



BUREAU OF THE ENVIRONMENT
ENVIRONMENTAL QUALITY BOARD
1615 Washington Street, East, Suite 301
Charleston, West Virginia 25311-2126
(304) 558-4002
Fax: (304) 558-4116

MINUTES
WEST VIRGINIA ENVIRONMENTAL QUALITY BOARD
APRIL 30, 1999

I. General

The West Virginia Environmental Quality Board ("the Board") met on April 30, 1999, at 9:00 a.m. The meeting was held at 1615 Washington Street, E., Charleston, West Virginia. The portion of this meeting concerning Water Quality Standards was audio-taped. Edward M. Snyder, Chair of the Environmental Quality Board called the meeting to order at 9:04 a.m.

Board members present were:

Edward Snyder, Chair
Donald Tarter, Vice-Chair
Betsy Dulin
Charles Jenkins
David Samuel

Staff members present were:

Libby Chatfield, Technical Advisor
Becky Charles, Legal Counsel
Ann Holstein, Administrative Secretary

II. Administrative Matters

A. Minutes

On April 30, 1999, the Board approved as submitted, the minutes of the March 25 and 26, 1999 Board meeting.

B. Budget Report

Ann Holstein presented a budget report. (See Attachment #1.) Ms. Holstein and Edward Snyder apprised the Board of budget concerns and the shortfall that is expected to occur in the next couple of years. Ms. Holstein suggested that the Boards begin discussions with the Commissioner of the Bureau of Environment to facilitate a joint effort in obtaining additional funding in the future.

C. Legislative Audit Update

Libby Chatfield updated the Board on the status of the Legislative Audit. Ms. Chatfield informed the Board that Mr. Paul Barnette, the Auditor working with the Board, had intended to turn in his report on Friday, April 23, 1999. If this deadline was met, the Board could expect a draft report in the next couple weeks. Board members requested a copy of the draft report when received by staff.

D. Personnel Matters

Becky Charles presented the Clerk's job description (see Attachment #2) amended by the Air Quality Board (AQB) at their April meeting. The Board approved the job description as amended by the AQB to be sent to the Division of Environmental Protection to begin the hiring process. The Board discussed the position's Secretary I classification and agreed with the Air Quality Board's decision to pursue a reclassification to a higher grade.

III. Legislative Rules - 46 CSR 1 (Water Quality Standards) and 46 CSR 12 (Groundwater Standards)

A. Groundwater Standards

Dave Watkins from the Office of Water Resources of the Division of Environmental Protection made a presentation to the Board regarding updating the Groundwater Standards rule (46 CSR 12). He reiterated comments submitted to the Board in 1997, regarding adoption of federal Drinking Water Standards for microbiology parameters. He explained that the WV Groundwater Protection Act provides authority for the Board to adopt Maximum Contaminant Levels from the Safe Drinking water Act as standards for groundwater protection in WV. More stringent limits may be adopted where justified by unique circumstances in state. Currently EPA has developed a Maximum Contaminant Level Goal (MCLG) value for total coliform of zero, but has not established a Maximum Contaminant Level (MCL) value for that parameter. Treatment techniques have been promulgated for *Giardia lamblia*, *Legionella*, and Standard Plate Count. Mr. Watkins suggested that the Board put together a study group to review the need for and challenges associated with trying to develop an appropriate groundwater standard for fecal coliform for inclusion in the standards. The Board agreed to look into this and directed

Ms. Chatfield to work with Mr. Watkins on this issue.

B. Public A Use Category

Libby Chatfield distributed a memorandum (attachment #3) which provided updated information on the implementation of the public drinking water use category waters in Virginia and Maryland. The Board discussed the origin of the 5-mile zone of protection in Virginia, and the delineation process that was used in Maryland. Ms. Chatfield indicated that she will be receiving more information from Maryland before the next meeting.

Ms. Chatfield reported to the Board that she had received from Don Kuntz, of the West Virginia Bureau for Public Health, Environmental Health Division, (WVBPH) a copy of a report submitted to USEPA pursuant to requirements in the federal Safe Drinking Water Act, entitled "State of West Virginia Source Water Assessment and Protection Program," (SWAPP) dated February 4, 1999 (see Attachment #7). Ms. Chatfield explained that the document outlines a number of steps to be completed by the WVBPH regarding protection of drinking water sources, both in groundwater and surface water. Ms. Chatfield indicated that one step outlined in that document which may be pertinent in the Board's reassessment of the Public A use category, is the delineation of zones of protection for existing drinking water intakes in surface waters. Ms. Chatfield reported that she has a meeting scheduled with Don Kuntz and Bill Toomey from WVBPH next week to discuss the SWAPP document. The Board was interested in the schedule for completing the delineations and the methods to be used conduct the delineations.

C. Phenols

Ms. Chatfield distributed a memorandum to the Board discussing the need for further action on the numeric criteria for phenol, and other phenolic compounds (see attachment #4). She explained that when the criteria for total phenolic materials was removed and replaced with criteria for phenol during the last triennial review, that a number of phenolic compounds were left out. USEPA is expected to comment on this change, and suggest that the WQS be amended to include the numeric criteria for additional phenolic compounds. Ms. Chatfield suggested that this change might be appropriate to incorporate during the review of the Public A use category and adopted as part of the anticipated emergency rulemaking on that issue.

D. Antidegradation Implementation

Ms. Chatfield distributed a tentative proposal (see attachment #5) for the development of a stakeholder group to review the antidegradation implementation procedures developed by the agency working group in 1998. The Board continued its discussion of the list of participants to be included in the stakeholder group, and agreed to follow Option 2 from the preliminary proposal, with the understanding that interested parties attending the stakeholder group meetings would be given an opportunity to provide comments during the meetings.

E. Aluminum

Ms. Chatfield updated the Board regarding a meeting held this month to discuss information received from Dr. William Sharpe from the University of Pennsylvania regarding aluminum sensitivity in certain fish species. Another meeting is scheduled for May 4th for further discussion of the aluminum issue.

Mike Brown, representing American Electric Power, distributed an EPA document (#EPA841-F-95-002, September 1995) titled "Watershed Protection, Clean Lakes Case Study - Phosphorus Inactivation and Wetland Manipulation Improve Kezar Lake, NH". (see attachment #6) The document describes the use of aluminum salts injection to inactivate sediment phosphorous buildup in the lake.

IV. Contested Cases

This portion of the meeting is not subject to the requirements of the Open Meetings Act. These items were the Board's deliberations for making decisions in quasi-judicial proceedings. W. Va. Code § 6-9A-2(4).

A. Appeal Decisions and Deliberations

1. Doyle Coakley v. Office of Water Resources; Appeal No. 98-18-EQB

The Board reviewed a draft final order prepared pursuant to its deliberations on March 25, 1999. After reviewing and discussing the draft order, David Samuel moved that the Board accept the order as amended. Betsy Dulin seconded the motion which then passed by a unanimous vote. The Board's legal counsel was instructed to amend the order in accordance with the discussion, then to enter it.

2. Alan Sisler v. Office of Waste Management; Appeal No. 98-22-EQB

The Board reviewed the Order Dismissing Appeal presented to the Board by the parties. After reviewing the Order and Settlement Agreement, Betsy Dulin moved to accept the Order and Settlement Agreement as presented. Don Tarter seconded the motion which then passed by a unanimous vote.

