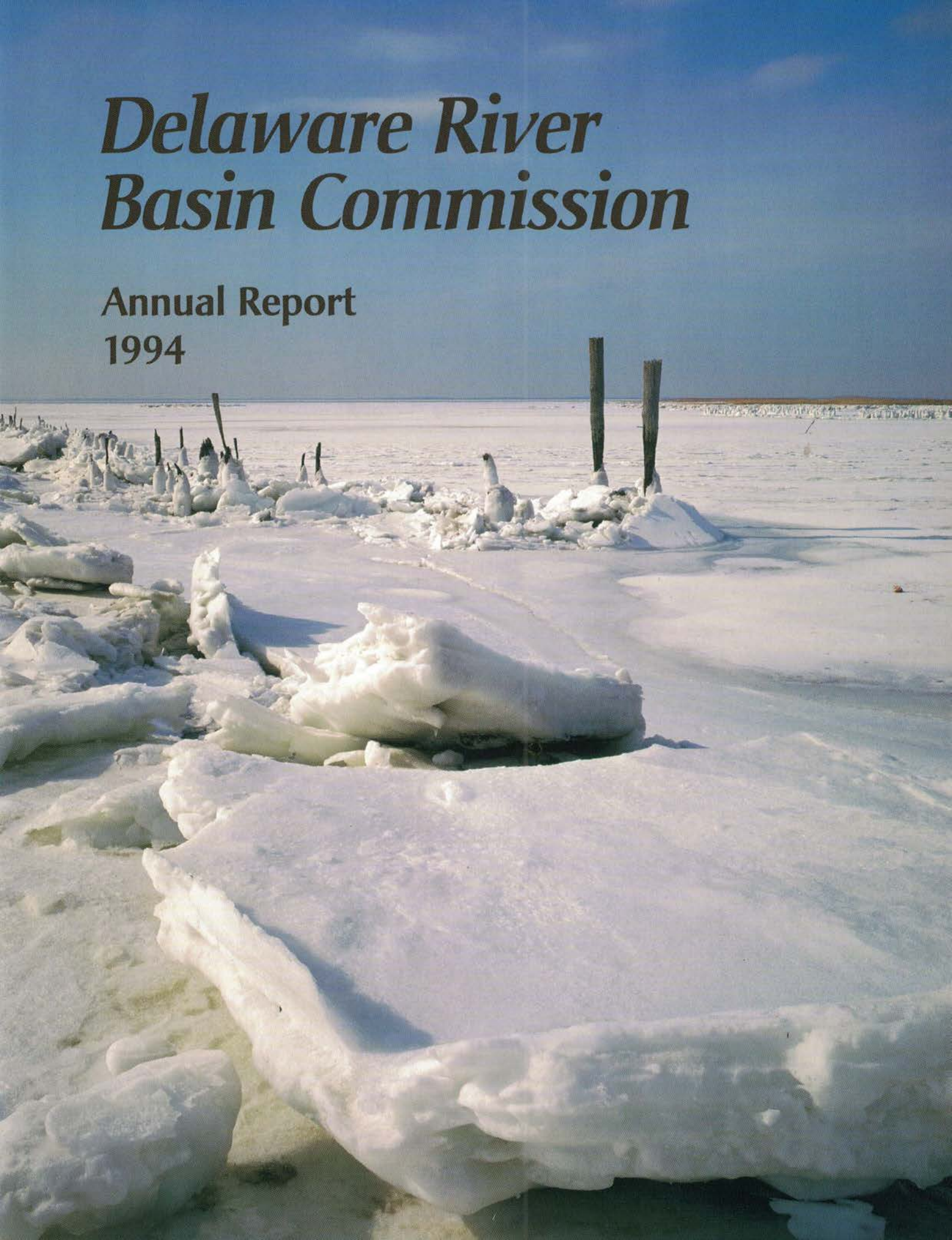
Delaware River Basin Commission

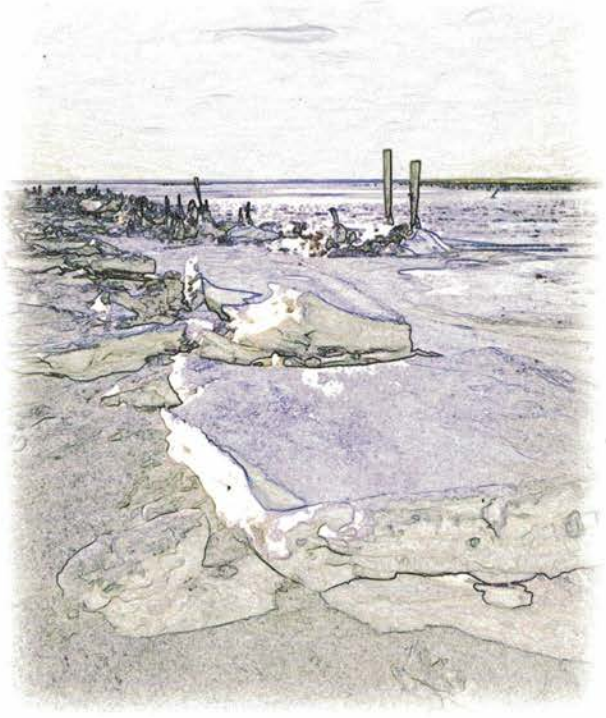
Annual Report 1994



Material for this report was generated by the staff of the Delaware River Basin Commission. The report, covering calendar year 1994 and published in the spring of 1995, was compiled and edited by Christopher M. Roberts, the Commission's public information officer. Free copies are available by contacting the Commission at P.O. Box 7360, West Trenton, N.J., 08628 (Phone 609-883-9500, ext. 205). A list of other Commission reports published during 1994 appears on the last page of this report.

Front cover: The bitter temperatures of the winter of 1993–94 locked sections of the Delaware Bay in ice. Shown is the upper bay off Bayview, N.J., located near the mouth of Stow Creek. (Photo by Michael Hogan)

DELAWARE RIVER BASIN COMMISSION



ANNUAL REPORT
1994

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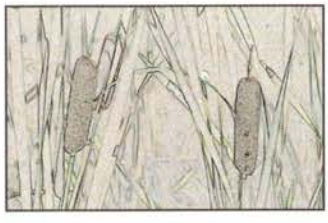


The Commission

On the Crest of Watershed Management

The Delaware River Basin Commission was created on October 27, 1961, by the Delaware River Basin Compact, marking the first time in the nation's history that the federal government and a group of states had joined together as equal partners in a river basin planning, development, and regulatory agency.

The Commission's formation was driven by the realization that the basin's waters and related resources are regional assets vested with local, state, and national interests for which there is a joint responsibility. At the time the Commission was founded, some 43 state agencies, 14 interstate agencies and 19 federal agencies exercised a multiplicity of splintered powers and duties within the watershed. The compact created a regional body with the force of law to oversee a unified approach to the development and control of the river system.

Commission programs include: water quality protection, water supply allocation, regulatory review, water conservation initiatives, regional planning, drought management, flood control, and recreation.

The members of the Commission are the governors of the four basin states (Pennsylvania, Delaware, New York, and New Jersey) and a federal member appointed by the President of the United States. Traditionally, the federal member has been the U.S. Secretary of the Interior. The president also appoints an alternate commissioner, as do the four governors, selecting high-ranking officials in the four state environmental regulatory agencies.

Annual elections are held for Commission chair, vice chair, and second vice chair, based on a rotation of the five signatory parties.

The Commission holds monthly business meetings and hearings on policy matters and water resource projects under regulatory review. These sessions, along with meetings of the Commission's various advisory committees, are open to the public.

Each commissioner has one vote of equal power,

The Delaware River Basin

The mainstem Delaware River extends 330 miles from the confluence of its East and West branches near Hancock, N.Y., to the mouth of the Delaware Bay. Almost seven percent of the nation's population relies on the basin's waters for drinking and industrial use, and the Delaware Bay is but a gas tank away for 40 percent of the people living in the United States. Yet, the basin drains only 0.4 percent of the continental U.S. land area.

The Delaware River is fed by 216 tributaries, the largest being the Schuylkill and Lehigh Rivers in Pennsylvania. In all, the basin takes in 13,539 square miles, including portions of Pennsylvania (6,422 square miles, or 47.4 percent of the basin's total area); New Jersey (2,969 square miles, or 21.9 percent); New York (2,362 square miles, or 17.4 percent); and Delaware (1,004 square miles, or 7.4 percent). Included is the 782 square-mile Delaware Bay, which lies roughly half in New Jersey and half in Delaware.

Two reaches of the Delaware River and the Maurice River in New Jersey, a Delaware Bay tributary, have been included in the National Wild and Scenic Rivers System. The first section of the Scenic Delaware extends 73 miles from Hancock, N.Y., downstream to Millrift, Pa.; the second extends 34 miles from just south of Port Jervis, N.Y., downstream to the Delaware Water Gap near Stroudsburg, Pa. Combined, the two river corridors take in 124,929 acres. Another reach of the Delaware, a 54-mile stretch linking the Delaware Water Gap and Washington Crossing, Pa., just upstream of Trenton, N.J., is being studied for possible inclusion in the system, as is the White Clay Creek, which flows from Pennsylvania into Delaware.

with a majority vote needed to decide most issues. Exceptions are votes on the Commission's annual budget and drought declarations, which require unanimity.

The Commission is funded by the five signatory parties, receiving additional revenue from project review fees; water-use charges; fines; and federal, state, and private grants.

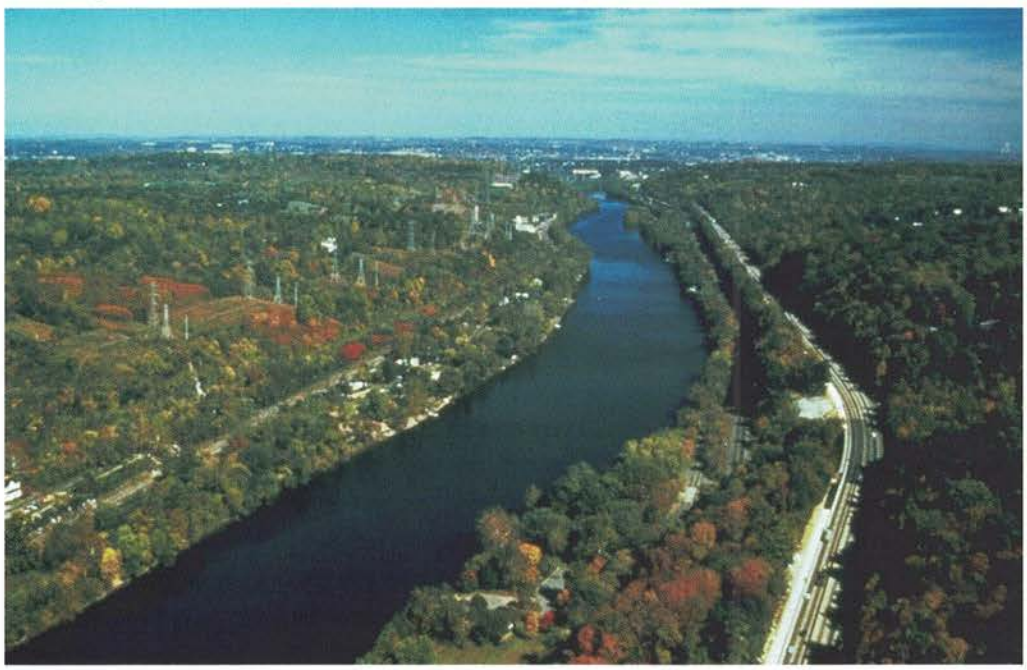
As a result of pollution abatement efforts, the cleanup of the Delaware has been hailed as one of the world's top water quality success stories. Discharges of oxygen-demanding wastes have been reduced dramatically as the result of a wasteload allocation program initiated by the Commission in 1968. Antiquated sewage treatment plants have been upgraded, partly with funds generated by the 1972 Federal Water Pollution Control Act. The Commission, working with federal and state agencies, conducts ongoing water quality programs designed to address such areas as point and non-point source runoff, pesticides, heavy metals, PCBs, thermal stress, and the impact of combined sewer overflows.

The Delaware River Basin Commission takes a watershed approach in managing the river system, without regard to political boundaries.

Today, the Delaware River, once foul-smelling and oxygen-starved as it flowed past Philadelphia and neighboring cities, supports year-round fish populations, offering excellent trout, bass, walleye, herring, and shad fisheries. Pleasure-craft marinas line waterfronts once visited only by commercial vessels. The river and many of its tributaries are flanked by attractive greenways and parks. Two river reaches above the Delaware Water Gap are now part of the National Wild and Scenic Rivers System.

The Delaware River Basin Commission takes a watershed approach in managing the river system, without regard to political boundaries. That five separate governmental bodies with their own sovereign powers can successfully work together on an equal footing in managing a common resource has caught the eye of other river managers. In recent years, the Commission's executive director has been invited to Australia, Slovakia, and Bulgaria to tell the DRBC story and offer help in developing and financing new water supply and pollution abatement programs. Officials from those countries also visited the Commission's offices in West Trenton, N.J., as have delegations from Indonesia, the United Kingdom, South Korea, the People's Republic of China, the Czech Republic, Hungary, Portugal, Finland, Italy, Brazil, the former Soviet Union, Sweden, Uruguay, India, and Japan. And the Commission often is asked for help from officials in this country who are working to solve water disputes among bordering states.

The Schuylkill River, looking downstream toward Philadelphia and its confluence with the Delaware.



The Commission • 1994

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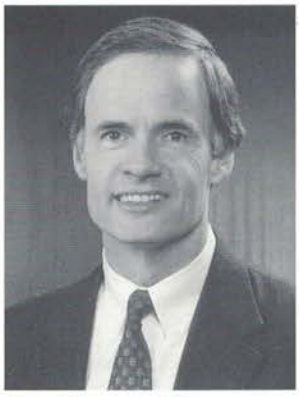

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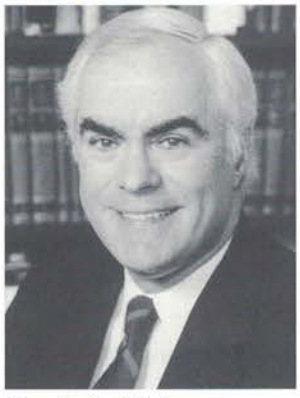

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Comings...

Three new commissioners came onboard during 1994—two representing the federal government, the third the state of New Jersey.

President William Clinton appointed U.S. Interior Secretary Bruce Babbitt to serve on the Commission as the federal member and picked Vincent P. D'Anna, a former aide to U.S. Sen. Joseph R. Biden, Jr., as the federal government's alternate commissioner.

