Carol Majors

Part 3:

Measuring Water Quality — Four-Part Harmony

by Bill Finger

To keep the public posted on North Carolina's water resource, state officials have to sing a four-part harmony. Because no one can go without clean drinking water, this choir of officials has to sing a pretty good tune. Each of the four parts operates under separate legal, administrative, and regulatory arrangements. Consequently, arriving at a single indicator on the state of the state's water quality and supply is neither possible nor desirable. Any single indicator would obscure the subtleties and complexities involved. But indicators can lead to an Index within each of the four parts: surface water, groundwater, estuaries and sounds, and water supplies. (Estuaries and sounds are also surface waters but have separate ecological and legal considerations, and hence separate data sources; still, management strategies must be basinwide.) Under current administrative arrangements, the first three parts of this choir generally concern ambient water *quality* while the fourth focuses on water *supply*—drinking water quality.

The single most comprehensive source of in-

formation on water quality in North Carolina is the "305b report." Released by the Department of Natural Resources and Community Development every two years since the mid 1970s, it documents the state's effort in monitoring and regulating water quality as required by the federal Clean Water Act. The most recent report (July 1986) runs 150 pages, with separate sections on surface water, groundwater, water pollution control programs, and special concerns/problems. (The 1988 report, to be released this fall, emphasizes major problems in coastal waters). An additional 46-page appendix shows the technical measurements made at each water monitoring station. In its *State of the Environment Report-1987*, NRCD spotlighted water resources as one of two issues of special significance, relying mostly on the 305b data base.

Both the 305b and *State of the Environment* reports contain an upbeat tone on water quality but do not present clear data to support their claims. "Under guidance of the federal Clean Water Act, state efforts since the early 1970s have emphasized the control of point sources [of water pollution], and this has resulted in substantial improvement of our water bodies," says the 1987 NRCD report.[1] The 1986 305b report reads: "There is evidence that substantial success has been accomplished in improving lake and stream quality across the State."[2]

A close review of these two and other documents leads to a far more complicated picture than the "substantial improvement" or "substantial success" claimed by the two NRCD reports. Some data do indicate improvements; other numbers point out problems. Perhaps most important are the gaps in the data currently being collected—data that are not collected because of the difficulty and the expense. As Richard N.L. Andrews of the UNC Institute for Environmental Studies puts it, "What substances do you monitor for? . . . What information do we want to have? . . . There are fundamental tradeoffs here."

Surface Waters. There are 37,000 miles of fresh water streams and rivers in the state and some 320,000 acres of lakes and reservoirs (excluding small water supply reservoirs and private ponds). Water officials use a "best use" base measurement for surface waters as a guidepost for analyzing water quality. Virtually all N.C. inland surface waters have an assigned best usage within one of two general classes: water supply (6,400 miles of streams and rivers) and fishable/swimmable (31,000 miles). The Division of Environmental Management (DEM), which prepares the 305b report, matches a surface water segment with its best use classification to see whether it: 1) supports that use, 2) partially supports that use, or 3) does not support the use. For streams and rivers, 67 percent of the miles support the best-use classification, 27 percent are partially supporting, and 5 percent are not supporting (see Figure 3, for proportions according to river basin).

