992). Monitoring and enforcement are also more difficult for these diffuse sources. *Id.* at 2.

43. LIS 3.0 is a three-dimensional(east-west, north-south, surface to bottom) time-variable model combining both the hydrodynamics of the Sound with water quality components. It uses tide and current measurements to simulate the water's circulation. HYDROQUAL, INC., WATER QUALITY MODELING ANALYSIS OF HYPOXIA IN LONG ISLAND SOUND USING LIS 3.0 (July 1996) (prepared for the Management Committee, Long Island Sound Estuary Study and New England Interstate Water Pollution Control Commission).

44. The Policy Committee, which is composed of the Administrators of the U.S. Environmental Protection Agency's Regions I and II, the New York State Commissioner of Environmental Conservation, and the Connecticut Commissioner of Environmental Protection, has overall responsibility for the LISS. CCMP, *supra* note 2, at 5-6, and Figure 2.

45. The states will propose Clean Water Act permit modifications and commit to necessary nonpoint source actions by August 1999; the nitrogen reduction targets are to be achieved 15 years after that date. LISS Policy Committee, Proposal for Phase 3 Actions for Hypoxia Management, February 7, 1997 [hereinafter Policy Committee Proposal].

46. *Id.* at 2.

47. *Id.* at 1.

The Policy Committee further proposed to assure that its actions in administering and enforcing the nitrogen reduction targets would be consistent with the Clean Water Act by formally developing a total maximum daily load (TMDL) for nitrogen as required by the Act, including both point and nonpoint sources. Once a TMDL is established, the states will develop zone-by-zone plans to allocate the wasteload or wasteload reductions among dischargers.[48] By 1999, wastewater discharge permits will be modified to reflect the allocations,[49] and commitments made toward nonpoint reductions by 1999. The Policy Committee's proposal was the subject of public meetings in the fall of 1997 and it was adopted in final form in February 1998.[50]

In the meantime, interest has been expressed by Long Island Sound officials in the potential for employing market mechanisms, such as a point source nitrogen trading program, to achieve the necessary reductions at the lowest overall cost. The Long Island Sound Study Management Conference released in August 1996 a *Framework for Incorporating Flexible, Market-Based Incentives into Geographic Targeting of Nitrogen Reduction Actions for Long Island Sound, Draft Final.*[51] The document analyzed the benefits and drawbacks of trading and recommended a specific "strawman" trading program for the Sound. In its February 1997 proposal, the Policy Committee appointed an Ad Hoc Nitrogen Trading Discussion Group consisting of federal, state and local officials, academics,[52] and environmental public interest representatives to review the issue and report by June 1998 regarding the feasibility of a nitrogen trading program. It is the proposal for trading on Long Island Sound that is the ultimate subject of this article, but to fully understand the issue some understanding of the basics of pollutant trading and its history is essential.[53]

48. The TMDL process is discussed in Part IV, *infra.*

49. The proposal contemplates that NPDES permits will be modified to require plans for meeting the long-term limits, and to impose nitrogen loading limitations in accordance with the five-year target. Policy Committee Proposal, *supra* note 45, at 2.

50. LISS Policy Committee Meeting Summary, Feb. 5, 1998, at 1; John T. McQuiston, *15-Year Plan Is Adopted To Clean L.I. Sound,* N.Y. TIMES, Feb. 7, 1998, at B4. In spite of the commitment to reducing hypoxia in the Sound demonstrated by the proposal, there remains a real likelihood that even if all scheduled reductions are achieved, the goal of substantially improved oxygen levels may remain elusive. *See* PHASE III PROPOSAL, *supra* note 21, at 9.

51. A.T. KEARNEY, INC., *supra* note 33.

52. The author is a committee participant.

53. For further information regarding Long Island Sound see Ann Powers and Eric S. Andreas, *Long Island Sound: A Bibliography of Legal and Related Materials,* 14 PACE ENVTL. L.

III. THE ELEMENTS OF A TRADING PROGRAM

Pollutant trading is a market-based approach to environmental protection intended to take advantage of the differences in pollution control costs confronting dischargers of the pollutant in question. The theory is to allow those dischargers that can achieve pollution reduction most cost effectively to sell or barter their excess pollutant reduction capabilities to other eligible dischargers for whom reducing their own pollutant loads is more costly. By this process, the more efficient pollution reduction sources profit financially, while the less efficient sources take the regulatory credit for the reductions.[54] Trading seeks to inject a large degree of flexibility into a pollution control program by separating the issue of who will pay for the control from who will install it.[55] In this manner it addresses the complaints of rigidity and inefficiency which arise in the traditional regulatory programs.[56]

REV. 447 (1996). A full listing of federal environmental law statues and related authorities may be found on the Pace Virtual Environmental Law Library. *See* Pace University School of Law, Center for Environmental Legal Studies, *Global Environmental Law Network* <http://www.law.pace.edu/env/vell6.html>.

54. *See* Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulation: A New Era From an Old Idea*, 18 ECOLOGY L. Q. 1, 8-9 (1991) [hereinafter Hahn & Stavins, *Incentive Base-Environmental Regulation*]; TOM TIETENBERG, EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY 16 (1985) [hereinafter TIETENBERG, EMISSIONS TRADING]; Paul Faeth, *What is Trading?* ¶ 1, in *Summary of Presentations, Water Quality Trading Conference* (Surface Water Quality Division, Michigan Department of Environmental Quality) (visited December 20, 1997) <http://www.deq.state.mi.us/swq/trading/htm/confsum.htm> [hereinafter Faeth, *What is Trading?*].

55. *See* TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 410 (1992).

56. *See generally*, Ackerman & Stewart 1985, *supra* note 12; Breger et al., *Providing Economic Incentives in Environmental Regulations*, *supra* note 13; Richard B. Stewart, *Models for Environmental Regulation: Central Planning Versus Market-Based Approaches*, 19 B.C. ENVTL. AFF. L. REV. 547, 554 (1992). The term "command-and-control" is often used, sometimes negatively, to describe traditional pollution control regulations which give specific directives to dischargers concerning the level of control to be achieved or the types of technology to be installed. *See* Hahn & Stavins, *Incentive-Based Environmental Regulation*, *supra* note 54, at 5-6. Professor Driesen argues that the term "command and control" is usually used inaccurately to refer to regulatory measures which specify emission levels, not just precise compliance methods. *See* Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 9-12). Whatever its flaws, even those who criticize it as inefficient concede that a traditional regulatory approach may be preferable in certain situations, such as when pollutants have local impacts, or where the sources are too few to provide a competitive market. Hahn & Stavins, *supra* note 54, at 14-15. In Hahn's and Stavins' view, the best set of pollution control policies will involve a mix of market mechanisms and traditional regulatory measures. *Id.* at 15. *See also infra* note 180 (discussing of technology-based standards).

A. Market-Based Principles

The goal of a pollutant trading program is to attain ecological objectives while effectively lowering overall discharge control costs. To attain this goal, trading programs must rely on the basic elements found in every market: a commodity to be traded, a demand for the commodity, and a structure in which trading can occur.[57] In a pollutant trading scheme, pollution discharge units are the commodity that is traded. These units represent a defined amount of pollution expressed in terms of kilograms, pounds, or tons,[58] and are typically referred to as credits or allowances.[59] Since the goal is to protect environmental resources, the tradable units must be real and quantifiable to assure that actual pollutant reductions are achieved.[60] Once the trading program has been established, potential cost savings are the primary economic incentive that will create demand. A discharger will be inclined to trade if the trade allows it to reduce its cost of pollution control, but if cost savings are unavailable, trading is unlikely to occur.[61] Generally, a discharger would have incentive to purchase units if it could thereby achieve the required pollution reduction at a price below its own control costs. On the other hand, a discharger would have incentive to sell if its control costs were low and it could profit by generating excess saleable pollution reduction units.[62] Finally, the structure of a trading program (the rules of the game or the trading guideline) is likely to be determined, especially in the water pollution context,

57. *See* Kurt Stephenson & Leonard Shabman (Virginia Water Resource Research Center), *Effluent Allowance Trading: A New Approach to Watershed Management*, WATER SCIENCE REPORTER 2 (National Institutes for Water Resources), Oct., 1996 [hereinafter WATER SCIENCE REPORTER].

58. *See Introduction to Market-Based Programs*, *supra* note 17, ¶ 3.

59. Whether these units are called credits or allowances depends upon the nature of the trading program. *See infra* note 66.

60. *See Introduction to Market-Based Programs*, *supra* note 17, ¶ 3; Breger et al., *Providing Economic Incentives*, *supra* note 13, at 471.

61. *See* OFFICE OF WATER, U.S. ENVIRONMENTAL PROTECTION AGENCY, PUB. NO. EPA 800-R-96-001, DRAFT FRAMEWORK FOR WATERSHED-BASED TRADING (1996) [hereinafter DRAFT FRAMEWORK]. Optimally, all sources would control to the same marginal cost level, that is, the additional or incremental costs of achieving one additional unit of pollution reduction would be equal. *See* Hahn & Stavins, *supra* note 54, at 6 & n. 25.

62. *See* Hahn & Stavins, *supra* note 54, at 6 & n. 25; TIETENBERG, EMISSIONS TRADING, *supra* note 54, at 16; Robert W. Hahn & Gordon L. Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOL. L. Q. 361, 364 (1989) [hereinafter Hahn & Hester, *Marketable Permits*]; Esther Bartfeld, *Point-Nonpoint Source Trading: Looking Beyond Potential Cost Savings*, 23 ENVTL. L. 43, 56-57 (1993) [hereinafter Bartfeld, *Point-Nonpoint Source Trading*].

through negotiations between the dischargers, government permitting authorities, and interested citizen groups.[63]

B. Types of Markets

One of the first considerations in establishing a trading program is to determine the type of "market" which will be created, since that will dictate how units of pollution reduction will be created and how new sources can gain entry into the market. Trading programs are either structured as open or closed, and both can take place in an existing regulatory framework.[64] An "open" market program has no cap on the overall amount of pollution discharged, or limit on the number of pollution units which may be traded.[65] A baseline generally is established by a regulatory program, and a source in the system creates saleable reduction units (credits)[66] by reducing discharge levels more than necessary to achieve its permitted baseline level. [67] The credits may be traded, used for compliance or banked. A source wishing to sell credits can do so after documenting that it has in fact reduced its discharge below the regulated mandated levels. The trading program is "open" to new sources, in that the only barrier into the market is compliance with the regulatory requirements, usually use of specified technological controls or attainment of the performance level which might be achieved using those controls. [68] Accordingly, sources meeting these requirements do not need to purchase credits to begin operation.[69]

Because open-market trading systems are based upon existing discharge limits without a cap, they may require little additional

63. *See* WATER SCIENCE REPORTER, *supra* note 57, at 9-13.

64. *See* Faeth, *What is Trading?*, *supra* note 54; *Introduction to Market-Based Programs*, *supra* note 17, ¶¶ 7-10. Virtually all trading programs rely on an existing permitting system. HAHN, *supra* note 11, at 50.

65. One example of an open market type trading arrangement, the use of offsets under the Clean Air Act, is examined below in Part II. C. 3.

66. These terms are often used interchangeably, but "credits" tend to refer to the excess pollution units created in an open program by reductions below the baseline. "Allowance" is the term usually used when referring to the pollution units allocated in a closed program.

67. *See* Faeth, *What is Trading?*, *supra* note 54. The baseline for reduction for an open trading program comes from the existing regulatory framework, such as existing technology based standards expressed in individual discharge permit.

67. *See id.*

68. Participation in the program is voluntary, without restriction on the number of participants.

69. *See* A.T. KEARNEY, INC., *supra* note 33, at 2-9.

environmental information and monitoring, and permits need not generally be issued or altered. Thus, this type of program lends itself to relatively prompt implementation. But because credits can be used by dischargers to meet the baseline requirements, there is substantial possibility for localized impacts, or "hot spots."[70]

An "open" trading program is not really feasible for Long Island Sound, since the Clean Water Act requires any water body which is not meeting water quality standards *(e.g.,* the Sound) to have a total limit on loadings as discussed in Part IV, A. However, understanding this type of market is necessary when reviewing other trading programs.

Although open trading programs may have appeal because of their apparent flexibility, closed trading programs, generally referred to as "cap and trade," are the most common. The acid deposition control provisions of the Clean Air Act are of this nature,[71] as well as all of the existing water pollutant trading programs.[72]

In a closed trading program the sources which are subject to the program are specified by statute, regulation or other mechanism.[73] A regulatory agency or other entity sets a cap, fixed or declining, on the amount of pollutants that a watershed, air shed or ecosystem may absorb.[74] Once this cap or baseline is set, dischargers are allocated a specified number of pollution units (allowances), and will produce a surplus of credits or allowances when they reduce their pollutant loads below the allocation.[75] These surplus pollution units may be traded with other sources in the program, or may be "banked" for future use. No allocations are made for new sources, which must purchase unused allowances to gain market entry.[76] In this way, new sources will not affect the total aggregate limit placed on the pollutant of concern.[77] These concepts are

70. *See Introduction to Market-Based Programs, supra* note 17, ¶ 9. Because of the relatively unregulated nature of open programs, and the possibility of hot spots, it is unlikely that the Environmental Protection Agency would allow open trading to address water pollution. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-4.

71. Clean Air Act § 402, 42 U.S.C. § 7651.

72. DRAFT FRAMEWORK, *supra* note 61, at Appendix C.

73. *See* Faeth, *What is Trading?, supra* note 54, ¶ 2; *Introduction to Market-Based Programs, supra* note 17, ¶¶ 7-10.

74. Faeth, What is Trading?, supra note 54, ¶ 2.

75. *See id.*

76. *See* A.T. KEARNEY, INC., *supra* note 33, at 2-10.

77. *See id.* at 2-9. The *Draft Framework* does not use the open-market/closed-market terminology. However, EPA's Trading Principle 3 enunciates that states must establish TMDLs

somewhat confusing in the abstract, but an exploration of trading under the Clean Air Act will help in gaining a clearer understanding of how they work in practice.

C. Trading Experience Under the Clean Air Act

The first large scale pollution trading program was undertaken pursuant to Title IV of the Clean Air Act Amendments of 1990, the acid deposition control provisions.[78] Other sections of the Act also allow trading in some fashion, and merit examination. Some of these predate the acid deposition provisions, and provided early experience in market mechanisms. These early trading mechanisms are bubbles, netting, offsets, and banking.[79] By examining each, the potential cost savings and environmental impacts of emission trading can better be understood.

1. Bubbles (regulation of existing sources)

Under the Clean Air Act a single facility may be composed of numerous emitting units or "sources," each subject to individual controls. The Environmental Protection Agency (EPA) introduced regulatory flexibility into this situation through a "bubble" policy which allows existing plants (or groups of plants) with multiple emission sources to be treated, for regulatory purposes, as a single source.[80] Once the Agency has approved a bubble, provided the total emissions limit is met by the plant, it may vary source emissions within the facility as it desires.[81] The bubble policy was up-

where technology-based limits are insufficient to protect water quality, at required in section 303(d) of the Clean Water Act. *See infra* notes 190-197 and accompanying text; 33 U.S.C. § 1313. In such cases it appears that an open-market system would be unavailable. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-6.

78. *See* Clean Air Act §§ 410-416, 42 U.S.C. §§ 7651i-7651o (1994).

79. *See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 3-9; Robert W. Hahn and Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 118-136 (1989) [hereinafter Hahn & Hester, *Where Did All the Markets Go?*]; Hahn, *Doctor's Orders*, *supra* note 13, at 98-99; Hahn & Hester, *Marketable Permits*, *supra* note 62, at 368-376; Daniel J. Dudek & John Palmisano, *Emissions Trading: Why is this Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217, 223-229 (1988) [hereinafter Dudek & Palmisano, *Emissions Trading*]. In its review of the various pollution control methods available to policy makers the Office of Technology Assessment characterized bubbles and netting as integrated permitting rather than trading since they deal with pollution transfers within a single facility, and not between facilities. *See* ENVIRONMENTAL POLICY TOOLS, *supra* note 11, at 108.

80. EPA, Emissions Trading Policy Statement: General Principles for Creation, Banking, and Use of Emission Reduction Credits, 51 Fed. Reg. 43,814, 43,830 (1986) [hereinafter EPA Emissions Trading Policy].

81. *Id. See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 4-6; Hahn & Hester, *Where Did All the*

held by the Supreme Court in *Chevron v. NRDC*,[82] but remains controversial because under the policy some sources escape otherwise applicable technology requirements, and other sources have on occasion been manipulated to avoid stricter emission standards,[83] with potentially adverse environmental consequences. Nonetheless, the deferential standard articulated by the Court when reviewing EPA's construction of the Clean Air Act provisions certainly has relevance as the Agency develops pollutant trading policies under the Clean Water Act.[84]

2. Netting (modification of existing source)

Netting is a concept similar to a bubble, but is employed when a major emitting source under the Clean Air Act undertakes a modification resulting in increased emissions.[85] If there are other units or sources within the same facility which can reduce emissions to compensate for the new emissions caused by the modification, certain preconstruction permit requirements can be avoided.[86] Netting is the most frequently employed method of trading by a wide margin. It has been calculated that some 8,000 sources used netting between 1974 and 1984,[87] with an estimated saving of $25 to $300 million in permitting costs, in addition to $500 million to $12 billion saved in emission control costs,[88] although the accuracy of

Markets Go?, *supra* note 79, at 123-29.

82. 467 U.S. 837 (1984) (a landmark opinion which held that where the legislative intent of a statute is ambiguous, the court must grant great deference to the interpretation of the agency).

83. *See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 98-99; David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 39). Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 123. EPA policy does not allow emission reduction from existing sources to meet technology based requirements applicable to new or modified stationary sources. EPA Emissions Trading Policy, *supra* note 80, at 43,830. Through 1985, EPA had only approved 42 bubbles under the Act. *See* Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 123. However, state-permitted bubbles, available in a few states, had been created on a more frequent basis. *Id.* at 137.

84. For an example of the "bubble" concept used in the water pollution control context see Part IV, B, 4.

85. EPA Emissions Trading Policy, *supra* note 80, at 43,830.

86. *Id.* *See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 6; Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 132-136.

87. *See* Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 133. The authors point out that netting could have an adverse impact on local air quality if several sources in a single area utilized this method of trading. *See id.* at 136.

88. *See id.* at 138, Table 4.

these types of figures has been questioned.[89] Both bubbles and netting apply to existing sources within the same facility or under the same ownership. The next category, offsets, apply more generally to new sources.

3. Offsets (new sources)

Under the Clean Air Act, new major emitting units or sources seeking to emit pollutants in areas where air quality is impaired may only do so if the total load of pollutants to the environment is not increased. To accomplish this, new sources are required to "offset" their anticipated emissions by finding an existing source able and willing to reduce by the same, or a greater, amount.[90] This offset can be achieved through internal trades between emission sources within a single facility or external trades with another entity.[91] Offset provisions essentially create an open market in which the regulatory limitations placed on sources to attain National Ambient Air Quality Standards for the traded pollutant are used as individual baselines for sources engaging in trades, but there is no overall numerical cap. Over 2,000 offsets transactions occurred between 1977 and 1986, however, external trades accounted for only a small percentage of the offsets.[92] This may result from a lack of "readily identifiable" sellers, and subsequently higher transaction costs to find suitable trading partners.[93] As for environmental impacts, at least some commentators have concluded that although offset transactions may not protect air quality as effectively as possible in all instances, they have not had a significant negative impact on environmental quality.[94]

89. David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 33-34).

90. EPA Emissions Trading Policy, *supra* note 80, at 43,830-831. The offset policy originally developed by EPA was subsequently adopted by Congress in various provisions of the Clean Air Act amendments of 1977. *See, e.g.*, Clean Air Act § 173(c), 42 U.S.C. § 7503(c)(general); Clean Air Act § 182(a)(4), (b)(5), [c](10), (d)(2), & (e)(1), 42 U.S.C. § 7511a(a)(4), (b)(5), [c](10), (d)(2), & (e)(1)(ozone nonattainment).

91. EPA Emissions Trading Policy, *supra* note 80, at 43,830-831. *See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 6-7; Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 119-123.

92. *See* Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 119-120.

93. *See id.* at 122.

94. *See id.*; Dudek & Palmisano, *Emissions Trading*, *supra* note 79, at 122-23.

4. Banking

A fourth mechanism under the Clean Air Act, banking,[95] allows firms to store credits for future use or sale,[96] but it has not been particularly effective.[97] A credit bank can also be used as a market place in which credit buyers and sellers can be located at a minimal transaction cost. However, banking activity has been nearly nonexistent as banks have not effectively promoted trading, nor have firms deposited many credits. Hence, banking has had a de minimis effect on air quality and cost savings. It has been suggested that two factors may be responsible for this inactivity. First, firms find little use for banks in attainment areas, which have no offset requirements. The utility of banked credits is further diminished by other restrictions which may limit the use to credits to only offset or internal application. Secondly, the uncertain nature and value of banked credits explains the dearth of banking activity. Banked credits may be reduced or eliminated by a change in regulatory policy. Limited credit-life also raises the possibility that credits may disappear prior to an opportunity for their use.[98]

5. Title IV Acid Deposition Control Program

The 1990 amendments to the Clean Air Act brought about a major change in the manner of dealing with acid deposition by creating an emission trading program for sulfur dioxide (SO_2).[99] The program, known as the "Title IV program," seeks to reduce the emissions of sulfur dioxide from electrical utilities by setting an overall cap on SO_2 emissions and creating a scheme of tradable emission allowances.[100] The trading provisions are a free standing

95. EPA Emissions Trading Policy, *supra* note 79, at 43,831.

96. *See* LIROFF, TOIL & TROUBLE, *supra* note 13, at 7; Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 129-132; EPA Emissions Trading Policy, *supra* note 79, at 43,831.