3. Roy V. Wolfe, III, Esq. v. Office of Water Resources; Appeal Nos. 98-04- EQB and 98-05-EQB

The Board reviewed the Consent Order and Order Dismissing Appeals without Prejudice presented to the Board from both parties. After reviewing and discussing the Orders, Betsy Dulin moved to accept the Consent Order and Order Dismissing Appeals without Prejudice as presented. Dave Samuel seconded the motion which passed by a unanimous vote.

4. Valero Terrestrial Corporation v. Office of Waste Management and Lackawanna Transport Company v. Office of Waste Management, Appeal Nos. 98-10-EQB and 98-11-EQB.

The Board reviewed and discussed the Appellant's request for a second Summary Judgement Hearing. After discussion, Dave Samuel moved to Deny the Request for a second Summary Judgement Hearing. Don Tarter seconded the motion which passed by a unanimous vote.

5. Monongahela Power Co. v. Office of Water Resources; Appeal No. 98-20-EQB and Ohio Power v. Office of Water Resources; Appeal No. 98-21-EQB.

The Board reviewed and discussed the Appellee's Motion to Dismiss Appeals. Betsy Dulin moved to Dismiss the Appeals without a hearing on the basis that the Board does not have jurisdiction over the 303(d) listings, pending Legal Counsel's investigation into the status of the appeal. Don Tarter seconded the motion which passed by a unanimous vote.

Betsy Dulin made a motion to adjourn the meeting. Dave Samuel seconded the motion and the Chair adjourned the meeting at 2:35 p.m. on April 30, 1999.

We hereby certify that the foregoing is a true and correct record of the proceedings of the meeting held on April 30, 1999, by the West Virginia Environmental Quality Board.

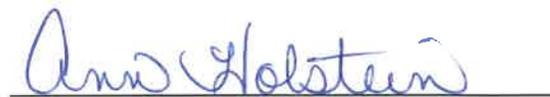
Submitted this 17th day of May, 1999.

Approved by the Board as submitted on 5/17/99.

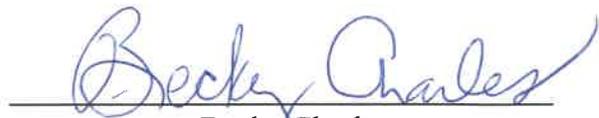
Approved by the Board as amended on _____.



Libby Chatfield
Technical Advisor



Ann Holstein
Administrative Secretary



Becky Charles
Legal Counsel

**Job Description
for
Clerk Position**

Attachment #2

General Summary

Works for two Boards that hear appeals of environmental permits and enforcement actions by the Office of Water Resources, Office of Waste Management and Office of Air Quality. Employee reports to the office supervisor for administrative duties and requirements and reports to the attorney for all substantive duties and assignments. Employee assists the Boards' attorney in all aspects of processing appeals filed from Division of Environmental Protection (DEP) decisions. Work includes the drafting and serving of hearing notices, continuance orders, certificates of service and such other procedural orders as may be requested by the attorney. Receives and maintains pleadings and orders for appeals. Maintains computerized tracking system of all appeals and motions filed. Work includes performing legal research, primarily by electronic means (Internet and CD-ROM), for the attorney. Assists the Technical Advisor by performing any requested research. Compiles factual summaries from the certified files that are submitted by DEP for each appeal. Works with the Board members and staff to schedule hearings and board meetings and to set meeting agenda. Work includes scheduling hearing rooms and court reporters. Communicates with parties and attorneys in appeals to keep them informed as to the status appeals, scheduling of hearings, answers general procedural questions, etc. Responds to public information requests (in compliance with the WV Freedom of Information Act) regarding appeals. Assists in the writing and distribution of informational memos, brochures and articles for public information regarding the Boards' duties and activities. Updates the legal library by properly filing supplements, pocket parts, etc. Assists the Boards' secretary in answering telephone calls and maintaining Boards' Internet Websites. Performs other duties as assigned.

hr./wk	Description of Work
10	Receives and maintains pleadings and orders for all appeals filed with the Boards. Maintains computerized tracking system of all appeals, motions and Board orders filed in each appeal.
8	Drafts and serves notices of hearing, continuance orders, certificates of service for all orders. Issues subpoenas upon a party's request.
5	Assists staff attorney and technical advisor by performing legal research via traditional and electronic means - Internet and CD-ROM.
4	Communicates with parties and attorneys involved in appeals. Answers procedural questions and questions regarding status of appeals and hearing dates for appeals.

As amended by AQB on 4-22-99 and as provided to EQB on 4-30-99 for comment.

- 4 Reviews Certified Files submitted by DEP and compiles factual summaries from the documents they contain for the Boards' attorney.
- 2 Updates legal library by properly filing supplements, pocket parts and amendments to code books, rule books, and various other legal resources.
- 3 Attends hearings and assists court reporter number and track documentary evidence submitted by the parties.
- 2 Assists in answering telephone
- 1 Collects and sends pertinent documents to Board members prior to meetings and hearings
- 1 Responds to requests for information in accordance with the WV Freedom of Information Act.

Knowledge, Skills and Abilities

1. General knowledge of legal and judicial procedures.
2. Ability to understand and appreciate ethical and confidentiality requirements involved in judicial proceedings.
3. Ability to research and interpret case law and statutes and regulations.
4. Good writing and communication skills.
5. Ability to interact with public in a professional manner.
6. Good typing and computer skills - WordPerfect and Internet.
7. Self-motivated and trustworthy.
8. Good organizational and scheduling skills.
9. Interest in environmental and legal fields.
10. Ability to assist staff and members of Board in carrying out all aspects of Boards' duties.