In New Jersey, Gov. Christine Todd Whitman designated Robert C. Shinn, Jr., head of the state's Department of Environmental Protection (DEP), as her representative on the Commission. And she reappointed Steven P. Nieswand, administrator of the Water Supply Element of DEP's Division of Water Resources, as New Jersey's alternate to the Commission.

Mr. Shinn succeeds Jeanne M. Fox, a former DEP acting commissioner who was named regional administrator of the U.S. Environmental Protection Agency's Region II office.

Bruce Babbitt

Mr. Babbitt was governor of Arizona for nine years (1978–87) and before that served as Arizona's attorney general. He was sworn in as the 47th Secretary of the Interior on January 22, 1993.

After graduating from the University of Notre Dame, he received a master's degree in geophysics from the University of Newcastle in England. He graduated from Harvard Law School in 1965.

As Arizona's governor he was instrumental in the passage of a nationally acclaimed state water management code and later a water quality act touted as one of the toughest laws in the nation to protect ground water.

Mr. Babbitt's appointment to the Commission became effective May 16, 1994.

Vincent P. D'Anna

Mr. D'Anna joined Senator Biden's staff in 1974 where he had major oversight responsibility for all environmental legislation. Prior to that he was employed by the New Castle County (Del.) Planning Department, playing a key role in securing federal grants for upgrading wastewater systems and transportation networks.

Mr. D'Anna is a 1962 graduate of the University of Delaware, where he earned a bachelor of arts degree in economics. He also pursued graduate studies in urban affairs.

He succeeded Irene B. Brooks, who resigned her Commission post on March 4, 1994, to become executive director of the Chester County Water Resources Authority.

Robert C. Shinn, Jr.

Prior to being sworn in as the eleventh commissioner of DEP in February of 1994, Mr. Shinn served for 26 years as an elected official at the local, county, and state levels. He devoted much of his efforts to Pinelands and farmland preservation, open space, solid waste, recycling, and water supply management issues.

He served as a state assemblyman from 1985 until accepting his new post, representing parts of Atlantic, Burlington, and Camden counties. Prior to that he served as a township committeeman, the mayor of Hainesport, N.J., and as a Burlington County freeholder.

Mr. Shinn majored in commerce and engineering at Drexel Institute of Technology before an Army tour of duty in Korea. He founded and served as president of Material Handling Systems, an equipment sales and service company located in Hainesport.

Robert P. Magnifico

Lt. Col. Robert P. Magnifico, sworn in as commander and district engineer for the U.S. Army Corps of Engineers' Philadelphia District in July of 1994, is the Commission's new federal advisor. He succeeds Lt. Col. Richard F. Sliwoski.

As district engineer, Colonel Magnifico is heavily involved in water resource management in the Delaware River Basin, overseeing the operation and maintenance of federal navigation projects in the Delaware and Schuylkill Rivers, Wilmington Harbor, and the Chesapeake & Delaware Canal. He also is responsible for the operation of five dams in eastern Pennsylvania, federal beach protection and navigation projects on the New Jersey and Delaware coasts, and military construction projects.

Colonel Magnifico is a graduate of the Colorado School of Mines, with a bachelor of science degree in geological engineering. He holds a master of science degree from the Georgia Institute of Technology.

Marilyn Gelber

New York Mayor Rudolph W. Giuliani named Marilyn Gelber, commissioner of the city's Department of Environmental Protection, as the city's advisor to New York State on Commission matters.

Ms. Gelber is responsible for the operation and maintenance of New York's 550-billion-gallon water supply system, which serves eight million city residents and another one million residents of upstate counties.

A graduate of Queens College with a B.A. in English literature, Ms. Gelber previously held a number of planning and executive management positions in New York's Department of City Planning and in the office of Brooklyn Borough President Howard Golden.

...And Goings

David C. Yaeck

David C. Yaeck, who built one of the most respected local water resource management programs in the country during his 22 years as executive director of the Chester County Water Resources Authority, retired on January 7, 1994.

Fortunately he agreed to remain as chairman of the Commission's Ground Water Advisory Committee, a post he has held since 1981. Obviously unable to completely shake loose from the world of water, he also is using his expertise in consulting work.

The Commission thanks him for his outstanding service over the years and wishes him well in his semi-retirement.

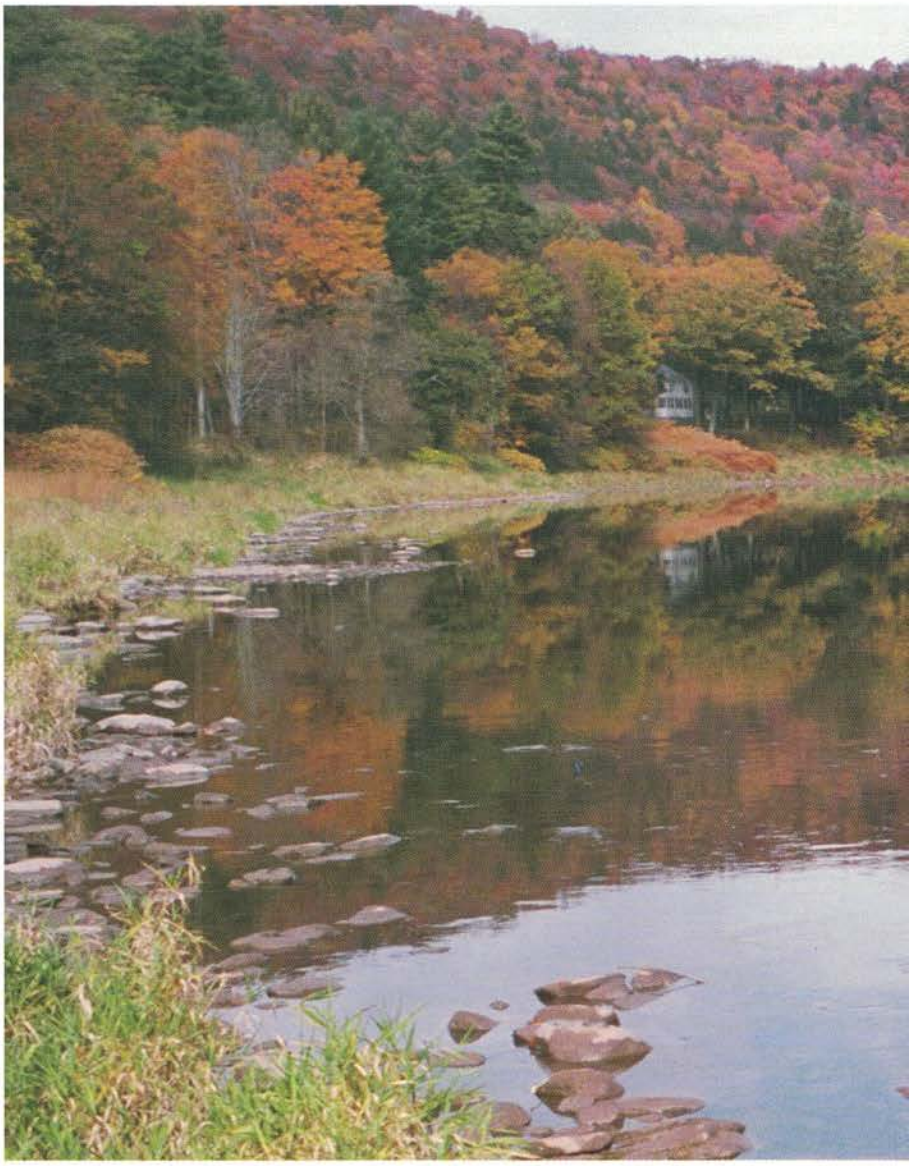
Water Quality

The Big Picture

The Delaware River primped for the cameras during 1994 as part of a study designed to detect possible sources of pollution and to learn more about the waterway's habits.

A fixed-wing float plane, flying at low altitudes, filmed two river corridors during November—a 30-mile reach from Callicoon, N.Y., upstream to the confluence of the East and West branches of the Delaware near Hancock, N.Y., and a 20-mile reach from Milford, Pa., north to Pond Eddy, N.Y.

The plane's space-age camera equipment, using both conventional and infrared color slide film and near infrared band hyperspectral video film, focused in on the river's physical characteristics, including discharge plumes, non-point sources of pollution, mixing zone patterns, and aquatic plant growth. In addition, the film



Trees flanking the Upper Delaware begin their colorful show, nipped by October's cooling air.

was examined by the New York Audubon Society in an effort to locate bald eagle nesting sites along the river.

The flights were conducted over a two-day period by A.W. Research Laboratories of Brainerd, Minn., under contract to the Commission. The project's $6,500 cost was funded by the Norcross Wildlife Foundation.

The photographic data collected during the over-flights were analyzed and documented, then referenced on maps and video tape. A final report was prepared by A.W. Research, detailing any suspected contamination activities and providing a topographic "photo album" of the two river reaches.

"The results not only provide us with a profile of the physical characteristics of these two sections of the river, but also give us an idea of the types of pollution sources to be addressed," explained Richard C. Albert, the DRBC supervising engineer who is heading up the project. "The baseline data generated by this work will

Warren Huff

be useful for evaluating the results of future overflights. Is the river changing and how? Are we finding increased aquatic plant growth that could indicate increased nutrient levels in stormwater runoff from new development? Is sediment build-up occurring? The information should prove very useful in the overall management of the river."

In 1992 the Commission adopted a regulatory package that created a "Special Protection Waters" classification covering the two study areas as well as the entire 125-mile reach of the Delaware from Hancock downstream to the Delaware Water Gap at Stroudsburg, Pa. Included are both the Upper and Middle Delaware Scenic and Recreational Rivers and an eight-mile reach between Millrift and Milford. Portions of tributaries located within the boundaries of the Delaware Water Gap National Recreation Area and the Upper Delaware Scenic River corridor also were included.

The two Scenic River reaches were added to the National Wild and Scenic Rivers System by Congress in 1978. Unlike most Scenic Rivers, they are located near heavily populated areas, being but a day's drive for about 20 percent of the U.S. population.

The "Special Protection Waters" regulations are designed to prevent water degradation in streams and rivers in the basin considered to have "exceptionally high scenic, recreational, ecological or water supply values...."

The data resulting from the aerial photography complement a wealth of water resource data on the Upper and Middle Delaware generated by the Commission and the National Park Service over the past decade. In 1984 the two agencies initiated the "DRBC/NPS

This infrared photo, taken November 9, 1994, during the overflight study, shows the town of Equinunk, Pa. The crimson areas depict land with suspected higher-than-natural nutrient levels, perhaps due to the application of fertilizer. Note the crimson area in the bottom right corner which pinches down to the edge of the Delaware River. To the left, a path also leads to the river, appearing to provide a route for stormwater runoff. Most of the river and stream banks in the area shown are covered with vegetation which acts as a buffer against runoff. Equinunk Creek winds through the middle of the photograph, emptying into the Delaware. After a detailed review of the slides and video tapes, the Commission will develop a plan for ground-site inspections as part of the Scenic Rivers Monitoring Program, a joint venture with the National Park Service.

A.W. Research Laboratories

Scenic Rivers Monitoring Program" on the 125-mile reach of the river. Annual reports are issued summarizing the findings.

The program is being redesigned to increase the focus on the ecological and biological characteristics that make up the habitats and aquatic life communities of the river ecosystem. The change in emphasis reflects a concern that traditional monitoring, which relies on chemical and bacterial analyses, does not adequately pinpoint the more subtle impacts of water pollution.

"The information gleaned from the aerial photography is helping us to move in this direction," noted Gerald M. Hansler, the Commission's executive director. "We now have a snapshot of 50 miles of the river. We have a better handle on what's happening out there, and that will aid us in shaping future policies and programs."

In 1978, Congress added two Delaware River reaches to the National Wild and Scenic Rivers System. The highlighted areas depict the reaches filmed during the overflight study.

Non-Point Source Regulations Adopted

When the Commission adopted the regulations in 1992 creating the "Special Protection Waters" classification, it did not act on companion proposals to deal with the complex issue of pollutants from non-point (non-specific) sources. The public hearing process continued into 1993, generating considerable interest and input. Finally, on February 23, 1994, after addressing concerns raised during the hearing process, the Commission wrapped up its "Special Protection Waters" package, passing regulations that:

- Address new non-point source pollutants on a project-by-project basis under the Commission's existing project review regulatory process.
- Address new and existing non-point sources on a priority watershed basis, with management plans being developed and implemented for high-priority watersheds.
- Encourage the development and implementation of watershed non-point source plans on a voluntary basis in watersheds that are not considered high priority.

Pollutants are found in runoff from non-point sources, especially after heavy rains. Often the runoff increases with new development where landscapes are altered and where land that once soaked up rain and melting snow is paved over. The impervious surfaces significantly increase the amount and speed of the runaway water, flushing such contaminants as parking lot motor oil and lawn pesticides into rivers and streams.

In much of the area now subject to the "Special Protection Waters" regulations development has risen sharply. Double-digit growth rates were posted in Pennsylvania's Pocono Mountains between 1980 and 1990. In Pike County the population increased 53.1 percent during that ten-year span and jumped 37.9 percent in neighboring Monroe County, both located in the heart of this popular outdoor playground which flanks the Delaware River.

It was in 1987, before the U.S. Census Bureau came out with its latest figures, that the Commission and the National Park Service recognized the need to develop a water resource management plan to protect the high water quality within the Delaware Water Gap National Recreation Area from degradation. The spurt in new development already was evident with a projected increase in loadings of non-point source pollutants. And proposals for new or expanded wastewater treatment plants were being developed to accommodate

Martin W. Wollaston

Water quality in the White Clay Creek, which flows from Pennsylvania into Delaware, is being assessed as part of the Christina River Basin study.

this growth, with new discharges planned for the Delaware and its tributary streams.

The management planning later was expanded to include the Upper Delaware Scenic and Recreational River corridor, recognizing its water quality impact on the lower reaches.

For the next six years Commission and Park Service staff worked to develop "Special Protection Waters" regulations designed to mesh orderly growth with environmental protection. They were guided by scientific and policy input from the Commission's Water Quality Advisory Committee, which includes representatives from the four basin states, the federal government, the academic and scientific communities, and the public sector.