97. Hahn & Hester, *Where Did All the Markets Go?*, *supra* note 79, at 119, 130-131, 137.

98. *See id.*

99. *See* Pub . L. 101-549, title IV, § 403, 104 Stat. 2589 (Nov. 15, 1990) (codified as Clean Air Act § 403, 42 U.S.C. § 7651b).

100. Clean Air Act § 403, 42 U.S.C. § 7651b (1995). The amendments also address another pollutant implicated in acid deposition, nitrogen oxides (NOx), but not through an allowance trading program. Instead, performance standards are required, although there is some allowance for averaging between units with the same owner or operator. Clean Air Act § 407(c), (e), 42 U.S.C. § 7651f (c), (e)(1995). EPA has promulgated regulations which allow a state or group of states to establish a cap and trade program for NOx under defined circumstances, 40 C.F.R. § 76.16 (1997), and is developing a model NOx trading rule. 62 Fed. Reg. 54,409 (1997). The 1990 amendments did include a directive to the Administrator to evaluate and report to Congress by 1994 on the environmental and economic conse-

program, separate from the general design of the air pollution control program based on national ambient air quality standards carried out through state implementation plans. Under this "closed" trading program, a specified group of utilities received initial allocations of tradable allowances based on an annual tonnage emissions formula set forth in the statute.[101] Utilities which reduce their emissions below allocation levels may sell the excess allowances; if a utility emits more that the allowances it is allocated, it can remain in compliance by purchasing additional allowances from other electric generating units or the EPA which holds a limited number of allowances for auction.[102] The Title IV program has two-phases, the first of which became effective in 1995[103] and applies to 110 utility plants specified in the Clean Air Act, most of which are large, coal-fired Midwestern power plants.[104] Phase II will regulate approximately an additional 700 utility plants after January 1, 2000.[105]

While the commentators are not uniform in their assessments of the program, three observations summarize the Title IV program to date. The first is that SO_2 emission reductions thus far have exceeded present Clean Air Act requirements. Second, the cost of this compliance has been below that which was projected. Finally,

quences of trading sulfur dioxide allowance for nitrogen oxides allowances. Clean Air Act § 403(c), 42 U.S.C. § 7651b(c)(1995). The 1990 Clean Air Act amendments also greatly expanded the number of instances where emission trading or other market-based control concepts may be used. *See, e.g.,* Clean Air Act §§ 607, 616, 42 U.S.C. 7671f, 7671o (1995) (chlorofluorocarbon trading); Clean Air Act § 211(k)(7)(A), (m)(5), 42 U.S.C. § 7545(k)(7)(A), (m)(5) (reformulated gasoline credits; marketable oxygen credits for fuels); Clean Air Act § 246(f), 42 U.S.C. § 7586(f) (1995) (centrally fueled fleets). *See also* Hahn & Stavins, *Incentive Based-Environmental Regulation, supra* note 54, at 22 n.136.

101. Clean Air Act § 403(a), 42 U.S.C. § 7651b(a) (1995); Acid Rain Program: General Provisions and Permits, Allowance System, Continuous Emissions Monitoring, Excess Emissions and Administrative Appeals, 58 Fed. Reg. 3590 (Jan. 11, 1993); 40 C.F.R. Parts 72, 73, 75, 77 & 78 (1997).

102. Clean Air Act § 403(b), 42 U.S.C. § 7651b(b) (1995). EPA is a vendor of what are designated Special Reserve Allowances, representing 2.8 percent of the annually allocated allowances. Clean Air Act § 416(b), 42 U.S.C. § 7651o(b) (1995).

103. Clean Air Act §§ 404, 405, 42 U.S.C. §§ 7651c, 7651d.

104. *See* Clean Air Act § 404, Table A, 42 U.S.C. § 7651c Table A (1995); U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-95-30, AIR POLLUTION: ALLOWANCE TRADING OFFERS AN OPPORTUNITY TO REDUCE EMISSIONS AT LESS COST 16 (1994) [hereinafter GAO, ALLOWANCE TRADING]; David Sohn and Madeline Cohen, *From Smokestacks to Species: Extending the Tradable Permit Approach From Air Pollution to Habitat Conservation,* 15 Stan. Envtl. L. J. 405, 422-23 (1996) [hereinafter Sohn & Cohen, *Smokestacks*].

105. *See* Clean Air Act § 405, 42 U.S.C. § 7651d (1995); GAO, ALLOWANCE TRADING, *supra* note 104, at 16.

there has been very limited allowance trading activity.[106]

Overall, the Title IV program appears to have led to a sharp reduction in SO_2 emissions in the first years of operation. In a 1997 report, the Environmental Protection Agency indicated that for 1996 all of the sources covered by the law were in compliance with their emission limitations, either through actual emission reductions or by the purchase of allowances. Moreover, SO_2 emissions were 5.4 million tons, 2.9 million tons (35 percent) below Title IV's maximum levels.[107] It is suggested that the reduction in emissions resulted in decreased sulfate deposition in the Northeast, with corresponding increases in benefits to human health.[108] From an environmental standpoint, because the targeted reduction of SO_2 emissions for Phase I has already been exceeded, terming the allowance trading program a present success would not be inaccurate.

As to the second point, Title IV compliance has been achieved at costs well below those that were projected. An indicator of the costs of reducing SO_2 emissions is the price of the allowances themselves. Despite early predictions ranging between \$300 to \$1000 per ton of $S0_2$ reduction, the average price of an allowance during 1996 was less than \$100 per ton,[109] and has dipped to as low as \$68 per ton.[110] However, judging the actual cost savings due to trading is difficult for several reasons. First, while the proponents of trading point to these figures as a sign of the cost effectiveness of the program, it is obvious that some of the disparity between estimates and current costs stems from inflated estimates used by industry to oppose the program.[111] Second, although increased flexibility in

106. *See* GAO, ALLOWANCE TRADING, *supra* note 104, at 4, 25, 27; Byron Swift, *The Acid Rain Test*, 14 ENVTL. FORUM: THE POLICY JOURNAL OF THE ENVTL. L. INST. NO. 3 16 (May/June 1997) [hereinafter Swift, *Acid Rain Test*]; Dallas Burtraw & Byron Swift, *A New Standard of Performance: An Analysis of the Clean Air Act's Acid Rain Program*, 26 ENVTL. L. REP. (ENVTL. L. INST.) 10411 (1996); Sohn & Cohen, *Smokestacks*, *supra* note 104, at 424-426.

107. *See* OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY, EPA/430-R-97-025, 1996 COMPLIANCE REPORT: ACID RAIN TRADING PROGRAM 7 (1997) (visited Apr. 15, 1998) <"http://www.epa.gov/acidrain/cmprpt96/cr1996.html"> [hereinafter 1996 COMPLIANCE REPORT].

108. *See* Swift, *Acid Rain Test*, *supra* note 106, at 17.

109. *See* Swift, *Acid Rain Test*, *supra* note 106, at 22. The working assumption at the time of passage was that costs would be in the \$1000 a ton range. Gregory Wetstone, *Congressional Efforts to Eradicate Environmental Laws*, 14 PACE ENVTL. L. REV. 123, 124 (1996).

110. EPA, 1996 COMPLIANCE REPORT, *supra* note 107, at 10. The price of an allowance may not indicate the actual cost of a ton of emission reduction today, but instead may reflect the long-term scarcity value, or marginal cost. Swift, *Acid Rain Test*, *supra* note 106, at 22.

111. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 42); Mat-

control options may contribute to the decrease in compliance costs, the drop has been greatly aided by reduced rail costs which have encouraged utilities to switch to lower sulfur western coal, and also by reduced costs of improved scrubber technologies.[112] Plus, the demand for additional allowances has been suppressed. This is primarily attributed to the large quantity of surplus emission allowances, which keep the price at relatively low levels.[113] The resultant excess allowances are being saved ("banked") for future compliance needs.[114] Finally, although the program has reduced the overall cost of complying with C.A.A. requirements, it has not reached expected levels. Factors which may have impacted this result include transaction costs.[115]

Title IV has been characterized by sparse allowance trading activity; in most cases trading has not been used to achieve compliance even in instances where the potential for significant cost savings is apparent.[116] The General Accounting Office reported that only three percent of Phase I utilities planned to use allowance pur-

thew L. Wald, *Acid-Rain Pollution Credits Are Not Enticing Utilities*, N.Y TIMES, June 5, 1995, at A11 ("industry executives picked high numbers in effort to dissuade Congress from imposing stricter standards"). *See also* Jim Bradley, *Buying High, Selling Low*, E/THE ENVIRONMENTAL MAGAZINE, July-Aug. 1996, < http://www.emagazine.com/2curr3.html>, ¶ 6.

112. ENVIRONMENTAL LAW INSTITUTE, IMPLEMENTING AN EMISSIONS CAP AND ALLOWANCE TRADING SYSTEM FOR GREENHOUSE GASES: LESSONS FROM THE ACID RAIN PROGRAM 2-3 (1997) [hereinafter ELI REPORT]; Professor Driesen concludes that the low cost of controls may result from conditions that would have produced the same results in a traditional regulatory program. David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 41-42).

113. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 41-42); Sohn & Cohen, *Smokestacks*, *supra* note 104, at 425; GAO, ALLOWANCE TRADING, *supra* note 104, at 27.

114. GAO, ALLOWANCE TRADING, *supra* note 104, at 25-26.

115. *Id.* at 25, 53-55. In the only study to explore the prospective costs versus the benefits of the Title IV program, researchers at Resources for the Future found that the expected benefits, mainly in reduced mortality risk, will substantially outweigh the compliance costs to electric utilities. DALLAS BURTRAW, ALAN KRUPNICK, ERIN MANSUR, DAVID AUSTIN, AND DEIRDRE FARRELL, THE COSTS AND BENEFITS OF REDUCING ACID RAIN 2 (Discussion Paper 97-31-REV) (1997).

116. *See* Sohn & Cohen, *Smokestacks*, *supra* note 104, at 425-426; GAO, ALLOWANCE TRADING, *supra* note 104, at 3. The picture is not totally negative on trading activity. EPA data indicates that there was a doubling of the volume of allowances traded (between organization not counting internal trades) from 1995 to 1996, and a second doubling from 1996 to 1997. *See* U.S. Environmental Protection Agency, *Acid Rain Program: Trading Activity Breakdown: Cumulative Graphics* (visited Apr. 15, 1998) <http://www.epa.gov/acidrain/ats/qlyupd>.

chases as a major means of achieving compliance.[117] The dearth of trading activities seems to be a result of a combination of factors. First, the two-phase design of the program unwittingly separates the natural sellers of allowances (e.g. the largest emitters) from the natural buyers (e.g. smaller plants which are not subject to Phase I regulation) until the year 2000.[118] Additionally, price confusion and a scarcity of price information make it difficult for a company to assess the market accurately.[119] This is compounded by the tendency of the utility industry to be risk-adverse and conservative, in part because of the impact which government regulation may have on its profit margins.[120] Moreover, interstate trading is resisted by some states which oppose the transfer of allowances from in-state facilities to out-of-state facilities located upwind.[121] Nevertheless, a number of observers express belief that trading will increase as the market matures and as the more stringent requirements of Phase II take effect.[122]

117. GAO, ALLOWANCE TRADING, *supra* note 104, at 27.

118. *See* Swift, *Acid Rain Test, supra* note 106, at 22; Sohn & Cohen, *Smokestacks, supra* note 104, at 426; GAO, ALLOWANCE TRADING, *supra* note 104, at 43-44.

119. *See* Swift, *Acid Rain Test, supra* note 106, at 22; Sohn & Cohen, *Smokestacks, supra* note 104, at 426-427; GAO, ALLOWANCE TRADING, *supra* note 104, at 53-58.

120. *See* Sohn & Cohen, *Smokestacks, supra* note 104, at 427; GAO ALLOWANCE TRADING, *supra* note 104, at 43, 45-47. Utilities are also concerned that EPA regulations may be issued for other pollutants which will affect compliance options. *Id.* at 5.

Other impediments to trading cited by the General Accounting Office include problems with the design of EPA's auction, the manner in which allowances are treated for capital gains tax purposes, and lingering environmental concerns. GAO, ALLOWANCE TRADING, *supra* note 104, at 43.

121. *See* Deborah M. Mostaghel, *State Reactions to the Trading of Emissions Allowances Under Title IV of the Clean Air Act Amendments of 1990*, 22 B.C. ENVTL. AFF. L. REV. 201, 207 (1995) [hereinafter Mostaghel, *State Reactions*]. New York filed suit against EPA to prevent New York-based utilities from trading allowances to utilities in the Midwest, *id.* at 208 (citing New York v. EPA, No. 93-1214 (D.C. Cir., filed Mar 12, 1993)), and the legislatures of New York and Wisconsin were contemplating bills to prohibit emission allowance trades to upwind facilities. *See id.* at 209-10. *See also* Alliance for Clean Coal v. Miller, 44 F.3d 591 (7th Cir. 1995) (striking down Illinois Coal Act); *See also* Bradley, *supra* note 111, ¶ 11-12. These and other states have enacted laws to control acid deposition, which may be used to regulate intrastate trading. *See* Mostaghel, *State Reactions* at 211. Also, states which produce high-sulfur coal may restrict trading to protect their coal industries. *See id.* at 214. Mostaghel contends that these types of regional controls could deter interstate allowance trading by making trading cumbersome and interfering with Tile IV's free-market approach. *See id.* at 224.

122. *See, e.g.*, Swift, *Acid Rain Test, supra* note 106, at 17. We should also consider the impact that deregulation of the utility industry might have on the future of the trading program. It is possible that properly structured competition and technological advances will take many old plants out of use, leaving a huge surplus of unwanted allowances. Conversely, closure of nuclear plants, coincident with a spurt in demand brought on by lower electric prices and a rise in gas prices might mean a very tight market for sulfur dioxide and a spurt

In spite of apparent progress made under Title IV in reducing emission, concerns still exist. The banked emission allowances are likely to reach the 10 million ton mark as the tighter limits of Phase II take effect, therefore, many years may pass before the allowances are exhausted and the more stringent emission levels actually have an impact. If this simply means that we are enjoying the benefits of early reductions, and will eventually reach the targeted goals, then well and good, especially if money has been saved in the process.[123] But questions have been raised as to whether allowances have been accurately calculated and assigned, and to what extent they might not represent real reductions.[124] The distributional issue is a troublesome one; a citizen living in the shadow of a smokestack may not take comfort in the overall cost efficiency when told that the plant, instead of reducing its emissions, will exercise the option of purchasing allowances from afar.[125]

If we accept the Title IV program as a success, there are several elements which arguably contribute to its effectiveness, and ought to be included in any pollutant trading program. Obviously, a clear baseline must be established from which trades can be made, and it must reflect an adequate level of protection for the environment. Of paramount importance to a trading program is a thorough and effective monitoring requirement.[126] Without this,

in trading.

123. However, one observer noted that "[i]f Congress was striking a balance between environmental toughness and financial mercy, it could have required tougher standards for the amount it had agreed to make utilities spend." Wald, *supra* note 111, at A11.

124. The formula which Congress dictated for allocating allowances was based on historical fuel consumption which may have been higher than a given facility's current usage, thus creating unearned "paper credits" which did not reflect actual pollution reductions. In addition, utilities were allowed to earn credits when they achieved reductions that they were otherwise mandated to carry out by technology based requirements. *See* Daniel A. Seligman, Sierra Club, Air Pollution Emissions Trading: Opportunity or Scam? A Guide for Activists 16 (1994). The original allocations specified in the statute therefore grandfathered much pollution, and contained "politically inspired exceptions," which served "special interests at public expense." ELI REPORT, *supra* note 113, at 35. In addition, special bonus provisions for such items as early cleanup tended to enlarge the number of allowances banked. *Id*

125. It is worth noting that the NOx reduction program also resulted in substantial reductions in its first year through traditional emission limitations, with averaging by commonly owned units. All units subject to the NOx requirements in 1996 were in compliance with applicable emission limitations, and total emissions declined 33 percent from 1990 to 1996. *See* EPA, 1996 COMPLIANCE REPORT, *supra* note 107, at 12, 14, 16.

126. *See* ELI REPORT, *supra* note 112, at ii. Facilities subject to Title IV must install, maintain, and report the results from a continuous emission monitoring system (CEMS). Clean Air Act § 412(a), 42 U.S.C. § 7651k(a) (1995). If for some reason monitoring data is not obtained, the facility may be deemed to be operating in an uncontrolled fashion during the

there can be no assurance that trading units represent actual pollution reductions. Key elements of Title IV are the enforcement provisions, and the substantial noncompliance penalties.[127] Finally, there is a publicly available allowance tracking system that should foster compliance and enforcement.[128]

Despite the minimal trading activity, the program is still generally regarded as having spurred a reduction in current emission levels. At least one commentator has suggested that even if little reduction in costs or innovation in controls result from a trading program, a well-designed program may be worthwhile because it is politically effective in reducing opposition to controls.[129] This comment may be applicable beyond the Title IV program.

6. EPA's Lead Phasedown Program

Before concluding our examination of air pollution related trading programs, an additional effort in this area merits attention: the program employed by EPA to eliminate lead as a gasoline additive.

To reduce the high levels of airborne lead, EPA in 1982 inaugurated an "inter-refinery averaging" program allowing gasoline refiners to trade rights to use lead additives.[130] Under the program, refiners were permitted to trade lead content allowances which were proportionate to the amount of lead added to the gasoline being produced. These allowances could be deposited in a "bank" for a period of up to three years. The program was characterized by an active trading market , with over half of all refineries making trades.[131] The result was a program which dramatically reduced and eventually eliminated the use of lead in gasoline, apparently with substantial cost efficiency.[132]

entire period for which data is not available, and penalized accordingly. Clean Air Act § 412(d), 42 U.S.C. § 7651k(d) (1995).

127. Clean Air Act Section 411(a) establishes a penalty of $2000 a ton for excess emissions. 42 U.S.C. § 7651j(a) (1995). In addition, the facility must offset the excess emissions by an equal amount in the next calendar year. Clean Air Act § 411(b), 42 U.S.C. § 7651j(b) (1995).

128. *See* Clean Air Act § 403(d), 42 U.S.C. § 7651b(d) (1995).

129. David M. Driesen, *Five Lessons from the Clean Air Act Implementation*, 14 PACE ENVTL. L. REV. 51, 58 (1996).

130. 40 C.F.R. § 80.20(d) (1988) (expired Jan. 1, 1986) EPA, Regulation of Fuel and Fuel Additives, 47 Fed. Reg. 49,322 (1982) (expired, 50 Fed. Reg. 13,116 (1985)). For a full description of the program see Hahn & Hester, *Marketable Permits*, *supra* note 62, at 380-391.

131. Hahn & Stavins, *Incentive Based-Environmental Regulation*, *supra* note 54, at 17; Hahn & Hester, *Marketable Permits*, *supra* note 62, at 384-391.

132. Hahn & Hester, *Marketable Permits*, *supra* note 62, at 380-391.

Commentators point to several factors which they assert made this program a success. First, the program had a clear goal: elimination of lead in gasoline, as well as a fixed end.[133] Second, transaction costs were relatively low and trading was easy to monitor because the market participants were a small and homogeneous pool of refiners who had previously traded refinery product amongst themselves. Added to that, creation of the allowance bank provided additional flexibility and resulted in a significant increase in trading activity. Finally, the program had a simple regulatory framework which lacked burdensome restrictions such as credit certification or trade approval requirements.[134] While this led one author to single out the program as coming closest to the economist's ideal,[135] the actual market driver seems to be the eventual ban, which suggests that a traditional phase-down program might well have achieved the same results.[136]

IV. EPA'S DRAFT FRAMEWORK FOR WATERSHED-BASED TRADING

A. In General

The experience in emissions trading under the Clean Air Act, along with a growing interest in pursuing market based pollution reduction measures, spawned efforts to adapt the lessons learned thus far to water pollution controls. In 1996 the Environmental

133. *See* Hahn, *Doctor's Orders*, *supra* note 13, at 102-03.

134. *See id.*

135. HAHN, *supra* note 11, at 41-44; Hahn, *Doctor's Orders*, *supra* note 13, at 101. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, *supra* note 14, (manuscript at 39).

136. An additional trading program worth noting is the Regional Clean Air Incentives Market (RECLAIM) which allows for the allocation and trading of emission credits among firms in Los Angeles, emitting nitrogen oxides (NO_x) and sulfur oxides (SO_x). The RECLAIM program is administered by the South Coast Air Quality Management District (SCAQMD), which oversees federal and state air legislation for the Los Angeles area. The number of credits annually allocated by SCAQMD diminishes each year in order to facilitate reducing NO_x and SO_x emissions by a set percentage. Credits are typically swapped at semi-annual credit auctions or over the Internet. Trades must be recorded by SCAQMD, but do not require prior approval or public input.

While the RECLAIM trading market was sluggish shortly after its inception in 1994, it has become quite active. The cost of emission reduction has been lower than that anticipated under a command-and-control regime, as the price of credits continues to fall. The large number of firms, in addition to the simple regulatory framework and the various forums for trades, keeps transaction costs low. *See* Sohn & Cohen, *Smokestacks*, *supra* note 104, at 430-432

Protection Agency (EPA) published a *Draft Framework for Watershed-Based Trading*, which is essential to understanding the regime within which a water pollutant trading program must operate.[137] The *Draft Framework* does not, however, provide an adequate analytical basis either for evaluating the legal aspects of a proposed program, or for judging its economic and administrative aspects.

