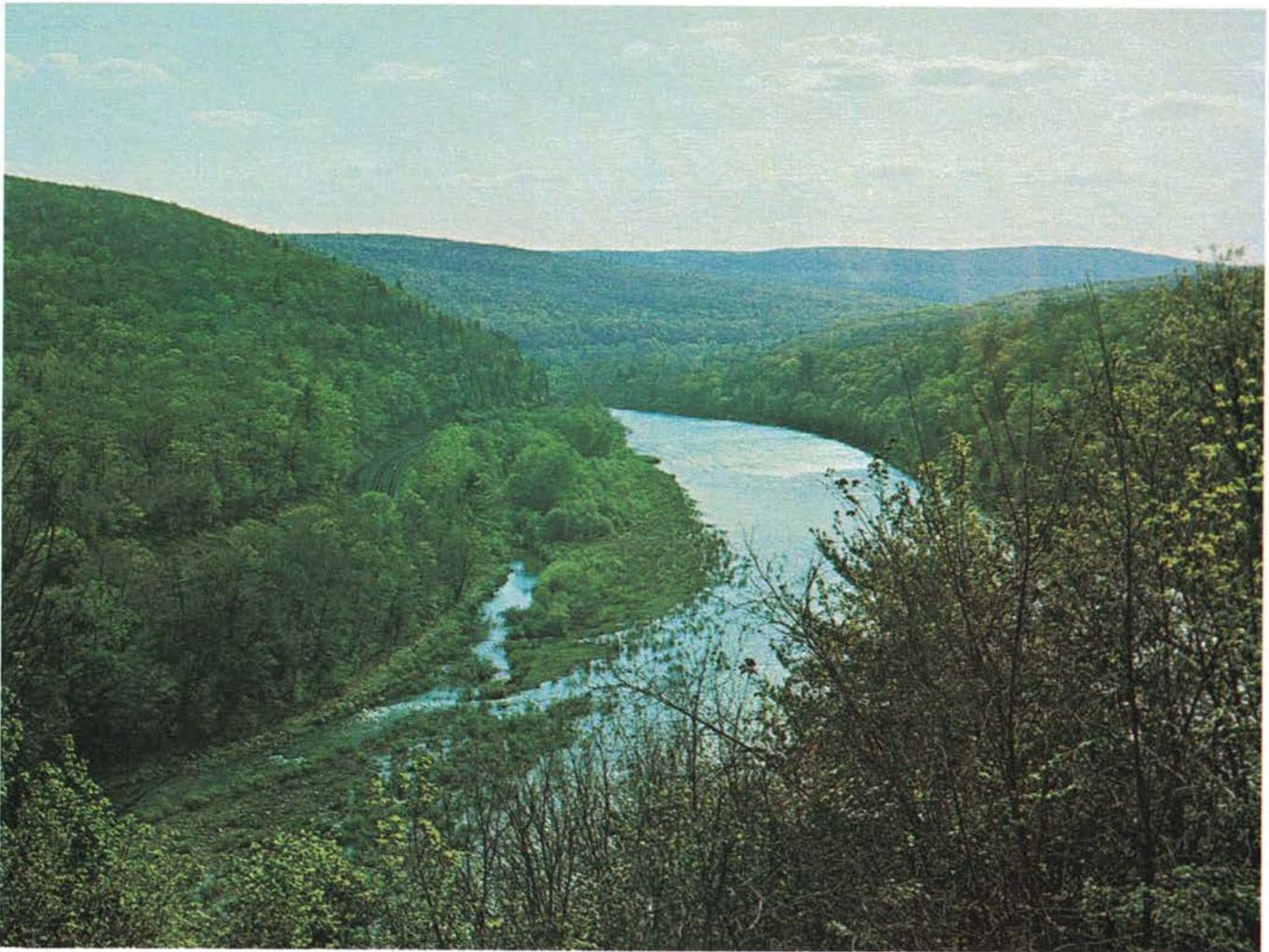


DELAWARE RIVER BASIN COMMISSION



Annual Report 1968



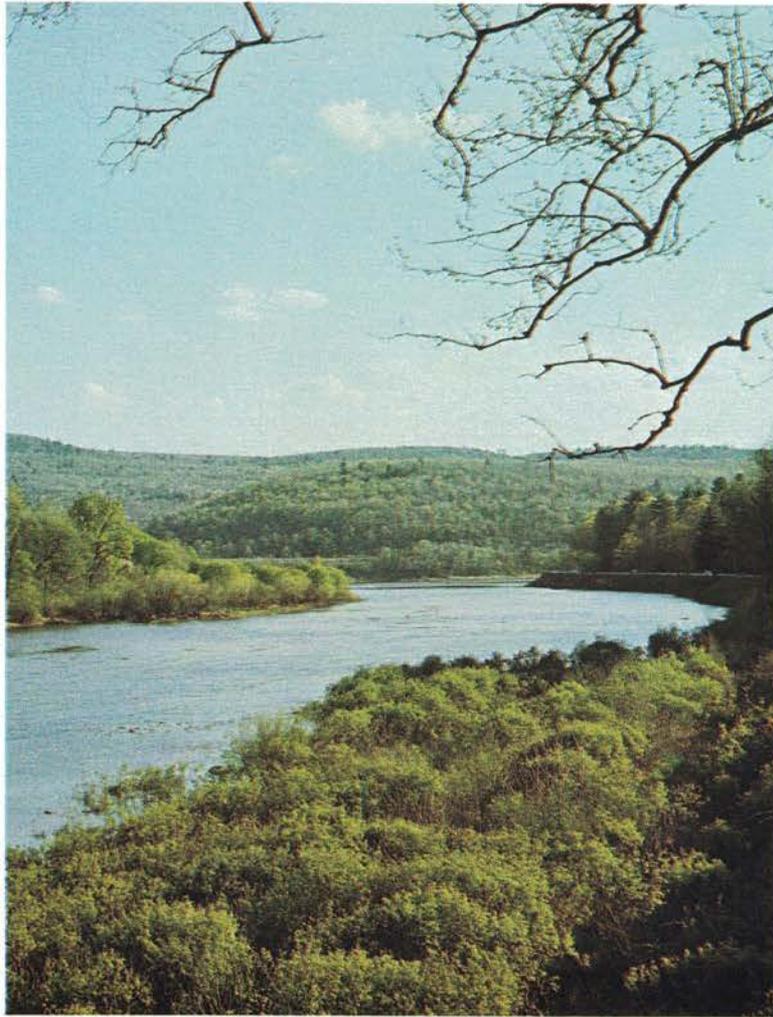
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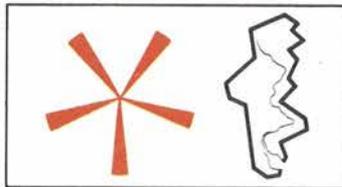
On October 2, 1968 President Johnson signed legislation establishing a National Wild and Scenic Rivers System. About 75 miles of the upper Delaware River from Hancock, N.Y., to Matamoras, Pa., and including the Pond Eddy, Pa., area shown here, will be studied for possible inclusion in the System.

Photograph by James M. Staples



Color photographs (left and opposite page) were taken in the Hawk's Nest area of the upper Delaware that is under study as a National Scenic River.

Introduction



This is the sixth annual report of the Delaware River Basin Commission, covering the year ending June 30, 1968. It is presented respectfully to the 7 million people of the river basin community, to their fellow citizens of Pennsylvania, Delaware, New York and New Jersey, and to their representatives in the four State Legislatures and in the Congress of the United States.