Line Item	EQB Annual Budget	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		YTD Expenditures	(+/-) Balance
		July 1998	Aug. 1998	Sept. 1998	Oct. 1998	Nov. 1998	Dec. 1998	Jan. 1999	Feb. 1999	March 1999	April 1999	May 1999		
Salaries	\$41,000.00	\$3,442.04	\$1,607.02	\$3,214.04	\$3,214.04	\$3,214.04	\$3,214.04	\$3,214.04	\$3,214.04	\$3,214.04			\$27,547.34	\$13,452.66
Annual Increment	\$228.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$228.00
Personnel Fees	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Social Security	\$3,000.00	\$251.98	\$117.27	\$234.54	\$234.54	\$234.54	\$234.54	\$234.54	\$234.54	\$234.54			\$2,022.79	\$977.21
Pub. Emp. Insurance	\$50.00	\$0.00	\$24.57	\$3.29	\$3.29	\$0.00	\$6.58	\$0.00	\$0.00	\$0.00			\$50.89	(\$0.89)
Workers Comp	\$1,200.00	\$222.21	\$0.00	\$0.00	\$241.63	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$648.94	\$551.06
Pension/Retirement	\$3,800.00	\$288.92	\$326.99	\$305.33	\$305.33	\$0.00	\$610.66	\$0.00	\$0.00	\$0.00			\$2,447.89	\$1,352.11
Per Diem	\$0.00	\$0.00	\$0.00	\$1,100.00	\$0.00	(\$64.25)	\$0.00	\$0.00	\$0.00	\$0.00			\$1,575.75	(\$1,575.75)
Office Expense	\$0.00	\$0.00	(\$552.22)	\$0.00	(\$33.00)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			(\$760.22)	\$760.22
Rental Expense (Bldg.)	\$0.00	\$0.00	\$1,401.28	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$1,401.28	(\$1,401.28)
Utilities	\$0.00	\$0.00	\$537.70	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$537.70	(\$537.70)
Telecommunications	\$0.00	\$0.00	\$1,139.97	\$951.34	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$2,334.53	(\$2,334.53)
Contractual/Professional	\$0.00	\$0.00	\$214.42	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$214.42	(\$214.42)
Travel	\$1,500.00	\$0.00	\$813.80	\$1,000.14	\$1,452.94	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$3,649.24	(\$2,149.24)
IS&C/WVNET	\$0.00	\$0.00	\$170.70	\$0.00	\$0.00	\$13.50	\$0.00	\$0.00	\$0.00	\$0.00			\$184.20	(\$184.20)
Rentals (Machine)	\$0.00	\$0.00	\$757.14	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$757.14	(\$757.14)
Association Dues	\$240.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$195.00	\$45.00
Clothing/Household/Suppli	\$0.00	\$0.00	\$40.72	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$40.72	(\$40.72)
Advertising	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Maintenance Contracts	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Miscellaneous	\$1,000.00	\$0.00	\$1,198.10	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$1,198.10	(\$198.10)
Training/Development	\$500.00	\$0.00	\$1,380.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$1,380.00	(\$880.00)
Postal & Freight	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Computer Expenses	\$0.00	\$0.00	\$385.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$385.50	(\$385.50)
Credit Card (Supplies)	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$500.00
Office & Comm Repairs	\$0.00	\$0.00	\$77.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$77.00	(\$77.00)
Office & Comm. Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Books/Periodicals	\$0.00	\$0.00	\$268.74	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$268.74	(\$268.74)
Other Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00
Credit Card Purchases-Equi	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$500.00
Computer Equipment	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$500.00
Computer Software	\$982.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00			\$0.00	\$982.00
	\$55,000.00	\$4,205.15	\$9,908.70	\$6,808.68	\$5,818.77	\$3,705.30	\$4,001.57	\$4,541.37	\$3,452.55	\$3,714.86	\$0.00	\$0.00	\$46,156.95	\$17,141.53

Environmental Quality Board - Fiscal Year 1998 Budget Report

Line Item	EQB Annual Budget	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			YTD Expenditures	(+/-) Balance	% of Budget
		July 1998	Aug. 1998	Sept. 1998	Oct. 1998	Nov. 1998	Dec. 1998	Jan. 1999	Feb. 1999	March 1999	April 1999	May 1999	June 1999			
Salaries	\$63,609.00	\$5,409.90	\$8,634.74	\$4,378.90	\$4,532.86	\$4,998.90	\$4,822.91	\$4,924.65	\$4,662.58	\$4,456.92	\$0.00	\$0.00	\$0.00	\$46,842.36	\$16,766.64	73.64%
Annual Increment	\$443.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$443.00	\$0.00	0.00%
Personnel Fees	\$5,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$5,000.00	\$0.00	0.00%
Social Security	\$5,000.00	\$408.59	\$646.37	\$328.10	\$364.38	\$378.17	\$333.35	\$379.66	\$358.08	\$335.02	\$0.00	\$0.00	\$0.00	\$3,531.72	\$1,468.28	70.63%
Pub. Emp. Insurance	\$7,500.00	\$0.00	\$460.40	\$415.60	\$415.60	\$0.00	\$831.20	\$0.00	\$0.00	\$1,592.60	\$0.00	\$0.00	\$0.00	\$3,784.60	\$49,54%	
Workers Comp	\$1,200.00	\$0.00	\$0.00	\$0.00	\$386.36	\$0.00	\$0.00	\$329.85	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$716.21	\$483.79	59.68%
Pension/Retirement	\$8,826.00	\$0.00	\$513.96	\$474.88	\$415.98	\$0.00	\$829.20	\$419.09	\$0.00	\$459.67	\$0.00	\$0.00	\$0.00	\$3,112.78	\$5,713.22	35.27%
Per Diem	\$0.00	\$0.00	\$0.00	\$1,000.00	\$100.00	\$400.00	\$1,400.00	\$600.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$3,500.00	(\$3,500.00)	ERR
Office Expense	\$0.00	\$0.00	\$121.42	\$0.00	\$93.00	(\$245.75)	\$0.00	\$62.08	(\$33.25)	\$0.00	\$0.00	\$0.00	\$0.00	(\$2.50)	\$2.50	ERR
Printing/Binding	\$0.00	\$0.00	\$360.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$360.00	(\$360.00)	ERR
Rental Expense (Bldg.)	\$0.00	\$0.00	\$767.50	\$0.00	\$0.00	\$0.00	\$0.00	\$767.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,535.00	(\$1,535.00)	ERR
Utilities	\$7,210.00	\$0.00	\$0.00	\$0.00	\$11.00	\$22.95	\$0.00	\$0.00	\$16.50	\$0.00	\$0.00	\$0.00	\$0.00	\$50.45	\$7,159.55	0.70%
Telecommunications	\$1,000.00	\$0.00	\$0.00	\$0.00	\$307.66	\$51.58	\$0.00	\$373.87	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$733.11	\$266.89	73.31%
Contractual/Professional	\$0.00	\$0.00	\$0.00	\$0.00	\$190.00	\$2,852.50	\$1,801.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4,843.50	(\$4,843.50)	ERR
Travel	\$10,666.00	\$0.00	\$0.00	\$2,015.82	\$1,069.18	\$867.46	\$2,328.66	\$994.56	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$7,275.68	\$3,390.32	68.21%
Computer Services	\$1,200.00	\$0.00	\$1.00	\$0.00	\$91.00	\$0.00	\$0.00	\$97.67	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$189.67	\$1,010.33	15.81%
Rentals (Machine)	\$2,500.00	\$0.00	\$0.00	\$0.00	\$618.82	\$0.00	\$0.00	\$335.70	\$11.95	\$0.00	\$0.00	\$0.00	\$0.00	\$966.47	\$1,533.53	38.66%
Association Dues	\$110.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$110.00	\$0.00	0.00%
Clothing/Household/Suppli	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	ERR
Advertising	\$0.00	\$0.00	\$119.14	\$119.16	\$33.23	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$271.53	(\$271.53)	ERR
Maintenance Contracts	\$500.00	\$0.00	\$42.87	\$0.00	\$0.00	\$0.00	\$0.00	\$21.44	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$64.31	\$435.69	12.86%
Miscellaneous	\$2,000.00	\$0.00	\$475.75	\$0.00	\$0.00	\$103.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$578.75	\$1,421.25	28.94%
Training/Development	\$500.00	\$0.00	\$0.00	\$0.00	\$149.67	\$57.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$207.17	\$292.83	41.43%
Postal & Freight	\$750.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$533.63	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$533.63	\$216.37	71.15%
Computer Supplies	\$500.00	\$0.00	\$0.00	\$190.00	\$0.00	\$95.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$285.00	\$215.00	57.00%
Credit Card (Supplies)	\$1,500.00	\$0.00	\$602.71	\$0.00	\$4.00	\$0.00	\$108.59	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$715.30	\$784.70	47.69%
Office & Comm Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$131.23	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$131.23	(\$131.23)	ERR
Books/Periodicals	\$250.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$105.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$105.31	\$144.69	42.12%
Other Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	ERR
Credit Card Purchases-Equi	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$500.00	0.00%
Computer Equipment	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$500.00	0.00%
Computer Software	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$500.00	0.00%
	\$117,264.00	\$5,818.49	\$12,745.86	\$8,922.46	\$8,933.97	\$9,581.31	\$12,454.91	\$9,945.01	\$5,015.86	\$6,844.21	\$0.00	\$0.00	\$0.00	\$80,262.08	\$37,001.92	68.45%