The Agency's goal, as expressed in the *Draft Framework*, is "to assure that trading programs are designed to provide flexibility with accountability as well as incentives to trade" within the existing framework of federal, state and local governmental statutes and regulations.[138] The *Draft Framework* encourages innovation in meeting water quality goals, yet supports only those trades that adhere to water quality requirements set forth under the Clean Water Act.[139] Moreover, EPA spells out clearly in the document that it "will not depart from its enforcement and compliance responsibilities under the CWA . . . [and] [t]rades that depend on fundamental changes in EPA's enforcement and compliance responsibilities will not be allowed."[140] It does not, however, analyze how various trading schemes might or might not comport with the requirements of the Act and regulations.

The *Draft Framework* recognizes five different kinds of trading, two of which are most relevant to proposals being put forth for the Sound. The first, "point/point," occurs when one point source attains greater than required pollutant reductions, and trades those reductions to another point source which cannot achieve its required pollution reduction.[141] The second type of trading, "point/nonpoint," trading occurs where a point source arranges for a nonpoint source to undertake best management practices (BMPs) to reduce polluted runoff in lieu of performing plant upgrades.[142] Currently the type of trading being discussed for Long

137. *See* DRAFT FRAMEWORK, *supra* note 61. The document is intended to "a framework on how best to implement the Clean Water Act and EPA's regulations to facilitate pollutant trading in watersheds." *Id.* at iv. In actuality, there is very little discussion of the details of structuring programs which meet legal requirements. The Draft Framework is also intended to provide information on how EPA intends to exercise its discretion in implementing its regulations. The Agency asserts specifically that the Draft Framework is not a regulation, and is not legally binding. *Id.*

138. *See id.* at i.

139. *See id.* at xi.

140. *Id.*

141. *See id.* at xv.

142. *See id.* The three other types of trading are "intra-plant", "pretreatment", and "nonpoint/nonpoint". The most straightforward, intra-plant, occurs when a facility has sev-

Island sound is point/point, with the possibility of point/nonpoint left open for future consideration.[143]

In the *Draft Framework*, the Agency has further spelled out general principles which it believes a trading scheme should follow in order to comply with existing laws and regulations for attaining water quality.

B. The Framework's Principles

Although EPA has defined in the *Draft Framework* eight separate principles[144] to guide pollutant trading, to some extent, significant overlap exists and they may effectively be consolidated and restated as four principles. First, trades must occur within constraints of the Clean Water Act. Specifically, point sources must meet technology-based standards established under the Act; the trades must be consistent with attainment of water quality standards, including the processes used to implement the standards;[145] trades must occur in the context of current regulatory (i.e., permitting) and enforcement mechanisms; [146] and they must include public participation.[147]

eral permitted outfalls and is allowed to shift pollutants from outfall to outfall, so long as the combined permitted discharge with trading is not greater than without. *Id.* at xv, 5-2. Pretreatment refers to the program requiring industries which discharge to publicly owned sewage treatment plants to "pretreat" their wastes prior to discharge in order to avoid interfering with the sewage plant's operations or causing pollutants to pass-through the plant without adequate treatment. *See* Clean Water Act § 307(b), 33 U.S.C. § 1317(b) (1994). In a trading program the sewage treatment plant arrange with the pretreater to undertake greater than required reductions in its pollutant discharge to the plant, in lieu of the plant performing upgrades of its own system. *See* DRAFT FRAMEWORK, *supra* note 61, at xv, 6-1. Nonpoint/nonpoint trading occurs where one nonpoint source arranges for BMPs at another nonpoint source in lieu of installing or upgrading more expensive BMPs at its own site. *See id.* at xv, 8-1.

143. *See* A.T. KEARNEY, INC., *supra* note 33, Exhibit 4-4, at 4-20. For an interpretive survey of the research into and the practical experience with point/nonpoint trading, in which the author concludes that its time has not yet come, see Letson, *Point/Nonpoint Source Pollution Reduction Trading: An Interpretive Survey*, *supra* note 42. *See also* Bartfeld, *Point-Nonpoint Source Trading*, *supra* note 62 (may offer cost-effective control alternative in limited number of waterbodies).

144. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-4.

145. Technology-based standards and water quality standards are discussed in Part IV, *infra*.

146. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-7.

147. EPA expresses strong support for the role which stakeholders play in ensuring environmental protection and asserts that stakeholder involvement and public participation are key components of trading. Trading is envisioned as a partnership decision that brings the regulators, the regulated, and the public together to form a solution to water quality problems. It is viewed as a way to build alliances between stakeholders and to educate the general public. Ultimately, trading with stakeholder involvement is a way of promoting local solu-

Second, trading boundaries should generally coincide with watershed or waterbody segment boundaries to ensure that the environmental consequences of trades between parties occur in the same waterbody or stream/river segment.[148] Boundaries should be of manageable size and should be selected to prevent localized problems.[149] Third, trading should generally result in increased water quality monitoring to assure that trading is not having an adverse environmental effect.[150] Fourth, EPA requires that careful consideration be given to the types of pollutants traded, and discourages trading of toxics,[151] or of one pollutant for another.[152]

Of these four categories, a nitrogen trading program on Long Island Sound would appear on its face to satisfy the second and fourth principles; the trading program boundaries match the geographic boundaries, and only one pollutant (nontoxic) is involved. As to the third category, since point sources are primarily involved, there is already an established, if not necessarily sufficient, monitoring system.[153] Beyond that, considerable monitoring and modeling has been in order to establish the yearly loadings, which, barring funding cutbacks, should continue. This should help to provide the technical information essential in determining whether trading is adversely affecting water quality in the Sound. The remaining category, compliance with the existing regulatory program will be discussed in Part IV.

tions to local problems. *See id.* at 2-10-11. Encouragement of citizen participation and place-based-programs are key themes in current Agency activities. *See* OFFICE OF THE CHIEF FINANCIAL OFFICER, U.S. ENVIRONMENTAL PROTECTION AGENCY, EPA/190-R-97-002, EPA STRATEGIC PLAN 13, 20, 29, 50, 83-84 (1997).

148. DRAFT FRAMEWORK, *supra* note 61, at 2-8.

149. *Id.*

150. *Id.* at 2-9.

151. Toxics present special problems since localized "hot spots" may present risks to both human health and the environment. Toxics are also often persistent in the environment, and accumulate in the foodchain. *See* Robert I. Fassbender, *Reducing Great Lakes Toxics: Can We Do More for Less Through Wastewater Effluent Trading?*, 1 Wis. Envtl. L.J. 57, 83 (1994). The author recognizes that technology standards would have to be attained, and suggests that trading could take place in the process of implementing water quality standards. *Id.* at 84. *See also* Alexandra Teitz, *Assessing Point Source Discharge Permit Trading: Case Study in Controlling Selenium Discharges to the San Francisco Bay Estuary*, 21 Ecology L.Q. 79, 95 (1994) (only reductions beyond what is required by technology based-standards could be traded).

152. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-9. This principle is not a ban on toxic pollutant trading, but ensures that toxic trading is given considerable thought. Additionally, this principle is not a ban on "cross-pollutant" trading, but EPA does not believe such trades are possible under the current regulatory framework. Therefore, all trades likely will involve the same pollutant. *Id.* at 2-9-10.

153. *See* 40 C.F.R. § 122.48.

Since its publication in May 1996, the *Draft Framework* has been assaulted by environmentalists and the regulated community alike.[154] Environmentalists are validly concerned with the fact that the *Draft Framework* does not assure maintenance or improvement of water quality.[155] They seek a ban against trading among different watersheds and want to limit point/nonpoint trading until nonpoint source reduction is enforceable under the CWA.[156] Industry, on the other hand, is calling for just the opposite, arguing that the *Draft Framework* is too restrictive and in need of greater flexibility.[157] Due to these complaints the Agency is unlikely to issue a final version of the *Framework* in the near future, thus the draft will continue to provide the best indication of EPA's approach to proposed water pollution trading programs such as the one being considered for Long Island Sound.[158]

V. THE LEGAL FRAMEWORK

Barring congressional changes, a nitrogen trading program on Long Island Sound must take place within the well-established framework of the Clean Water Act,[159] including the goals of achieving fishable/swimmable waters and eventually eliminating the dis-

154. *See EPA May Scale-Back Controversial Effluent Trading Framework*, INSIDE EPA, January 24, 1997, (Weekly Report), at 7; WATER ENVIRONMENT FEDERATION (WEF), COMMENTS ON DRAFT FRAMEWORK FOR WATERSHED-BASED TRADING, September 9, 1996, on file with U.S. Environmental Protection Agency, Comment Clerk, Water Docket MC-4101. These comments may also be found at the Federation's website, (visited Apr. 15, 1998) <http://www.wef.org/docs/trade.comments.html>.

155. *See* INSIDE EPA, *supra* note 153, at 7.

156. Sierra Club, Comments on Draft Framework for Watershed-Based Trading, September 11, 1996; National Wildlife Federation, Comments by the National Wildlife Federation on the U.S.E.P.A.'s Draft Framework for Watershed-Based Trading, September 11, 1996. These comments are on file with the U.S. Environmental Protection Agency, Comment Clerk, Water Docket MC-4101. The full text of comments received by the Agency as of December 1996 may be found at <http://www.epa.gov/OWOW/watershed/tradecom.html> (visited Apr. 15, 1998).

157. *See* WEF, Comments on Draft Framework for Watershed-Based Trading, *supra* note 154.

158. *See EPA Slows Effort to Establish Clean Water Act Trading Program*, Inside EPA, Sept. 12, 1997, (Weekly Report), at 11.

159. The present statutory framework was enacted in 1972 as the Federal Water Pollution Control Act (FWPCA) Amendments. Pub. L. No. 92-500, 86 Stat. 816 (1972). FWPCA was substantially amended by the Clean Water Act of 1977, Pub. L. No. 95217, 91 Stat. 1566 (1977), which provided that: "This Act may be cited as the 'Federal Water Pollution Control Act' (commonly referred to as the Clean Water Act)." The Clean Water Act (Clean Water Act) appellation will be used in this article. The Act has been amended several other times, most significantly by the Water Quality Act of 1987, Pub. L. No. 100-4, 101 Stat. 7 (1987).

charge of pollutants into the Nation's waters.[160] The Act essentially prohibits the discharge of pollutants[161] into our Nation's waters unless done in conformance with a federal or state permit under the National Pollutant Elimination Discharge System (NPDES).[162] Standards are established to govern the issuance of permits, along with a regulatory scheme for implementing the program.[163] That scheme includes enforcement mechanisms,[164] and the opportunity for citizen input.[165] In contrast to the Clean Air Act, there are no explicit provisions in the Clean Water Act for pollution trading.[166] Moreover, there is a clear requirement both to meet health-based water quality standards and to apply maximum technological controls,[167] with few opportunities to take cost into account.[168] But if

160. Clean Water Act § 101, 33 U.S.C. § 1251(a)(1),(2).

161. Clean Water Act § 301, 33 U.S.C. § 1311. The term "discharge of pollutants" means the addition of any pollutant to navigable waters from any point source. Point source is defined to generally encompass pipes and other "discrete" conveyances, but not runoff. Clean Water Act § 502(14), 33 U.S.C. § 1362(14); *see supra* note 18. Navigable waters is defined in the Act as waters of the United States, Clean Water Act § 502(7), 33 U.S.C. § 1362(7), and further defined in EPA regulations to include all waters susceptible to use in interstate or foreign commerce. 40 C.F.R. 122.2. When enacting the Clean Water Act, Congress stated that it fully intended "that the term navigable waters be given the broadest possible constitutional interpretation." House Consideration of the Conference Committee, October 4, 1972, reprinted in 1972 Legislative History 251 (1973) (statement of Rep Dingell, a principle sponsor of the bill). *See* United States v. Riverside Bayview Homes, Inc., 474 U.S. 121 (1985).

162. Clean Water Act § 402, 33 U.S.C. § 1342. The NPDES system focuses on point sources; with limited exceptions, such runoff from industrial sites or the streets of larger cities, nonpoint source pollution is essentially unregulated under the Act. *See* Clean Water Act § 402(p), 33 U.S.C. § 1342(p).

163. Congress recognized the important role of the states in water quality protection, *see* Clean Water Act § 101(b), 33 U.S.C. § 1251(b), and provided for delegation of the wastewater discharge permit program to the states. Clean Water Act § 402(b), 33 U.S.C. § 1342(b).

164. Clean Water Act § 309, 33 U.S.C. § 1319 (government enforcement); Clean Water Act § 505, 33 U.S.C. § 1365 (citizen suits).

165. *See, e.g.*, Clean Water Act § 402(b)(3), 33 U.S.C. § 1342(b)(3) (public notice and hearing on proposed permits).

166. EPA regulations do allow limited internal facility trading, or bubbling, for iron and steel manufacturing point sources, but not if the resulting discharge would violate applicable water quality standards. 40 C.F.R. § 420.03.

167. Under the Act, increasingly stringent technology controls are imposed over time, forcing the development of new technologies. See Clean Water Act § 301(b), 33 U.S.C. § 1311(b).

168. Consideration of costs can play a limited role in establishing technology standards under the Act. The total cost of best practicable technology (BPT) controls must not be "wholly disproportionate" to the benefits, Chemical Manufacturers Association v. EPA, 870 F.2d 177 (5th Cir. 1989); Weyerhaueser Co. v. Costle, 590 F.2d 1011 (D.C. Cir. 1978); Clean Water Act §§ 301(b)(1)(A), 304(b)(1), 33 U.S.C. §§ 1311(b) (b)(1)(A), 1314(b)(1), and the costs of controlling conventional pollutants by industry and sewage treatment plants

these important strictures are met, room for trading within the confines of the Act still exists.[169]

The necessity of complying with an existing regulatory program complicates, but does not preclude, a trading program. Any emissions trading program must generally be based on some type of pollution abatement regulatory program designed to control emissions. In general, that control may either be exerted directly through emission standards, or indirectly through technology requirements.[170] Under the Clean Water Act, emission limitations embedded in the NPDES permit can serve as the trading benchmark[171] and the flexibility inherent in the TMDL process allows trading to be used as one method of allocation.[172]

In analyzing the provisions of the Clean Water Act which affect a trading program it is useful to focus on four areas: standards (both for technology and water quality), permits, enforcement, and citizen participation.

should be comparable. Clean Water Act §§ 301(b)(2)(E), 304(b)(4), 33 U.S.C. §§ 1311(b)(1)(E), 1314(b)(4). Cost is one of the factors which may be taken into account in setting best available technology (BAT), §§ 301(b)(2)(A), (C), (D), (E), 304(b)(2), 33 U.S.C. §§ 1311(b)(2)(A), (C), (D), (E), 1314(b)(2), and standards of performance for new sources, Clean Water Act § 306(b)(1)(B), 33 U.S.C. § 1316(b)(1)(B), but only to determine whether the standards are economically achievable. *See* Rybachek v. EPA, 904 F.2d 1276 (9th Cir. 1990).

169. Water quality standards and technology controls arguably reflect two different regulatory philosophies; the former has been described as economically based, the latter as ethically based. 2 W. RODGERS, ENVIRONMENTAL LAW: AIR & WATER § 4.1, at 12-16. Water quality standards assume that water may legitimately be polluted to a "reasonable" extent in order to achieve an economic good. The "moralist" view, on the other hand, would hold pollution as fundamentally wrong, and favor maximum limitations on pollution. *See id.* The Federal Water Pollution Control Act originally adopted water quality standards as its control mechanism, but the dismal history of accomplishment led Congress to adopt technology based controls in the Clean Water Act as a more practical method of achieving the statutes goals. Since 1972 it has been the national goal to reduce the discharges of pollutants to the Nation's waters to zero. Clean Water Act § 101(a)(1), 33 U.S.C. § 1251(a)(1). *See also* ENVTL. LAW INST., CLEAN WATER DESK BOOK 9 & n. 98 (1991) (discussion of regulatory consequences of philosophies).

170. TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, *supra* note 55, at 410. *See also* HAHN, PRIMER, *supra* note 11, at 50.

171. *Id.*

172. The statute and regulations dictate how the TMDL must be established, but are silent as to allocation. Clean Water Act § 301(d)(1)(C), 33 U.S.C. § 1313(d)(1)(C); 40 C.F.R. § 130.7. Another area of flexibility relevant to a trading program arises in regard to nonpoint sources. The Act deals with this type of pollution through planning mechanisms and voluntary programs, not under the regulatory provisions. *See* Clean Water Act §§ 208, 319, 33 U.S.C. §§ 1288, 1329. This provides substantial room to shape trading programs dealing only with nonpoint sources, and leeway in designing point/nonpoint trading.

A. Standards

To achieve the goal of protecting the Nation's waters, Congress established two types of standards under the Clean Water Act, both of which must be employed in issuing discharge permits under the NPDES program. The first are the so-called technology standards, which control how much pollutants may be discharged by various categories of dischargers.[173] The second are water quality standards, which dictate the level of pollutants that may be present in a water body without impairing the quality of the water.[174] Both are used to establish final effluent limitations for a discharger.[175]

1. Technology Based Standards

Technology based categorical effluent standards form the backbone of the Clean Water Act. Technology based means that the discharger must achieve the same pollutant reduction levels as can be attained using a specified technology.[176] These standards are devised by the EPA as national discharge limits for various categories of industries[177] and must be complied with regardless of the quality of the receiving water.[178] In the case of sewage treatment

173. *See* Clean Water Act §§ 301, 304, 306, 33 U.S.C. § 1311, 1314, 1316. These standards may only be waived under certain narrowly defined circumstances. *See* Clean Water Act §§ 301(g)-(i), (k), (m), (n), & (p), 33 U.S.C. § 1311 (g)-(i), (k), (m), (n), & (p).

174. *See* Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C); Clean Water Act § 303, 33 U.S.C. § 1313.

175. Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 301(b)(1)(C).

176. Although based on a specific technology, this is a performance standard.

177. *See* Clean Water Act §§ 304(b), 306, 33 U.S.C.§§ 1314(b), 1316. Effluent limitations are generally specified in permits in terms of both mass and concentration, although federal regulations require only the former. *See* 40 C.F.R. § 122.45(f). At least one author has suggested that concentration limits inhibit a trading program, *see* Teitz, *Assessing Point Source Discharge Permit Trading: Case Study in Controlling Selenium Discharges to the San Francisco Bay Estuary*, *supra* note 151, at 105-106, but they are extremely important ecologically since they dilute the discharges and prevent high loadings in a short period of time from acutely degrading water quality.

178. *See* Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C); EPA v. California, 426 U.S. 200 (1976). The Act originally required sources other than sewage treatment plants to apply the "best practicable control technology", or BPT, Clean Water Act § 301(b)(1)(A), 33 U.S.C. § 301(b)(1)(A), but BPT was largely superceded by more stringent standards. Existing sources other than publicly owned sewage treatment works must now apply "best conventional pollutant control technology (BCT)" to conventional pollutants such as biological oxygen demand, suspended solids, fecal coliform, and pH. Clean Water Act § 301(b)(2)(E), 33 U.S.C. § 1311(b)(2)(E); Clean Water Act § 304(a)(4), 33 U.S.C. § 1314(a)(4). Toxics and non-conventional pollutants must be controlled by the "best available technology (BAT)." Clean Water Act § 301(b)(2)(A), 33 U.S.C. § 1311(b)(2)(A); *see* Clean Water Act § 304(b)(2)(A), 33 U.S.C. § 1314(b)(2)(A). New dischargers must meet

plants, the applicable technology standard is called "secondary treatment,"[179] and it is the general standard for treatment plants.

Although a requirement that minimum technology levels be achieved may reduce the market scope in a trading program to some extent,[180] it provides a national uniformity and a minimum

even more stringent standards of performance. *See* Clean Water Act § 306(a)(1), 33 U.S.C. § 1316(a)(1).

179. Clean Water Act § 301(b)(1)(B), 33 U.S.C. § 1311(b)(1)(B); *see* Clean Water Act § 304(d), 33 U.S.C. § 1314(d). Sewage treatment plants typically are designed to treat the types of pollutants found in human waste, which include biochemical oxygen demanding pollutants (BOD) such as nitrogen, along with suspended solids(SS), and pH. Secondary treatment is defined by EPA regulations as a removal rate of at least 85% for BOD and SS; the 30-day average may not exceed 30 milligrams/liter, and the 7-day average may not exceed 45mg/l. 40 C.F.R. § 133.102(a),(b). The pH of the discharge must be between 6.0 and 9.0. 40 C.F.R. § 133.102(c).

180. *See* Elise Fulstone, *Effluent Trading: Legal Constraints on the Implementation of Market-Based Effluent Trading Programs Under the Clean Water Act*, 1 Envtl. Law 459, 474, 478-80 (1995). The author identifies what she considers to be a number of obstacles to effluent trading imposed by the Clean Water Act's current regime. Regarding the technological-based requirements of the C.W.A., she asserts that they limit the amount of pollutant load available for trading and the number of trading participants, thereby reducing the potential for cost-savings. She argues that national standards are not cost-efficient because they ignore local environmental variables, and that variances should be allowed so that dischargers might meet their individual technology based effluent limitations through trading. *Id.* at 478-80. *See also* Ackerman & Stewart 1988, *supra* note 12, at 1335-40. This view reflects a negative view of technology-based standards that is not necessarily shared by all who have analyzed the issue.