It relates the activities of the Commission in carrying out its assignment under the Delaware River Basin Compact to attain multi-functional development, balance and protection of the valley's resources for the benefit of the people and institutions that rely upon them. And it describes the management state of water and related natural resources of the 13,000-square-mile drainage area of the river and its tributaries — extending 265 miles from the ocean capes, across the coastal plain, through the rolling hill country above Trenton, and into the popular Pocono and Catskill Mountains.

Full recovery from the work-consuming drought of the 1960s having passed, the Commission's staff and program attentions were directed toward more productive efforts. This year's report reflects a predominance of pollution control activities — just as attention focused previously on the drought and other concerns. But droughts, floods, pollution, recreation, water supply and fisheries are deeply interrelated and work that emphasizes one is not to the exclusion of the others.

The uses and problems of water resources are many-faceted, and water is no respecter of political boundaries. Accordingly, the Compact supplies the Commission with multi-purpose flexibility and responsibility and with a geographic jurisdiction that is conterminal with the basin's natural borders. It is the Commission's hope that it is using these tools for effective resource management in the public interest.

The Commission 1968

Chairman
Stewart L. Udall*
U.S. Secretary of Interior

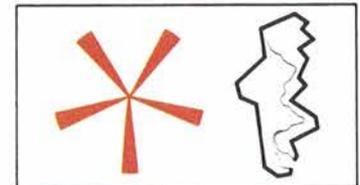
Vice Chairman
Nelson A. Rockefeller
Governor of New York

Richard J. Hughes
Governor of New Jersey

Charles L. Terry Jr.
Governor of Delaware

Raymond P. Shafer
Governor of Pennsylvania

*U.S. Member appointed by the President
Governors serve ex officio



Secretary Udall, Governor Hughes, Governor Rockefeller (standing); Governor Terry, Governor Shafer (sitting)

Alternate Members

Vernon D. Northrop	<i>United States</i>
R. Stewart Kilborne	<i>New York</i>
H. Mat Adams	<i>New Jersey</i>
Harold L. Jacobs	<i>Delaware</i>
Maurice K. Goddard	<i>Pennsylvania</i>



Mr. Northrop, Mr. Jacobs, Mr. Kilborne, Mr. Adams, Dr. Goddard

Advisors

Col. James A. Johnson	<i>United States</i>
Maurice M. Feldman	<i>New York</i>
Samuel S. Baxter	<i>Pennsylvania</i>

The Staff



James F. Wright
Executive Director

William Miller
General Counsel

W. Brinton Whittall
Secretary

Dawes Thompson
Public Information Officer

Arthur E. Peeck
Chief Administrative Officer



Mr. Wright (left); and Mr. Peeck, Mr. Whittall, Dr. Miller, Mr. Thompson

Planning Division

Herbert A. Howlett
Chief Engineer

J. W. Thursby
Staff Economist

John W. Kelley
Staff Biologist

Ralph Porges, Head
Water Quality Branch

Robert L. Goodell, Head
Operations Branch

Theodore Briganti, Head
Project Review Branch

C. H. J. Hull, Head
V. Stevens Hastings, Assistant Head
Program Planning Branch



Mr. Howlett, Dr. Kelley, Mr. Thursby (above)

Mr. Goodell, Mr. Porges, Dr. Hull, Dr. Hastings, Mr. Briganti (right)



1967-68 Review

Regional waste remedies pushed as pollution controls gain; Research and watershed management stepped up

The complex and painstaking job of keeping water pollution under control was dominant in the work of the Delaware River Basin Commission in 1967-68.

Not an end in itself, combatting pollution is a big factor in presenting the public clean water supplies and recreation and protecting fisheries and other resources. The 1968 pollution cleanup and prevention efforts thus responded to the Commission's multi-purpose obligations under the interstate-federal Delaware River Basin Compact.

U. S. Interior Secretary Stewart L. Udall declared that only the Delaware among the nation's river basins was moving into "high gear" in its pollution abatement program. He said this following the Commission's 1968 annual meeting at which important cleanup action was taken.