ENVIRONMENTAL QUALITY BOARD

1615 Washington Street, East, Suite 301
Charleston, West Virginia 25311-2126

Telephone: (304) 558-4002
Fax: (304) 558-4116
Telephone: 1-800-480-4598
E-Mail: clerk@mail.wvnet.edu

MEMORANDUM

TO: Board Members
FROM: Libby Chatfield
DATE: April 29, 1999
RE: Public A use category

At the March meeting you asked me to follow up on the drinking water use category designation in Virginia and Maryland. The following is a summary of the additional information I have gathered for those two states.

Virginia

As outlined in a previous memo, Virginia implements the drinking water use category based on 5-mile protection zones above existing intakes. The basis for the 5-mile zone is a provision in the Virginia State Code which authorizes "localities" (counties, cities or towns) to "prevent the pollution of water and injury to waterworks for which purpose its jurisdiction shall extend to five miles beyond the locality." This language has been in the statute for some time, and the staff person from the Water Division did not know what kind, if any, research it was based on. The five mile designation has been used in the Water Quality Standards regulation since about 1968.

Out of 193 of the water supplies designated in the standards, 94 are from the intake to a point five miles upstream. The other 99 are listed as reservoirs, or from an intake structure to the headwaters of the stream. Some of these designated areas are greater than, and some less than, five miles.

The reasons for establishing greater than five mile zones are somewhat site-specific. A large section of the Staunton (Roanoake) River is designated, but has no intakes in the designated stretch. It is thought that the local planning commission thought it might be needed as a water supply in the future. Recent attempts to limit the drinking water designation in that stream to 5 miles was met with resistance by the local citizenry. Other reasons include linking segments where more than one intake occurs on a stream or stream stretch, or where reservoir or lake systems are more than 5 miles long. Additionally, where the intake is within, for example, 5.4 miles of the stream's headwaters the entire stretch is designated. Other reasons include historic

designations greater than five miles that just haven't been corrected or updated.

Permitted discharges in areas above designated drinking waters are required to meet the water supply use standards just inside the 5-mile designated zone. Mixing zones are allowed waters designated for drinking water, but to date, none has been requested.

There has been no specific monitoring of the effectiveness of the 5-mile protection zone other than the routine monitoring conducted by the water treatment facilities on the tap water leaving the facility. The Virginia Department of Health has submitted a Source Water Protection Plan to USEPA, pursuant to federal Safe Drinking Water Act requirements. They intend to use the 5-mile zone above intakes as their primary delineation zone. The contact that I spoke with at the Department of Health indicated that that process will be helpful in assessing the effectiveness and protectiveness of the 5-mile zones designated as drinking water supply use category waters.

Maryland

Prior to about 1995, Maryland's drinking water use category was similar to our current situation - ie, it applied to all waters of the state. In 1995, the state reviewed the application of that category with assistance from their Department of Health, which administers the drinking water program for the state. Using a watershed approach, the two agencies delineated streams that were existing sources of drinking water at that time, and also identified waters that were potential drinking water sources. The waters in those two categories were designated as drinking water supply waters. That process took about a year for the two agencies to complete.

The process to identify the drinking water supply waters appears to be similar to the process being used by states now as they develop their Source Water Protection Plans under the federal Safe Drinking Water Act. Mary Jo Garreis, former head of the Water Division in Maryland, indicated that Maryland did do a fairly extensive review of the state's waters when they conducted the review of the drinking water use designation. I am still collecting information about implementation of that use category as well as Maryland's Source Water Protection Plan.



ENVIRONMENTAL QUALITY BOARD

1615 Washington Street, East, Suite 301
Charleston, West Virginia 25311-2126

Telephone: (304) 558-4002
Fax: (304) 558-4116

Telephone: 1-800-480-4598
E-Mail: clerk@mail.wvnet.edu

MEMORANDUM

TO: Board Members
FROM: Libby Chatfield 
DATE: April 15, 1999
RE: Update on phenol criterion

As you may recall, during the last triennial review we revised the criteria for phenolic materials in section 8.24 of the water quality standards. Prior to the review, the rule included a numeric value of 5 ug/l for total phenolic materials which applied to all aquatic life categories and to the public A use category. As a result of the 1997 review, the phenolic materials limit was removed and replaced with USEPAs criteria for phenol - 10,200 ug/l for the acute aquatic life category, 2,560 for the chronic aquatic life category and 3.5 ug/l for the Public A use category.

In a recent discussion with George Golliday, he indicated that USEPA intends to disapprove that change because the rule currently does not include human health criteria for a list of 9 substituted phenols, which are priority toxic pollutants under the Clean Water Act (see attachment). Those 9 parameters would have been considered phenolic materials under the prior 8.24 listing.

Another concern raised by EPA is that the new aquatic life criteria adopted for phenol are not criteria recommended by EPA, but represent the Lowest Observed Effect Level (LOEL) values. Due to insufficient data, EPA has not developed recommended criteria for the protection of aquatic life for phenol.

Because the missing values are criteria for the protection of the Public A use category, it may be appropriate to address this issue as part of the review of the Public A use category. If it is determined that there is a need for corrections, they could be incorporated in the emergency rulemaking scheduled for this fall.

We have placed this issue on the agenda for this month's meeting. Call if you have any questions before the meeting.

**ENVIRONMENTAL QUALITY BOARD
ANTIDegradation IMPLEMENTATION STAKEHOLDER GROUP**

**PRELIMINARY PROPOSAL
4/30/99**

Committee Objectives

To review the draft antidegradation implementation procedures developed by the agency committee and attempt to resolve areas of disagreement among the stakeholders. The ultimate goal is to develop antidegradation implementation procedures consistent with state and federal antidegradation policies and other applicable laws and regulations.

Committee Membership

Advisory Members

Environmental Quality Board
US Environmental Protection Agency - Region 3

Stakeholder Representatives

OPTION 1: Expanded representation

Point Source Industries

WV Coal Association, WV Chamber of Commerce - Rick Herd
WV Manufacturers Association - Eli McCoy
WV Municipal Water Quality Association

Nonpoint Source Industries

Forestry - Roger Sherman
Agriculture - Farm Bureau

Environmental Community/ Public Interest

West Virginians for Clean Water - Margaret Janes
WV Rivers Coalition - Pam Moe-Merritt
Other interested organizations

State Agencies

DEP - Office of Water Resources
DEP - Office of Mining and Reclamation
Division of Agriculture (nonpoint source)

Division of Forestry (nonpoint source)

Federal Agencies

US Fish and Wildlife Service

OPTION 2: Consolidated Representation

Point Source Industry representative
Nonpoint Source Industry representative
Environmental Community representative
Public Interest representative
Point Source State Agency representative (DEP)
Nonpoint Source State Agency representative (WV Department of Agriculture or Forestry)
Federal Agency representative (US Fish and Wildlife Service)

Schedule

April 1999 - May 1999	Finalize makeup of group, establish goals, expectations of EQB
June 1999 - December 2000	Group meets to prepare document/report
January 2000	Final document/report submitted to EQB
January 2000 - March 2000	Board reviews document, amends if appropriate and approves for public notice
March 2000	Board files rulemaking public notice with Secretary of State
April 2000	Board holds public hearing on proposed rule
May 2000 - July 2000	Board reviews comments received, amends rule if appropriate and approves rule for filing with Legislative Rulemaking Review Committee of the WV Legislature (LRMRC)
August 2000	Board files rule with LRMRC

Facilitator

A neutral facilitator will assist the stakeholder committee in the negotiation process

during the course of the committee's meetings. That assistance will include establishing and enforcing procedural rules governing the meetings and working to resolve impasses during the negotiation process.