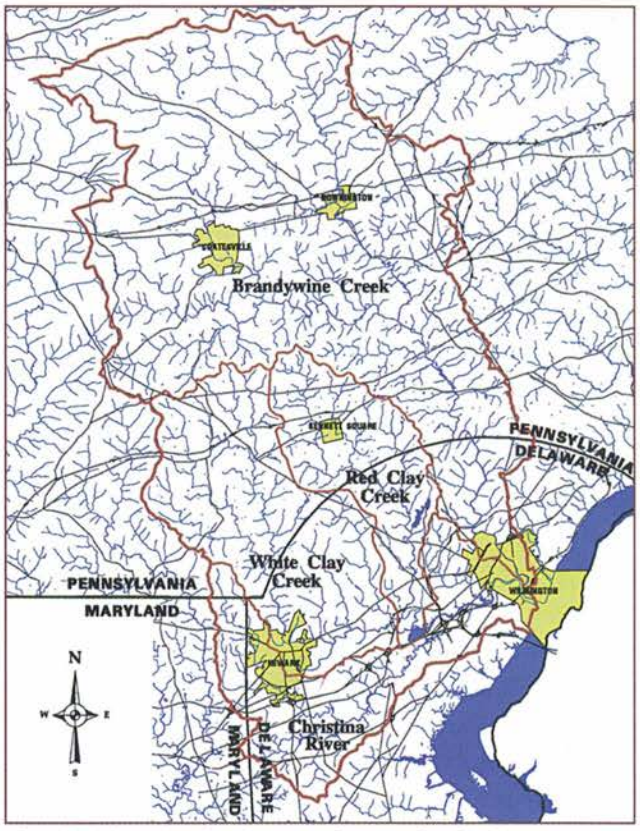
The "Special Protection Waters" regulations currently affect only the Middle and Upper Delaware. But they could be applied to other basin waterways meeting certain criteria. The Commission will consider nomination petitions from local, state, and federal agencies and the public calling for the designation of "Special Protection Waters" in other parts of the basin. Any proposal would involve further studies and public hearings on a case-by-case basis before Commission action could be taken.

A Bridge Over Troubled Waters

A major study to develop a management plan to protect the waters of the Christina River Basin, a fragile watershed under heavy pressure from two bordering states, got underway in the fall of 1994.

The five-year program is designed to take a whole-basin approach in assessing and controlling the water quality within the watershed, a program that recognizes the many benefits gained by setting aside home-turf diplomacy. The effort was initiated by the Commission at the request of Commission members from Delaware and Pennsylvania.

"This plan took a long time to assemble because



Water Resources Agency for New Castle County

The Christina River begins near the Maryland/Delaware state line, entering the Delaware Bay southeast of Wilmington. The headwaters of two tributaries, the Red and White Clay Creeks, originate in Pennsylvania, linking up near Stanton, Del. Their combined flow then empties into the Christina at Churchmans Marsh, one of numerous freshwater wetlands within the basin that provide wildlife habitat. A third and the largest tributary, the Brandywine, also originates in Pennsylvania, flowing through historic Chadds Ford, Pa., before entering the Christina just upstream of its confluence with the Delaware River.

water-use priorities in Pennsylvania and Delaware did not always mesh. There were conflicts," noted Caren E. Glotfelty, a DRBC commissioner and deputy secretary for water management in the Pennsylvania Department of Environmental Resources (PADER). "But after a lot of hard work, compromise, and consensus building, I believe all parties are finally and firmly committed to a common goal based solely on the principles of sound resource management. And that goal is to ensure that future water quality and water supply needs of both Delaware and Pennsylvania are met while preserving a river system high in historic, cultural, ecological, and recreational value."

Gerard L. Esposito, also a DRBC commissioner and director of the Division of Water Resources in Delaware's Department of Natural Resources and Environmental Control (DNREC), embraces the plan because it addresses upstream discharges that affect water quality at the state line. "When you live downstream, there's always a bit of apprehension about what's heading your way especially if it's coming across the border," he said. "What makes this study so unique is that political boundaries have been set aside and a holistic stance adopted. There is one mission. Protect the watershed."

The Christina River Basin drains a portion of southeastern Pennsylvania, most of northern Delaware, and a small parcel of northeastern Maryland. It supplies water to over 50 percent of the population of Delaware's New Castle County and to over 44 percent of the residents in Pennsylvania's Chester County.

The management plan was developed by the Christina Basin Study Technical Advisory Committee (TAC) and was adopted June 30, 1994. Committee members at the time represented DRBC, DNREC, PADER, the Chester County Water Resources Authority (CCWRA), the U.S. Geological Survey (USGS), and the U.S. Environmental Protection Agency (EPA). The committee later was expanded to include the Water Resources Agency for New Castle County, the U.S. Soil Conservation Service, and local Conservation Districts in both Delaware and Pennsylvania.

The plan calls for a three-year program to identify instream pollutant loadings. The program is designed to ensure consistency between Pennsylvania and

Estimated Costs of Christina River Basin Study

Five agencies have allocated funds. Additional funding is being sought from EPA.

Funding Organization	Year 1: Monitoring	Years 2 and 3: Model Development and Public Hearings
DNREC	$750,000	$250,000
PADER	488,000	101,000
CCWRA & USGS	205,983	
DRBC	94,500	10,000
Total	**$1,538,483**	**$361,000**

Delaware on monitoring objectives, sample frequency and timing, targeted water quality parameters, and analytical procedures.

The data collected will then be used to generate water quality and hydrodynamic computer models to help create a Total Maximum Daily Load (TMDL) program for the Christina Basin. The program utilizes a "pooled water concept," with limits placed on the amount of pollutants that can be discharged by individual wastewater treatment plants without collectively violating basinwide water quality standards. Targeted pollutants include oxygen-demanding substances and toxics.

Development of a draft TMDL program is expected to take about a year, to be followed by a one-year period for public participation and comment on the proposal.

The water quality management program adopted by the Technical Advisory Committee builds on an EPA study prepared by a consultant, Science Applications International Corp. (SAIC), and on numerous other past and ongoing studies.

A report summarizing SAIC's work, which focused on the non-tidal reach of the Brandywine, shows there are significant data gaps for toxic pollutants and nutrients, as well as minimal data on non-point source pollutant loadings, which also are being addressed as part of the TAC study.

"When you live downstream, there's always a bit of apprehension about what's heading your way, especially if it's coming across the border."

– Gerard L. Esposito
Delaware Department of Natural Resources and Environmental Control

Water Quality: A Report Card

Water quality in the Delaware River and Bay has in general improved over the past several years, based on an analysis of recent data.

The findings are contained in the Commission's latest "Delaware River and Bay Water Quality Assessment 1992-1993 305(b) Report," issued in May of 1994.

The Commission directs an ongoing water quality monitoring program along the entire length of the river and in portions of the bay. Stations are located approximately seven miles apart on average.

Eight determinants of water quality (temperature, oxygen, pH, bacteria, dissolved solids, alkalinity, nitrogen, and phosphorous) are monitored routinely at most stations; toxicants, such as heavy metals and pesticides, are sampled at key stations in the Delaware Estuary–the Delaware Bay and the tidal reach of the river. The head of tide is at Trenton.

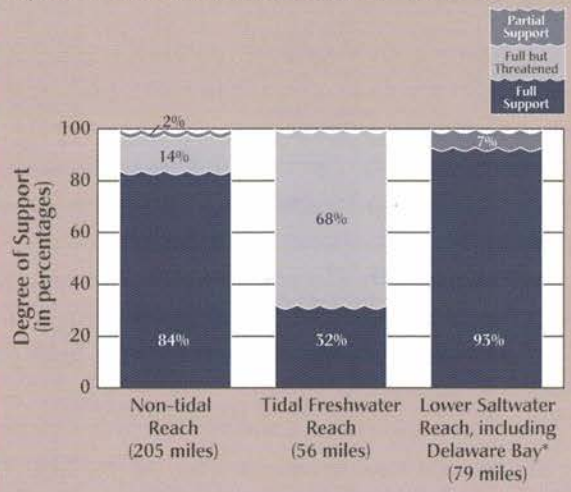
Section 305(b) of the Federal Clean Water Act requires biennial assessments of water quality to be prepared by state agencies and interstate commissions. From these reports the U.S. Environmental Protection Agency (EPA) prepares a national report for the U.S. Congress. The Commission's 1994 305(b) Report to EPA describes the quality of water in the Delaware River and Bay based on an analysis of monitoring data collected during 1992 and 1993.

The report provides an assessment of the degree to which the river and bay supported specific water uses that are protected by the Commission's regulations, namely: water supply, support of fish and aquatic life, and recreation. Water supply (for agricultural, industrial, and public uses) was either fully supported, or supported but threatened, throughout the entire waterway. Recreational use was fully supported everywhere except in 2 percent of the non-tidal section (in the vicinity of Port Jervis, N.Y.), where it was partially supported. (Reported high levels of coliform bacteria resulted in a beach closing in the Port Jervis area on two occasions in 1992.) Fish and aquatic life use was fully supported, or supported but threatened, in all reaches except for 7 percent of the area assessed in the Delaware Estuary. Approximately 14 percent of the non-tidal river, the reach above Trenton, was found to provide full but threatened support for water supply and aquatic life uses due to high pH levels.

Although fish and shellfish consumption by humans are not protected uses under Commission

A Report Card on the Quality of Water in the Delaware River and Bay

The degree of support for the Commission's regulated uses of (1) water supply (agricultural, industrial, and public uses), (2) recreation, and (3) support of fish and aquatic life varied from the headwaters to the ocean.



*Only 21 percent of this area was assessed.

regulations, they are protected by the Clean Water Act. Sixty-three of the 216 square miles assessed in the estuary, or 29 percent, did not support these uses due to high levels of chlordane and/or PCBs in American eels, channel catfish, and white perch, and high levels of bacteria in shellfish. These high concentrations prompted the issuance of fish consumption advisories by the lower basin states. Less than 3 percent of the non-tidal reach of the river was affected by the issuance of fish advisories.

As noted earlier, water quality in general has improved over that detailed in the 1992 305(b) Report. Tidal river oxygen levels have improved during the critical summer period, and the populations of such important fish species as striped bass and American shad have increased. The level of pH and fecal coliforms dropped slightly in some non-tidal sections, although pH was slightly higher at some tidal river stations.

Based on a 1992 report by the National Oceanic and Atmospheric Administration entitled *Results From the First Five Years of the NOAA Mussel Watch Project*, Delaware Bay mollusks had high DDT, nickel, and cadmium levels compared to mollusks found in other parts of the country; all other metals and pesticides were in the average range or less. Silver and arsenic levels have declined.

Controlling Toxics in the Estuary

Public briefings were held during 1994 on policies and procedures to establish permit limits for the discharge of toxic pollutants from industrial and municipal wastewater treatment plants bordering the Delaware Estuary.

The policies and procedures are the second major output of the Commission's Estuary Toxics Management Program, designed to address the effects of acute and chronic toxicity on aquatic life, and the potential for effects on humans through ingestion of water and resident fish and shellfish.

One public briefing was held June 23 at the New Jersey State Aquarium in Camden. Others were held during symposiums sponsored by the Water Resources Association of the Delaware River Basin in Lambertville, N.J. (April 29) and at Bushkill, Pa. (October 3), and at a June 17 meeting in Newtown Square, Pa., sponsored by the Water Supply Committee of the PENJERDEL Council.

The first major output of the program, water quality criteria for toxic pollutants, was updated during 1994. Formal public hearings on proposed changes to the Commission's regulations to adopt the water quality criteria and implementation policies and procedures are planned for the summer of 1995.

Fish tissue contamination by toxic pollutants was highlighted in June of 1994 by the issuance of fish-consumption advisories by the Delaware Department of Natural Resources and Environmental Control. No consumption of recreational-size striped bass, channel catfish, white catfish, and white perch caught between the Chesapeake & Delaware Canal (River Mile 58.9 measured from the mouth of the bay) and the Pennsylvania-Delaware state line (R.M. 78.8) was recommended due to elevated levels of polychlorinated biphenyls (PCBs) in their flesh. Limited consumption of

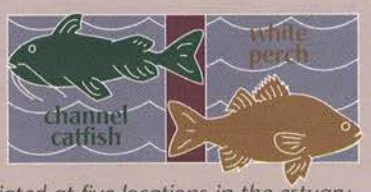
striped bass, white catfish, and white perch caught in Delaware Bay also was recommended. These advisories supplement the advisories previously issued by the states of New Jersey and Pennsylvania for channel catfish, white perch, and the American eel from the Pennsylvania-Delaware state line to Yardley, Pa. (R.M. 139), also due to PCB contamination.

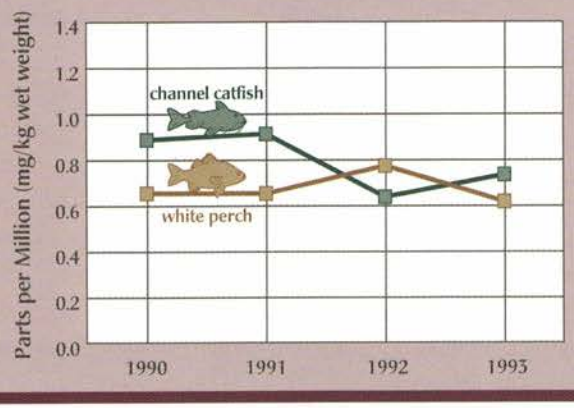
Monitoring of fish tissue samples is primarily the responsibility of the Commission and the three downbasin states, with the U.S. Environmental Protection Agency providing technical assistance. In 1990 a monitoring program to assess fish tissue contamination of catfish and white perch was initiated at five locations in the estuary as part of the Toxics Management Program.

The graph below illustrates the trends in the concentration of PCBs in these two species for the years 1990 to 1993. The data indicate that tissue concentrations are not declining. Investigations of industrial and municipal discharges conducted by Commission staff have not revealed any significant sources of PCBs. Several hazardous waste sites are suspected sources of this contaminant. Further investigations of the sources of PCBs and other chlorinated organic chemicals such as DDT are planned in the next phase of the program, which will look at such non-point sources as landfills, hazardous waste sites, industrial and urban stormwater, atmospheric inputs, and combined sewer overflows.

Average PCB Concentrations in the Delaware River Estuary

In 1990, a monitoring program to assess fish tissue contamination of channel catfish and white perch was initiated at five locations in the estuary. The data indicate little change in the concentration of PCBs in these two species between 1990 and 1993. Further studies will focus on such non-point sources of PCBs as landfills and hazardous waste sites.





A New Model for Measuring Dissolved Oxygen

The concentration of dissolved oxygen (DO) is a key indicator of water quality–the more oxygen, the better the aquatic environment.

As municipal and industrial wastewater treatment plants discharging to the Delaware Estuary have been upgraded over the years, DO concentrations have improved significantly. The improvement, however, has been higher than that predicted by the existing computer model being used to assess the overall health of the estuary.

This observation was confirmed by studies by two consultants: Greeley and Hansen/WRc, retained by the City of Philadelphia, and Tetra Tech, Inc., under contract to the U.S. Environmental Protection Agency (EPA).

Consequently, the Commission retained a consulting firm specializing in model development, HydroQual, Inc., to conduct an evaluation of the model in use, the Delaware Estuary Model, or DEM.

HydroQual provided the following comments and recommendations:

- While it is possible to recalibrate the Delaware Estuary water quality model, the new model would probably not be reliable.