Environmental regulatory schemes generally use one of three approaches to redressing pollution problems. They have been described as harm-based standards, technology-based standards, or individualized cost-benefit analysis. Howard Latin, *Regulatory Failure, Administrative Incentives, and the New Clean Air Act*, 21 ENVTL. L. 1647, 1659-60 (1991) [hereinafter Latin, *Regulatory Failure*]. Harm-based standards require the regulatory agency to determine what level of environmental impact is acceptable, and to impose whatever controls are necessary to achieve that level. *See, e.g.*, Clean Water Act § 307, 33 U.S.C. § 1317. Technology-based standards instead require a certain level of technological control to be imposed, without being linked to the environmental result of the controls. *See, e.g.*, Clean Water Act § 301(b)(2)(A), 33 U.S.C. § 1311(b)(2)(A). A cost-benefit analysis approach may involve both. *See* Latin, *Regulatory Failure*, *supra*. While harm-based standards may appear to be more likely to result in achievement of environmental goals, in actuality they have had limited success. They are difficult to establish and administer, and often lead to inaction on the part of regulatory officials. Technology standards, while presenting difficulties of their own, are more administratively feasible, and thus more likely to be employed and enforced. *Id.* at 1662-63. Technology standards are especially important in a national program since they decrease the likelihood that industries will attempt to locate in areas with lower environmental standards or create "pollution havens." *See* Howard Latin, *Ideal versus Real Regulatory Efficiency: Implementation of Uniform Standards and 'Fine-Tuning' Regulatory Reforms*, 37 STAN. L. REV. 1267, 1271 (1985). Other advantages noted by Professor Latin include greater consistency and predictability of results, increased likelihood that regulations will withstand judicial review, and decreased information collection and evaluation costs. *Id.*

Cost-benefit approaches also present problems in implementation, and may overly empha-

level of control that has long been a key consideration under the Act.[181] In addition, as stated by the Agency in explaining its inclusion as the first of the principles in the *Draft Framework*, technology standards also promote fairness by allowing only those sources which have already met a baseline contribution to water quality protection to benefit from trading.[182]

In the case of the Long Island Sound, the question of technology-based standards may not present significant difficulties, since most of the entities which discharge substantial quantities of nitrogen, and would thus be eligible to participate in a trading program, are sewage treatment plants. The technology required of these plants is secondary treatment, and all of the plants on the Sound now meet that requirement.[183] However, the Clean Water Act requires that if technology-based limitations are not sufficient to prevent a facility's discharges impairing the quality of the receiving water, the permitting authority must develop more stringent effluent limits (referred to as water quality-based effluent limitations) for

size the cost side of the equation. They also fail to consider noneconomic values which have important social consequences. *See* Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale For Technology-Based Regulation*, 1991 DUKE L.J. 729 (1991) (discussing the Occupational Safety and Health Act).

181. While Congress has employed harm-based standards and cost-benefit analysis in pollution statutes, there has been a continuing shift to technology-based strategies. Congress' disenchantment with the use of harm-based water quality standards under the Clean Water Act led to wholesale revisions in the Act in 1972, which now relies substantially on technology standards, with water quality standards essentially serving as a backstop. *See* Oliver A. Houck, *Of Bats, Birds and B-A-T: The Convergent Evolution of Environmental Law*, 63 MISS. L.J. 403 (1994).[hereinafter Houck, *BAT*]; Latin, *Regulatory Failure*, *supra* note 180, at 1660-61. *See also supra* note 168. For a detailed discussion of the weaknesses of the water quality standards program see ROBERT W. ADLER, JESSICA C. LANDMAN, DIANE M. CAMERON, THE CLEAN WATER ACT: 20 YEARS LATER 119-128 (1993).

The requirement that all water discharges meet a national engineering standard (BAT) has been described as "a great innovation in environmental law," "a radical, indeed an heretical approach at the time . . . ." *See* Houck, *BAT*, *supra* note 181, at 417.

182. DRAFT FRAMEWORK, *supra* note 61, at 2-4. A similar view was expressed by Professor Robert W. Adler when discussing the difficulties inherent in point/non-point trading. After noting that nonpoint sources are not subject to minimum controls, as are point sources, he continued, "Arguably trading will work best as an economic incentive after minimum controls are imposed on all sources, so that trading proceeds from a position of equity among potential trading partners." *See* Robert W. Adler, *Economic Incentives for Wetlands and Water Quality Protection: A Public Perspective* 15, American Bar Association Section of Natural Resources, Energy and Environmental Law, 26th Annual Conference on Environmental Law, March 13-15, 1997. Environmentalists are especially concerned about weakening technology-based requirements in favor of water-quality-based standards considering the poor record of implementation of the latter program. *Id.*

183. INTERSTATE SANITATION COMMISSION, 1997 ANNUAL REPORT 7 (1998).

that discharger and incorporate those limits into its NPDES permit.[184] Because water quality standards for dissolved oxygen are not being met in the Sound, additional controls beyond technology-based must be imposed to attain state water quality standards for dissolved oxygen.[185]

2. Water Quality Standards

Unlike technology based standards which apply numerical limits to specific categories of dischargers, water quality standards dictate the quality that the ambient water in the stream, lake or other water body must achieve. Established pursuant to Section 303 of the Clean Water Act,[186] they are designed to ensure that a water body maintains a level of quality which protects human health and the environment. States are required to designate water quality uses such as "fishable" or "recreational contact," and to set standards to protect those uses employing criteria established by EPA.[187]

If water quality standards are being violated in a particular body of water, the state is required to take certain actions to reverse the impairment. Under section 303(d)(1)(c) of the Act, the state must determine the maximum amount of each offending pollutant that may be discharged into the water body without causing the level of that pollutant in the ambient water to exceed the state water quality standard.[188] This is essentially a technical and scientific en-

184. See Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1(C).

185. Connecticut and New York water quality standards for dissolved oxygen for the Sound are 5-6 mg/liter. *See* discussion, *supra* note 21. In addition to the POTWs, there are a few private industrial plants in Connecticut which have significant discharges of nitrogen to the Sound, although their combined discharges are only 6717 pounds a day. PHASE III PROPOSAL, *supra* note 21, at 10. None of these plants have total nitrogen limits in their permits, although they are required to monitor for the pollutant. Personal communication with Kenneth W. Major, Permits, Enforcement & Remediation Division, Water Management Bureau, Connecticut Department of Environmental Protection (Apr. 23, 1998). Accordingly, there is no technology-based effluent limitation in effect.

186. *See* Clean Water Act § 303, 33 U.S.C. § 1313.

187. Clean Water Act § 303(a)(3), 33 U.S.C. § 131(a)(3). If the water quality standard set by the a state does not meet EPA approval, the EPA must promulgate an appropriate standard in its place. Clean Water Act § 303(c)(3), § 33 U.S.C. 1313(c)(3).

As part of its water quality standards a state must have an antidegradation policy, which is intended to insure that water quality will not fall below its current level and that existing uses of a waterbody will be maintained. This applies regardless of whether the uses actually have been designated. See 40 C.F.R. § 131.12(a)(1). If the water is cleaner than necessary to support fishable/swimmable uses, that water quality must be maintained unless important economic and social goals dictate otherwise. See 40 C.F.R. § 131.12(a)(2); DRAFT FRAMEWORK, *supra* note 61, at 2-1

188. 33 U.S.C. § 1313(d)(1)(c). *See* DRAFT FRAMEWORK, *supra* note 61, at 2-3. The Clean

deavor, in which the state may employ various tools and techniques, including monitoring and modeling.[189] The aggregate amount of a pollutant which can be discharged and still maintain water quality standards, including a margin of safety, is the "total maximum daily load (TMDL)."[190] The calculations to establish TMDLs must be made available to the public,[191] but there is no explicit mechanism required for public input unless the proposed TMDLs are disapproved and EPA issues its own.[192]

Once a state determines the TMDL for a pollutant, it must allocate the total load among the various point and nonpoint dischargers on the waterbody.[193] The EPA provides little guidance on the manner in which the loadings are to be apportioned, and the decision is essentially a matter of state policy.[194] After an allocation has been made to a discharger, it is used to calculate an effluent discharge limit for the pollutant at issue, which will be more strin-

Water Act envisions a federal-state partnership. Within the federal regulatory framework states may choose to administer substantial portions of the Act. See 33 U.S.C. § 402(b). Both Connecticut and New York have been delegated such responsibility, and both have adopted water quality standards for various pollutants, including dissolved oxygen. *See supra* note 21.

189. 40 C.F.R. § 130.7(a).

190. Clean Water Act Section 303 (d)(1)(C) provides that each state shall establish:

> the total maximum daily load, for those pollutants which the Administrator identifies . . . as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

33 U.S.C. § 1313(d)(1)(C).

191. 40 C.F.R. § 130.7(c)(1)(ii).

192. 40 C.F.R. § 130.7(d)(2).

193. The allocations given to point source dischargers for their waste streams are denominated waste load allocations (WLAs); the allocations for nonpoint sources are called load allocations (LAs). Identifying nonpoint sources and measuring their contribution to the pollution problem can pose substantial difficulties, especially when some of the pollutant loading derives from air sources. Controlling nonpoint sources is even more problematic. In practice, the states often calculate as best they can the overall pollutant contribution from all nonpoint sources, as well as from natural sources, and subtract it from the total pollutant loading that will be allowed. The balance is then allocated among the various point sources.

194. See Oliver A. Houck, TMDLs, Are We There Yet?: The Long Road Toward Water Quality-Based Regulation Under the Clean Water Act, 27 ENVTL. L. REP. (ENVTL. L. INST.) 10391, 10398 (1997) [hereinafter Houck, TMDLs]. Professor Houck notes that the Act contains no explicit language actually requiring implementation of the TMDLs, and that the Agency may be left to its authority to review and reject TMDLs, see C.W.A § 303(d)(2), 33 U.S.C. § 1313(d)(2), bolstered by its supervision of the permit system. *Id.* at 10399. This raises a question about the strength of the Agency's ability to force implementation of TMDLs involving nonpoint sources, since these sources are not regulated under the Act. *Id.*

gent than the limits dictated by the technology standards.[195] The TMDL process is one which focuses on overall pollutant loadings and seeks to allocate control responsibility.[196] Thus it lends itself readily to a program in which the responsibility might be shifted among dischargers through a market mechanism.[197]

In the case of the Sound, the states have essentially approached the Sound-wide loading determination on a macro-scale, having calculated the amount of yearly reduction that will be necessary from the 1990 baseline, and thus the "total maximum yearly loading."[198] The targeted reduction of 58.5 percent has been evenly distributed among the management zones established by the LISS, and maximum loadings will have to be set for each plant, first on a yearly basis, and then reduced to monthly and/or daily limits.[199] To comply with the Clean Water Act, a formal TMDL process meeting the requirements of Clean Water Act Section 303(d) must be followed by each state, and the basic calculations for each plant must be done.[200] The loading allocations will be converted into effluent

195. Clean Water Act § 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C).

196. The TMDL process can be viewed in itself as a type of trading program, in which the state rather than the market makes the allocations. It is essentially a closed type of system, since a new source or new discharger will not be allowed to discharge unless "there are sufficient remaining pollutant load allocations to allow for the discharge." 40 C.F.R. § 122.4(i)(1). Existing dischargers are supposed to be subject to compliance schedules designed to achieve applicable water quality standards. 40 C.F.R. 122.4(i)(2). It appears that this requirement has been honored in the breach.

197. One potential impediment is the poor progress which has actually been made in TMDL implementation. Few states have actually established adequate TMDLs for their waters, and those which have still failed to carry out meaningful allocations. This failure to comply with the requirements of the Act has led to a series of lawsuits brought by environmental organizations around the country. *See, e.g.*, Sierra Club v. Hankinson, 939 F. Supp. 865 (N.D. Ga. 1996); Idaho Sportsmen's Coalition v. Browner, 951 F. Supp. 962 (W.D. Wash. 1996); Alaska Center for the Environment v. Reilly, 762 F. Supp. 1422 (W.D. Wash. 1991); Alaska Center for the Environment v. Reilly 796 F. Supp. 1374 (W.D. Wash. 1992), *aff'd sub nom.* Alaska Center for the Environment v. Browner, 20 F.3d 981 (9th Cir. 1994); Scott v. City of Hammond, 530 F. Supp. 288(N.D. Ill. 1981), *aff'd in part, rev'd in part*, 741 F.2d 992, 996 (7th Cir. 1984), *cert. denied*, 469 U.S. 1196 (1985); *see also* Houck, *TMDLs, supra* note 194, at 10393-10396. As of September 1997, there were nine states with respect to which EPA is under court order to establish TMDLs if the states do not do so; twelve states in which litigation is pending; and 5 states with respect to which citizens groups have filed notices of intent to sue. EPA, Office of Water, TMDL Litigation By State, (visited Apr. 15, 1998) <http://www.epa.gov/OWOW/tdml/lawsuit1.html>.

198. The loading must of course accurately represent the reductions necessary to achieve water quality standards, which is not assumed. *See supra* note 54 and *infra* note 225.

199. *See* 40 C.F.R. § 122.45(d)(1).

200. A survey conducted by EPA found TMDL cost estimates as high as $1 million. OFFICE OF WATER, EPA, TMDL DEVELOPMENT COST ESTIMATES: CASE STUDIES OF 14 TMDLS, EPA-R-96-001 13, Fig. 4 (1996), (visited Apr. 15, 1998) <http://www.epa.gov/

limitations incorporated in the NPDES permits. They thus will serve as the baseline for a trading program.

The Long Island Sound dissolved oxygen target is based on achieving and maintaining desired levels in the most stressed parts of the Sound. The allocation of loadings is designed to distribute the loadings fairly across all zones and dischargers. However, a discharger which is within its overall limit still may have a substantial impact upon local water quality. It is possible, therefore, that some plants may be required to meet even more stringent limits than dictated by the 58.5 percent reduction goal because their discharges are or would contribute to localized water quality problems, creating "hot spots." Plants in such a situation present problems in any trading program, but are especially troublesome for water programs, since most discharge to relatively confined bodies of water. These plants should be required to meet their specified effluent discharge limitations, and not be permitted to purchase credits to achieve compliance.[201] However, to the extent a source controls its discharge to a level lower than required by water quality considerations, it could be allowed to sell the increment.

The ultimate goal of the Clean Water Act is to eliminate the discharge of pollutants to our Nation's waters,[202] and the entire structure of the Act is designed to require increasingly stringent technology limits, with the safety net of water quality standards. To be faithful to both the language and the intent of the Act, any trading program must be constructed in a way which advances towards the goal. It is critical, therefore, that the trading baselines established, which are contingent upon water quality standards, are as accurate as possible, a problem when limitations are based on modeling, an imprecise science. Moreover, monitoring must be thorough and extensive to insure that reductions actually occur as claimed and

OWOW/tdml/tmdlcost.html>. These costs are borne by the public, and should be considered in any discussion of transaction costs of developing a pollution trading program. In addition, it has been suggested that the analysis costs to the plant or permit writer of reviewing a trade or the effort involved in revising a TMDL or wasteload allocation due to new data could be an impediment to trading. WEF, Comments on Draft Framework for Watershed-Based Trading, *supra* note 154, at 6-7.

201. The situation is similar under the Clean Air Act, since the Act does not relieve a discharger from complying with the National Ambient Air Quality Standard (NAAQS) for SO2. In that regard, localized impacts of water discharges, which are usually into relatively confined waters, may be more severe than air emissions which tend to disperse more widely. Members of the Long Island Sound Ad Hoc Trading Group have generally agreed that trading should not be allowed when it contributes to local water quality impairment.

202. Clean Water Act § 101(a)(1), 33 U.S.C. § 1251(a)(1).

that water quality is not endangered. But meeting water quality standards will only achieve the fishable/swimmable goal of the Act; therefore, to reach the goal of eliminating discharges, a trading program should also contain successively more stringent reduction requirements.

B. Implementation

1. Permits

The primary implementing mechanism of the Clean Water Act is the NPDES permit. Along with a variety of other requirements, it prescribes the permit holder's effluent discharge limitations based on both technology and water quality standards.[203] The permit may be issued for no more than five years,[204] and provides that the issuing authority, typically the state,[205] may reopen the permit under specified conditions.[206] When issuing a permit, the state must provide for public input, including opportunity to challenge the permit.[207] Modifying a permit requires that similar procedures be followed, unless, under the regulations, the modification is deemed minor.[208] Since changes in effluent limitations, in most instances,

203. Conditions applicable to all permits include requirements for proper operation and maintenance, inspection and entry, monitoring and record keeping and reporting, 40 C.F.R. § 122.41, as well as compliance with both water quality and technology based standards. 40 C.F.R. § 122.44. The regulations make it explicit that a permit may not be issued "[w]hen the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States[.]" 40 C.F.R. § 122.4(d).

204. Clean Water Act § 402(b)(1)(B), 33 U.S.C. § 1342(b)(1)(B).

205. Authority to administer the Clean Water Act has been delegated to both Connecticut and New York pursuant to Clean Water Act § 402(b), 33 U.S.C. § 1342(b). *See supra* note 164.

206. 40 C.F.R. § 122.41(f); 40 C.F.R. § 122.44(c). The reasons for which a permit may be modified are spelled out at 40 C.F.R. § 122.62(a). There is not an obvious one within which a modification due to a trading program would fit, although this is apparently being done in at least one trading program. *See* Teitz, *Assessing Point Source Discharge Permit Trading: Case Study in Controlling Selenium Discharges to the San Francisco Bay Estuary*, *supra* note 151, at 111 & n.188.

207. Clean Water Act § 101(e), 33 U.S.C. § 1251(e) (public participation in implement Act encouraged; states must develop regulations); Clean Water Act § 402(b)(3), 33 U.S.C. § 1342(b)(3) (state must provide opportunity for public hearing on proposed state permit); 40 C.F.R. §§ 124.10-12, 124.17 (public notice and comment, hearings, agency duty to respond to comments). *See also* 40 C.F.R. § 123.30 (judicial review must be the same as that available to obtain judicial review in federal court of a federally-issued NPDES permit; see Clean Water Act § 509, 33 U.S.C. § 1369).

208. *See* 40 C.F.R. § 122.62.

will always be major,[209] a draft permit must be issued and the public participation procedures and other applicable state or federal regulations must be followed.[210] Accordingly, modification of a permit may take a minimum of several months to complete, which could pose an impediment to trading effluent rights readily and with minimal transaction costs.[211] This issue is discussed in more detail in the analysis of the anti-backsliding restriction below.

An emissions trading program places substantial reliance on the discharge permits and inventories, so to the extent those are deficient, water quality may not be protected.[212] Facilities which have actual levels of discharges substantially below permitted levels would find themselves with a trading opportunity which, if exploited, could degrade water quality.[213] Accordingly, strict attention must be paid to defining the trading baselines or benchmarks incorporated into the program, and to the corresponding monitoring.[214] Because of the complications introduced by interfacility trading, it is likely that both effluent and ambient water monitoring will need to be increased in order to assure that reductions are actually taking place, and that localized impacts are not created.

209. Minor modifications are strictly limited to such matters as correcting typographical errors, reflecting changed ownership, requiring more frequent monitoring, changing certain schedules and other ministerial type actions, none of which relate to substantive changes in effluent limitations. *See* 40 C.F.R. § 122.63.

210. 40 C.F.R. § 122.62. The public notice and comment period, and possible public hearing may take several months. *See* 40 C.F.R. §§ 124.10-12. Nevertheless, it is a crucial element of Clean Water Act implementation.

211. This was apparently a problem in the Fox River trading program discussed in the following section. *See infra* Part V, A. The Water Environment Federation has suggested that reopener clauses create market uncertainly, since a permittee cannot be sure that its permit requirements will be unchanged for the duration of the permit. The Federation suggests that some minimum time period be established during which the discharge limitation subject to trading will not be changed, in order to foster market certainty. *See* WEF, Comments on Draft Framework for Watershed-Based Trading, *supra* note 154, at 10.

212. *See* TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, *supra* note 55, at 411.

213. This situation is not an unusual one, since facilities often discharge below their permitted levels. This may occur because the effluent limitations are categorical ones established for the industry as a whole, and not for the individual plant, or because the facility is being operated conservatively in order to assure compliance and avoid penalties. Unlike effluent discharge limitations for industrial sources, which are calculated based upon a reasonable measure of actual production, limitations for POTWs are calculated based on design flow, not actual discharge levels. 40 C.F.R. § 122.45(b) (1991).

214. TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, *supra* note 55, at 411.

2. Anti-backsliding.

In order to achieve the no discharge goal established in the Clean Water Act[215] Congress inserted into the Act an increasingly stringent set of technology requirements, and prohibited easing of most effluent discharge limitations once they had been incorporated into a permit.[216] Thus, Clean Water Act § 402(o)(1) bars the renewal, reissuance or modification of a permit which contains an effluent limitation that is less stringent than those contained in the previous permit.[217] This basic proscription is consonant with both the scheme of increasingly stringent discharge requirements, and the overall technology forcing theme of the Act.[218] Accordingly, the Act is most strict when the effluent limitation in question is based on technology, rather than water quality considerations. In the former situation, the discharge limitations may not be relaxed in an existing permit, even if new technology based effluent guidelines are issued which would otherwise allow a more generous discharge limit.[219]

The requirements of the Act are somewhat less strict when a permittee's effluent limitations are water quality rather than technology based.[220] In that event, backsliding may occur in two situations. First, pursuant to section 402(2), if water quality standards are not being achieved, but a new TMDL and wasteload allocation has been accomplished whereby the cumulative effect of the revised loadings will result in lower total pollutant loadings and will ensure that water quality standards will be attained, then a reissued permit may contain less stringent limits.[221] In essence, the loading

215. Clean Water Act § 101(a)(1), 33 U.S.C. § 1251(a)(1).

216. Clean Water Act § 402(o), 33 U.S.C. § 1342(o).

217. 33 U.S.C. § 1342(o)(1); *see* 40 C.F.R. § 122.44(l).