Watershed Protection: Clean Lakes Case Study

Phosphorus Inactivation and Wetland Manipulation Improve Kezar Lake, NH

Key Feature:	A lake restoration effort using sediment phosphorus inactivation and wetlands management
Project Name:	Kezar Lake
Location:	USEPA Region I/Sutton, New Hampshire
Scope/Size:	Watershed area 2770 ha; Lake area 73.5 ha
Land Type:	Ecoregion 58, Northeastern highlands
Pollutant(s):	Sediment phosphorus
Pollutant Source:	Historical POTW discharges
Data Sources:	State and local
Data Mechanisms:	Modeling and sediment core analysis
Monitoring Plan:	Yes
Control Measures:	Aluminum salts injection and wetlands management

Summary: Kezar Lake, located in central New Hampshire (Figure 1), has had a long history of water quality problems. Following a major fish kill and persistent algae blooms beginning in the early 1960s, a Diagnostic/Feasibility Study (Phase I of the Clean Lakes Program) was initiated in 1980 under section 314 of the Clean Water Act. The study established that the lake's problems were from internal loading of phosphorus, and outlined a management strategy to restore the lake. Lake sediments, contaminated by years of effluent discharge from a nearby wastewater treatment facility, were the source of this internal loading.

A Restoration/Protection Project (Phase II of the Clean Lakes Program) commenced in 1984 to implement the recommended management strategy for Kezar Lake. Two main approaches were employed to reduce phosphorus concentrations in the lake. First, aluminum salts were injected into the hypolimnion to inactivate sediment phosphorus. The injections were performed using a modified barge system that was an efficient and cost-effective means of aluminum salts application. Second, upstream riparian wetlands were manipulated by elevating water level and planting new species to encourage phosphorus removal by sedimentation and vegetative uptake.

From 1984 to 1994, comprehensive water quality monitoring programs (including part of the Phase II project, a state-assisted volunteer program, and an EPA Phase III Post-Restoration Monitoring Project) were conducted to assess the effects of the restoration activities. Results from these efforts have generally indicated that water quality has improved following aluminum salts injection, although some parameters did worsen during 1988 and 1993. Furthermore, recreational use of Kezar Lake has increased substantially since restoration.

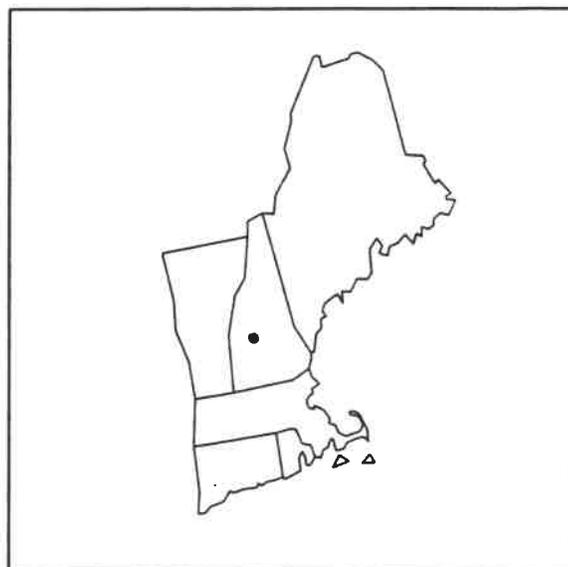


Figure 1. Location of Kezar Lake in New Hampshire

Contact: Jody Connor, New Hampshire Department of Environmental Services, Water Supply and Pollution Control Division, 6 Hazen Drive, P.O. Box 95, Concord, NH 03301, phone (603) 271-3414.

BACKGROUND

Kezar Lake is a "fairly shallow, north temperate, dimictic, phosphorus-limited lake at 276 m above sea level" that drains approximately 28 square kilometers of land in central New Hampshire (Figures 1 and 2) (Connor and Martin 1989a). Land use in the watershed is comprised of forestland (approximately 70 percent), urban/residential (25 percent), and agriculture (5 percent). The lake's volume is 1,975,500 m³ and its shoreline measures 3400 m. Mean and maximum depths are 2.7 m and 8.2 m, respectively. Flushing rate for the lake is 44.5 days.

In addition to nonpoint sources of pollution (e.g., runoff and erosion) associated with land use, one point source of particular concern exists in the Kezar Lake watershed. In 1931, the nearby Town of New London opened a sewage treatment facility that began discharging effluent into Lion Brook, the main tributary to Kezar Lake. The New London treatment facility was upgraded in 1969 and decommissioned in 1981.

Water quality problems in Kezar Lake were first documented in 1963, when blooms of algae (*Cyanophyceae*) were observed. Five years later, following continued blooms and a massive fish kill, lake-shore property values around Kezar Lake dropped significantly. Throughout the 1960s and early 1970s, copper sulfate applications and mechanical destratification were used to attempt to improve water quality. The success of these efforts proved to be short-lived, however, and eventually ineffective in preventing algae blooms. Although New London's waste was rerouted to a new treatment facility in the Town of Sunapee in 1981, algae blooms persisted in Kezar Lake.

ASSESSING AND CHARACTERIZING THE PROBLEM

The Clean Lakes Program, section 314 of the Clean Water Act, provides assistance to states for identifying and restoring lakes that are water-quality-impaired. In 1979, the biennial statewide assessment of lakes in New Hampshire ranked Kezar Lake as having the highest priority for restoration. A Diagnostic/Feasibility Study (Phase I of the Clean Lakes Program) for Kezar Lake was initiated in 1980. The purpose of a Diagnostic/Feasibility Study is to determine the causes and extent of pollution, evaluate potential solutions to water quality problems, and recommend an effective and feasible method for restoring and maintaining water quality in a particular lake.