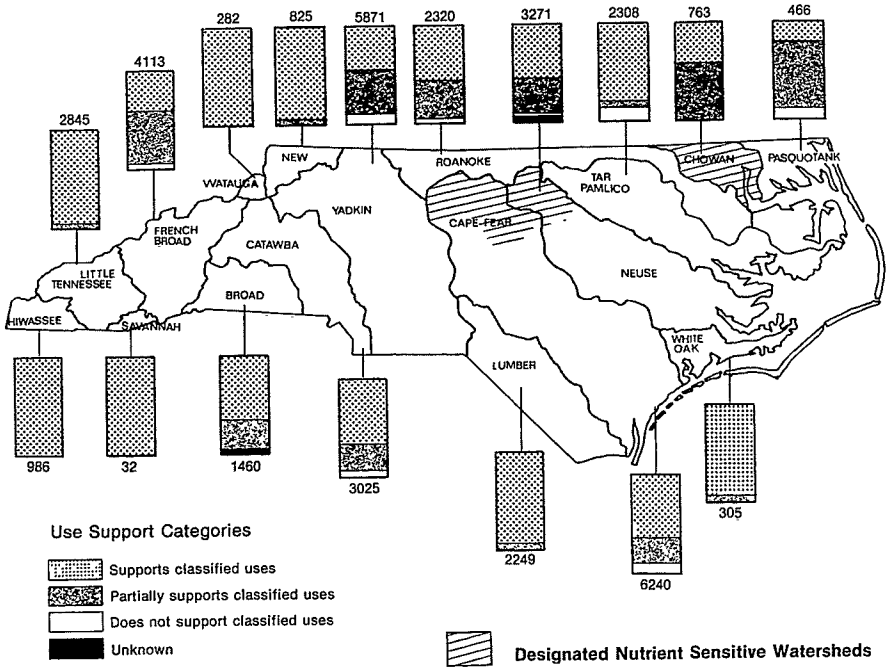
The most useful analysis of surface water quality over a span of years, according to interviews with the state officials who prepare the 305b report, is what they call a "use impairment index." Traditional analysis of water quality has tested chemicals in the water. This new index adds to that chemical analysis information on sediment, turbidity, biological indicators, and professional judgment. This new system, used first in 1986, "makes comparisons problematic" for past years' data on the percentage of surface waters meeting their best-use classifications, says the 305b report. The 1986 report did include a use impairment index for two river basins (the French Broad and the Cape Fear), showing trends from 1980 to 1985. Improvements appeared at some measuring stations but not at others. Data on water quality are taken at a series of measuring stations along the river.

Other 305b data show clear progress with surface water quality, such as a running total of streams classified as "degraded."

"The highest good is like water.
Water gives life to the ten thousand things and does not strive.
It flows in places men reject and so is like the Tao."

LAO-TZU

Figure 3. Total Freshwater Stream Miles and Proportions in Various Use Support Categories (1984-1985) for Major N.C. River Basins



Source: State of the Environment Report –1987, N.C. Department of Natural Resources and Community Development, p. 4

From 1977 to 1985, the number of miles of degraded streams *decreased* by 80 percent, from 3,000 to 600 miles. "Given the amount of money we've spent on wastewater treatment, one would expect to have progress on water quality—on the conventional criteria measured at point sources of pollution," says David H. Moreau, director of the Water Resources Research Institute, in the University of North Carolina system.

Moreau and others believe, however, that the current system of measuring surface water quality can make the quality *appear* to be better than it really is. "The samples are located primarily *below* point source discharges," explains Moreau, referring to the points in a stream or river where a municipality or major industry discharges its wastewater into a river or stream. "The samples are reflecting the effects of the construction program for wastewater treatment programs. What they do not reflect very well are the nonpoint source loads," he adds, referring to the pollutants that enter surface waters from rainwater washing across farms, developments, cleared land, and highways. "Nor do they reflect the emerging concerns over synthetic chemicals—pesticides and solvents going into our surface waters through nonpoint sources."

Douglas N. Rader, senior scientist for the N.C. Environmental Defense Fund and himself a former NRCD official, says, "Monitoring for water is exceedingly difficult if the aim is to test a hypothesis of improvement or degradation, because variability is so great. Dr. Moreau's points are well stated. Another major problem is the minimal compliance/enforcement program for surface water dischargers: compliance with discharge permits is verified by the dischargers themselves, and enforcement occurs only following citizen complaints."