218. See, e.g., Clean Water Act § 301(b).

219. Clean Water Act § 402(o)(1), 33 U.S.C. § 1342(o)(1); *see* 40 C.F.R. § 122.44(l). There are certain exceptions, such as for plant alterations or for technical mistakes or mistakes of law made in issuing the permit. Clean Water Act §§ 402(o)(2)(A)-(E), 33 U.S.C. §§ 1342 (o)(2)(A)-(E); 40 C.F.R. § 122.44(l)(2)(i)(A)-(E). If the permittee has installed and is properly operating and maintaining the appropriate technology, and is meeting current effluent guideline requirements but cannot meet the more stringent requirements of the permit, Clean Water Act § 402(o)(2)(E) allows the limits to be relaxed to the level which the plant is actually attaining. 33 U.S.C. § 1342(o)(2)(E); 40 C.F.R. § 122.44(l)(2)(i)(E).

220. However, technical mistakes or mistaken interpretations of law made when issuing the permit, which may allow backsliding from a technology based permit, do not apply to water quality based permits. *See* Clean Water Act § 402(o)(2)(B)(ii), 33 U.S.C. § 1342(o)(2)(B)(ii).

221. Clean Water Act § 402(o)(2)(B), 33 U.S.C. § 1342(o)(2)(B); *see* Clean Water Act §

has been reallocated during the process and another discharger will be reducing its loadings to compensate.[222] In the second situation, if a waterbody is attaining water quality standards, the permittee's water quality based effluent limitations may be reduced only following compliance with the antidegradation policy established under the Act.[223] Overall, the statute makes it explicit that no permit may be renewed, reissued, or modified if the effluent limitations do not meet current technology-based effluent guidelines and assure that applicable water quality standards are achieved.[224]

Similar to the issue of whether a trade would constitute a permit modification, the applicability of the backsliding prohibition may present problems for a trading program. Assuming a plant is given a specific pollutant loading limitation in its permit, but complies with that limit by purchasing credits, has it, in effect, been allowed to backslide to a less stringent limitation? This may be especially problematical if the permit is actually altered to reflect the arguably "less stringent" limit and the credit purchase. However, a close analysis of the statutory scheme and implementing regulations suggests that this provision could be addressed in a manner that will keep it from being a major impediment to nitrogen trading on the Sound.

First, if a changed permit limitation based on a trade is deemed to fall within the scope of the anti-backsliding prohibition, it may still be allowed if it comes within one of the narrowly circumscribed exceptions spelled out in the statute. As discussed above, the technology standard applicable to sewage treatment plants is secondary treatment, with which all of the relevant plants are in

303(d)(4)(A), 33 U.S.C. § 1313 (d)(4)(A). Section 303 was revised in 1987 to prohibit revision of a TMDL unless all designated uses will be attained. Water Quality Act of 1987, § 404(b), Pub. L. No. 100-4, 101 Stat.7, 68 (1987).

222. One further situation in which water quality based effluent limitations may be reduced when the standards are not being attained arises when a designated use has been eliminated. Clean Water Act § 303(d)(4)(A), 33 U.S.C. § 1313 (d)(4)(A). The circumstances under which a state may remove designated use are quite limited. *See* 40 C.F.R. § 131.10(h).

223. Clean Water Act § 402(o)(1), 33 U.S.C. § 1342(o)(1); *see* 40 C.F.R. § 122.44(l)(2)(ii). *See also* DRAFT FRAMEWORK, *supra* note 61, at 2-3. Each state is also required to establish an antidegradation policy to protect water quality. It must comply with minimum requirements established by EPA. 40 C.F.R. § 131.12; *see, e.g.*, New York State Department of Environmental Conservation, Organization and Delegation Memorandum No. 85-40, Water Quality Antidegradation Policy, September 9, 1985

224. Clean Water Act § 402(o)(3), 33 U.S.C. § 1342(o)(3).

compliance.[225] Nitrogen limits in the plants' permits will accordingly be based on water quality considerations. It may be argued that the formal TMDLs to be prepared by Connecticut and New York for the Sound will allow the states to relax individual permit limits, since the cumulative effect of all the sewage treatment plant permit revisions will result "in a decrease in the amount of [nitrogen] discharged to the [Sound]" [226] and "will assure the attainment of [the applicable] water quality standard."[227] Although this is appealing on its face, one factual complication does arise. Based on LISS modeling efforts, it is not at all certain that dissolved oxygen goals can be achieved even if the full 58.5 percent reduction is achieved Sound-wide.[228] Moreover, both the interim and long-term goals established in the Management Plan are not regarded as sufficiently stringent to meet current state water quality standards.[229] But if that is indeed the situation, then the TMDL would appear to be insufficient from the beginning, calling into question the legality of the entire procedure.

In the final analysis, the antibacksliding issue can be avoided in large part, since very few dischargers now have actual nitrogen limitations in their permits, and steps could be taken to assure that any new or reissued permits are drafted in such a fashion as to specifically avoid the problem. Permit writers have substantial latitude in defining the terms of a permit, so long as the statute and regulations are observed. For instance, a permit might be written to specify that, provided the requisite technology based limitations and localized water quality limitations were met,[230] the effluent limitations specified in the permit could be achieved either by actual reductions at the plant, or through the purchase of allowances or as an alternative method of compliance.[231] By careful attention to the

225. *See supra* Part IV, A, 1.

226. Clean Water Act § 402(o)(2), 33 U.S.C. § 1342(o)(2).

227. Clean Water Act § 303(d)(4)(A), 33 U.S.C. § 1313(d)(4)(A).

228. PHASE III PROPOSAL, *supra* note 21, at 9. The situation is further complicated since EPA is in the process of developing regional marine oxygen criteria to deal with nutrients. These may lead to changes in state water quality criteria. *Id.* at 15; *EPA to Develop New Water Quality Criteria for Nutrients*, INSIDE EPA, Oct. 10, 1997, (Weekly Report), at 1-2.

229. *See supra* notes 49.

230. Obviously trading to improve the water quality in the Sound should not be allowed to cause local water quality impairment.

231. The prohibition on discharges found in Section 301 (b)(1)(C) of the Clean Water Act provides that effluent limitations must be sufficiently stringent to "meet water quality standards . . . established pursuant to any State law or regulations." Arguably a trading program will only be approved if the states [and EPA] determine that the total impact of all in-

language of the permits, the potential impediments inherent in the anti-backsliding provisions of the Act might be avoided. Questions of enforceability may nevertheless be raised, to which we turn next.

3. Enforcement.

From the inception of the Clean Water Act, enforcement has played a key role in assuring that statutory and regulatory requirements were met and water quality protected. Section 309 of the Act[232] contains both civil and criminal sanctions and provides a powerful tool to force compliance by dischargers. Similar provisions are found at the state level.[233] Congress empowered citizens to bring enforcement actions to both stimulate and supplement the efforts of the government,[234] and it has been citizens who have been responsible for many compliance suits.[235] The cornerstone of Clean Water Act enforcement, both for the government and for citizens, is the system of self-monitoring and reporting established by statute and by regulation.[236] Section 308 of the Act requires the permit holder to install and maintain appropriate equipment to sample and monitor its effluent, establish and maintain records of the results, and report them to the permitting agency.[237] Discharge monitoring reports (DMRs), required to be filed at prescribed intervals which detail the level of compliance achieved for the specified effluent limitations,[238] are key to facility of oversight and en-

dividual permit limitations will be to maintain or improve water quality, thus meeting the letter and the intent of the law.

232. 33 U.S.C. § 1319.

233. For an examination of the tensions inherent in the federal-state partnership see David R. Hodas, *Enforcement Of Environmental Law In A Triangular Federal System: Can Three Not Be A Crowd When Enforcement Authority Is Shared By The United States, The States And Their Citizens?* 54 MD. L. REV. 1552 (1995).

234. Clean Water Act § 505, 33 U.S.C. § 1365. For background on federal citizen suit provisions see JEFFREY G. MILLER , ENVTL. L. INST., CITIZEN SUITS: PRIVATE ENFORCEMENT OF FEDERAL POLLUTION CONTROL LAWS (1987); *see also* MICHAEL D. AXLINE, ENVIRONMENTAL CITIZEN SUITS (1991).

235. *See* Adam Babich, *Citizen Suits: The Teeth in Public Participation*, 25 ENVTL. L. REP. (ENVTL. L. INST.) 10,141 (1995); *see also* DANIEL RIESEL, ENVIRONMENTAL ENFORCEMENT, CIVIL AND CRIMINAL § 15.03[1] (1996).

236. *See* Clean Water Act § 308, 33 U.S.C. § 1318; 40 C.F.R. §§ 122.41(j), 122.44(i), 122.48.

237. Clean Water Act § 308(a), 33 U.S.C. § 1318(a).

238. *See* 40 C.F.R. § 122.41(l)(4). The reporting frequency may be determined on a case-by-case basis, as appropriate for the nature and effect of the discharge, but in no case may it be less than once a year. 40 C.F.R. § 122.44(i)(3). In practice, reporting is much more frequent. Permit holders must also report within 24 hours any discharge which may endanger health or the environment. 40 C.F.R. § 122.41(l)(6).

forcement.[239] If the actual discharge exceeds that specified in the permit, then the DMR provides prima facie evidence of a violation of the statute, and strict liability will be imposed on the permittee.[240] Enforcement then becomes a relatively straightforward matter, based on the permit holder's own data.[241] To the extent that permit limitations are unclear, enforcement will be impeded.[242]

A transaction between point sources can be reasonably accommodated within the current permit process. The same technology and water quality based effluent limitations which would be imposed in the absence of a trading program should be included, with the permit written to specify the level of discharge limitation necessary to meet technology based standards, and any additional increment required by water quality. The need to prevent localized water quality impacts would be taken into account at this point in setting effluent limits. The permit would then explicitly recognize that the permit holder might achieve the requisite water quality based effluent limitations either by actually reducing its loadings, or by the purchase of credits.

When a permit with such a condition is issued, citizens will have the opportunity to comment and to present any arguments they might have against allowing compliance by trading.[243] If there is

239. *See* U.S. v. CPS Chemical Co., 779 F. Supp. 437, 442 (E.D. Ark. 1991). Congress intended enforcement under the Act to be streamlined and straightforward, stating explicitly that the purpose of the enforcement provisions "'is to avoid the necessity of lengthy fact finding, investigations, and negotiations at the time of enforcement. Enforcement of violations of requirements under this Act should be based on relatively narrow fact situations requiring a minimum of discretionary decision making or delay.'" (quoting S.Rep. No. 414, 92nd Cong., 1st Sess. 64, reprinted in 1972 U.S. Code Cong. & Admin. News 3668, 3730). *See* U.S. v. Gulf Park Water Company, Inc., 972 F. Supp. 1056, 1060 (S.D. Miss. 1997).

240. *See* U.S. v. Aluminum Co. of America, 824 F. Supp. 640, 649, 23 Envtl. L. Rep. 21,558 (E.D. Tex. 1993); Chesapeake Bay Foundation, Inc. v. Bethlehem Steel Corp., 608 F. Supp. 440, 451-52, 15 Envtl. L. Rep. 20,785 (D. Md. 1985).

241. *See* U.S. v. Aluminum Co. of America, 824 F. Supp. 640, 648, 23 Envtl. L. Rep. 21,558 (E.D. Tex. 1993).

242. Permit limitations which include a trading provision may also provide difficulties for the discharger in instances in which it wishes to avail itself of the bypass and upset provisions of the regulations. *See* 40 C.F.R §§ 122.41(m), (n). Under these provisions a permit holder may be excused for bypassing treatment works or exceeding discharge limitations in narrowly circumscribed conditions, but must make prompt notification to the permitting authority. 40 C.F.R. §§ 122.41(m)(3)(ii), (n)(3)(iii). Unless the permit has been amended to show the actual effluent limitations resulting after a trade, it may be difficult for the operator to ascertain when the defense might appropriately be raised.

243. Clean Water Act § 402(b)(3), 33 U.S.C. § 1342(b)(3) (state must provide opportunity for public hearing on proposed state permit); 40 C.F.R. §§ 124.10-12, 124.17 (public notice and comment, hearings, agency duty to respond to comments).

the potential for local water quality impairment, then a challenge could be raised at that time and trading would be limited or refused altogether. The exact scope of the allowable trading should be explicitly spelled out so that once the permit is approved no further agency action is necessary for a trade to occur. Thus issuance of the permit should constitute final agency action as to allowable trading, and a court should find review appropriate.[244]

Once trading commences, citizens should have prompt access to information regarding purchase and sales, as well as compliance by dischargers.[245] While monitoring is important in any enforcement program, it is even more crucial in incentive based programs since both discharges and trades must be tracked and correlated.[246]

Unless a permit holder can demonstrate to state authorities a completed transaction to purchase pollution credits, it must comply with the effluent limitations spelled out in its permit. Any exceedances must be reported as such in the plant's DMRs. If a permit holder engages in a trading transaction, proof should be provided to the state, and the effluent discharge limitations recalculated and either raised (buyer) or lowered (seller) in both permits to reflect that trade. A seller who fails to meet its reduction obligations would therefore violate its permit and be subject to sanctions. Its adjusted discharge limitations then become the baseline against which compliance with the permit and the Clean Water Act is measured, and enforcement undertaken.

It is evident that such a trading scheme would require additional administrative work to recalculate limits based on trades and to make data readily available,[247] but the process is critical to maintain-

244. It is important to avoid situations in which a court would find that a challenge to a trading scheme could not be brought until an actual trade had taken place. There might be no mechanism for such a challenge under either federal or state law. The judicial review provision of the Clean Water Act, Section 509, which would apply to the issuance or denial of a permit by EPA, does not seem to be sufficiently broad to encompass a later trade under the permit. Clean Water Act § 509(b)(1)(F), 33 U.S.C. § 1369(b)(1)(F). Nor would the citizen suit provision of the Act, which allows suits against the Administrator for failure to carry out a nondiscretionary duty, be applicable, even if the permit was one issued by EPA. *See* Clean Water Act § 505(a)(2), 33 U.S.C. § 1365(a)(2). The issue becomes even more problematic under state law, since state judicial review formulations vary. Even if review was available, it would place an unreasonable burden on a trading program if each individual trade could be subjected to judicial review.

245. A publicly available on-line data base could provide both a mechanism to facilitate trading and a means for the government and citizens to monitor trading.

246. *See* Bartfeld, *Point-Nonpoint Source Trading*, *supra* note 62, at 65, 80-81.

247. For the acid rain program, EPA maintains an on-line Allowance Tracking System which contains information on allowance accounts and activities. It may be found at

ing enforceability of the permits and the integrity of the system, not only for government but also for citizen enforcers.[248]

Although the Clean Water Act may present some legal hurdles for a market based trading program, those hurdles represent important environmental protections crafted by Congress which cannot be ignored. Indeed, the Act provides an essential structure for trading. A carefully crafted nitrogen trading program for Long Island Sound could meet the requirements of the Clean Water Act, and be consistent with the principles spelled out in the *Draft Framework*. The question then remains whether it is economically and politically feasible. We approach these questions by first examining current water trading programs.

<http://www.epa.gov/acidrain/atsdata2.html> (visited Apr. 15, 1998).

248. There is strong concern on the part of environmentalists about the degree to which governmental enforcement is sufficiently vigorous. Both federal and state enforcement efforts have been criticized over the years, and citizens have brought litigation when the government failed to do so. *See* CLEAN WATER NETWORK, A PRESCRIPTION FOR CLEAN WATER: HOW TO MEET THE GOALS OF THE CLEAN WATER ACT 19-20, Appendix (Oct. 1997) (as of 1996, 14.5 percent of New York's and 19.5 percent of Connecticut's major industrial and municipal facilities were listed by EPA as being in significant non-compliance with their permits); Todd Robins, Public Interest Research Group, Testimony On Environmental Enforcement Issues, Connecticut General Assembly, Environmental Committee, (Mar. 31, 1997) (PIRG review found that the number of major industrial facilities in Connecticut in significant noncompliance was three times the number listed by EPA). For this reason, environmentalists are firm that any water pollution trading programs established under the Clean Water Act must be structured to facilitate enforcement efforts. *See* Sierra Club, Comments on Draft Framework for Watershed-Based Trading *supra* note 156; Comments by the National Wildlife Federation on the U.S.E.P.A.'s Draft Framework for Watershed-Based Trading, *supra* note 156.

When discussing citizen participation in the *Draft Framework*, EPA focuses primarily on the benefits to be achieved from engaging stakeholders in trading processes. DRAFT FRAMEWORK, *supra* note 61, at 2-11. However, of critical concern to environmental public interest groups are the mechanisms by which citizens may participate in the formulation and enforcement of wastewater discharge permits. The Clean Water Act, fortified by agency regulations, specifically provides the right for public comment in the issuance of a permit, and a right to challenge the permit once it has been issued. See 33 U.S.C. § 1342 (b)(3) (comment on state permit); § 509(b) (challenge federal permit); § 505 (enforcement state and federal permits). Section 505 of the Act further provides citizens the opportunity to enforce the terms and conditions of the permit. 33 U.S.C. § 1365. This provision has been used extensively by citizens, and has served to both supplement government enforcement efforts and to goad officials into action. Indeed, it is especially important to maintain citizens' ability to enforce compliance by public entities such as POTWs, since that has been unfortunately an area in which the government has often been reluctant to take action. Accordingly, under any trading program, citizens ability to obtain information and to seek compliance with the law must be maintained.

VI. CURRENT WATER POLLUTANT TRADING PROGRAMS

Water pollutant trading programs in various forms have been undertaken in a number of geographic locations.[249] Although they differ considerably in structure, scope, specific pollutants, trading partners and levels of participation, they all generally meet the requirements that EPA has specified in its *Draft Framework*. A review of several of these programs provides insight into how they fit into the legal framework and how they have functioned in practice, with some explanations. Four of the programs, all of which have received considerable attention, are discussed below.

A. Fox River, Wisconsin

The Fox River trading program, the first of its kind, was initiated by Wisconsin in 1981 in response to the failure of technology-based categorical effluent limitations to control biological oxygen demand (BOD) at two critical sites on the Fox River.[250] The program was established as a closed point source cap-and-trade program, to include fifteen industrial facilities, mostly paper mills, and six municipal facilities (a balance significantly different from Long Island Sound). Preliminary analysis suggested that trading would allow point sources to realize an annual control cost savings of as much as $6.8 million dollars over the traditional regulatory program.[251]

Although no provision of the Clean Water Act explicitly authorized trading, Wisconsin appears to have attempted to operate within the framework of the Act.[252] It calculated an overall BOD loading for the river and assigned wasteload allocations to the relevant point source dischargers, reflected in five-year discharge permits.[253] Dischargers may obtain BOD credits by reducing their pol-

249. *See* DRAFT FRAMEWORK, *supra* note 61, Appendix C. *See also* Surface Water Quality Division, Michigan Department of Environmental Quality, *Summary of Other State Programs* (visited Dec. 20, 1997) < http://www.deq.state.mi.us/swq/trading/html/statesum.htm >.

250. For more detailed discussions of the program see DRAFT FRAMEWORK, *supra* note 61, at 5-13; Hahn, *Doctor's Orders*, *supra* note 13, at 97-98.

251. *See* DRAFT FRAMEWORK, *supra* note 61, at 5-13.

252. It has been pointed out that the manner in which the program is structured may not conform to the strictures of federal law, and the program may be vulnerable to challenge. *See* Tripp & Dudek, *supra* note 13, at 387. The Fox River trading regulations may be found at WIS. ADMIN. CODE § 212.115 (1986); *see also id.* § 212.11 (1985) (detailing the process for modifying or temporarily reallocating point source allocations); § 212.40 (1996) (detailing the lower Fox River water quality related effluent limitations).

253. *See* Hahn, *Doctor's Orders*, *supra* note 13, at 97.

lutant loads below their respective allocations, or may purchase them to cover excess discharges. However, point sources may not trade unless they can demonstrate need, such as increased production or inability to achieve effluent limitations.[254]

Within the State's water pollutant trading program, trades must last at least one year, trading transactions must be reflected in dischargers permits and may not last longer than the permit, and all trades must be formally approved by the Wisconsin Department of Natural Resources. Because of the localized effect of BOD, the trading program is divided into three river segments, each with approximately an equal number of participants, with a prohibition on trading between the segments.[255]

Although the program began in 1981, only one trade has occurred to date, and that was not the type anticipated by the proponents of the plan.[256] While the objective of the program was clear and the allocation of pollutant credits relatively straight forward,[257] there were a number of factors which posed constraints on trading. Since most of the industrial facilities are paper mills, it is generally believed that competitive pressures within that industry dampened any willingness to trade. Moreover, given the uncertainty inherent in pollution control programs, the mills may well have been reluctant to trade away any portion of the BOD allocation that they may need to accommodate future growth.[258] The restriction on trading between stream segments also presented a problem; it meant that there were few available trading partners, and the overall economics may have made trading unattractive. Additionally, the administrative review process was described as complex and time consuming, with high transaction costs.[259]

Despite the lack of trading, the various dischargers did manage to reduce their pollutant discharges, and BOD reductions in the river were achieved. However, it is plausible that employing tradi-

254. *See* DRAFT FRAMEWORK, *supra* note 61, at 5-13. One author has suggested that the rationale for this requirement is to assure compliance with Clean Water Act requirements concerning permit modifications. *See* Teitz, *supra* note 151, at 57 & n.188; 40 C.F.R. § 122.62(a).

255. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-5; Hahn, *Doctor's Orders*, *supra* note 13, at 98.

256. In this "trade," a paper mill closed its wastewater treatment plant and moved its wastewater discharge to a municipal treatment plant. The mill then asked the state to shift its BOD allocation to that plant. *See* DRAFT FRAMEWORK, *supra* note 61, at 5-13.

257. *See* Tripp & Dudek, *supra* note 13, at 387.

258. *See* DRAFT FRAMEWORK, *supra* note 61, at 5-13.

259. *See* Tripp & Dudek, *supra* note 13, at 387; Hahn, *Doctor's Orders*, *supra* note 13, at 98.

tional regulatory means, with comparable costs, could have achieved similar reductions.

B. Tar-Pamlico River Basin, North Carolina

A second program which is featured prominently in the literature, is a closed, point/nonpoint, nutrient trading program developed in 1991 for the Tar-Pamlico River Basin in North Carolina.[260] The watershed for the river is approximately 5,440 square miles, and much of it is used for agriculture.[261] Although nonpoint sources were found to account for 92% of nitrogen loadings into the basin,[262] the state's initial response focused on further reducing discharges by requiring additional pollution controls at a dozen point sources, —mostly publicly owned sewage treatment plants— at an estimated cost of between $50 and $100 million.[263] However, an economic analysis suggested that similar reductions in nutrient pollution might be achieved through implementing best management practices for nonpoint sources at an approximate cost of only $10 million.[264] With such potential economic savings, the point sources in the basin (twelve POTWs and one industrial discharger) formed the Tar-Pamlico Association with the intent of avoiding costly point source reductions by inducing nonpoint sources to participate in a nutrient reduction plan.[265]

The program was designed to be implemented in two phases.

260. For more details on the program see Office of Wetlands, Oceans, and Watersheds, U.S. Environmental Protection Agency, Pub. No. EPA841-F-93-010, TMDL Case Study: Tar—Pamlico Basin, NC 2 (1993) (also available on internet at <http://www.epa.gov/owow/tmdl/cs10/cs10.htm> (visited Apr. 10, 1998)) [hereinafter Tar-Pamlico TMDL Case Study]; U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED 95-218, AGRICULTURE AND THE ENVIRONMENT: INFORMATION ON AND CHARACTERISTICS OF SELECTED WATERSHED PROJECTS 9, 31-37 (1995) [hereinafter GAO WATERSHED REPORT]; Office of Wetlands, Oceans, and Watersheds, U.S. Environmental Protection Agency, *Draft Trading Update—December 96: Tar-Pamlico River, North Carolina* (visited Dec. 21, 1997) <http://www.epa.gov/owow/watershed/trading/tarpam.htm> [hereinafter *Tar-Pamlico Update*].

The Tar-Pamlico River Basin consists of the Tar River in the upper part of the Basin and the Pamlico River in the lower part of the Basin. Tar-Pamlico TMDL Case Study, *supra*, at 2. The entire river is over 180 miles long and stretches from the Piedmont to Pamlico Sound. *See Tar-Pamlico Update*, *supra*, ¶ 2.

261. The watershed is home to over 246 swine, dairy, and poultry operations. *See Tar-Pamlico Update* at ¶ 2.

262. *See Tar-Pamlico Update* ¶ 2.

263. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-5, 3-6.

264. *See id.* at 3-6.

265. *See* GAO WATERSHED REPORT, *supra* note 260, at 33.

During the first, from 1991 to 1994, the point sources were to undertake engineering studies and to implement relatively low cost control measures.[266] In the second phase, 1995-2004, additional reductions would be required. To commence Phase I the Association, the North Carolina Department of Environmental Management, and two environmental public interest organizations, the Pamlico-Tar River Association, and the Environmental Defense Fund, entered into a point/nonpoint trading agreement. Under the agreement, a nutrient "bubble" was established with a declining cap on the total amount of nutrients that the thirteen Association members as a whole might discharge.[267] Credits for trading are earned by the Association when it is able to reduce its nitrogen or phosphorus loads below the cap.[268] Transactions may occur in two different ways. First, the members of the Association may trade among themselves to ensure that the Association meets its cap.[269] Second, if the Association cannot meet the overall cap, it may pay a fee to the North Carolina Division of Soil and Water Conservation's Agricultural Cost-Share Program, which uses the money to implement BMPs designed to reduce agricultural runoff.[270]

When the second phase was to be implemented there was serious disagreement over the goals and the allocation of the reductions, most of which were to be taken from nonpoint sources, sparing

266. Tar-Pamlico TMDL Case Study, *supra* note 260, at 5.

267. The first phase of the trading program set an initial nutrient cap for the Association in 1991 at 625,000 kg/yr, which was reduced to 425,000 kg/yr in 1994. This cap reflected the goal of reducing the projected nutrient loads for 1994 by 200,000 kg/yr. This translated into a 180,000 kg/yr reduction for nitrogen and a 20,000 kg/yr reduction in phosphorus. *See* Tar-Pamlico TMDL Case Study, *supra* note 260, at 5. A new cap was set in 1994 for the second phase of the trading program in 1994. *See Tar-Pamlico Update*, *supra* note 260 at ¶ 3. This cap consists of an overall nutrient cap of 475,000 kg/yr, with limits of 405,256 kg/yr for nitrogen and 69,744 kg/yr for phosphorus. *See id.* As is obvious from the numbers, the nutrient cap for Phase II is less stringent than that set for Phase I.

268. *See* Kurt Stephenson, Waldon Kerns, and Len Shabman, Virginia Tech, *Market-Based Strategies for Chesapeake Bay Policy and Management: A Literature Synthesis* ¶ 78 (visited March 5, 1997) <http://199.75.0.27/stac/pubs/litsyn96/steph.html> [hereinafter *Literature Synthesis*]. One credit allows the Association to emit one kilogram of nitrogen or phosphorus. *See* WATER SCIENCE REPORTER, *supra* note 57, at 4. The trading ratio between the two pollutants is thus 1:1. This is acceptable under EPA's Draft Framework since the impact on the water body of the two pollutants is similar. *See* DRAFT FRAMEWORK, *supra* note 61, at 2-9—2-10.

269. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-6. Members may also bank these credits for future use. *See also* WATER SCIENCE REPORTER, *supra* note 57, at 4.

270. The Association does not fund programs directly, but purchases credits for $29 for every kilogram of discharge that is above the cap. *See* WATER SCIENCE REPORTER, *supra* note 57, at 4. Credits are good for ten years for structural best management practices, and three years for non-structural BMPs. *See also Tar-Pamlico Update*, *supra* note 260 at ¶ 4.

point sources further control requirements. The dispute over the goals is especially troubling, since modeling indicated that a 45 percent reduction was called for. Claiming no confidence in the model, the state instead set a goal of 30 percent. As a consequence, the environmental groups refused to participate in the program and withdrew their support. Nevertheless, the state implemented its plan, with environmentalists threatening litigation proceedings.[271]

Obviously there is some question as to how this program fits within the structure of the Clean Water Act, since it appears to contemplate that violations of the permitted bubble will be addressed by payments to the cost-share program. The state has, however, indicated that it reserved the right to impose traditional effluent limitations and controls if the cap is not maintained, but this seems contrary to the trading agreement itself.[272] Most disturbing is the fact that point source members of the Association are not held accountable for the success of BMPs in reducing nutrient loadings.[273] This raises the possibility that the Association may discharge in excess of otherwise permitted point source levels and purchase credits by making payments to the state, without a matching nonpoint reduction. This concern exists because the state did not spend a substantial amount of the money which had been contributed to the fund by the Association. Of the monies it did spend, some were used for projects far up the watershed with no demonstration of impact on the area of concern. The Association was also given nitrogen reduction credits for the installation of monitoring equipment and for operational costs, which of course did not reflect any actual reductions.[274] In addition, it lowered the price of credits for Phase II, and subsequently recomputed the number of credits which the fund represented based on this lower price, swelling their number. As a result of this manipulation, the Association had a credit of over 22,000 kilograms at the commencement of Phase II.[275] The avenues available through which citizens are permitted to raise challenges to such state actions is not clear.

271. *See* GAO WATERSHED REPORT, *supra* note 260, at 9, 35.

272. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-6. Individual nitrogen permits are not issued for the members of the Association. *Id.*

273. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-6.

274. Personal communication with Douglas N. Rader, Ph.D., Senior Scientist, Environmental Defense Fund (Apr. 17, 1998).

275. *See* GAO WATERSHED REPORT, *supra* note 260, at 34.

Only two point/nonpoint trades have occurred, and were carried out at the beginning of the program as a test.[276] More commonly, point/point trades have occurred among Association members.[277] Even without nonpoint trades the Association did reduce its nutrient discharges 28% by the end of the initial phase, in spite of an 18% increase in its effluent flow.[278] These reductions were achieved at modest costs through relatively inexpensive equipment upgrades and operational plant improvements,[279] which suggests that the original cost estimates were seriously inflated and/or that the point sources had not made serious attempts to find low cost ways to reduce discharges. Therefore, the Association's protestations that it will need to purchase credits to meet its cap when, in the future, further reductions are required should be greeted with some skepticism. It should also be noted that in spite of the reductions, water quality does not appear to have improved.[280]

C. Lake Dillon, Colorado

A closed, point/nonpoint trading program for phosphorus has been in existence since 1984 for Lake Dillon,[281] a popular recreational area and a reservoir for Denver's drinking water.[282] Several substantial skiing resort communities surround the Lake;[283] their continuing expansion fueled concerns that increased nutrient loadings of phosphorus from rapid population growth in the area would cause eutrophication of the Lake.[284] Point sources were found to account for only 2% of the phosphorus load into the Lake,[285] primarily from local municipal sewage treatment plants; the main source of nonpoint source pollution was runoff from

276. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-6.

277. *See Tar-Pamlico Update, supra* note 260 at ¶ 1.

278. *See id.* ¶ 5.

279. *See* GAO WATERSHED REPORT, *supra* note 260, at 37.

280. *See id.* at 36.

281. *See* EPA, Office of Wetlands, Oceans, and Watersheds, *Draft Trading Update—December 96: Lake Dillon, Colorado,* ¶ 1 (visited March 4, 1997) <http://www.epa.gov/owow/watershed/trading/lakedil.htm> [hereinafter *Lake Dillon Update*]. The Colorado State Water Quality Control Commission codified the trading program as the Dillon Control Regulation in 1984. *See Lake Dillon Update, supra* note 281, ¶ 3; 5 Colo. Code Regs. § 1002.71 (1997).

282. *See Lake Dillon Update, supra* note 280 ¶ 2.

283. They include Breckenridge, Keystone, Dillon, Frisco, and Copper Mountain. *See id.* ¶ 2.

284. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-7.

285. *Id.*

towns and ski areas, along with seepage from failing septic systems.[286]

Initially, the State established a TMDL for the Lake for phosphorus and assigned waste load allocations to four POTWs.[287] The trading regulation allows the plants to meet their caps by purchasing phosphorus reduction credits from the program administrator, the Summit County Water Quality Committee. The credits are created by nonpoint source reductions achieved from implementing BMPs.[288]

To date, only one point /nonpoint trade has occurred, and that was executed in an effort to test the program.[289] Point sources have not been obligated to trade in order to meet their phosphorous limits as a result of increased plant efficiencies and slower than expected population growth.[290] Indeed, the Lake Dillon point sources were able to attain some of the highest phosphorus reduction capabilities in the country.[291] It appears, therefore, that anticipated point/nonpoint trades are unlikely to occur unless renewed population growth puts a strain on present capabilities.[292]

As a consequence, the trading program has refocused on nonpoint/nonpoint trading.[293] The 1984 trading program and local policies now essentially require a "no net increase" for phosphorus loads into the lake from nonpoint sources.[294] The trading program currently allows new nonpoint sources to offset their phosphorus

286. *See Lake Dillon Update, supra* note 281, ¶ 2.

287. It set a total loading of 4610 kg/yr. *See id.* ¶ 3 *See also* WATER SCIENCE REPORTER, *supra* note 57, at 4.

288. *See Lake Dillon Update, supra* note 281, ¶ 3. The Summit County Water Quality Committee coordinates the trading program. The Committee identifies potential BMP projects, distributes phosphorus credits, oversees monitoring, and ensures that nonpoint source pollution reduction ordinances are adopted and implemented. *See also* WATER SCIENCE REPORTER, *supra* note 57, at 4. The regulation calls for a 2:1 trading ratio, whereby a point source may receive a credit equal to one kilogram for every two kilograms of nonpoint phosphorus removed *See Lake Dillon Update, supra* note 281, ¶ 3. Additionally, point source permits must be modified when point/nonpoint trades occur to include a record of the credit amount, specified construction requirements for nonpoint source controls, monitoring and reporting requirements for nonpoint source BMPs, and operation and maintenance requirements for BMPs. *See id.*

289. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-7.

290. *See* DRAFT FRAMEWORK, *supra* note 61, at 8-1.

291. Phosphorus loadings were reduced from 3,748 kg/yr in 1981 to 529 kg/yr in 1991. *See Lake Dillon Update, supra* note 281, ¶ 5.

292. *See* A.T. KEARNEY, INC., *supra* note 33, at 3-7.

293. *See Lake Dillon Update, supra* note 281, ¶ 1.

294. *See Literature Synthesis, supra* note 268, ¶ 74.

loads by implementing BMPs at existing nonpoint sources.[295] There have been three nonpoint/nonpoint "trades" to date.[296]

D. Cherry Creek Basin, Colorado

Cherry Creek Reservoir is a major recreational spot southeast of Denver.[297] In 1984, the Cherry Creek Basin Authority,[298] in an effort to protect the water quality in the reservoir, calculated a TMDL for phosphorus and allocated the loadings to twelve sewage treatment plants. In 1985, the Cherry Creek Control Regulation was established which allowed point sources to receive credits for the reduction of nonpoint source loadings of phosphorus achieved by implementing BMPs. First, however, urban nonpoint sources had to make a 50 percent reduction from 1990 base year before trades could take place. However, no guidelines for trading were developed, and no trades occurred, most likely because the population did not increase as anticipated.[299]

In an effort to revitalize the program, the Authority drafted guidelines for a point/nonpoint trading program for phosphorus, and submitted a copy to the Colorado State Water Quality Control Commission in April, 1997, for approval.[300] The Authority gener-

295. *See Lake Dillon Update, supra* note 281, ¶ 5.

296. First, the Frisco Sanitation District used storm water controls to achieve additional phosphorus load reductions. The Town of Frisco plans to bank those "credits" to use for loads that a new golf course is expected to generate. Second, Keystone ski resort paid to connect individual septic systems to sewer lines to reduce phosphorus loads, essentially banking credits to apply to projected nonpoint source loading from future resort development. *See* DRAFT FRAMEWORK, *supra* note 61, at 8-1. Third, the Town of Breckenridge banked a 25 kg/yr credit when it sewered one subdivision that had a 50 kg/yr load. *See Lake Dillon Update, supra* note 281, ¶ 5.

297. *See* EPA, Office of Wetlands, Oceans, and Watersheds, *Draft Trading Update: December 96: Cherry Creek Basin, Colorado,* ¶ 2 (visited March 4, 1997) <http://www.epa.gov/owow/watershed/trading/cherry.htm> [hereinafter *Cherry Creek Update*].

298. *See id.* ¶ 2. The Cherry Creek Basin Authority is in charge of water quality management in the Basin, and is comprised of representatives from counties, cities, towns wastewater districts and ex-officio members that represent State, Federal and regional organizations who have a hand in protecting the Basin's watershed. *Id.* ¶ 3.

299. *See Cherry Creek Update, supra* note 297, ¶ 1; *Summary of Other State Programs, supra* note 249, ¶ 5.

300. Personal communication with Ronda L. Sandquist (March 24, 1997). *See generally* CHERRY CREEK BASIN AUTHORITY, DRAFT OF CHERRY CREEK BASIN WATER QUALITY AUTHORITY EFFLUENT TRADING GUIDELINES (1997) [hereinafter CHERRY CREEK GUIDELINES]. The purpose of the program is described as follows: "The Trading Program allows point source dischargers to receive phosphorus pounds for new or increased phosphorus wasteload allocations in exchange for reductions of phosphorus loading from nonpoint sources." *Id.* at 1 Under the new trading guidelines, two types of trades are allowed: (1) Authority project

ates credits by implementing BMPs and placing those credits in a "trading pool."[301] These trading pool credits may then be purchased by individual dischargers.[302] To date, the Cherry Creek Basin Authority has generated credits for the trading pool by implementing four nonpoint source control projects, with plans to initiate others.[303]

E. Analysis

Two dominant themes appear when analyzing the above examples. First, few real trades occurred in any of the programs. In all of them trading was rendered unnecessary, at least for the time being, because facilities reduced discharges to or below required levels through facility changes or improved operation and maintenance. Trading may have provided an incentive for dischargers to improve their pollution reduction controls and reduce their discharges below their cap, either to avoid purchasing credits, or with an expectation of selling them.[304] On the other hand, the existence

trades, and (2) private project trades (In-Kind Trades). *See id.*, at 1.

301. *See Cherry Creek Update, supra* note 297, ¶ 4.

302. *See id.* If there are credits in the Trade Pool, a point source may purchase phosphorus credits only if: (1) there is a need for credits, (2) the treatment facility operates as efficiently as possible now and in the future with current technology to achieve expected phosphorus reductions, (3) present and future compliance with all existing effluent limitations will be met, and (4) that the treatment facility and trade is consistent with the CCB Water Quality Management Master Plan and the Cherry Creek Control Reservoir Regulation. *See* CHERRY CREEK GUIDELINES, *supra* note 300, at 6-7. Under the second category, privately constructed BMPs to control nonpoint source pollution will be reviewed by the Authority to determine how many "in-kind" credits such projects are worth. The Authority will then assign those credits to the private party. A private party may apply its credits to its own point source discharges, or trade them with other point sources upon the Authority's approval. *See id.*

303. *See Cherry Creek Update, supra* note 297, ¶ 4. The EPA has also cited Boulder Creek, CO, where the City made ecological modifications to Boulder Creek which improved water quality, in lieu of requiring pollutant load reductions, as an example of a point/nonpoint trading program, with a twist. *See* EPA, Office of Wetlands, Oceans, and Watersheds, *Draft Trading Update—December 96: Boulder Creek, Colorado* (visited Mar. 4, 1997) <http://www.epa.gov/owow/watershed/trading/bould.htm> [hereinafter *Boulder Creek Update*]. *See also* DRAFT FRAMEWORK, *supra* note 61, at Appendix C. However, this program does not fit the basic criteria of a trading program: there are no established trading guidelines, there are no credits to be purchased or sold, and there are no real trading partners. Boulder Creek can really be viewed as a common sense approach alternative to trading. The City voluntarily used money to control nonpoint source pollution instead of implementing expensive plant upgrades. Obviously such an approach should be considered before a trading program is developed. Although the program is not a trading program, but simply a habitat restoration effort, it suggests other options which might be of some value on Long Island Sound.

304. *See* WATER SCIENCE REPORTER, *supra* note 57, at 5.

of the cap itself may be the real market driver.

Second, despite the lack of trading, pollution reduction goals, if not water quality goals, were attained.[305] Fox River achieved desired BOD levels; Tar-Pamlico achieved desired nutrient load reductions; and Lake Dillon achieved desired phosphorus load reductions.[306] Although proponents of trading argue that the programs were successful examples of trading programs, we must ask whether a major factor was the existence of caps on pollution discharges, and not necessarily the availability of trading. In fact it appears in the Tarr-Pamlico case that the less stringent requirements in the second phase of the program effectively reduced any incentive to trade. Additionally, critics might suggest that the same reductions could likely have been achieved through more traditional regulatory means.

In the final analysis, when these programs are evaluated strictly in terms of progress toward achieving pollution reduction and water quality goals, they can arguably be considered successful. However, in the programs, trading did not produce the desired load reductions. Instead, the reductions were accomplished by increases in plant operating efficiencies without regard to trades. It has been asserted that these programs are simply not ripe, and that trading will occur once low-cost options are unable to keep pace with rising pollutant loads.[307] Nevertheless, without a sufficient market driver, such as a lower cap, trading is not likely to occur within these programs in the near future. This is an important point to keep in mind when examining the Long Island Sound

305. For example, Fox River, Tar-Pamlico, and Lake Dillon have all had few trades that were actually contemplated by their respective programs. Fox River has had two reallocations of BOD and no actual point/point trades; Tar-Pamlico has had only two point/nonpoint trades to test the system and a few point/point trades among members of the Association; and Lake Dillon has had only one point/nonpoint trade to test the system and three nonpoint/nonpoint trades not initially contemplated by the program.

306. Cherry Creek is not included in the above analysis because it has only recently been developed. However, Cherry Creek does offer the opportunity to predict how a new program will progress. The Cherry Creek program is similar to the point/nonpoint trading program at Lake Dillon and at Tar-Pamlico. It is likely that the same fate will befall Cherry Creek as the other programs. Trading will most likely provide incentives to point source dischargers to become more efficient, thus relieving the need for any trades. If "no net increase" policies are implemented as with Lake Dillon, the program will likely become a nonpoint/nonpoint trading program.

307. *See* WATER SCIENCE REPORTER, supra note 57, at 4. "Rather than an indication of policy failure, the lack of immediate trades demonstrates how a trading system creates pollution prevention incentives. Once low-cost pollution prevention options are exhausted, trades will become more frequent." *Id.*

proposals.