The year's pollution control work represented the opening efforts at attaining the water-use and stream-quality goals established in 1967 with adoption of comprehensive Standards for the four-state river system. Heaviest concentration was directed at upgrading without delay the troubled waters of the 86-mile Delaware estuary between Delaware Bay and Trenton. This effort was made possible in large part by the extensive investigation into the causes and effects of pollution by the Delaware Estuary Comprehensive Study of the Federal Water Pollution Control Administration.

The Commission blazed a new trail in the pollution abatement field with one of its moves. This was the introduction of a cleanup approach that gives each discharger in the estuary a computed fair share of the river's waste assimilative capacity.

During the year, three important steps were taken by the Commission to follow up enactment of the 1967 Standards. They were the adoption of basin-wide Regulations for implementing and enforcing the Standards, the assignment of wasteload allocations to each estuary discharger, and the establishment of a broad surveillance program to keep full-time check on discharger effluents and stream quality. (Separate sub-sections appear on each of those three developments as well as a summary of all water quality activities.)

Regional Waste Control

In the Compact's spirit of regionalism, the Commission in earlier years had acted on a number of large regional problems, including an interstate water supply package, adoption of the pollution Standards, launching a fisheries management program, combatting effects of a drought, and developing a basinwide Comprehensive Plan. This year the Commission focused on regionalism of another — but equally important — scale by initiating an all-out drive for regional waste collection and treatment within sub-basins of the Delaware valley. As the year ended, the way was cleared for adoption of a new policy under which the Commission could mandate regional waste systems or build and operate them itself. Even prior to the policy's adoption, the Commission registered some success in persuading communities to join with neighboring waste operations.

Secretary Udall New Chairman

Secretary Udall became the first Commissioner to serve as presiding officer for the second time under the custom of rotating the chairmanship among the five signatory representatives. He succeeded Governor Raymond P. Shafer as chairman at the March 1968 meeting in New York City. Governor Nelson A. Rockefeller is the 1968 Vice Chairman. Colonel James A. Johnson, the new Philadelphia District Engineer of the Army Corps of Engineers, took over from Colonel W. W. Watkin Jr. as Advisor to the United States Member of the Commission and Water Resources Commissioner Maurice M. Feldman of New York City replaced Robert D. Clark as Advisor to the New York State Member.



Col. Johnson



Mr. Feldman

General Lack's Death

General Norman M. Lack, who had been a key figure in working out the federal-interstate partnership as enacted in the Delaware River Basin Compact in 1961, died on April 26, 1968, less than a year after his retirement as Alternate Member from Delaware. In that capacity General Lack represented two governors on the Commission from 1961 to 1967. A frequent mediating influence on critical issues, General Lack also was credited with focusing Commission attention and action on some key matters.

Watersheds-Groundwater

A tenth program was added to the activities of the Planning Division to assure more concerted attention to natural resource problems faced within the scores of tributary watersheds that comprise the four-state basin. Preparations also were under way to expand the program for comprehensive development of the basin's rich groundwater resources.

Research

Research became a larger part of the Commission's operation than previously as several new studies got under way. Many of these are searching for new information on anadromous, resident and shell fish species and are part of the 10-year fisheries research program launched a year ago on recommendation of the Commission's Fisheries and Wildlife Technical Assistance Committee. Other research efforts are integral parts of the Commission's pollution control program, while still others concern collection of important hydrologic data. (This report contains a separate section on research.)