- A replacement model should provide the capability for two- and three-dimensional segmentation, would be able to analyze time-varying flow and tidal-forcing inputs, and would include algal and sediment components.

HydroQual also recommended special estuary water quality monitoring be conducted to assist in initial development of a new model. This monitoring was carried out by the Delaware Department of Natural Resources and Environmental Control during 1994.

Depending on the availability of funds, the Commission hopes to award a contract to a consultant to develop a replacement model in the near future.

CSOs: A Rainy-Day Problem

The Commission completed a three-year study in the fall of 1994 of the impacts of combined sewer overflows (CSOs) on water quality in the Delaware Estuary. The study was funded by the EPA, Region III.

Combined sewer overflows are a nationwide problem for waterways bordered by older urban development. These sewer systems, which collect sanitary sewage and industrial wastewater for delivery to wastewater treatment plants, are designed to also collect stormwater runoff.

When it rains, the combination of untreated wastewater and the stormwater runoff often is too great for the treatment plant to handle, resulting in a bypass directly into a waterway. Some discharges also occur during dry weather because the antiquated gates that divert the waste to the river or stream during storm events get stuck in the open position.

While all dry-weather CSOs are required to be eliminated under provisions of the National Pollutant Discharge Elimination System permitting program, it is deemed cost-prohibitive to replace all wet-weather combined sewer systems. Investigations continue on ways to minimize the impacts of the wet-weather CSOs, and owners and operators of the combined systems have developed programs to reduce untreated discharges.

During the Commission's study, data were gathered on combined sewer systems that discharge to the estuary or tributary streams. Computer models were then developed by the New Jersey Department of Environmental Protection (DEP), under contract to the Commission, to determine the pollutant loading of the combined sewage. The basic model used was EPA's Storm Water Management Model (SWMM). Also utilized was the U.S. Army Corps of Engineers' Storage Treatment Overflow Runoff Model (STORM).

The results of DEP's work are contained in a September 1994 report entitled *Projected Storm Water Generated Pollutant Loadings to the Delaware Estuary: A Modeling Study.* The report describes and is supplemented with computer software for SWMM models for 36 sewered areas plus models for 35 tributaries. The report and the models were made available to the CSO owners and operators discharging to the estuary and tributary streams.

To provide guidance to Commission staff, a CSO subcommittee to the Commission's Water Quality Advisory Committee met regularly during the study period. The subcommittee includes representatives from the CSO owners/operators, state environmental regulatory agencies in Pennsylvania, New Jersey, and Delaware, and EPA. The Commission also hosted a seminar to train staff of the CSO owners and operators, as well as other members of the CSO subcommittee on use of the SWMM software. Instructors from DEP provided hands-on training on the use of the SWMM model, a useful tool in determining the extent of CSO pollution and the effectiveness of control measures.

An ore ship heads up the Delaware River toward Philadelphia, one of the many older cities with CSO systems.

Free Water Rights Not for Sale

The Commission has amended its water-charging regulations in an attempt to prevent the transfer of free water rights in cases where there is a change of company ownership or control.

The changes, adopted December 7, 1994, were brought about by two lawsuits challenging the Commission's longstanding policy to terminate "certificates of entitlement"–which provide for the free use of surface water–in such situations. The suits were filed by Texaco, Inc., and Chevron.

The Commission's water-charging program began in 1974. The revenue it generates is used to pay off a 50-year federal debt for the cost of water storage the Commission owns in two U.S. Army Corps of Engineers' reservoirs–Blue Marsh on the Schuylkill River and Beltzville on the Lehigh River. The water in the two

Water Supply

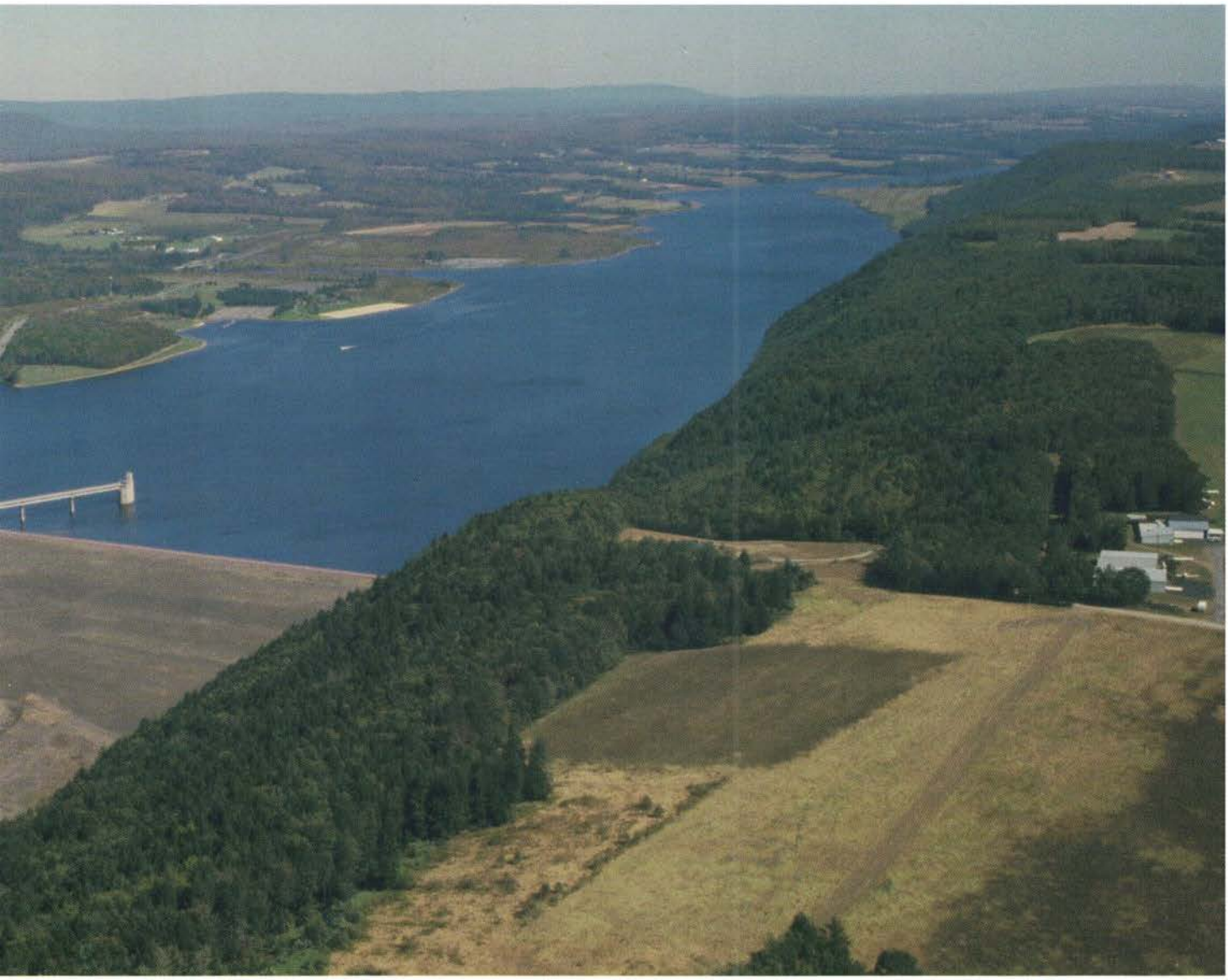
Beltzville Reservoir is located four miles east of Lehighton, Pa., on Pohopoco Creek, a tributary of the Lehigh River. When full, it contains 13 billion gallons of water supply storage. Proceeds from the Commission's water-charging program are used to pay off a federal debt for storage in both Beltzville and Blue Marsh reservoirs.

impoundments is released to augment river flows during low-flow or drought periods to help repel the upstream migration of salty water from the Delaware Bay, to improve water quality, and to enhance fisheries and recreation.

The Commission collects roughly $1.3 million in water charges annually to apply against the federal debt which at year's end amounted to just over $18 million. In addition, the Commission must pay annual operating and maintenance costs for its portion of the reservoir water.

The Commission charges 60 cents per million gallons for non-consumptive use (water that is returned to the hydrologic cycle) and $60 per million gallons for consumptive use (water that is evaporated or used up, say, in a manufacturing process).

It first gave notice of its intent to charge for withdrawals or diversions of Delaware River Basin surface



U.S. Army Corps of Engineers

U.S. Army Corps of Engineers

The Commission owns 6.5 billion gallons of water supply in Blue Marsh Reservoir, a favorite attraction for bathers and boaters located six miles northwest of Reading, Pa., on Tulpehocken Creek, a Schuylkill River tributary. Releases are made from both the Blue Marsh and Beltzville impoundments to augment downstream river flows during dry periods, to improve water quality, and to enhance fisheries and recreation.

water back in the mid-1960s, unveiling a proposed rate schedule in February of 1973. The draft regulations which went to public hearing in 1973 exempted from charges surface-water withdrawals or diversions that were legally permissible prior to the adoption of the Delaware River Basin Compact, which created the Commission on October 27, 1961.

The proposed regulations provided for the issuance of certificates of entitlement to pre-Compact surface-water users, entitling them to withdraw or divert water without charge. But the regulations also provided for the termination of certificates of entitlement upon change of ownership of the water user, without exception.

Following public hearings in 1973 and 1974, the draft regulations were revised to establish limited exceptions to the "no transfer" rule. In their final form, the regulations exempted transfers involving "land in agricultural use" and transfers of a certificate of entitlement held by corporations if made in connection with a corporate reorganization within the following categories:

1. whenever property is transferred to a corporation by one or more persons solely in exchange for stock or securities of the same corporation, provided that immediately after the exchange the same person or persons are in control of the transferee corporation, that is, they own 80 percent of the voting stock and 80 percent of all other stock of the corporation;

2. whenever the transfer is an incident of a statutory merger or consolidation pursuant to the corporation laws of any state, the District of Columbia or the United States;

3. whenever the transfer is included in a transfer by a corporate holder of a certificate of entitlement of all or a part of its assets to another corporation if immediately after the transfer the transferor or one or more of its stockholders, or

any combination thereof, are in control of the corporation to which the assets are transferred, and such transfer is in exchange solely for stock or securities of the transferee corporation as a party to a reorganization within the meaning of Section 354 or Section 361 of the Internal Revenue Code; or

4. where such transfer is required merely as a result of a change of the name, identity, form or place of organization of a corporate holder of a certificate of entitlement.

In the 1980s, Texaco and Chevron, which had purchased oil refineries using the surface waters of the basin, sought to remain exempt from water charges even though a change of ownership and control of the original corporate owners had occurred. Texaco purchased the Getty Oil Co. and Chevron bought Gulf Corp.

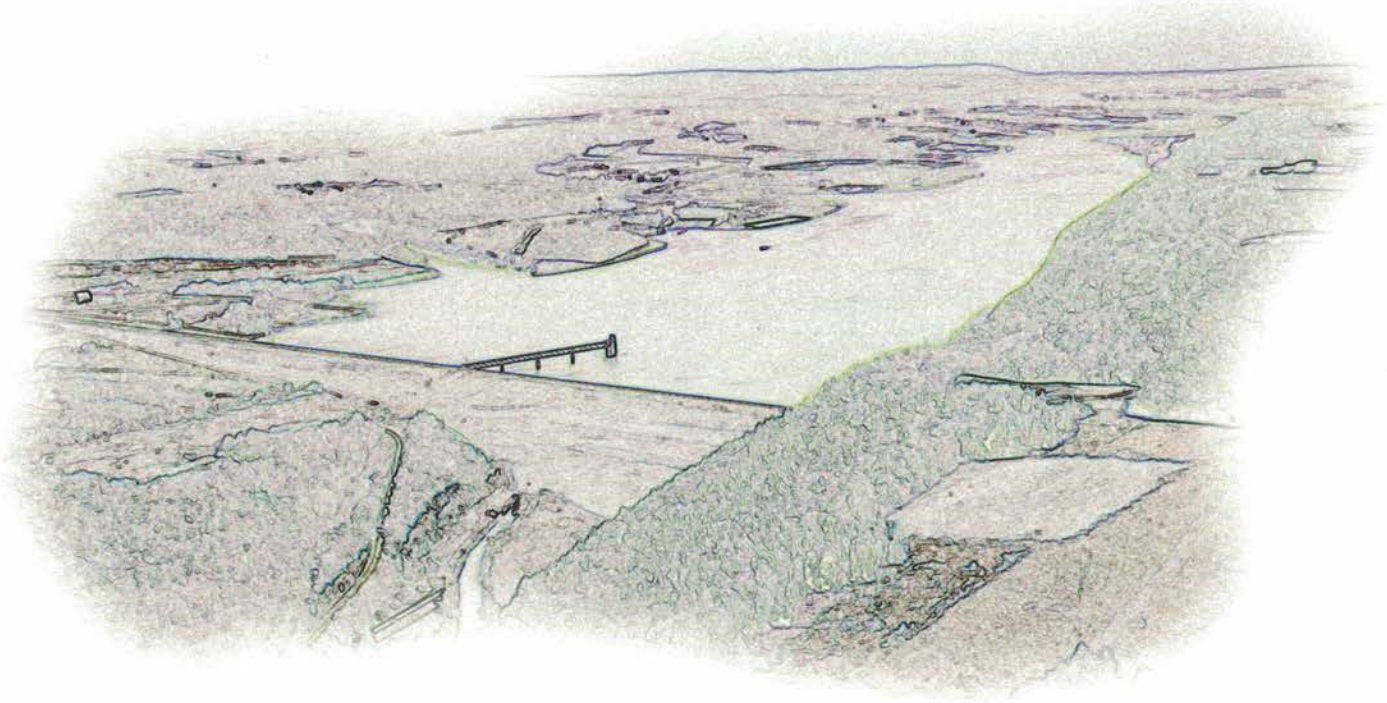
Getty Oil had owned one of the refineries, located at Delaware City, Del., since it was built in the 1950s. In February of 1984, Texaco acquired 100 percent of Getty Oil's stock for $10.2 billion. Included among Getty's assets was the Delaware City refinery. Following administrative hearings, the Commission ruled that certificates of entitlements for the refinery had been terminated as of February 17, 1984, the date of acquisition of Getty by Texaco.

In the second case, Chevron purchased 100 percent of the stock of Gulf Corp. for $80 per share in June of 1984. Gulf at the time of the acquisition was the owner of an oil-refining facility in Philadelphia. In May of 1990, the Commission determined that the certificate of entitlement issued for the Philadelphia refinery was terminated when Chevron acquired Gulf.

Both Texaco and Chevron appealed the Commission's decisions by filing separate actions in U.S. District Court in Delaware. The court considered the cases together.