The Diagnostic/Feasibility Study for Kezar Lake, which was completed in 1983, provided the following information (Connor and Martin 1989a):

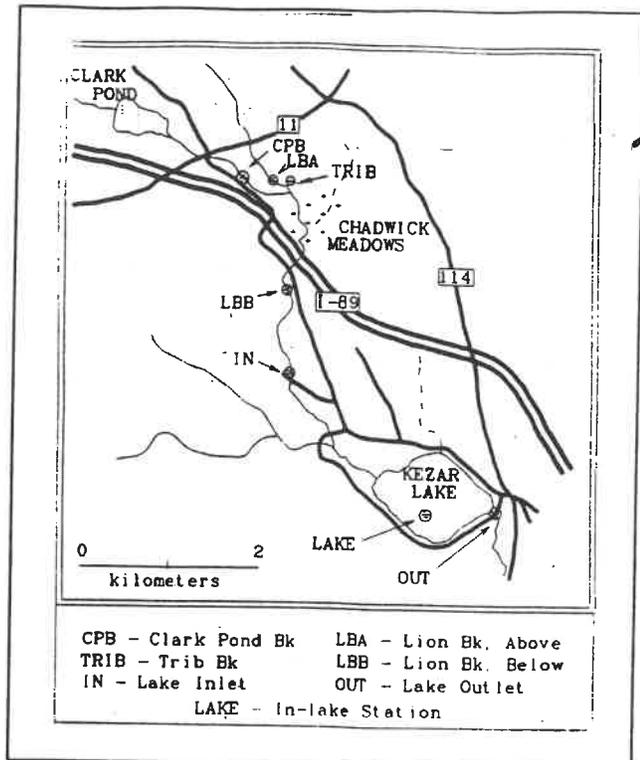


Figure 2. Kezar Lake and Chadwick Meadows monitoring stations (from Connor and Martin 1989a)

- Examination of the existing water quality and trophic state of the lake.
- Analysis of historical water quality trends.
- Determination of hydrologic and phosphorus inputs and outputs (budgets) for Kezar Lake.
- Determination of the importance of the lake's sediments in providing phosphorus to support phytoplankton (algae) populations.
- Recommendations to improve the water quality in Kezar Lake.

Water quality and quantity data for the study were analyzed from the lake itself, tributaries, groundwater seepage meters and shallow wells, rainfall gauges. Sediments from the lake bottom were also collected and analyzed. Nutrient budgets were developed using mass balance equations.

Trophic state, a measure of a lake's level of biological productivity and age, was assessed for Kezar Lake during the Diagnostic/Feasibility Study. Three separate classification models, from the State of New Hampshire, EPA, and Dillon-Rigler, all confirmed that Kezar Lake was eutrophic. Phosphorus, the limiting nutrient for biological growth in the lake, existed in high

concentrations ($> 30 \mu\text{g/l}$) at a depth of 6 m during nearly the entire first year of study. Such high levels of phosphorus translate into poor water quality because of increased biological productivity. Water quality parameters measured in Kezar Lake during the study included high chlorophyll *a* concentrations (indicative of algae blooms), low transparency, and low dissolved oxygen levels, especially during summer months.

Another major determination made in the Diagnostic/Feasibility Study was the source of the phosphorus causing the water quality problems in Kezar Lake. The main external source of phosphorus, the New London Sewage Treatment Facility, had been decommissioned in 1981, eliminating 71 percent of the external phosphorus load. Blooms of algae persisted after this date, however, forcing researchers to look elsewhere for the source. Through sediment core analysis, computer modeling, and mass balance, they established that internal loading of phosphorus from lake sediments was the controlling factor in determining the trophic state of the lake (Snow and DiGiano 1976, Connor and Martin 1989b). The models showed that lake phosphorus concentrations were more sensitive to changes in sediment loadings than to morphological or watershed loading changes. Lake sediments, which often contain much higher concentrations of phosphorus than does the lake water, can provide a net flux of phosphorus into the water under anaerobic conditions (Wetzel 1983).

The final part of the Diagnostic/Feasibility Study focused on providing recommendations to restore and maintain water quality in Kezar Lake. The main objective for lake restoration was to prevent phosphorus in the sediment from continuing to enter lake water. The Diagnostic/Feasibility Study recommended that the most feasible method to accomplish this objective was to inject aluminum salts into the hypolimnion to inactivate the sediment phosphorus.

Although the Diagnostic/Feasibility Study determined that most of the phosphorus in Kezar Lake came from the lake sediments, additional management measures were also recommended to deal with external phosphorus inputs from the watershed. The Study proposed manipulating Chadwick Meadows, an upstream riparian wetland area (Figure 2), to remove phosphorus that would enter the lake from Lion Brook. According to the hydrologic budget developed in the study, Lion Brook contributes nearly 90 percent of the annual inflow to Kezar Lake (Figure 3) and is therefore an appropriate focal point for restoration. Specific activities proposed in the wetland included increasing water level in the Meadows and planting additional vegetation, theoretically causing less phosphorus to enter the lake because of sedimentation and vegetative uptake (Connor and Martin 1989a).

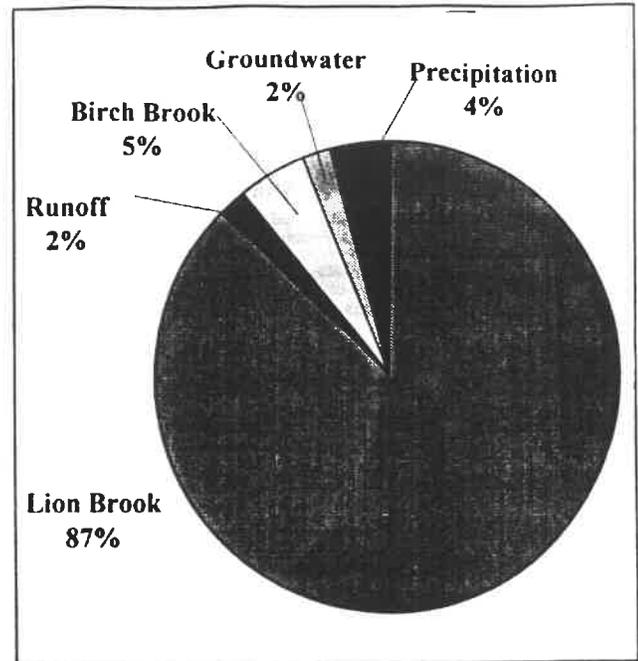


Figure 3. Kezar Lake inflow distribution, 1981-1982 (from Connor and Martin 1986)

IMPLEMENTATION AND MONITORING EFFORTS

Based on recommendations from the 1983 Diagnostic/Feasibility Study, aluminum salts injection and wetlands management projects were implemented to reduce phosphorus concentrations in Kezar Lake. To measure changes in the lake's status due to restoration efforts, a water quality monitoring program was instituted in 1984 and pursued through 1988 (Connor and Martin 1989a). These activities were performed, in part, through a section 314 EPA grant for a Restoration/Protection Project (Phase II of the Clean Lakes Program). Additional monitoring activities were also performed from 1988 to 1994 through a state-assisted volunteer program and an EPA Phase III Post-Restoration Monitoring Project.