VII. THE LONG ISLAND SOUND PROPOSALS

The Long Island Sound Ad Hoc Nitrogen Trading Discussion Group has been reviewing the feasibility of developing a nitrogen trading program to facilitate progress toward the ultimate nitrogen reduction goal. A "strawman" proposal was prepared which evaluated the various trading possibilities in light of the EPA's *Draft Framework for Watershed-Based Trading.*[308] A point-point cap-and-trade trading program was suggested to include publicly owned treatment works and the handful of industrial dischargers of high levels of nitrogen, with an option to integrate a point/nonpoint program in the future.[309] The program would cover the entire Long Island Sound Study area. The Clean Water Act would provide the basis for credit allocations, issued for a specific period of time, and trades would be reflected in NPDES permits. Under this original proposal, trades could be made at anytime, with an annual accounting; dischargers that exceeded their discharge limits for nitrogen would be required to purchase the additional credits necessary for compliance. A credit bank was suggested, operated by the states, to supply credits when the market could not meet the demand, and to oversee implementation of the program.[310] Utilizing this proposal as a starting point, various permutations have been and continue to be examined by the committee in light of the particular geographic, legal, economic and political situation in the Long Island Sound region. Because of the extent to which these proposals are in flux, we examine only the major components of the proposals.

A. Geographic Considerations

Long Island Sound differs from many other estuaries in that it has no major source of freshwater at its head, and it is open at both ends. It receives salt-water flow from the ocean at its eastern end, and less saline waters from the Upper Bay of New York Harbor through the East River and Harlem River tidal straits.[311] The un-

308. *See* A.T. KEARNEY, INC., *supra* note 33, at 4-19 to 4-23.

309. If a point source trading program was established, it might lead to additional attention to the lack of control of nonpoint sources, and perhaps increase pressure for change.

310. *See* A.T. KEARNY, INC., *supra* note 33, at 4-20 to 4-22.

311. Both of these sources deliver nitrogen to the Sound from outside its geographic

synchronized tides of the these rivers and the Atlantic, as well as the differential in spatial openings, contribute to a complex flow and circulation pattern which varies with the season and meteorological conditions.[312] During the summer months stratification occurs when warmer fresher water on the surface of the Sound lies on top of cooler saltier water. The density difference, called a pycnocline, prevents the two layers from mixing which would infuse oxygen into the lower strata. This leads to hypoxic conditions and their attendant ecological damage.[313]

As noted earlier, the areas of greatest oxygen deprivation generally occur in the western end of the Sound, near New York City. Nitrogen from sources in that region therefore has a direct impact on the area of greatest ecological concern. The impact of nitrogen from sources farther removed from this area is attenuated. Thus a given amount of nitrogen discharged in eastern locales contributes much less to hypoxic conditions levels than does a nitrogen discharge of equal magnitude in western regions.

Nitrogen is a regional pollutant; nitrogen discharged anywhere in the watershed will have some impact on the western Sound. It may also have a substantial local impact at the point of discharge. [314] This is an important consideration when designing a pollutant trading program, since pollutants which have a strong local impact may not be prime candidates for a large scale trading program.[315] Trading functions more effectively when the effects of the pollutants are regional in nature, and the location of the source of the emissions is not a major factor. A good example of this is the sulfur dioxide trading program under the Clean Air Act, where diverse sources, mostly located in the Midwestern United States, contribute at essentially the same impact level to air quality problems

boundaries. This "boundary contribution" is roughly twenty percent of the human-related nitrogen load. CCMP, *supra* note 2, at 20-21.

312. CCMP, *supra* note 2, at 1.

313. *See* CCMP SUMMARY, *supra* note 27, at 12; *supra* note 24.

314. TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, *supra* note 55, at 423.

315. *Id.* at 410.

> Emissions trading seems to work especially well for uniformly mixed pollutants [those for which the location of emission is not an important policy concern]. No diffusion modeling is necessary to establish effects on ambient concentrations and regulators do not have to worry about trades creating "hot spots" or localized areas of high pollution concentration. Trades can be on a one-to- one basis.

Id.

in the East.[316] The Long Island Sound situation differs, however, from the sulfur dioxide trading program, because although the pollutant may be regional in nature, source location is nevertheless an important factor. Due to the varying impacts of the treatment plants along the Sound, trades cannot readily be made on a one-to-one basis, and the employment of some type of zone system with trading ratios may be necessary if the trading system is to achieve success.[317] Accordingly, the original "strawman" proposal recommended that the Sound be segmented into the eleven geographic management zones which had previously been designated by the Long Island Sound Study. It was also suggested that the ratios developed by the Long Island Sound Study reflect the actual impact of each zone's discharges on critical dissolved oxygen levels in the Sound an be utilized as trading ratios, or "normalized" exchange rates.[318]

Furthermore, trading can fit well into the holistic geographic approach called for in a watershed strategy, since the goal of the strategy is to improve the overall health of the waterbody.

B. The Market

In addition to the legal issues that must be addressed when any trading program is established, the economics of the potential market must be examined. Two factors in particular require attention. The first is the pollution control costs of the potential trading partners. A rational basis for trading exists only if there is a substantial difference among dischargers in the costs of controlling a given amount of pollution. The second factor is the difference in environmental impact of equivalent loadings from each source. The ecological benefit of reducing a single unit of pollution from one source can be compared to reducing a unit of pollution from a different source and expressed as a ratio.[319] Where trading occurs

316. The same conclusion may also apply to nitrogen oxides (in terms of regional haze, smog and fine particle pollution) and to carbon dioxide and other greenhouse gases.

317. TIETENBERG, ENVIRONMENTAL ECONOMICS AND NATURAL RESOURCE ECONOMICS, *supra* note 55, at 411. Although zoned systems may require additional management and transaction costs, the effort to take location into account may be worth it both in terms of cost efficiency and environmental response. *See id.* at 492-94.

318. Local impacts of nitrogen discharges would have to be evaluated, and trades which would impair those waters would be prohibited, even if they were within the overall program limits for the Sound. Extensive monitoring and analysis would likely be required to ensure that local waters were protected.

319. *See* DRAFT FRAMEWORK, *supra* note 61 , at 3-5.

between sources in areas with differing influence on the protected water body, these ratios can compensate for the geographical location of parties.[320] Because of the geographic conditions previously described, for a Long Island trading program to be an environmental success the use of trading ratios would likely be necessary.

1. Costs of Plant Improvements

Overall costs estimates for upgrading sewage treatment plants have varied substantially. The Long Island Sound Study originally estimated costs for nitrogen removal to exceed $8 billion, although a substantially lower figure is likely.[321] More significant than overall costs are the individual costs to upgrade each plant, since it is the differential in costs among plants that encourages trading and leads to market efficiencies. Other factors being equal, plants having high pollution reduction costs will find it economically advantageous to purchase credits from plants having lower control costs.

Plant-by-plant estimates of upgrade costs, prepared by Connecticut and New York based on guidance developed by the Long Island Sound Office, demonstrate the incremental cost effectiveness of the various upgrades. By comparing the estimated cost of an individual plant upgrade with the incremental reduction in nitrogen discharge expected from that expenditure, the amount of nitrogen removed for each million dollars spent can be calculated for each of the plants. Those figures ranged from 809 lbs/$1 million, down to less than one pound/$1 million.[322] Additional calculations were carried out combining these costs with the impact ratios described above. Recognizing the inherent weaknesses in cost estimates, the resultant figures nonetheless give an approximate idea of the comparative ecological improvement which could be expected in the most severely stressed portions of the Sound as a result of spending $1 million in nitrogen reduction at each plant. The impacts ranged from 1.9 to 0.0008 for each million dollars spent.[323] This variation in impact is not surprising, since the areas with the lowest

320. *See* A.T. KEARNEY, INC., *supra* note 33, at 2-17 to 2-18..

321. *See supra* note 33.

322. *See* Memorandum from Mark Tedesco, Technical Director, Long Island Sound Office, to Nitrogen Trading Discussion Group, December 13, 1996, Table 1. The cost data was provided by the Connecticut Department of Environmental Protection and the New York State Department of Environmental Conservation. Id., Table 2.

323. *Id.*, Table 2.

dissolved oxygen readings are in the western half of the Sound[324] and, as we have seen, nitrogen loadings in eastern locales contribute much less to hypoxic conditions than do nitrogen loadings of equal magnitude in western regions.

2. Trading Ratios

As noted, the Long Island Sound Study has already divided the watershed into 11 management zones and measured their comparative effects on the Sound.[325] Ratios have been established to indicate roughly the comparative effect on hypoxia of nitrogen discharge in different areas of the Sound; the zone with the greatest influence on the areas of lowest dissolved oxygen[326] is given a value, or normalized exchange rate, of one. Zones with lower impact have lower values. The following chart shows the zones and the values. A Long Island Sound trading program could use the values calculated for the management zone exchange rates as a basis for the trade ratios in a Sound-wide trading market.

Using these exchange rates, Table 1 was created showing the relative value of each zone's "credit," or unit of pollution reduction, in each of the other zones. If a credit equals one pound of nitrogen removed, we see that a single credit from zone 10, which is located at the western end of the Sound and has the highest impact on the areas of low oxygen, is worth almost six credits from zone 1, at the eastern end. The table has been provided to demonstrate the relationships among the various sources.[327]

Recognizing the theoretical setting in which this exercise is being carried out, and the limitations of the data, we can nonetheless usefully engage in an analysis of the potential for trading in a Long Island Sound market.

324. *See* CCMP, *supra* note 2, at 11.

325. *See* A.T. KEARNEY, INC., *supra* note 33, at 4-16. The ratios were calculated based on data produced by the LIS 3.0 model. In addition to the management zones, the Sound itself was divided into "response" zones, which correspond to the levels of dissolved oxygen in the water column.

326. Zone 10.

327. This exchange rate chart was calculated for the author using the normalized exchange rates. For the source of each zone's rates, *see* A.T. KEARNEY, INC., *supra* note 33, at 4-16. By and large areas located closer to the areas of low oxygen will have a greater impact than those located at a distance. Zones 8 and 9 are somewhat of anomaly, since they lie at the junction of the Sound and the East River and are affected by circulation patterns there.

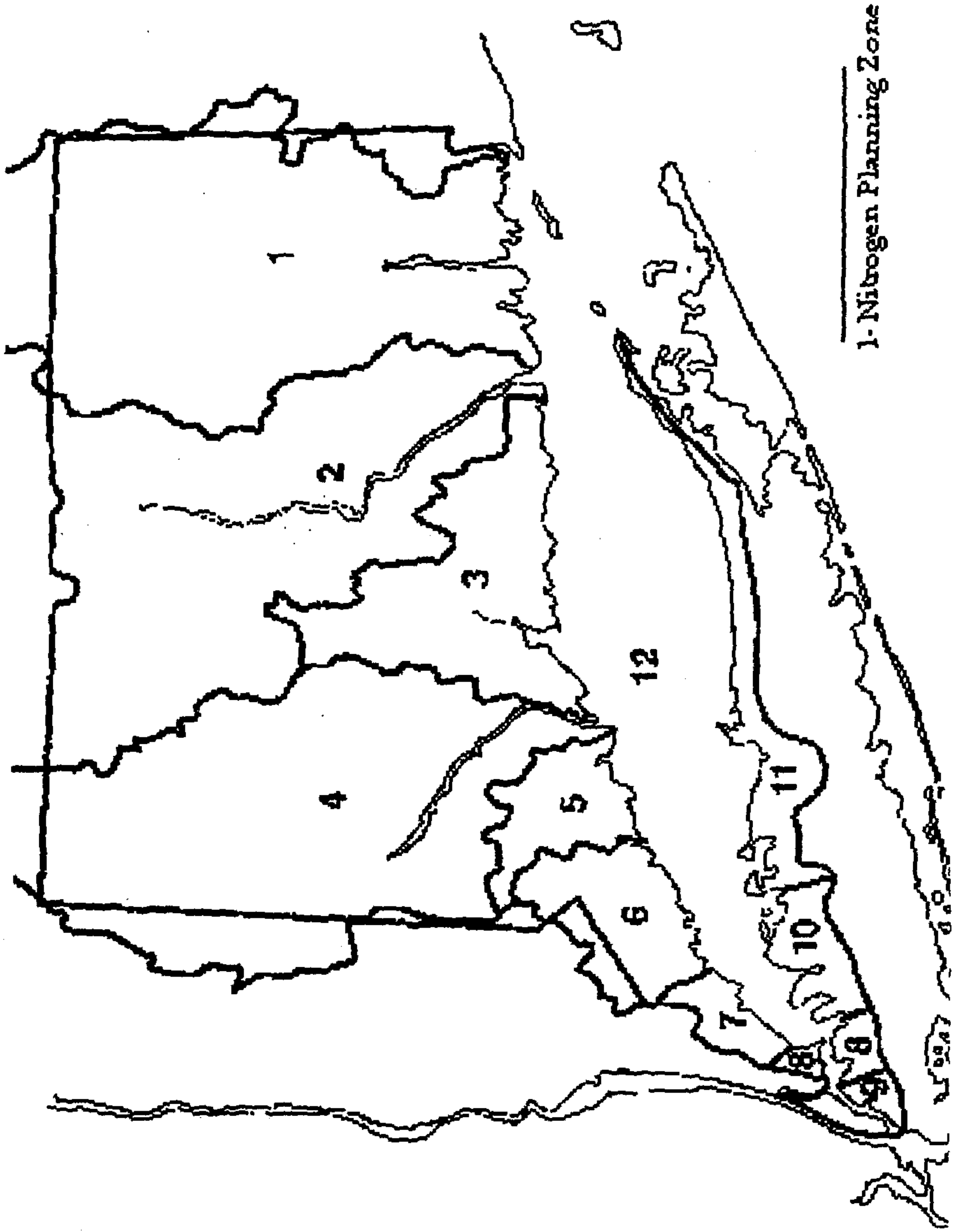
1- Nitrogen Planning Zone
1
2
3
4
5
6
7
8
8
9
10
11
12

TABLE 1
EXCHANGE RATES FOR LISS POLLUTANT TRADING

Purchaser's Region		Seller's Region 1 (0.169)	2 (0.202)	3 (0.552)	4 (0.662)	5 (0.792)	6 (0.927)	7 (0.826)	8 (0.210)	9 (0.109)	10 (1.000)	11 (0.936)
1	(0.169)	1.000	0.837	0.306	0.272	0.213	0.182	0.205	0.805	1.550	0.169	0.181
2	(0.202)	1.195	1.000	0.336	0.324	0.255	0.218	0.245	0.962	1.853	0.202	0.216
3	(0.552)	3.267	2.733	1.000	0.887	0.697	0.595	0.668	2.627	5.064	0.552	0.590
4	(0.622)	3.680	3.080	1.127	1.000	0.785	0.671	0.753	2.962	5.710	0.622	0.665
5	(0.792)	4.686	3.921	1.435	1.273	1.000	0.854	0.959	3.771	7.267	0.792	0.846
6	(0.927)	5.485	4.589	1.679	1.490	1.170	1.000	1.122	4.414	7.578	0.927	0.990
7	(0.826)	4.888	4.089	1.496	1.328	1.043	0.891	1.000	3.633	7.578	0.826	0.882
8	(0.210)	1.246	1.040	0.380	0.338	0.265	0.227	0.254	1.000	1.927	0.210	0.224
9	(0.109)	0.645	0.540	0.661	0.175	0.138	0.118	0.132	0.519	1.000	0.109	0.116
10	(1.000)	5.917	4.950	1.812	1.608	1.263	1.079	1.211	4.770	9.174	1.000	1.068
11	(0.936)	5.538	4.634	1.697	1.505	1.182	1.010	1.133	4.457	8.587	0.936	1.000

Seller's Region: The number at the nexus of Seller's and Purchaser's zones equals the value of Seller's credit in Purchaser's zone.

Purchaser's Region: The figure indicates how many credits Purchaser will have to buy from Seller to gain one credit in Purchaser's zone.

3. Buyers and Sellers

Management Zone 10, which is located at the environmentally stressed western end of the Sound, is a logical place to start an examination of interzone trading. It has the most direct impact on areas of low dissolved oxygen, and its normalized exchange rate is 1.000. Considering only the ecological impact, and assuming similar costs of pollution control among the prospective trading partners, this favorable exchange rate should result in Zone 10 sources becoming suppliers of credits. A source in Zone 10 would have high incentive to produce and sell credits, as each credit would be worth at least 1.068 credits in any other zone. A single Zone 10 credit would be worth as many as 5 credits in Zone 1, located at the eastern end of the Sound, suggesting that even Zone 10 plants with high incremental costs could produce credits competitively. If this is the case, then economic self interest should lead to a reduction in discharges of nitrogen by Zone 10 sources as they attempt to produce and export as many credits as economically feasible. A load reduction in Zone 10 could directly enhance the water quality of the traditionally oxygen depleted western Sound.

On the flip side, Zone 1 plants could be major credit consumers because these sources would have much less incentive to make incremental expenditures to produce credits. For instance, a Zone 1 source wishing to produce excess credits to sell in neighboring Zone 2 would have to produce roughly 1.2 pounds of nitrogen reduction for each pound that Zone 2 needed, because one pound of pollution in Zone 2 has about 1.2 times the effect on ambient DO levels than a pound discharged in Zone 1. A price adjustment to reflect the value of the purchased credit could make it difficult for the Zone 1 source to recoup its investment or turn a profit.

Nevertheless, an economically efficient source within a zone with a poor trading ratio might choose to proceed with capital expenditures in the expectation of trading with less efficient sources within the same zone. Moreover, the weak exchange rate could foster trading in general by bolstering the demand for credits from other zones. Zone 1 sources should prefer to achieve compliance by purchasing "foreign" credits worth five or six times as much in terms of pollution reduction as their "domestic credits." This would effectively foster pollution reduction in the zones with the highest trading ratios, which are also the zones with the greatest

ecological impact. This transfer of pollution reduction activities to the most sensitive areas from less threatened ones should be beneficial to the Sound.

Recognizing that both control costs and trading ratios may have a substantial impact on the market, we must consider how the two may affect market decisions in order to determine whether there is likely to be a sufficient supply of credits for trading to occur.

4. Forecasting Supply and Demand [328]

The probable suppliers and purchasers in a Long Island Sound trading program can be forecast by examining three factors: the market size of the zones in question; the number of facilities within those zones and their incremental cost projections; and the projected volume of nitrogen removal. An analysis of these factors will help determine the potential number of credits available. However, the actual geographic extent of the market is somewhat uncertain. There appears to be some skepticism among water pollution officials, especially in New York, regarding the need and the practicality of a trading program. Some New York officials appear to believe that the situation confronting major nitrogen dischargers is being sufficiently addressed through current efforts, and that a trading program would not enhance reductions.

The major sewage treatment plants which affect the Sound are located either in New York City, or in Westchester County, New York, which lies immediately north of the city, or on the western portion of Long Island. Many of the Manhattan plants are currently slated for upgrades, and the state is providing substantial funding. A number of these upgrades are required by court order, and it is unlikely that any of the parties to the litigation would be interested in attempting to modify the orders so as to allow a trading program. The four plants in Westchester County already operate under a bubble permit, as do some of the Long Island plants.[329]

328. The source of all cost and New York volume data is a spreadsheet report entitled "Point Source Actions," which was distributed to members of the Nitrogen Trading Group. Connecticut volume data is taken from a spreadsheet dated January 12, 1998, also distributed to members. Both are on file with the author.

329. *See* New York State Department of Environmental Conservation, SPDES Permits Nos. 0026697 (New Rochelle), 0026701 (Mamaronek), 0026786 (Port Chester), and 0026719 (Blind Brook) all in Westchester County, and Nos. 0026999 (Great Neck), 0022128 (Village of Great Neck), 0021342 (Huntington), 0026841 (Belgrave), 0026620 (Glen Cove), 0026778 (Port Washington), 0021822 (Oyster Bay), and 0023311 (Kings Park).

Consequently, there appears to be little enthusiasm at the present time on the part of most New York officials for engaging in the substantial administrative work which a trading program entails, and which they regard as providing little benefit.[330] This may well change as the details of the program become more defined, especially if plant operators perceive that potential benefits could be derived through trading.

It is possible that trading might be initiated in Connecticut instead of New York, as Connecticut officials have voiced more support for trading. Accordingly, two trading scenarios are provided below, one reflecting a Sound-wide trading program using the interzone trading ratios, the other a Connecticut only program.

a. Interzone Trading

An interzone trading arrangement would allow trades among facilities in all eleven zones designated by the Long Island Sound Study, employing the calculated trading ratios. A key factor will be whether the zones with favorable rates actually produce a substantial number of credits for the market. A review of the data discloses three zones (Zones 6, 11, and 10) that have very strong exchange rates with trade ratios of .927 or better. This suggests that sources in these zones would have a strong economic incentive to produce nitrogen credits, assuming an appropriate demand. Furthermore, many of the plants can achieve nitrogen removal rates of at least 100 pounds a day for each million dollars expended in capital upgrades above the 58.5 percent removal goal.[331] Three of these POTWs have cost efficiency ratings of over 330 pounds per day per million dollars spent; Greenwich, located in Zone 6, may be able to reduce nitrogen more cost effectively than any other plant. That facility has a cost efficiency rating of over 800 pounds per day per million dollars spent on capital costs. These levels of cost efficiency

330. Personal communications with Mark Tedesco, Technical Director, Long Island Sound Office (April 22, 1998), and Phillip M. DeGaetano, Director, Bureau of Watershed Management, Division of Water, New York State Department of Environmental Conservation (April 21, 1998). *See generally*, LISS SUMMARY OF PUBLIC COMMENTS ON THE PROPOSAL FOR PHASE III ACTIONS FOR HYPOXIA MANAGEMENT (Dec. 1997).