The oil companies challenged the Commission's power to terminate exemptions from water charges when there had been a change of ownership. They contended that the Delaware River Basin Compact perpetually exempted from charges any diversions or withdrawals that were legally permissible prior to 1961. They further argued that a transfer did not occur if ownership of the water-using facility was vested in a corporate subsidiary that continued in existence, even though ownership and/or control of the corporation had totally changed. And they maintained that doctrines of general corporate law prevented the Commission from going beyond the corporate shell, and that issues of ownership and control were not applicable.

The oil companies also took the position that even if the court rejected these other defenses, the literal wording of the Commission's existing water-charging regulations continued certificates of entitlement if a transfer were carried out pursuant to a statutory merger



of corporate entities according to the laws of a state or the federal government. The Commission acknowledged that the acquisition of Getty and Gulf by Texaco and Chevron, respectively, had been carried out pursuant to the merger statutes of the State of Delaware. The Commission, however, interpreted its regulations to exclude such mergers from the exception if there had been a transfer of ownership and/or control.

On June 11, 1993, the U.S. District Court issued an opinion and order in favor of Texaco and Chevron. The Commission appealed to the U.S. Court of Appeals for the Third Circuit, which affirmed the District Court's decision on June 24, 1994. The appeals court, however, rejected the argument of the oil companies that the Compact required the Commission to continue exemptions from water charges simply because the withdrawal or diversion was legally permissible prior to 1961. The court further rejected the argument that the legislative history of the Compact prevented the Commission from applying a test of ownership and control in determining whether a transfer had occurred. It held that the Commission had the right to terminate certificates of entitlement if there had been a transfer of ownership and/or control of a water-using facility.

The court concluded, however, that the Commission's application of the ownership and control test to transfers that occurred as part of a statutory merger was inconsistent with the Commission's existing water-charging regulations. In short, the court found that the literal language of the regulations *did* insulate transfers that were done pursuant to state merger statutes.

The court held that the Commission had the right to terminate certificates of entitlement if there had been a transfer of ownership and/or control of a water-using facility.

The revised regulations, which were the subject of a public hearing on October 26, 1994, are designed to address this judicial finding by defining a "transfer" to include, among other things, the sale of corporate stock. They also delete existing exceptions to the transfer rule for corporate merger transactions and certain transactions under the Internal Revenue Code.

It is hoped that the changes will further the Commission's longstanding objective of terminating water charge exemptions when there has been a change of ownership and/or control, with the goal of having all water users eventually pay for the benefits they receive from water storage projects provided through Commission programs.

A Jump in Consumptive Use

Consumptive use of water is projected to increase by roughly 29 percent in the Delaware River Basin by the year 2020.

Water that is used consumptively is lost to the hydrologic cycle through evaporation, evapotranspiration (absorption and emission by plant life), exportation to a watershed outside the basin, or incorporation into a product. It is often of greater concern to water resource managers in terms of future water availability and quality than total withdrawals. Thus, it is not surprising that the Commission's drought management plans are aimed at reducing consumptive losses.

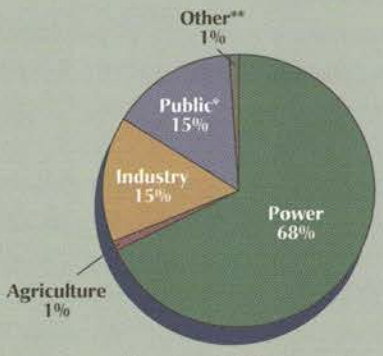
Fortunately, most water use in the basin is non-consumptive, being treated, then returned to streams and rivers. Schuylkill River water, for instance, is re-used about seven times during low-flow periods before it reaches Philadelphia.

In addition to consumptive losses that occur within the basin, water is exported out of the basin to serve the needs of the New York City area and portions of central and northern New Jersey. Under normal hydrologic conditions, New York is allowed to divert up to 800 million gallons a day (mgd) from three Delaware River headwater reservoirs, and New Jersey up to 100 mgd through the Delaware and Raritan Canal.

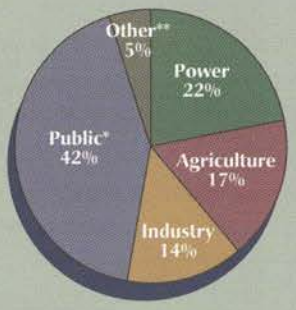
One of the major influences on water use is population pressure, which especially affects public water supply and power generation. During 1993, the

A Snapshot of Basin Consumptive Use: 1991–2020

Most water withdrawn from the basin is used for power generation, followed by public and industrial use, golf course irrigation, livestock watering, and snow making. Although public supplies accounted for only 15 percent of total average withdrawals in 1991, this use category comprised 42 percent of the total average consumption for the year. Conversely, power suppliers accounted for 68 percent of total average withdrawals, but only for 22 percent of the average consumptive use.



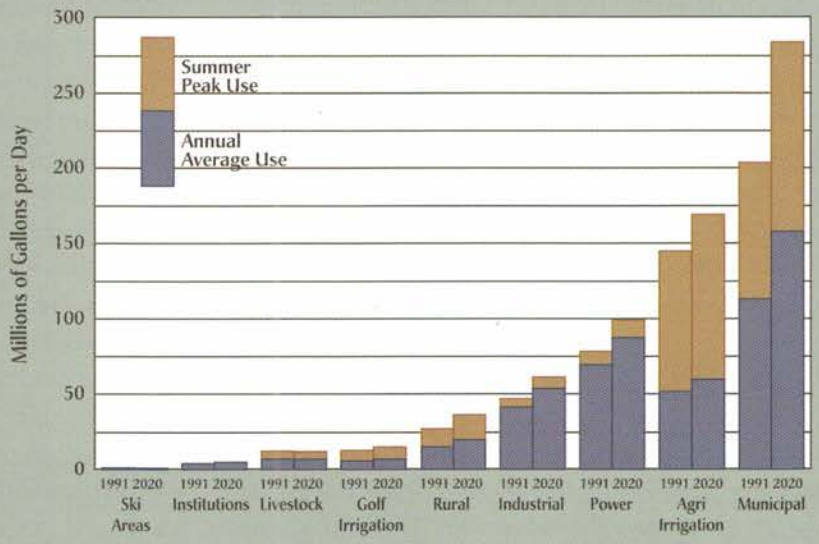
Average Withdrawals (1991)



Average Consumptive Use (1991)

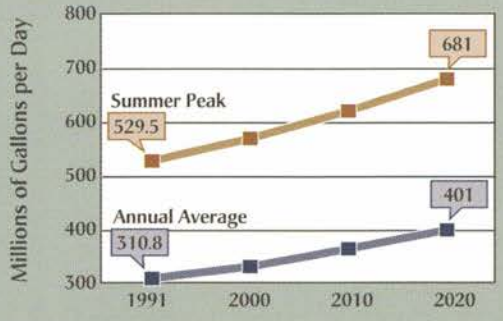
*"Public includes purveyor, rural, and institutional uses.
**"Other" includes golf, livestock, and snow-making uses.

Actual and Projected Consumptive Demand



During summer months, water demand is generally at its peak. Although agricultural water use accounted for only 1 percent of average annual withdrawals in 1991, it accounted for 27 percent of the average summer consumptive use because roughly 90 percent of water used for crop irrigation is consumed through evaporation and evapotranspiration. Public water use is also a lot more consumptive during the summer due to evaporative losses from swimming pools, car washing, and the watering of lawns and shrubs.

Consumptive use of water is projected to increase by roughly 29 percent in the Delaware River Basin by the year 2020. In-basin consumptive use is expected to average 401 million gallons a day (mgd), with the summer peak averaging 681 mgd. Public water supply's average annual consumptive use is expected to increase from 133 mgd in 1991 to 184 mgd in 2020, the largest increase among all user categories.



Note: The projections for future consumptive use in this graphic are based on data from the 1991 water year, which featured a hot, dry summer.

Commission, using 1990 population data provided by the U.S. Census Bureau and several regional agencies, determined the basin's population had increased by 4.5 percent since 1980. This was well below the national growth rate of 10.2 percent.

In Philadelphia, where roughly 22 percent of the basin's population is concentrated, there was a population drop of 100,000 people during that ten-year span. In contrast, double-digit growth rates were posted in other areas of Pennsylvania–Chester County (19 percent), the Poconos (14 percent), and Bucks County (13 percent).

Based on the 1990 figures, some 7.3 million people live in the basin, a figure that is expected to increase to 8.4 million by the year 2020. In addition, another 9.9 million people rely on water exported from the basin, mainly in the New York City area and northern New Jersey. In all, a total of 17.2 million people, or 7 percent of the U.S. population, are supplied with basin water.

Dissecting the Neshaminy

The U.S. Geological Survey (USGS) has completed preliminary work on a computer program that will be used to assess the allocation of ground and surface water in the Neshaminy Creek Basin in Bucks County, Pa. The basin is located in the Southeastern Pennsylvania Ground Water Protected Area, a region in which ground water supplies have been stressed by development.

The study was recommended by the Commission's Ground Water Advisory Committee to provide better information for use in water allocation decisions and, if successful, may be extended to other watersheds in the Protected Area. The work is being conducted jointly by Commission staff and the Malvern, Pa., office of the USGS.

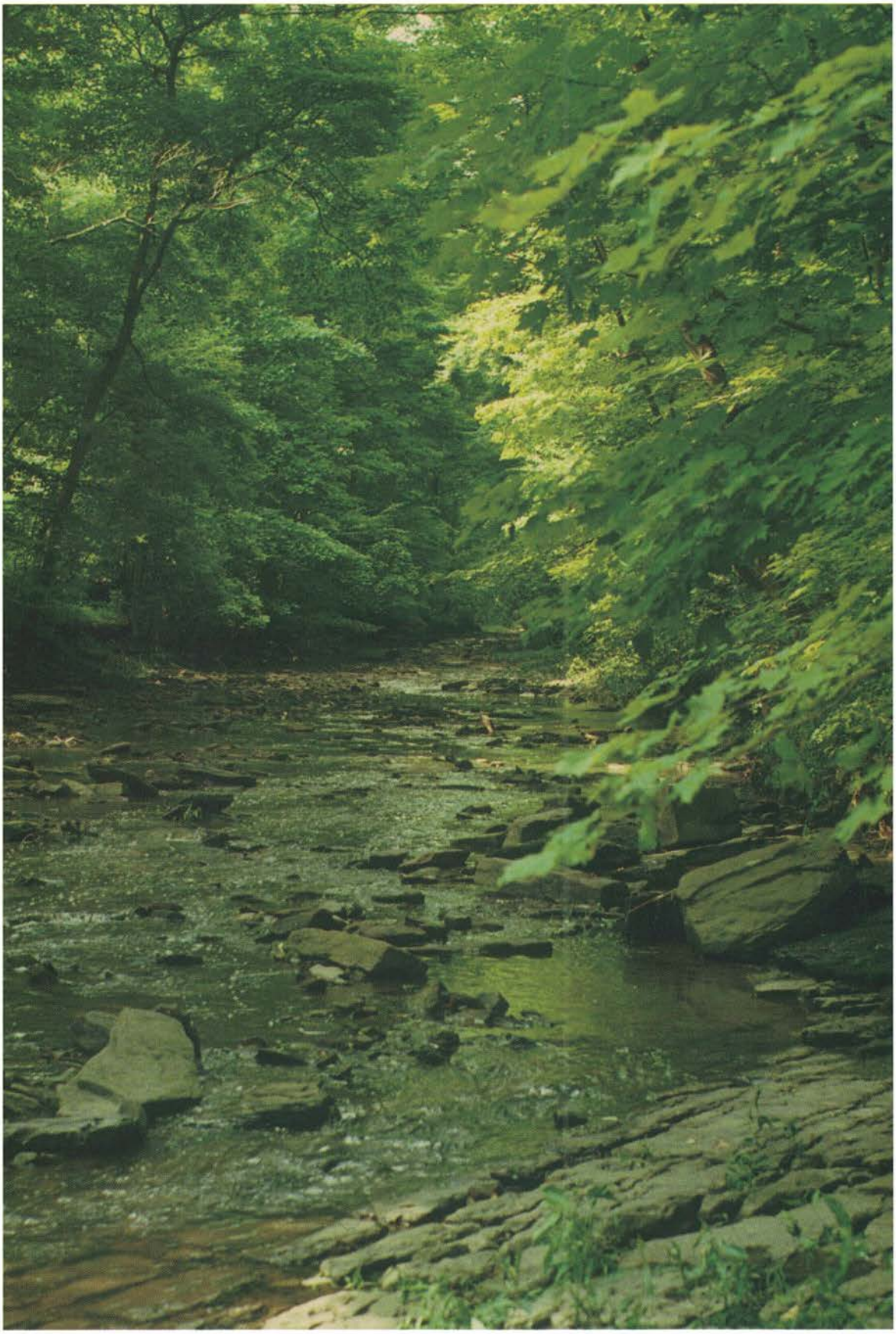
The watershed has been divided into 14 sub-basins averaging 20 to 25 square miles each and defined primarily by the major tributaries and branches to the Neshaminy.

The major output from the study will be a geographically referenced data base for withdrawals and discharges in each of the sub-basins. Data in the computer program will include basin water imports and exports, geology, evaporation rates, estimates of domestic well use, and annual ground-water yield for various hydrologic conditions.

The computer program will perform calculations of total water use, comparing this to ground-water availability in each of the sub-basins. In addition, the USGS will prepare Geographic Information System (GIS) data layers and maps for each sub-basin.

The GIS products and a final report of the study are expected in 1995.

Facing page: Fish Creek, a tributary of the Neshaminy.



Heritage Conservancy

Water Conservation

Good to the Last Drip

Unaccounted-for water, the yardstick used to estimate leakage within water-supply systems, has significantly decreased throughout the Delaware River Basin in recent years, the result of programs aimed at making every drop count.

Eight years have passed since the Commission adopted regulations in the spring of 1987 requiring large water purveyors (those distributing 100,000 gallons per day or more) to develop and implement systematic programs to monitor and control leakage.

Each program is subject to review and approval by the four basin states, which, along with the Commission, have tracked trends in water loss levels.

Based on Commission calculations, there was a 15.7 percent reduction in total unaccounted-for water between 1989 and 1993 (see graph on page 28). While it seems clear this reduction in lost water was driven in large part by the Commission's regulation, credit also is due to the many water purveyors which have implemented aggressive leak detection and repair (LD&R) programs in recent years. And that's not surprising, considering that most LD&R programs are very cost-effective.

It doesn't make much sense to extensively treat water to meet rigorous national and state drinking-water standards if that highly treated and often rather expensive water gets lost in the distribution system.

Implementing such programs is a wise venture for other reasons. Like other water-conservation initiatives, LD&R programs can delay or eliminate the need for developing new water supplies or enlarging existing supplies. Many water-supply systems consist of costly water-treatment plants, pumping stations, aqueducts, and pipes. LD&R programs also can enhance drought preparedness, since water saved during both normal times and drought periods can extend water supplies and improve a water utility's ability to deal with drought conditions.