The NRCD *State of the Environment Report-1987* does address the problems with nonpoint source pollution. NRCD reports that nonpoint

sources account for 71 percent of the pollution for streams and rivers not supporting their classified uses.[3] But neither the NRCD report nor the 305b document takes the issue one step further, to reflect Moreau's concern. Judging whether a stream supports its classified best use must still be done primarily on the basis of data taken at point sources of pollution, i.e., municipal or industrial wastewater discharge points. (For more on policies affecting point and nonpoint pollution, see "Clean Water—A Threatened Resource?," *North Carolina Insight,* March 1988, pp. 53ff).

Groundwater. The data problems concerning surface water pale compared to groundwater. "There is no comprehensive groundwater statute that requires good data gathering," explains Lark Hayes, a specialist on groundwater issues and director of the North Carolina office of the Southern Environmental Law Center. More than one of every two North Carolinians depends on wells, i.e., groundwater, for drinking water. North Carolina has more domestic wells (some 822,000) than any other state and another 5,100 community wells.

Some data related to groundwater exist. For example, a registration program has begun for underground storage tanks, which can leak and contaminate groundwater. "But this data needs to be related to existing and future drinking water supplies," says Hayes. Other data include the groundwater withdrawal permitting program information for designated Capacity Use Areas, as well as local municipal data.

The 305b report devotes 65 pages to surface water (plus the 46-page index) and *less than 4 pages* to groundwater. "We have hardly any measurements on groundwater contamination," says Moreau. Even so, he believes, "we do not have a groundwater contamination problem in North Carolina."

There are, however, localized problems that do not show up in statewide data—perhaps because groundwater is highly variable in quality. The state may not know about all these localized problems. And conversely, eastern North Carolina has high-quality groundwater supplies, but they are not used that often. Instead, surface waters like rivers, which may have a history of pollution problems, often are the suppliers of raw water for municipal drinking water supplies.

Hayes is more worried about the groundwater supply. "The counting up of the groundwater pollution sites needs to be related to current and future uses of groundwater." NRCD investigates about 200 such sites a year, but the data are not easily accessible. "We need a state-mandated planning process around future groundwater uses. Even within the general problems of data for water, groundwater is the neglected stepchild."

An eight-page report released by the U.S. Geological Survey in February 1988 found that groundwater in North Carolina is generally clean and mostly meets drinking water standards.[4] "Some other states are in a much weaker position than North Carolina," says James F. Turner Jr., district chief of the U.S. Geological Survey water resources division in Raleigh. "But the quality is becoming impaired as we get more development."

Estuaries and Sounds. While technically part of the state's surface water system, estuaries and sounds have characteristics unique to coastal ecosystems, development patterns, and regulatory systems. (For more on coastal issues, see "Upcoming Issues on the Coast," *North Carolina Insight,* March 1988, pp. 70ff.) Data that reflect *actual water quality* include shellfish acres that are closed and fish yields and kills. By contrast, data related to *managing* the coastal resource, such as the number of permits issued under the Coastal Area Management Act, indicate increased pressure on the water resource through escalating development but do not reflect the water quality directly.

Data on estuaries and sounds closed to shellfishing can be misleading. For example, overall data indicate an *improvement* in the quality of shellfish waters. From 1980 to 1987, the number of acres closed to shellfishing *decreased* by 4 percent, from 328,000 to 316,500, suggesting an improvement in overall water quality. But within this general set of data lie several important subsets, including prime shellfish acreage and brackish water acreage. In contrast to the overall data, from 1980 to 1987, the number of *prohibited* acres in saline waters (oyster and saltwater clam areas) *increased* by 16 percent, from 49,500 to 57,300 (see Table 2). And certain unusual incidents, such as the red tide phenomenon of 1987 (a toxic tide that closed shellfishing areas), also affect such data. Biological problems such as fish and crab diseases, fish kills, submerged plant beds disappearing, algae blooms, and other problems "demonstrate that environmental tolerance has been exceeded [and] that assimilative capacity for wastes has been surpassed," says Rader.