Phosphorus Inactivation

Aluminum salts injection was selected for Kezar Lake partially because of the success this methodology has had in reducing phosphorus concentrations in other thermally stratified lakes (Connor and Martin 1989a). The effectiveness of aluminum salts application rests on the ability of aluminum to form complexes, chelates, and insoluble precipitates with phosphorus, thereby removing it from the water column and depositing it in the sediment in forms unusable by phytoplankton. Depending on pH, phosphorus concentration, aluminum concentration, and the rate at which additional phosphorus is supplied, aluminum salts can provide

Table 1. A comparison of aluminum dose, cost, and productivity for phosphorus inactivation (from Connor and Martin 1989b)

Lake	Year Treated	Area Treated (ha)	Aluminum Dose ¹	Costs for Chemicals, Labor and Equipment	Personday/ha	Cost/ha
Medical Lake, Washington	1977	60	8.0 g Al/m ³ Aluminum Sulfate	\$132,093	No data	\$2,202
Annabessacook Lake, Maine ¹	1978	121	25 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$234,000	1.12	\$1,934
Kezar Lake, New Hampshire ²	1984	48	40 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$65,604	0.50	\$1,367
Lake Morey, Vermont ²	1986	133	45 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$165,640	0.57	\$1,245
Cochnewagon Lake, Maine ²	1986	97	18 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$81,840	0.41	\$844
Sluice Pond, Massachusetts ²	1987	6	20 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$13,196	0.67	\$2,199
3 Mile Pond, Maine ³	1988	266	20 g Al/m ³ Aluminum Sulfate Sodium Aluminate	\$170,240	0.06	\$640

¹old barge system
²modified harvester
³new barge system

long-term inactivation of sediment phosphorus (Connor and Martin 1989a). Furthermore, aluminum has been shown to have no toxicity to aquatic life at the pH and dose necessary for lake restoration (Cooke and Kennedy 1981). Although not all forms of phosphorus (e.g., dissolved organic phosphates) are removed by aluminum salts application, this methodology has proven to be an effective strategy for phosphorus inactivation in many water-quality-impaired lakes.

The week prior to aluminum salts application, copper sulfate was applied as an algicide to remove phosphorus tied up in the phytoplankton. Theoretically, this phosphorus could recycle in the lake system for many years (Connor and Martin 1989a). Additionally, bioassays were conducted to assess the impact of both the copper sulfate and aluminum salts applications to benthic macroinvertebrates in Kezar Lake. Results from before and after the applications indicated no apparent detrimental effects to the macroinvertebrate community (Connor and Martin 1989a).

Pilot jar and tank studies were also performed before aluminum salts application to determine the best ratio and dosage of aluminum sulfate and sodium aluminate for phosphorus inactivation. Based on results from these studies, a 10-hectare portion of Kezar Lake was treated using 30 mg Al/m² at a 2:1 aluminum sulfate-to-sodium aluminate ratio. Since no adverse impacts on aquatic biota were observed following this application, an additional 48-hectare area of Kezar Lake was treated at a

higher concentration (40 mg Al/m² at the same ratio) to improve flocculation.

A special method for applying aluminum salts on Kezar Lake was developed to improve both efficiency and cost (Connor and Smith 1986). Prior to the Kezar Lake project, aluminum salts were applied using large barges that were slow and imprecise. A weed harvester was modified to simultaneously apply two aluminum salts and carry a large payload. These alterations provided a less cumbersome, more maneuverable means by which to deliver aluminum salts accurately and quickly.

Table 1 summarizes cost-effectiveness information associated with seven phosphorus inactivation projects. Note the varying degrees of effectiveness based on the application system used. Additional improvements (i.e., "new barge system" in Table 1) have further increased the efficiency and cost-effectiveness of aluminum salts application since the development of the modified barge for Kezar Lake (Connor and Smith 1986).

As part of the Phase II Project for Kezar Lake, intensive monitoring was conducted for 4 years to determine the effectiveness of the aluminum salts applications. Water quality parameters included in the monitoring program were dissolved oxygen, pH, alkalinity, total dissolved aluminum, total phosphorus, chlorophyll *a*, transparency, phytoplankton, and zooplankton. A qualitative summary of the response of each of these parameters from 1984 to 1988 is given in Table 2. Initial success was realized following treatment, but

Table 2. Water quality response to sediment phosphorus inactivation in Kezar Lake (from Connor and Martin 1989b)

Parameter	Water Quality Response	Duration of Major Response	Return to Pre-Treatment Conditions	Response Mechanisms
Dissolved Oxygen	reduced hypolimnetic DO deficit	treatment year only	1987	toxic effect on BOD-producing microbes
pH	reduced variance; increased hypolimnetic pH	4 years	1988	decreased algal productivity; reduced anoxia in hypolimnion
Alkalinity	reduced variance; reduced concentration	3 years	1987	decreased algal productivity; reduced anoxia in hypolimnion; direct effect of treatment
Dissolved Aluminum	no impact	n/a	n/a	none
Total Phosphorus	reduced variance; reduced concentration	3 years	still better than pre-treatment conditions	immediate effect of alum; reduced anoxia in hypolimnion; ongoing effect of alum
Chlorophyll- <i>a</i>	reduced peak and mean concentration	3 years	1988	reduced phosphorus supply
Transparency	reduced variance; increased transparency	2 years	still better than pre-treatment conditions	reduced phytoplankton abundance
Phytoplankton	reduced abundance; elimination of noxious blue-greens	3 years	1987, w/no major blooms as of 1988	reduced phosphorus supply
Zooplankton	fewer cladocerans; elimination of <i>Daphnia</i> as a co-dominant; increased <i>Keratella</i> ; decreased <i>Polyartha</i> ; increased ciliates	?	community still altered as of 1988	altered food chain by change in phytoplankton community structure

within 4 years many parameters returned to near pretreatment levels, although this change may be due to meteorologic variability. Most parameters did show stabilization (i.e., less extreme variability), however, at the end of the 4-year monitoring period (Connor and Martin 1989b). Furthermore, and most significantly, these levels were suitable for recreation, and average attendance at Wadleigh State Park, which abuts the lake, increased by almost 2000 people per summer in 1984 and 1986.

Additional monitoring from a state-assisted volunteer program and an EPA Phase III Post-Restoration Monitoring Project was performed from 1988 to 1994 to supplement the Phase II monitoring and provide a longer time frame by which to evaluate water quality changes in the lake. Results from these monitoring studies indicate that water quality had, in fact, generally improved since restoration and that the poor quality measured during the last year of the Phase II project in 1988 (as well as in 1993) was not indicative of overall water quality trends. A quantitative example of the concentrations of chlorophyll *a* from 1980 to 1994, shown in Figure 4, represents the improving water quality trend following restoration.

Wetlands Management

The second management action taken to restore Kezar Lake's water quality was manipulation of the 20-hectare Chadwick Meadows (a seasonally flooded riparian area) along Lion Brook. Research has shown that wetlands attenuate phosphorus with distinct seasonal variation (Connor and Martin 1989a). Although wetlands might

not attenuate or might even be a source of phosphorus in the fall and spring during periods of high flow, several studies have shown phosphorus removal in wetlands to be greater than 80 percent during the summer growing season, when algae growth is most common. Macrophytic nutrient uptake and sedimentation of suspended particulates are the primary mechanisms responsible for phosphorus removal in wetlands.