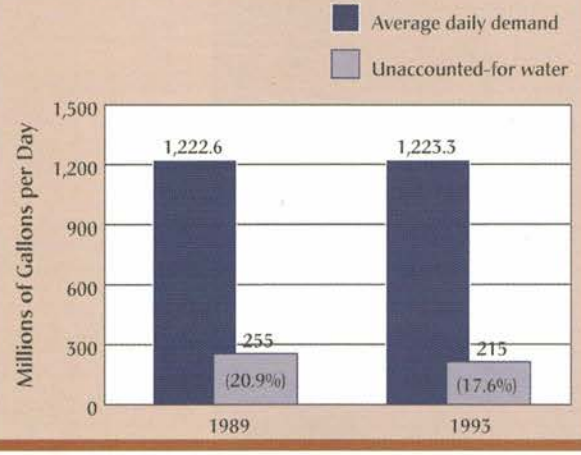
Also, like other water conservation programs, instituting expanded LD&R programs can have positive

Replacing leaky pipes can eliminate the need for additional water supply development, which can result in diminished flow of rivers and streams.

It doesn't make much sense to extensively treat water to meet rigorous national and state drinking-water standards if that highly treated and often rather expensive water gets lost in the distribution system.

Unaccounted-for Water in the Delaware River Basin

In 1989, purveyors reported an average daily demand of 1,222.6 million gallons per day (mgd), the amount of water entering the purveyors' distribution systems. Average daily unaccounted-for water in 1989 was 255 mgd, or 20.9 percent of the daily average demand. In 1993, purveyors reported an average daily demand of 1,223.3 mgd, with average daily unaccounted-for water recorded at 215 mgd. That's 17.6 percent of the amount of water entering the distribution systems. This represents a 15.7 percent reduction in total unaccounted-for water over a four-year period.



environmental impacts. By stabilizing or reducing overall water demands, such programs can eliminate the need for additional water-supply development, which can result in diminished flows of rivers and streams.

Unaccounted-for water is the most commonly used measure for estimating leakage within a water supply system. To calculate the amount, a "metered ratio" is derived–the volume of water delivered through service meters divided by the volume of water entering the distribution system. The amount of unaccounted-for water then becomes the difference between the metered ratio and 100 percent. For example, if a system has a metered ratio of 85 percent, the remaining 15 percent constitutes the unaccounted-for water.

Under the Commission's regulation, purveyors distributing more than one million gallons per day submitted their LD&R programs in 1989; the remaining purveyors, those distributing between 100,000 gallons per day and one million gallons per day, in 1991. The regulation requires purveyors to submit updated programs every three years thereafter.

An Incentive to Save

One way to conserve water is to price it in a way that discourages waste. It works.

That's the conclusion of the University of Delaware's Center for Energy and Environmental Policy which conducted a study of Artesian Water Co.'s water-conservation initiatives.

Artesian, based in Newark, Del., bills residential customers using inclining-block rates in which the unit price of water increases as the quantity of water used goes up. An increasing number of other water utilities in the basin, faced with limited water supplies, have adopted similar water-saving price structures.

The center's study was based on the water-use patterns of Artesian's residential customers during a one-year period spanning 1992 and 1993. It was sponsored by the Delaware Department of Natural Resources and Environmental Control.

In a June 1994 report, the center concluded that Artesian's inclining-block rates were effective in reducing discretionary, or largely non-essential, water consumption. This was particularly true during the summer months, when many homeowners traditionally display a wild passion to hose down anything green. The table on the opposite page shows Artesian's rates during the study period.

The researchers determined a summer price elasticity of -0.605 and a winter price elasticity of -0.176. "Elasticity" is a measure of responsiveness to price. For example, the summer price elasticity of -0.605 means that a 1 percent increase in price led to roughly a 0.6 percent decrease in water usage. This magnitude of elasticity is relatively high, but well within the range of reported elasticities of other studies.

The researchers determined other impacts of Artesian's water-conservation program. These include:

- Customers who obtained water conservation devices (like low-flow shower heads, faucet

Artesian's Rates During Study

Faced with limited water supplies, an increasing number of water utilities in the basin are adopting water-saving price structures. Artesian Water Co. bills residential customers using inclining-block rates in which the unit price of water increases as the quantity of water used goes up.

Price per 1,000 Gallons	Quantity Consumed per Quarter
$2.25	0–5,000 gallons
$2.38	5,000–20,000 gallons
$2.74	More than 20,000 gallons

aerators, toilet dams) from Artesian reduced their consumption by 19 percent over those who did not receive such devices.

- Those customers who received and could recall water-conservation–related information supplied by Artesian tended to consume less water than those who did not by 4 percent.

The researchers outlined four conclusions that have policy implications:

1. Seasonal and inclining-block pricing can be effective in reducing discretionary water consumption in the summer months.
2. Utility-sponsored programs to increase purchases of water-conservation technology can realize significant, measurable conservation results.
3. States and utilities can encourage conservation through the dissemination of information on how to reduce discretionary water consumption.
4. Through a combined strategy of conservation pricing, consumer education, and the provision of conservation technology, Delaware residents can take effective action to ensure adequate water supplies while minimizing adverse environmental impacts.

The Commission has on the books a regulation that promotes the adoption of retail water pricing to encourage conservation and that requires water companies to submit conservation plans with applications for new or expanded withdrawals.

The regulation, adopted in 1992, is another component in the Commission's long-range program to reduce water use throughout the basin. The program is driven by research as well as recommendations from the Commission's Water Conservation Advisory Committee. Peter Johnson, Artesian Water Co.'s senior vice president, serves on the committee and has been a staunch supporter of water-conservation initiatives both locally and basin-wide.

The conservation plans that accompany applications must describe how the water purveyors have implemented water-saving regulations already on the books, including requirements for metering programs to track water usage and programs to identify and fix leaky distribution systems.

Water companies applying to the Commission after June 30, 1992, for new or expanded withdrawals of one million gallons per day or more also must complete an evaluation of the feasibility of implementing a water-conserving retail-pricing structure and billing program.

Two workmen repair a leaky water main.

Hydrologic Report

Frozen Assets Yield Dividends

Ice choked the Delaware River and Bay and many tributary streams during the storm-packed winter of 1993-94, with frigid temperatures trapping billions of gallons of potential runoff in frozen snowpack in the upper basin.

Small streams, some dammed by ice, jumped their banks in January and March, and the National Weather Service warned of the possibility of widespread spring flooding if a warm snap kindled a quick thaw.

But the deep snow and ice that ringed the basin's headwaters melted fairly slowly, and although the major rivers were swollen much of the spring, they didn't flood–helped out by upstream reservoirs that captured much of the runoff.

On the Delaware River at Port Jervis, N.Y., where rapidly rising backwater lifted huge slabs of trapped ice

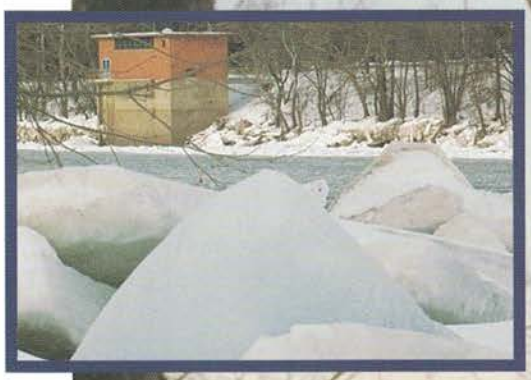
Delaware River ice off Gloucester City, N.J., during the bitter winter of 1993–94.

onto the city back in February of 1981 causing extensive damage, the river froze over again during the winter of 1993-94. By February 22, roughly six feet of backwater were piled up behind a blockage of ice anchored just upstream of a small island, and the town grew tense. This time, though, it wasn't a problem, with the icy, makeshift dam breaking up and floating downstream as temperatures warmed.

Ice jams also formed on the Lehigh River just downstream of Lehighton, Pa., and on the Delaware between Trenton, N.J., and Yardley, Pa., where ice slabs the size of pianos crushed small riverbank trees and boat docks. Near Walton, N.Y., highway workers used dynamite to break up anchored Delaware River ice.

The Commission, the National Park Service, the U.S. Geological Survey, and the U.S. Army Corps of Engineers kept the National Weather Service abreast of icing conditions on basin waterways and also alerted

Michael Hogan



Russell Recchion of Philadelphia captures the frozen Delaware on canvas in the fading light of a bitterly cold February afternoon in Yardley, Pa. A mile upstream (top left), a crumpled boat dock rests along the river's ice-choked banks. Lower left, looking from the Pennsylvania shore across the Delaware toward Ewing Township, N.J. (Photos by Chris Roberts)

More than a dozen storms pounded the basin over the winter, bringing snow, sleet, and freezing rain. Smaller rivers and streams swelled, inundating areas far removed from designated flood plains.

emergency management centers in Pennsylvania, New Jersey, and New York of the potential for flooding.

More than a dozen storms pounded the basin over the winter, bringing snow, sleet, freezing rain, and sometimes simply rain. Smaller rivers and streams swelled, inundating areas far removed from designated flood plains because ice diverted water from normal runoff channels.

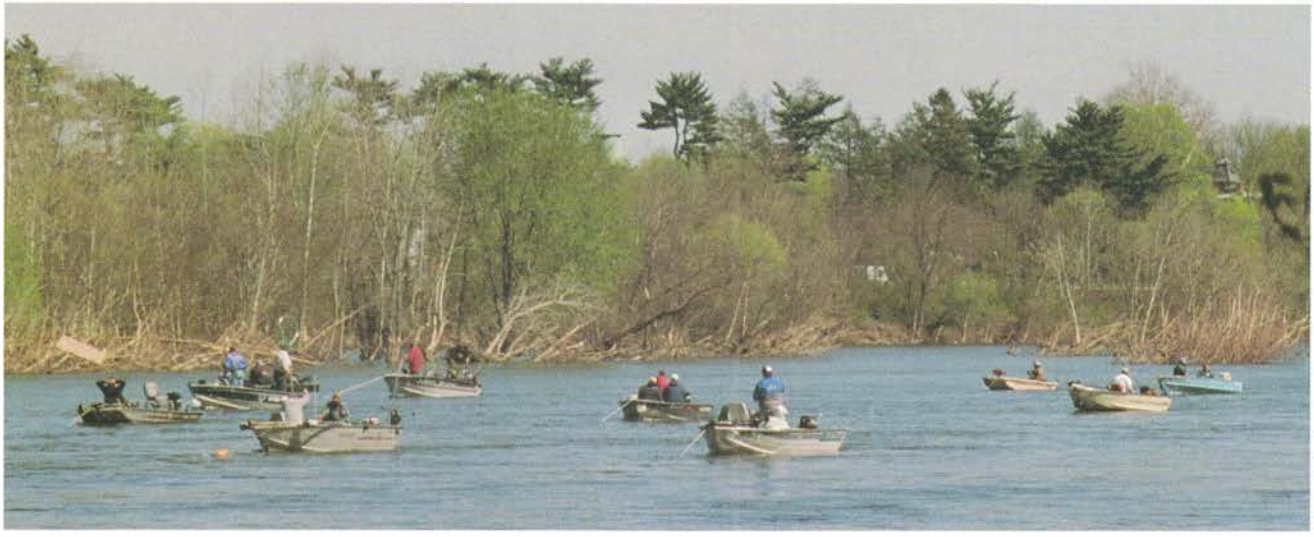
On January 28 temperatures turned balmy, and heavy rain fell over the lower basin, which was blanketed by ice and snow. Runoff from the sudden thaw carved little rivers in cornfields, flooded streets, and sent natural waterways over their banks. The Christina River crested at 12.19 feet just south of Newark, Del., more than three feet above flood stage. It was the third highest crest on record. The Assunpink Creek in New Jersey and the Neshaminy Creek in Pennsylvania also flooded.

And heavy rain triggered flooding on March 10, with the Assunpink exceeding flood stage by four feet at Trenton.

In the upper basin reservoir levels were declining with little or no runoff from the massive snowpack, which was locked in place by the frigid weather. On January 25, 1994, storage in New York City's three in-basin reservoirs—Pepacton, Neversink, and Cannonsville—dropped below the drought-warning line. Had it remained there for five consecutive days the basin, under the Commission's drought management plan, automatically would have entered drought warning. But what about all that snow and ice that would melt come spring? Those frozen assets?

The formula for normal reservoir diversions to New York City and releases from the three reservoirs to the Delaware River is contained in a 1954 U.S. Supreme

Runoff from snowpack in the upper basin swelled rivers and streams during the spring thaw of 1994, marking the second year in a row that high water and strong currents added an extra challenge to the sport of catching Delaware River shad. Anglers here tried their luck in April, just downstream of the Scudder Falls Bridge near Trenton, N.J.



Chris Roberts

Court decree that apportioned the waters of the river for use by the city and the four basin states.

In 1961, the Delaware River Basin Compact, which created the Commission, became law. Under Article 3 of the compact, the Commission may modify the diversion-and-release formula to reflect hydrologic conditions not anticipated when the 40-year-old decree was issued, as long as there is unanimous consent of the decree parties—New York City and the four basin states. The parties do not have to return to the court to make the changes.