"We've lost some of our prime shellfish waters," says George Gilbert, researcher at the Shellfish Sanitation Office in the N.C. Department of Human Resources. "My grandkids aren't going to be able to harvest oysters and clams like we did.

People will have to harvest them mechanically."

Another indicator of coastal water quality is fish yields. These data also have many subtleties, whether based on commercial fishery landings or actual testing in the water for "juvenile fish," as officials in the state Division of Marine Fisheries call them. From 1980 to 1985, yields for nine of 14 principal commercial fish species declined, including croaker, blue crab, flounder, and spot. But other factors besides water quality have a substantial impact on these numbers, ranging from the numbers and efforts of fishermen to the availability of prime fishing grounds at Oregon Inlet.

"Existing methods of measuring catch per unit of effort are not adequate for making valid year-to-year comparisons, because they do not accurately reflect the many variables and hidden factors that may be involved," says the NRCD *State of the Environment Report-1987.*[5]

Water Supply. There is no systematic reporting on water *supplies* in the state. The federal Clean Water Act and other federal requirements, including the federal Safe Drinking Water Act, focus on water *quality*. Currently, each individual community keeps track of its own water supply needs. "It would be very useful to have the legislature require the largest communities to report on their water supply needs and resources," says Moreau. There are about 55 water systems in the state serving more than 10,000 people, plus thousands of smaller ones (mobile home parks, etc.). Roughly 3,000 small water supply systems serve small communities, and most of these systems are too small to deal with all the problems that can affect water supply and water quality. Each individual community may be thinking about drought planning, for example, but no state data source exists as a basis for reviewing where communities may be able to help each other. "The data become more important when you get into problems like interbasin transfer and capacity use issues," says Moreau.

Moreau and others point out that the state requires extensive reporting from local governments on such capital needs as schools and roads. "We have no such requirement for water supply or wastewater," says Moreau. "We need a simple report saying, 'Here's what I think I need over the next 10 years.' Then you can begin to see where you will get resource shortages around the state. It will tell you where the imbalances are. And in terms of fiscal planning at the state level, through Clean Water Bonds and tax programs, they would tell you what kind of financial resources are needed for water supply." Even more valuable would be an analysis of the fixed yield, current and potential demand, and rate of growth so that communities and the state would have a better fix on required expansion.

Table 2. Acres Closed to Shellfishing in North Carolina

Year	Acres Closed	Saline-Water Acreage Closed
1980	328,088	49,468
1981	317,608	57,388
1982	319,887	60,667
1983	320,672	61,452
1984	312,610	52,390
1985	316,187	56,967
1986	316,505	57,284
1987	319,459	51,738

Source: Shellfish Sanitation Branch, N.C. Department of Human Resources

Conclusion. An easy-to-read summary of the state's water resource would require a creative presentation of existing data and the generation of new data. Extensive data exist on surface water issues, and the increased sophistication of the "use impairment index" is leading to a more thorough data source. Adding new data on nonpoint pollution would complete the picture for surface waters. New groundwater data are desperately needed. Currently, no data exist linking such problems as storage tank leaks and contamination incidents with existing and future groundwater drinking water sources. Data on estuaries and sounds should improve markedly through the ambitious Albemarle-Pamlico Estuarine Study now underway. Finally, the legislature should require NRCD to collect data on water supply needs and resources in order to improve state-level planning.

FOOTNOTES

[1]*State of the Environment Report-1987,* Department of Natural Resources and Community Development, April 1987, p. 5.

[2]*Water Quality Progress in North Carolina, 1984-85/ 305b report,* N.C. Department of Natural Resources and Community Development, July 1986, p. iii.

[3]*State of the Environment Report-1987,* p. 5.

[4]"North Carolina Groundwater Quality," U.S. Geological Survey, Water Resources Division, Raleigh, 1988, pp. 1-8.

[5]*State of the Environment Report-1987,* p. 28.