To encourage sedimentation of phosphorus-laden particles, the water level at Chadwick Meadows was elevated in the fall of 1983 by installing flashboards below the confluence of Lion Brook and Clark Brook

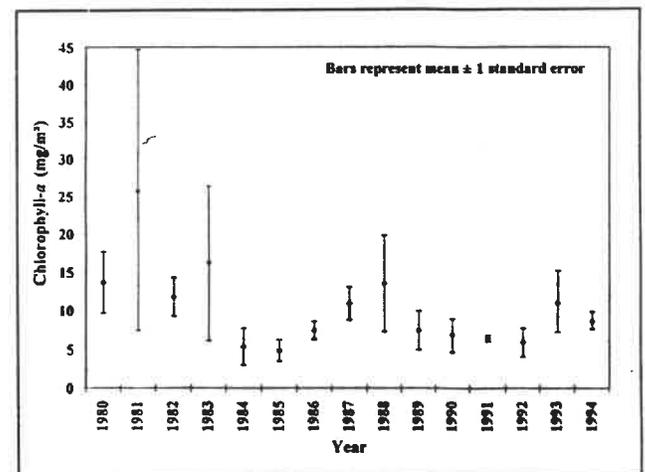


Figure 4. Kezar Lake summer mean chlorophyll *a* values (from Connor and Martin 1989a)

Pond (Connor and Martin 1986). The macrophyte community in the wetland, composed primarily of blue-joint grass (*Calamagrostis canadensis*), was also supplemented with plantings of wild rice (*Zizania aquatica*) in 1985 and 1986, to aid in phosphorus attenuation. It was anticipated that these manipulations to Chadwick Meadows would decrease phosphorus concentrations in Lion Brook, ultimately benefiting Kezar Lake (Connor and Martin 1989a).

A monitoring program was established from 1984 to 1988 to calculate changes in the phosphorus budget and measure the effects of the wetlands management activities. Phosphorus concentrations and flow measurements were taken monthly at the three tributaries and at the outlet of Chadwick Meadows (Connor and Martin 1989a). Results from the monitoring are shown in Figure 5. Although there were a few months when the wetland acted a sink, the overall effectiveness of Chadwick Meadows in removing phosphorus from Lion Brook was poor (Connor and Martin 1989a). The restoration activities did, however, prove valuable in increasing sedimentation and wildlife habitat. Furthermore, costs associated with the wetland manipulation were negligible, totaling \$250.00 for the purchase of wild rice.

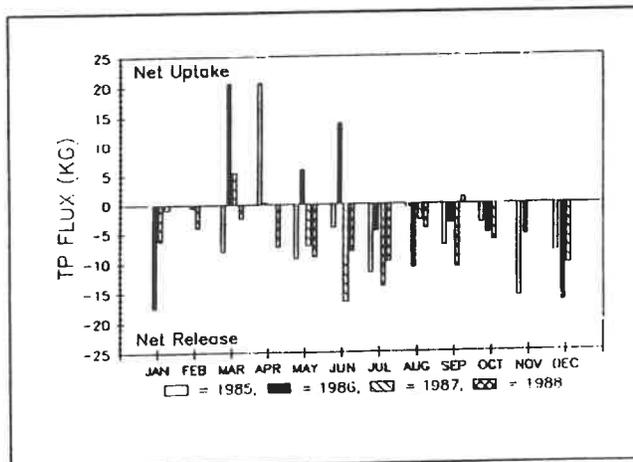


Figure 5. Monthly total phosphorus flux at Chadwick Meadows, 1985-1988 (from Connor and Martin 1989a)

The conclusions of the Restoration/Protection Project in the Phase II Final Report (Connor and Martin 1989a) offered four main hypotheses for the water quality response observed. First, the authors indicated the possibility that the aluminum bonding sites provided by the 1984 treatment eventually were all occupied, preventing long-term phosphorus inactivation. Second, the heavier aluminum salts, which initially created a physical barrier between the sediment and water interface, might have migrated vertically downward

through the sediment. This migration exposed some of the sediment that might contribute additional internal phosphorus loading. Third, additional phosphorus entered the lake from the tributaries, perhaps as a result of biological assimilation of phosphorus in Lion Brook that occurred during effluent discharge from the New London wastewater treatment facility. Fourth, historical anoxic conditions that occur in the hypolimnion during summer months in Kezar Lake increase the rate at which sediment phosphorus is released into the hypolimnion.

A final hypothesis generated from more recent monitoring data (collected from 1988 to 1994) suggests that the water quality in Kezar Lake may be influenced by the amount of annual precipitation (J. Connor, pers. comm., May 1995). As Figure 4 indicates, chlorophyll *a* levels following restoration (after 1984) fell below those measured before restoration efforts, except during 1988 and 1993. During both of these years, annual precipitation considerably exceeded normal amounts, as did runoff. It is thought that nonpoint source loads from the Kezar Lake watershed may contribute enough additional phosphorus during periods of high precipitation to noticeably decrease the water quality in Kezar Lake. It appears now that the quality of Kezar Lake is regulated by climatic conditions. High summer precipitation produces high productivity, while drought years, like 1995, produce record transparency and low productivity.

LONG-TERM MONITORING STUDIES

As previously discussed, a state-assisted Volunteer Lake Assessment Program was established to continue water quality data collection for Kezar Lake and to provide a means of public education following completion of the Phase II Project in 1988. An ongoing 5-year EPA Phase III Post-Restoration Monitoring Study is also assessing specific longer-term effects of aluminum salts application in Kezar Lake. Research in the Phase III Study includes:

- An assessment of potential leaching of sediment aluminum into overlying water.
- A comparison of aluminum levels in horned pout (*Ictalurus nebulosus*) and yellow perch (*Perca flavescens*) between Kezar Lake and several control lakes.
- A comparison of macroinvertebrate diversity and density between Kezar Lake and several control lakes.

A comprehensive description of this research and the results will be published in the near future in the Phase III Final Report.

REFERENCES

Connor, J.N. and M.R. Martin. 1986. *Wetlands management and first year response of a lake to hypolimnetic aluminum salts injection*. New Hampshire Department of Environmental Services, Water Supply and Pollution Control Commission, Staff Report Number 144. 76 pp.

Connor, J.N. and M.R. Martin. 1989a. *An assessment of wetlands management and sediment phosphorus inactivation, Kezar Lake, New Hampshire*. New Hampshire Department of Environmental Services, Water Supply and Pollution Control Division, Staff Report Number 161. 109 pp.

Connor, J.N. and M.R. Martin. 1989b. An assessment of sediment phosphorus inactivation, Kezar Lake, New Hampshire. *Water Resources Bulletin* 25(4):845-853.

Connor, J.N. and G.N. Smith. 1986. An efficient method of applying aluminum salts for sediment phosphorus inactivation in lakes. *Water Resources Bulletin* 22(4):661-664.

Cooke, G.D. and R.H. Kennedy. 1981. *Precipitation and inactivation of phosphorus as a lake restoration technique*. U.S. EPA Ecological Research Series. EPA-600/3-81-012. U.S. Environmental Protection Agency, Washington, DC.

Snow, P.D. and F.A. DiGiano. 1976. *Mathematical Modeling of Phosphorus Exchange Between Sediments and Overlying Water in Shallow Eutrophic Lakes*. Report ENVE.54-76-3 to the Massachusetts Division of Water Resources, Department of Environmental Quality. 244pp.

Wetzel, R.G. 1983. *Limnology*. 2nd Edition. Harcourt Brace Jovanich, Orlando, FL. 767 pp.

This case study was prepared by Tetra Tech, Inc., Fairfax, VA, in conjunction with EPA's Office of Wetlands, Oceans, and Watersheds, Watershed Branch. To obtain copies, contact your EPA Regional Clean Lakes Coordinator, or request a copy from:

NCEPI
11029 Kenwood Road, Building 5
Cincinnati, OH 45242
FAX 513-489-8695