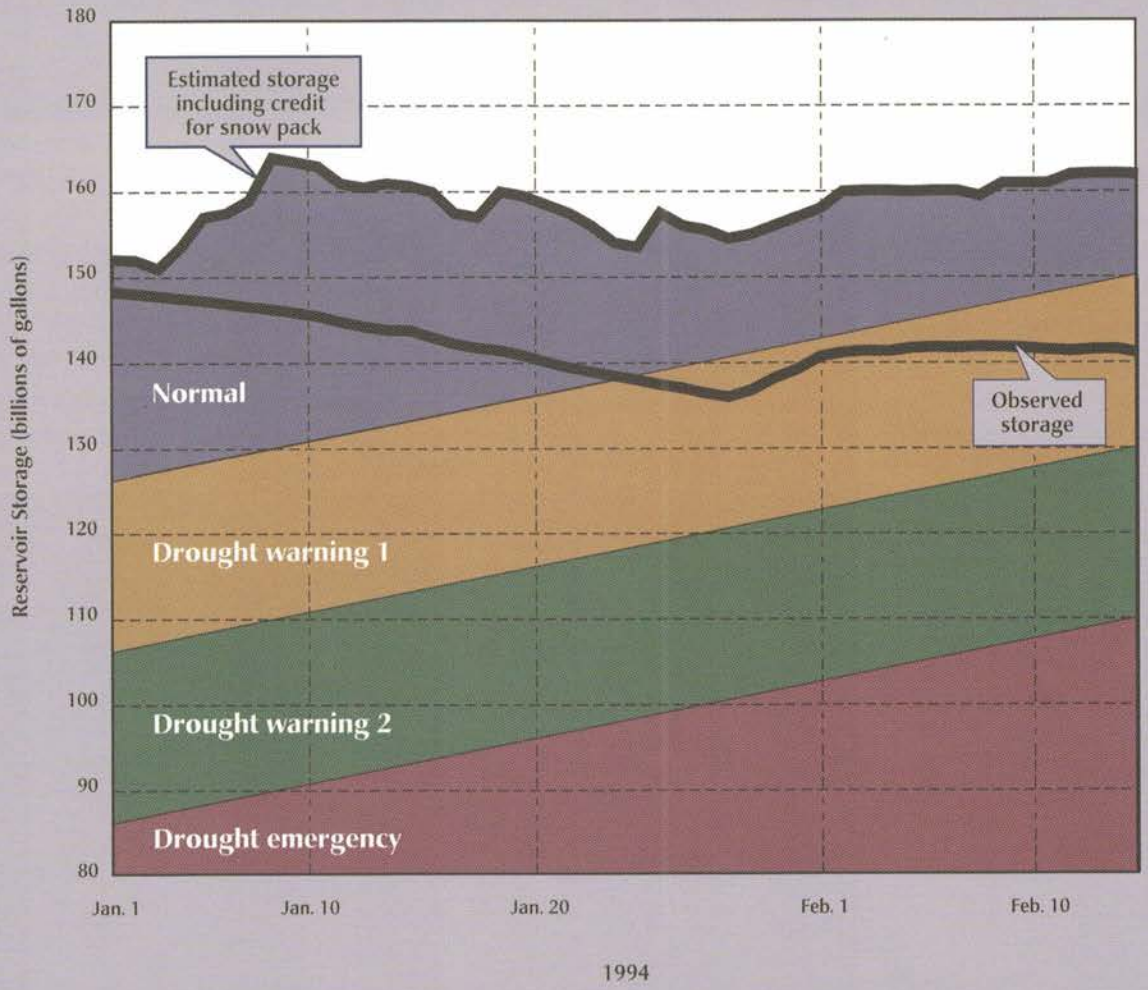
Thus, through the compact, drought managers can avoid lengthy litigation while gaining the flexibility to make modifications to the Commission's drought plan based on current hydrologic conditions in the basin.

It seems the framers of the compact may have

Total New York City Delaware Basin Storage

On January 25, 1994, storage in New York City's three in-basin reservoirs—Pepacton, Neversink and Cannonsville—dropped below the drought-warning line. If storage levels remained there for five consecutive days, the basin under the Commission's drought-management plan, automatically would have entered the drought warning stage.

However, substantial runoff into the reservoirs was expected in the spring from a massive snowpack that coated the upper basin. Taking this into account, the basin's drought managers agreed to add to the existing reservoir storage 50 percent of the difference between the estimated water content of the snow and ice and the long-term average snowpack water content. The spring melt came in late March, and by mid-April the three reservoirs were spilling.



had the winter of 1993-94 in mind when they drafted the document.

On the morning of January 28, the day streams and rivers in the lower basin jumped their banks and two days before the drought warning would have taken effect, the decree parties convened a telephone conference call to consider modifications to the Commission's drought operating plan.

Measurements of the existing snowpack had been taken. It was estimated that in the watersheds of the three reservoirs there were 70 billion gallons of frozen water, and there was also a large quantity of ice in the river downstream of the impoundments.

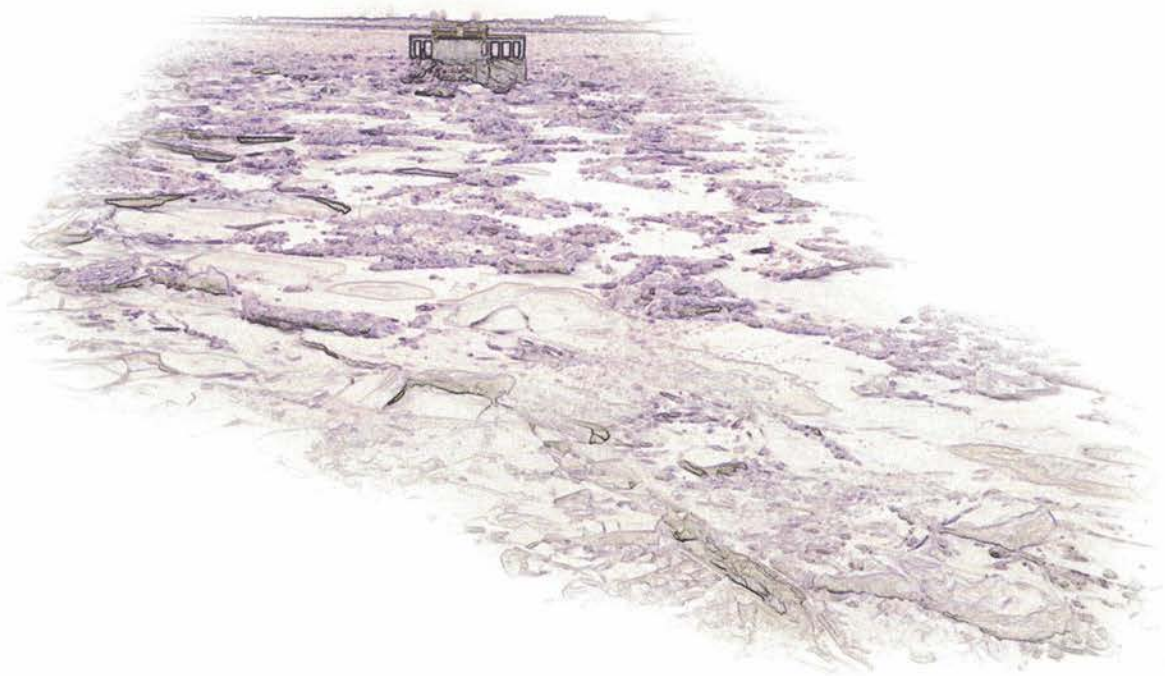
The parties agreed to add 50 percent of the difference between the estimated water content of the snow and ice and the long-term average snowpack water content to the existing reservoir storage. This raised the levels above the drought-warning line, as depicted on the reservoir storage chart on the opposite page.

The spring melt came in late March and by April 14 the reservoirs, which have a combined storage of 271 billion gallons, were spilling. In all, they had captured roughly 100 billion gallons of runoff over a three week period.

The snowpack was the largest in the last ten years, with a maximum water equivalent of 93.27 billion gallons being measured above the reservoirs on March 8. The table below shows the estimated reduction in peak flows at various points along the river due to the reservoirs capturing runoff.

River Points Measured	Estimated Reduction in Peak Flow
Trenton	1 ft.
Riegelsville	1.5 ft.
Montague	1.5–2 ft.
Callicoon	2 ft.

At Trenton, the peak flow of 75,600 cubic feet per second occurred on April 15, producing a stage of 16.3 feet. Without the reservoirs, the additional one-foot rise in the water level would have required road closures in lower Bucks County adjacent to the river.



Other Basin Highlights

Ice-Diversion Project Underway

The U. S. Army Corps of Engineers, Philadelphia District, has awarded a $969,000 contract to Avila Construction Co. in Columbus, N.J., to build an ice-diversion channel on a Delaware River island downstream of Port Jervis, N.Y. The notice-to-proceed was issued to the contractor on December 16, 1994. Construction is expected to be completed by the spring of 1996.

The project is designed to provide an escape route for ice and water backed up by jammed or anchored ice in the area of Thirsty Deer and Mashipacong Islands by selectively clearing trees within an existing natural overflow channel along the southeast side of Mashipacong Island.

Icy flood waters have caused damage along the Delaware in the past, especially in the Port Jervis area. In February of 1875 a massive ice jam broke loose,

destroying a major bridge linking New York and Pennsylvania. Another destructive ice flood occurred in the Port Jervis area in 1930, and in February of 1981 ice lodged against Mashipacong and Thirsty Deer Islands, creating a frozen dam. The river rose 14.5 feet in one hour, with huge blocks of ice floating over its banks, causing $15 million in damage and claiming one life.

As a result of the 1981 flood, the local communities, with the support of the Commission, requested through Congress that the Corps of Engineers conduct a study of the problem. The Commission later agreed to act as the project's sponsor after the Corps indicated that the creation of the ice-diversion channel on Mashipacong Island was environmentally sound and economically feasible.

In cooperation with the U.S. Fish and Wildlife Service, the National Park Service, and the New Jersey Department of Environmental Protection, the project

Michael Hogan

includes an environmental mitigation plan consisting of wetland improvements and the planting of trees and shrubs beneficial to wildlife on lands in the Delaware Water Gap National Recreation Area. The project's construction schedule also was modified to restrict tree-clearing activities to avoid potential impacts to wintering bald eagles and tree-roosting Indiana bats.

The project is being constructed under authority of Section 205 of the Flood Control Act of 1948, as amended. Under the terms of a Local Cooperation Agreement signed in July 1992, 75 percent of total project costs, estimated at $1.64 million, will be paid by the federal government and 25 percent by the Commonwealth of Pennsylvania, the State of New York, Matamoras Borough and Westfall Township in Pennsylvania, and the City of Port Jervis.

Annual maintenance of the project will be the responsibility of the three municipalities. The maintenance will consist mainly of continuing to clear trees greater than four inches in diameter.

Taking Out the Trash

The Delaware River is a big splash with tourists, attracting millions of anglers, campers, canoeists, and other fun-seekers each year. Unfortunately, some take their fond memories with them and leave behind beer and soda cans, tangled fishing line, candy wrappers, and other assorted junk.

Someone even dropped off a wheelbarrow, which was removed in 1994 along with tons of other litter during several cleanups conducted in the river's upper reaches by the National Park Service and private groups. Commission employees have taken part in recent years.

"Each year we feel like we've won the battle. In 1994 we felt like we were beginning to win the war," noted Ruth Jones, president of Kittatinny Canoes, a Delaware River livery that has spearheaded a litter patrol the past five years.

Ms. Jones observed that since the inception of Kittatinny's annual three-day "On and Under the Delaware River Cleanup," the amount of trash removed had increased each year until 1994, when there was a drop—18 tons removed, compared to 23 tons the year before.

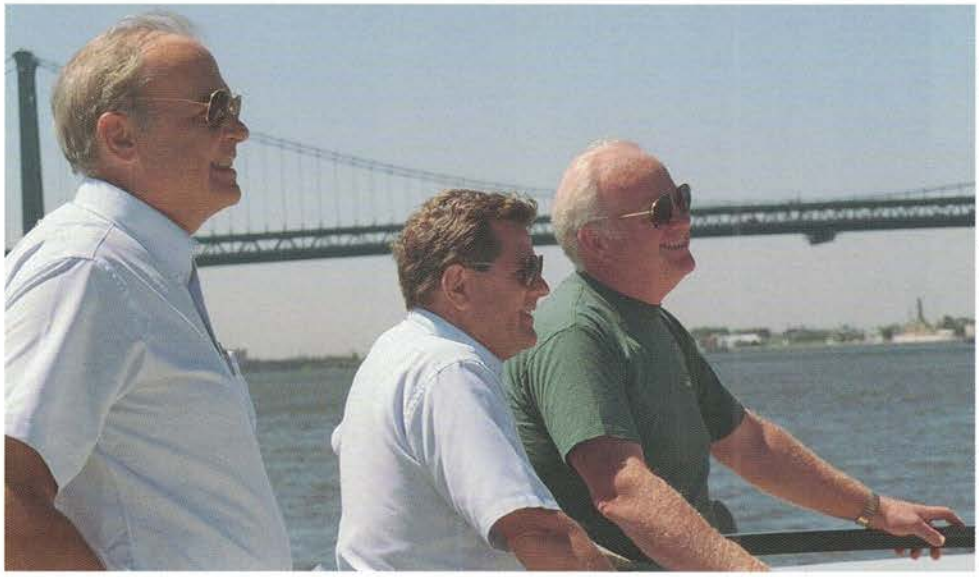
"A lot of this stuff has been around for a long time. This year we even removed parts from a car believed to be built in the 1920s," she said. "I think we're finally making a dent in this junk."

The Kittatinny cleanups attract hundreds of volunteers who work the river's shallows and banks from canoes while Scuba divers scour the bottom in deeper water for sunken objects.

In an effort to inject a little fun into what really

Robert J. Price, National Park Service

Discarded items, including tires, are inventoried during the 1994 Annual Litter Cleanup Competition sponsored by the National Park Service. The junk count took place at the Skinners Falls Access on the New York side of the Delaware River.



Chris Roberts

On June 22, 1994, the U.S. Army Corps of Engineers conducted an inspection tour of the Delaware River aboard the ferry boat Rainbow out of West Deptford, N.J. Taking in the sights are, left to right, Harold G. Budka, chief of the Water Quality Management Section of the New York State Department of Environmental Conservation's (DEC's) Division of Water; Acting Delaware River Master William E. Harkness; and Daniel J. Campbell, assistant director of DEC's Division of Water.

amounts to a lot of hard, dirty, but very satisfying work, Park Service staff of the Upper Delaware Scenic and Recreational River (UDSRR) compete for the amount of trash collected. They've been doing it for seven years.

Twelve teams, consisting of 30 Park Service employees (some on their days off), 11 summer youth employees, and 22 volunteers participated in the 1994 version of the Annual Litter Cleanup Competition. The top two teams won barbecued steak dinners, served up by the supervisor of their choice.

As in the past, the Park Service coordinated its efforts with Kittatinny's cleanup event to ensure that different sections of the river were covered.

A 26-mile reach of the river from Hankins to Ten Mile River was de-littered during the summer of 1994. Discarded material included 78 tires, an abandoned or dislodged eel weir, an automobile front seat, a washing machine motor, 55-gallon drums, and the wheelbarrow.

As part of an ongoing Park Service program, all metal, tires, cans, and plastics were recycled.

"We're committed to maintaining the water quality of the Delaware River, commented UDSRR Park Service Superintendent John Hutzky. "The Annual River Cleanup Competition is a fun way to help achieve this critically important goal."

"We're committed to maintaining the water quality of the Delaware River. The Annual River Cleanup Competition is a fun way to help achieve this critically important goal."