331. The 178 facilities that contribute effluent to the Sound have been ranked in terms of projected cost efficiency. The agency looked at the incremental amount of nitrogen removal over the incremental capital cost of removing nitrogen in excess of 58.5 percent. *See supra* note 322.

are encouraging because they indicate that these plants should be able to produce credits at relatively reasonable prices.

A final factor to consider is the projected volume of nitrogen removal. Even if a plant is located in a zone with a strong exchange rate and has a high efficiency rating, it may not generate many credits if it is a small volume facility. Some facilities have projected nitrogen reduction volumes of 20,000 to 30,000 pounds a day, which could translate into as many credits for the market. Conversely, small POTWs may remove less than 5 pounds a day. Capital investment in these facilities might prove to be cost effective, but do little to sustain the supply of credits to the market. In the three zones with the strongest ratios, only Stamford is projected to remove in excess of 1000 pounds per day. Therefore, these facilities alone may not be able to supply a substantial number of credits for the program. However, a sizable number of facilities could participate in the program; the right combination of supply and demand need not rest on the production of plants in zones 6, 10 and 11. This is in sharp distinction from some of the trading programs already considered, which were comprised of a small number of facilities.[332]

332. One other potential trading arrangement might be trading only within each zone. Such intrazone trading between facilities within the same management zone would be done at a 1:1 exchange rate, creating a straightforward market situation. If supply and demand are adequate, then trading within the confines of a single zone might take place, whether interzone trading is successful or even allowed. But as suggested by the Tar-Pamlico experience, the market is not assured. Again we must look at whether each zone has facilities which can supply credits, and whether there is a sufficient cost differential to create adequate demand for those credits. The answer is not obvious in all the cases.

Zone 1 appears to have the most positive prospects for sustaining intrazone trading. It contains twenty plants with varying abilities to implement nitrogen removal technologies in a cost-effective manner, and sufficient volume to support trading. While some plants will be able to cost-effectively implement nitrogen removal (Stonington-Mystic, Groton Town and Groton Village), others will have substantial difficulty doing so (UCONN, Ledyard, and Griswold). Each source could remove between 23 and 970 lbs of nitrogen a day, not an excessive spread. This suggests a reasonable likelihood that neither demand nor supply will outstrip the other. The fact that the most cost-effective suppliers in the zone are also the top producers is ideal, since they should be capable of creating enough credits to satisfy demand. Yet, these suppliers are not so large that they are likely to flood the credit market consequently making credit production unprofitable.

By contrast, a viable market within Zone 9 could be problematical. It has only 2 point sources, but one of its most efficient producers (Newton Creek) is quite large. Its supply of credits would far exceed the demand of the small intrazone market. Even if interzone trading were available, Zone 9's poor exchange rate (.109) would not make its credits particularly attractive, unless they were priced extremely low.

Zone 10 is unique in that each one of its sources has the potential to be a cost-effective credit supplier. Without interzone trading, this market could mirror Tar-Pamlico: plenty of

b. Connecticut-Only Trading

Exchange ratios. Because of a perceived reluctance by New York officials to participate in a trading program, there has been some discussion among Long Island Sound officials concerning the possibility of establishing a trading program that would include only Connecticut sources. To determine whether such a program is viable the exchange ratios must be reset and evaluated, and production and credit demand within the management zones in Connecticut should be examined.

Since the exchange ratios were normalized to Zone 10, a zone located in New York, they must be recalculated to fit a Connecticut-only arrangement. Due to its influence on the Sound, Zone 6 becomes the marker against which the ratios for the other zones will be calculated.

TABLE 2
Exchange Rate Charts for CT-Only Pollutant Trading

		Seller's Region 1 (0.182)	2 (0.218)	3 (0.596)	4 (0.671)	5 (0.854)	6 (1.000)
	1 (0.182)	1.000	0.835	0.305	0.271	0.213	0.182
	2 (0.218)	1.198	1.000	0.366	0.325	0.255	0.218
Purchaser's	3 (0.596)	3.274	2.733	1.000	0.888	0.698	0.595
Region	4 (0.671)	3.687	3.078	1.126	1.000	0.786	0.671
	5 (0.854)	4.692	3.917	1.433	1.273	1.000	0.854
	6 (1.000)	5.494	4.587	1.678	1.490	1.171	1.000

Seller's Region: The number at the nexus of Seller's and Purchaser's zones equals the value of Seller's credit in Purchaser's zone.
Purchaser's Region: The figure indicates how many credits Purchaser will have to buy from Seller to gain one credit in Purchaser's zone.

suppliers, no buyers. Given the zone's strong exchange rate, the environmental plus that credit exportation represents here, as well as a poor intrazone demand, interzone trading scheme is far more appropriate for Zone10.

The remaining zones have dynamics which appear to suggest that intrazone trading could be maintained. They are not "top-heavy" like Zone 10, nor as "small" as Zone 9. What would be lost in an intrazone trading program, however, is the benefit derived from the exportation of credits from zones near "hot spots" to areas with less impaired waters. This consideration militates in favor of interzone trading.

Looking only at trading ratios we see that Zones 5 and 6, with ratios of .854 and 1.000 respectively, have the greatest incentive to produce credits for the market, while Zones 1 and 2, with low trading ratios have the strongest incentive to purchase credits. The likely market role of Zones 3 and 4 is less clear.

Supply. It should be noted that the daily level of nitrogen removal is much lower at plants in Connecticut than in New York. Only eight Connecticut sewage treatment plants could be expected to remove more than 1000 pounds per day, and none over 5000 pounds.[333] This indicates that, barring unexpectedly large reductions at other plants, no single sewage treatment plant in Connecticut will dominate the market on either the supply side or the demand side. Zone 6, for example, is benefited by the most favorable ratio (1.000). It also boasts the most cost effective point source.[334] Yet it does not contain any facilities which remove more than 1400 pounds a day. This means that Zone 6 could not be the sole source of credits generated for trading, and could not by itself satisfy a reasonably active market. Similarly, Zone 5 has an exchange ratio conducive to credit production, but other factors would prevent it from becoming a dominate market figure. While the zone can potentially supply more credits than Zone 6, it still can only potentially remove 3,500 pounds per day as a zone. Also, none of the facilities in Zone 5 are projected to reduce nitrogen at an economically efficient level.

Demand. The lack of dominant suppliers could doom a trading scheme in which demand was high. Plants which were unable to attain the credits they desired would find it necessary to invest in capital improvements, even when that investment was not economically efficient. However, in a Connecticut-only trading scheme, it does not appear that the demand will exceed supply to any substantial degree. Due to the small size of the facilities, the potential demand from Zones 1 and 2, where low exchange ratios exist, will presumably be net purchasers rather than sellers, is not likely to be substantial.[335] An exception is Hartford, which is a high volume facility, but which is projected to be relatively cost efficient,

333. In contrast, the four plants in Zone 8 could each remove more than 5000 pounds of nitrogen a day.

334. Greenwich.

335. Zone 1 has 20 facilities, none of which is larger than 1000 pounds a day. Its larger facilities may be able to reduce nitrogen in a cost effective fashion. It does not appear, then, that Zone 1 will contribute to a demand that exceeds the credit supply.

increasing the likelihood that they will produce rather than consume credits.[336]

As for Zones 3 and 4, their exchange ratios are not strong enough to provide incentive to export credits to Zones 5 and 6, but they do provide incentive to export credits to Zones 1 and 2. Additionally, facilities here may seek to import credits from Zone 5 and 6. The volume and cost effectiveness data supports the prediction that Zone 3 and 4 will both simultaneously supply and demand credits.[337] The facility in Zone 3 which merits special attention is the Norwalk plant which removes a state-high 2400 pounds of nitrogen daily. In terms of cost efficiency, this plant ranks in the middle, thus a decision to undertake substantial capital upgrades could make it a major producer of removal credits. Overall, the direction in which the Norwalk and Hartford plants choose to proceed could significantly shape a Connecticut trading market.

In spite of the uncertainties, it does appear that a Connecticut only trading program would operate effectively. The exchange ratios are not substantially different than those which exist in a bistate program, and the variation is sufficient to provide incentives to export and import throughout the zones. Admittedly, the amount of nitrogen removed by Connecticut plants, both individually and overall is significantly less than in New York. However, this should mean that a Connecticut-only program will lack major power players that dominate either side of the market. This may result in less trading with regards to the number of credits transferred, but indicates that more facilities would participate in trading. Most importantly, there is no indication that either supply or demand will exceed the other to a degree which frustrates the market. The supply and demand seem to be close enough for active trading to take place, and overall the outlook seems positive.[338]

336. Hartford discharges over 5000 pounds of nitrogen a day, making it the largest facility in Connecticut. The fact that it is projected to be cost effective if upgraded may encourage the City to make those capital expenses necessary to met the reduction target of 58.5%, and become a major source of credits.

As in Zone 1, the larger Zone 2 facilities are clustered near the top of the rankings for potential cost effectiveness. Therefore, it is unlikely that Zone 2 will demand more credits than can be supplied.

337. For example, many of Zone 4's facilities have extremely low cost efficiency ratings. Many also have very small volumes: 9 have nitrogen removal rates of 10 lbs./day or less. It would be logical for these plants to buy credits because they are not cost effective and do not have the capacity to produce many credits for export. But, these facilities are small enough so that they alone will not drain the supply of credits.

338. It is important to keep in mind that prevailing market conditions will change with

5. Additional Market Considerations

Two problems which must be recognized in all of these discussions are the weaknesses in the available data concerning costs, and the potential impact of government funding. Cost estimates, in their initial stages, have varied widely, and officials have pointed out the degree to which the figures must be refined when more precise plans for each plant are drawn.[339]

The impact which government funding of plant upgrades has on a market based trading program also requires additional evaluation. Traditionally, federal and state governments have underwritten substantial portions of local upgrades, either through direct grants or through revolving loan programs.[340] Both New York and Connecticut employ grant and loan programs which are prioritized to target the most urgently needed projects first.[341] To the extent that a plant benefits from a state grant or loan, is there a distortion of the market? The answer is not clear, especially when we consider that all of the funds we are discussing are public monies, whether they come from the federal, state or local government. Grants and loans obviously favor the localities which receive them. This "inequity" would occur whether there was a trading program or not. All grants and loans could be suspended in order to keep a

each step taken toward achieving the 58.5% reduction target. After Phase III begins, substantial reductions in nitrogen discharges will be required every five years for the next ten years. Potential sellers will have fewer credits to sell as their discharge limits become more stringent, credit demand could be expected to rise, and credit prices might increase significantly. Adjusting to the ensuing market conditions will be another challenge for administrators and market participants to overcome.

339. *See* PHASE III PROPOSAL, *supra* note 21, at 11. *See also* Letter from Alan I. Stubin, Deputy Chief, Marine Sciences Section, New York City Department of Environmental Protection, to Mark Tedesco, Region II Coordinator, Long Island Sound Office 3 (Oct. 25, 1996) (on file with author) (current cost and nitrogen reduction estimates are based largely on limited pilot scale studies and early cost and efficiency projections).

340. The construction grants program established under Title II of the Clean Water Act, 33 U.S.C. 1281 et seq., provided billions of dollars in grants. It was substantially modified by the Clean Water Act amendments of 1987 and the bulk of the fund was used to capitalize state revolving loan programs. This was part of a Congressional effort to phase out the grant program and to encourage communities to assume more of the burden of funding improvements to local sewage treatment plants. See 133 CONG. REC. S19 (daily ed. Jan.6, 1987) (remarks of Sen. Mitchell).

341. Both New York and Connecticut provide low cost loans to localities to finance treatment plant construction and upgrades. Connecticut also provides grants to cover a portion of the costs, usually twenty percent. *See* PHASE III PROPOSAL, *supra* note 21, at 14-15; CCMP, *supra* note 2, at 160-163. While these funds are prioritized to address the most critical municipal sewage needs first, nitrogen removal is only one of the factors considered.

level field for trading, but that would be politically difficult, and would not necessarily make the trading program fair or efficient. Alternatively, one might question whether a trading program is warranted where there is a strong regulatory program in which standards can be tightened as necessary to accomplish water quality goals, and where the government could achieve cost efficiency by carefully targeting its funding to dischargers most directly impacting the Sound and having the best potential to economically reduce substantial levels of nitrogen loadings.

C. Duration of Credits

In any trading program the nature and duration of pollution credits must be carefully defined. The Clean Air Act specifically provides that sulfur dioxide allowances are a limited authorization to emit the pollutant and do not constitute a property right;[342] a water trading program should contain the same provision. Moreover, the exact duration of the credits must be carefully chosen and spelled out. In a situation where increasingly stringent limits are to be phased in, such as the Title IV acid deposition program, dischargers might find long-lived credits more attractive than short-lived ones since they can bank credits to meet future control requirements. That is not necessarily the case here. If the 58.5 percent reduction goal proves sufficient to achieve the desired environmental results, then more stringent limits may be unnecessary. Moreover, there is less certainty about future requirements in a water trading program than the Title IV program since the former is not specifically enshrined in the federal statute. Congress might choose in the next few years to modify the Clean Water Act, potentially affecting any existing trading program. In addition, it may not be wise to allow long term credits if it creates the potential for sizable future discharges which could have a deleterious impact on water quality. Accordingly, a relatively short credit duration may be appropriate, perhaps one year, with a yearly accounting and settlement of transfers.

D. Administrative Issues

One of the major drawbacks of a pollutant trading program is the administrative cost entailed with its operation. These rise as

342. Clean Air Act § 403(f), 42 U.S.C. § 7651b(f).

programs become increasingly complicated and hard to administer. It is often difficult to assess costs or to evaluate reductions, and no real cost estimates have been prepared for a Long Island Sound trading program. Depending on the structure adopted, some entity must monitor trades, keep records and perhaps provide a banking mechanism to support the purchase and sale of credits. Experience has shown that credit transactions often have higher transaction costs than originally anticipated, particularly if regulators must validate every trade. If the ecological impact of the pollutant traded is not similar for all the participating sources, as in the present case, the transaction costs can be particularly high.[343]

Monitoring can also present a significant cost item, but a thorough monitoring program is an essential element of a trading program. In this case monitoring would entail extensive water quality sampling and analysis to determine the impact of discharges on the Sound as a whole, and on local discharge areas. It would also require more thorough monitoring of effluent discharges, which may vary over time, as well as a strict enforcement regime. The requisite monitoring and enforcement costs are unknown, as is the question of evaluating and avoiding local water impacts. An equally important issue is raised by the notorious reluctance of state and federal officials to enforce compliance by resistant local governments.[344] Finally, if a banking feature is included in the program, the administrative load and the transactions costs are certain to be even greater.

In thinking about these questions we should also keep in mind that administrative choices may be strongly influenced by political realities. Previous experience with sewage treatment planning has shown that local political consideration can "dominate ecological

343. Trading in a Long Island Sound program would not be done on a unit for unit basis, but would entail calculation of trading ratios.

344. It was the Long Island Soundkeeper who filed suit under Clean Water Act § 505 on March 9, 1998, against the City of New York for failing to achieve compliance at several of its plants. The complaint also alleged over 4500 illegal discharges of nitrogen by eight of the City's plants over the past two years. Long Island Soundkeeper, et.al. v. New York City Dept. of Environmental Protection, No. CV-98-1635 (E.D. N.Y., filed March 9, 1998). The State of Connecticut subsequently intervened in the suit, and New York State filed a similar action in state court. State of New York v. City of New York, No. 98/400817 (S.Ct. N.Y., filed Mar. 9, 1998). *See also* David Miller, *Nitrogen Reduction For LIS Challenged*, LISS UPDATE, Fall 1997, at 2 (noting that New York sewage treatment operators themselves resist nitrogen removal). Enforcement is an area which has presented problems nationwide and continues to be a subject of serious concern. *See generally* Victor B. Flatt, *A Dirty River Runs Through It (The Failure of Enforcement in the Clean Water Act)*, 25 B.C. ENVTL. AFFAIRS L. REV. 1 (1997).

circumstances and technocratic rationality."[345]

E. Political Realities

Any decision to engage in nitrogen trading on the Sound is a political as well as an economic issue.[346] Most POTWs are under the control of a local political jurisdiction, generally a town or county. Consequently, questions regarding the local jurisdiction's authority to spend funds for purchases of credits may arise. Even if the authority exists, plant operators may have a preference for engineering solutions, and may prefer to meet their discharge obligations in the traditional manner.

Provided plant operators conclude that trading is the most beneficial option, there may be real difficulty in convincing elected officials that sending local tax dollars to another jurisdiction is appropriate. Reluctance might be even greater if the purchase were made from a private discharger, especially one in another jurisdiction.[347] Questions of equity may be raised, since the areas having the most impact on water quality in the Sound are typically more affluent. Would these wealthier counties choose to make the large capital investment in new or upgraded facilities; would less prosperous localities choose instead to purchase credits, thereby transferring funds to the wealthier jurisdiction? How many jurisdictions would choose to make large unmandated capital expenditures in the hopes of trading in the future? If credits are given a lengthy duration, and freely marketed, how many public officials would actually choose to purchase or sell credits for future use, essentially speculating with public money? There are no real answers to any of these questions.

VIII. CONCLUSION

Long Island Sound has been targeted for restoration so that this

345. *See* Latin, *Regulatory Failure*, *supra* note 180, at 1656.

346. As Professor Hahn noted, the choice of a program "with wonderful efficiency properties, but which ignores political concerns is likely to remain a theoretical curiosity." HAHN, *supra* note 11, at 18 (discussing the diversity of interest group perspectives and their influence on policy choices).

347. The question becomes even more complicated if the program were expanded to include nonpoint sources, since the governmental entities having responsibilities for the land areas which are the sources of runoff may not be the same as those having responsibility for sewage treatment.

resource can remain robust for generations to come. It has been determined that nitrogen loadings have been the main culprit contributing to hypoxic conditions in the Sound, and any program that can help redress this problem should be explored. Supporters of a nitrogen trading program see it as offering a potentially cost effective mechanism to help achieve the necessary reductions. However, the program must operate within the context of existing laws and policies, with due regard for administrative and political realities. Further, in fairness to those facilities which pledge their support to achieving the overall reduction goal, any trading program selected must do its best to ensure that the promised economic benefits materialize.

The Long Island Sound trading proposals pass at least part of this litmus test. A trading program could operate within the constraints of the Clean Water Act, through a TMDL process implemented within the context of the NPDES permit program. It appropriately is limited to a single pollutant, obviously reflects a watershed approach to pollution control, and would likely lead to enhanced ambient monitoring, thus adhering to the principles spelled out by the Environmental Protection Agency for trading programs.

Although previous pollutant trading programs enacted throughout the country have not resulted in active markets, we can glean from them certain characteristics that appear to contribute to overall results. The program should have clear goals, carefully spelled out and agreed upon by its participants. A trading baseline should be established, optimally in the form of a stringent limit on pollutant loadings. That limit should be a market driver and preferably should decrease over time to accord with Clean Water Act goals. Sufficient difference in control costs must exist to provide an incentive to trade. The trading participants should be relatively homogeneous, and there should be a sufficient level of participation to insure a viable market, however, not to the extent that it becomes difficult to identify trading partners and increases transaction costs. The pollutant traded should be regional in nature, and emissions from various sources should have identical impacts on the protected resource. Monitoring must be adequate both to insure against local impacts and to prevent evasion of control limitations. There must be a credible enforcement program and the political will to carry it out. Overall, the program should be as simple as possible with low transaction costs.

While the exact specifications of a Sound trading program have yet to be determined, it does appear to satisfy a number of these criteria. The program has a straightforward agreed upon goal, and a relatively modest number of potential trading participants with uniform types of discharges. Present cost estimates indicate sufficient disparity in control costs to stimulate a market. The Clean Water Act framework contains the mechanisms needed to establish the essential requirements for trading: a baseline, along with a monitoring and enforcement scheme. Monitoring will, however, need to be increased, and careful attention should be given to permit drafting, enforcement and citizen participation.

On the negative side, the use of trading ratios would likely complicate the process, increasing the complexity of the program and presumably adding to administrative burdens and transaction costs. The exact extent of this burden cannot be evaluated at the present time, and additional work must be done to more firmly fix all cost estimates. Determining the actual economic value of the trading program is made especially difficult because of the use of government funding, which is a sharp departure from an economist's free market ideal. Indeed, it is not clear that a trading program achieves any real cost reduction over the traditional regulatory program which can mandate pollution reductions and provide much of the necessary funds.

In addition, there remains a substantial possibility of local environmental impacts which increases the need for monitoring and raises administrative costs. Also, past experience indicates that enforcement against local entities is likely to be weak. Finally, it remains to be seen whether municipal officials will be driven by politics, rather than economics.

In the final analysis, a Long Island Sound nitrogen trading program appears, on paper at least, to meet some but not all of the criteria thought to indicate the potential for a successful trading program. Nevertheless there appears to be strong interest on the part of various state and federal officials, and they may determine that it is worth proceeding with such a program in spite of the uncertainties. But judging from experiences with previous market based programs, it is entirely possible that even if a nitrogen trading program is established, the amount of trading will be minimal. If that is the case, we can only hope that the same phenomenon we witnessed in other locales occurs on the Sound, with facilities reducing their loadings below permitted levels and thus achieving pollu-

tion reduction goals despite the lack of trades. If these reductions are achieved equitably, and at substantially reduced control costs and modest transaction costs then the Sound and the public will benefit. Otherwise we may later regard it as an interesting, but wasted effort.