– John Hutzky, Superintendent, National Park Service

How I Wonder What You Are

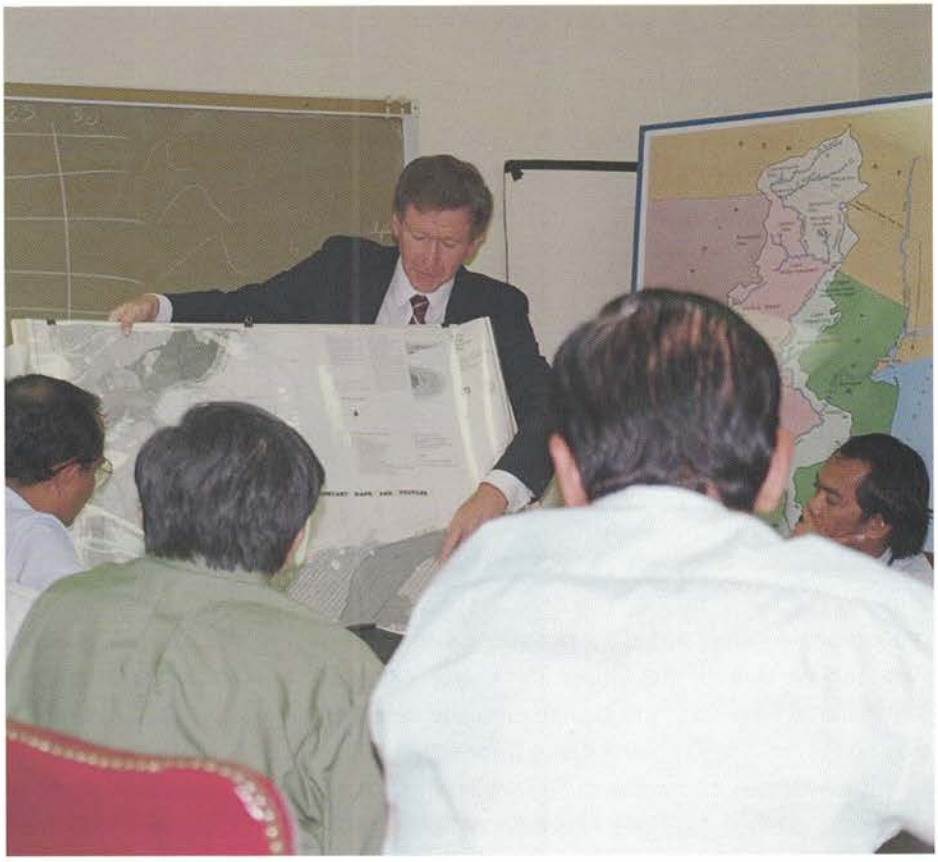
Ever wonder why up to a million migrating shorebirds stop off at Delaware Bay beaches each spring?

You can find the answer to this and other questions about activities in the Delaware Estuary, about water quality issues, about land-use management, aquatic and plant life, or maybe even about oil spills by ringing up the BBS.

This computerized Bulletin Board System is designed to enable users to query an index that lists a directory of data sources and provides the location of environmental information about the estuary–the tidal Delaware River and the bay. All you need is a personal computer, a modem, and a telephone.

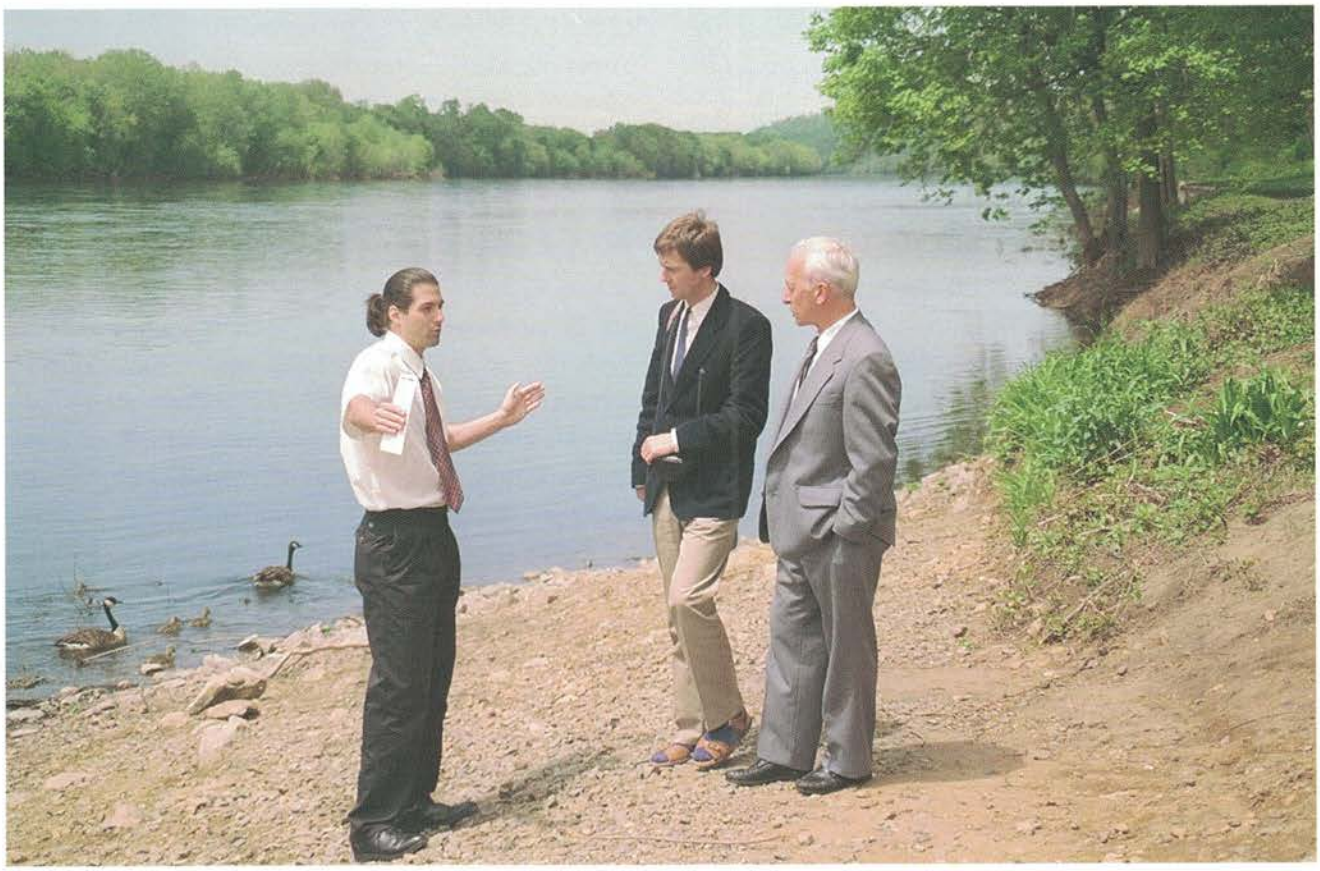
The data base is the brainchild of the Delaware Estuary Program, a component of the National Estuary

DRBC Water Resources Engineer Richard C. Fromuth explains the Commission's flood-loss-reduction program to a group of provincial water managers from the Republic of Indonesia during a two-day visit in May 1994.



Chris Roberts

Below, Andor Farkas (left) of Hungary, project leader for the World Wildlife Federation's Tri-Lateral National Park Project for the Danube River, discusses water-supply allocation issues with Dr. Richard C. Tortoriello, right, head of the Commission's Operations Branch, and with Miroslav Skarka of the Czech Republic, founder of an organization to manage the Moravka River Basin. The Commission also hosted a group of water resource engineers from South Korea during 1994, as well as an official from the National Rivers Authority in the United Kingdom.



Chris Roberts

Program established in 1987 to protect estuarine systems of national significance with priority management strategies. The Delaware Estuary Program selected the Commission in November 1994 to launch a pilot program to establish a Regional Information Management Service (RIMS), consisting of the BBS and data source index.

The one-year pilot program may be extended into a full-scale information system if it is determined to be of widescale use to the estuary community.

At year's end the Commission had hired a data manager, had selected a toll-free telephone number (1-800-281-RIMS) to access the system, and was working with other agencies to compile environmental information for inclusion in the data base. Plans called for the BBS to be programmed to relay messages to the data manager for help in locating data. A suggestion box connected to the BBS also will allow users to provide ideas on how to improve the system.

Protecting the Resource

One of the Commission's most important functions is the review of projects that could have an adverse impact on the basin's waters.

The Commission approved 90 dockets (permits) during calendar year 1994 for projects estimated to have total construction costs of $304 million. All docket action occurs during public hearings.

In reviewing applications, the Commission's Project Review Branch must assure that the projects comply with Commission policy and regulations and do not conflict with facilities previously included in the Commission's Comprehensive Plan. Often this requires on-site inspections and meetings with the applicant to clarify what conditions must be met for a project to receive favorable Commission action.

Once a project is approved, Commission staff may inspect the facility at any time to ensure there is full compliance. The Project Review Branch also reviews complaints from basin water users, usually well owners who contend neighboring Commission-approved wells are causing problems. It is Commission policy that if it can be demonstrated that the operation of an approved project "significantly affects or interferes with any domestic or other existing wells, the applicant, at its own cost, shall supply an alternate supply of water or other mitigating measures."

The Project Review Branch is headed by George Elias, a civil engineer. His staff consists of two geologists, a civil/environmental engineer, a technician and a secretary.

Types of Projects Requiring the Commission's Regulatory Review

- Construction of reservoirs
- Ground water and surface water withdrawals
- Diversion of water into or out of the basin
- Substantial flood plain encroachments
- Discharges to surface and ground waters
- Hydroelectric and other power projects
- Draining or filling of marshes or wetlands
- Construction or modification of wastewater treatment plants

Financial Summary

Statement of Revenues and Expenditures: General Fund

Year Ended June 30, 1994	*Budget*	*Actual*
Revenues		
Signatory parties:		
Delaware	$285,800	$285,800
New Jersey	548,100	510,000
New York	269,600	246,700
Pennsylvania	672,200	672,200
United States	511,000	484,750
Water Quality Pollution Control Grant	240,000	240,000
Sale of Publications and Sundry	40,000	21,291
Project Review Fees	115,000	78,221
Reimbursement of Overhead-Agency Fund	45,000	45,000
Fines and Assessments	15,000	10,541
Interest	60,000	101,336
General Fund Working Capital	83,800	0
Capital Designated for Special Projects	60,000	0
TOTAL REVENUES	**$2,945,500**	**$2,695,839**
Expenditures		
Personal Services	$1,707,000	$1,563,951
Special and Contractual Services	205,000	187,580
Other Services	71,600	71,353
Supplies and Materials	67,000	60,409
Space	200,500	133,079
Communications	54,000	38,628
Travel	28,000	20,838
Maintenance, Replacements and Acquisitions	112,500	64,058
Fringe Benefits	499,900	440,077
TOTAL EXPENDITURES	**$2,945,500**	**$2,579,973**
Excess of Revenues Over Expenditures	$0	$115,866
Other Financing Sources:		
Operating Transfers In	$0	$158,037
Operating Transfers Out	0	(204,237)
Net Transfers Out	$0	($46,200)
EXCESS OF REVENUES OVER EXPENDITURES	**$0**	**$69,666**

Financial Summary, continued

Schedule of Changes in Special Projects Advance/(Receivable) Balance–By Project

Project	*Advance Balances July 1, 1993*	*Cash Receipts (A)*	*Transfers*	*Expenditures (B)*	*Balances at June 30, 1994*
Advances:					
USGS Monitors	$14,712	$67,230	$72,167	($137,298)	$16,811
Groundwater–PA Protected Area	72,930	199,800	(117,109)	(155,621)	0
Upper Delaware Ice Jam Project	421,799	10,977	17,740	(53,658)	396,858
Delaware Estuary Project–PA	59,129	137,066	0	(161,270)	34,925
Comprehensive CSO Assessment	9,903	0	0	(9,903)	0
Toxics Study–PA	0	40,000	0	(31,004)	8,996
Salinity–U.S. Army Corps of Engineers	6,883	0	0	0	6,883
Subtotal Advances	**$585,356**	**$455,073**	**($27,202)**	**($548,754)**	**$464,473**
Accounts Receivable:					
Delaware Estuary Project–EPA	($181,647)	$643,221	$37,056	($640,766)	($142,136)
Comprehensive CSO Assessment	0	103,669	(30,234)	(95,201)	(21,766)
Toxics Management Study–PA and NJ	(121,406)	87,037	41,075	(108,734)	(102,028)
Dispersion Study	(2,800)	2,800	0	0	0
Estuary Salinity Model	(4,974)	0	0	0	(4,974)
Subtotal Accounts Receivable	**($310,827)**	**$836,727**	**$47,897**	**($844,701)**	**($270,904)**
TOTALS	**$274,529**	**$1,291,800**	**$20,695**	**($1,393,455)**	**$193,569**

(A) Cash receipts were derived from:

United States Government	$742,848
Commonwealth of Pennsylvania	454,787
State of New Jersey	8,050
State of Delaware	6,000
Interest	12,043
Third-Party Fees for Services	68,072
TOTAL	**$1,291,800**

(B) Expenditures were primarily for payroll costs and contractual services.

The records of the Commission are audited annually as required by the Compact.

Financial Summary, continued

Statement of Revenues and Expenditures–Capital Projects

Year Ended June 30, 1994	*Budget*	*Actual*
Revenues		
Commonwealth of Pennsylvania	$25,000	$25,000
State of New Jersey	2,000	2,000
Water Charges	1,400,000	1,604,763
Western Berks	20,500	21,683
Interest Income	230,000	235,258
TOTAL REVENUES	**$1,677,500**	**$1,888,704**
Expenditures		
Debt Service on Projects	$862,000	$861,143
Operation and Maintenance Cost on Projects	245,000	169,024
Administrative Cost	174,500	181,380
TOTAL EXPENDITURES	**$1,281,500**	**$1,211,547**
EXCESS OF REVENUES OVER EXPENDITURES	**$396,000**	**$677,157**

Note: Debt services and operating and maintenance costs are for the Beltzville and Blue Marsh Reservoir Projects. Payments are made to the United States Army Corps of Engineers.

Reports Published by the Commission During 1994

Findings of the 1993 Scenic Rivers Water Quality Monitoring Program and Stream Flow Rating Curves for Seventeen Tributaries

Delaware River and Bay Water Quality Assessment 305(b) Report

Delaware River Basin Commission 1993 Annual Report

Delaware River Basin Commission Water Resources Program 1994-1995

Water Quality Criteria for Toxic Pollutants for the Delaware River Estuary

Recommended Implementation Policies and Procedures: Phase I TMDLs for Toxic Pollutants in the Delaware River Estuary

Proceedings of the Upper Delaware Water Quality and Biological Monitoring Conference

Redesign of the DRBC/NPS Scenic Rivers Monitoring Program

Public Hearing Response Document, Special Protection Waters Non-Point Source Regulations

Project Guidance Manual for Special Protection Waters

Determination of Travel Time in the Delaware River, Hancock, N.Y. to the Delaware Water Gap, by Use of a Conservative Dye Tracer (Published Jointly by U.S.G.S.)

Longitudinal Dispersion of a Conservative Solute in the Delaware River, Hancock, N.Y. to the Delaware Water Gap.

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