Recreation-Conservation

The Commission continued to promote orderly development of recreational resources throughout the basin. Its fifth Water Resources Program emphasized support for the Evansburg reservoir project in Montgomery County, Pa., Hackettstown reservoir in Northwest Jersey, Nockamixon reservoir and park in Upper Bucks County, Pa. and other joint recreation and water supply projects. It was engaged in exploration of means to protect Tinicum Marsh near Philadelphia International Airport. It was studying methods to minimize effects of a growing number of high voltage power lines that formerly have cut swaths in forests in or near lands dedicated to parks and recreation. It responded to demands that Sunfish Pond be left in its natural state and helped produce a plan to preserve the lake. It added to its Comprehen-

sive Plan two important new outdoor recreation facilities — the Philadelphia marina and a Bucks County recreation area on Prah's Island in the Delaware. To balance estuarine protection with continued growth, it began developing a long-range biological, pollution and land use planning program for the Delaware Bay area. And it had nearly finished the job of restoring the 130-year-old wing dams that will preserve one of the river's most thriving recreation "lakes" at Lambertville-New Hope.

Project Review

The Commission cleared for construction plans submitted by government agencies, commercial institutions and others for 185 water-related projects which were found after review — and some after modification — not to pose any harmful effects on the basin's resources. The statistics indicate the extent of continued economic and population growth in the Delaware valley and also increased awareness of the need for consolidated public waste facilities. Most numerous were the 75 industrial water supply operations, followed by 41 public water supplies, 29 public sewage works, several with regional tie-ins, and 24 industrial waste installations.

Reservoirs

Despite a general slowdown nationally on domestic civil works, construction of the Beltzville reservoir in the Lehigh valley progressed at full speed. And final preconstruction work moved ahead, but at a reduced rate, on the larger and better-known Tocks Island reservoir and Delaware Water Gap National Recreation Area. (A separate section appears on these projects.)

This was a year when the Commission was getting more deeply involved in matters stemming from these and other reservoirs that are either under construction, on the drawing boards or planned in the basin. Some of the matters posed by the reservoirs resulted in staff work on water supply pricing, identification of consumer areas, post-drought reevaluation of the basin's water crop, hydroelectric power investigations, protecting reservoir areas from contamination, adapting fish environment to dams and other changes, use of dam releases to combat pollution, and many others.

A break has occurred in the land acquisition problems that have delayed development of a series of flood control dams planned for years on upper Brodhead Creek, a Pocono Mountains watershed that suffered heavily in the 1955 flood. When built, the structures will protect an immediate area where nine persons died in that flood. Eventually, they will be part of a larger program, mostly flood protection, covering the whole Brodhead watershed. Stroudsburg and East Stroudsburg, on the lower Brodhead, enjoy protection by flood walls built since 1955. This overall federal-state-local program is part of the Commission's Comprehensive Plan.

Office Building

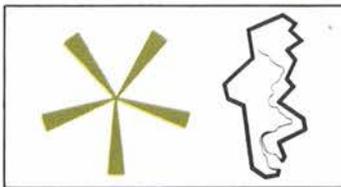
Preparations for developing the agency's own office building were begun as the State of New Jersey donated to the Commission a 4½-acre site a short distance from the Delaware River just outside Trenton. The Commission authorized the Executive Director to engage an architect to design a building to cost about \$650,000. Summer 1970 is the target date for completion. Growth of the Commission this year necessitated the relocation of its water quality branch operation from the agency's offices to other rented quarters two miles away.

Budget and Administration

The Commission's operating expenditures and encumbrances for fiscal 1968 totaled \$1,022,543, which supported the nine basic planning programs. This represented a spending increase of \$413,340 over the previous year, mostly to pay for stepping up the pollution control program. A \$2,000 capital expenditure went into a fund for future water supply.

The Commission also spent \$397,155 on special programs and projects not included in the regular operating budget. These were the Tocks Island Region Environmental Study, rehabilitation of the Lambertville-New Hope wing dams and the Tocks Island reservoir fluctuation-fish study. They are being financed by grants and revenue sources other than the regularly allotted state and federal appropriations.

At the end of the year, there were no vacancies in the authorized staff of 52. Eleven new positions were filled, nine of them in the water quality program.



The late Gen. Lack

Water Quality • Summary

The intensive program to implement the year-old Delaware River pollution code moved off the starting line in 1968.

The Delaware's headstart over other United States rivers in keeping pace with recently enacted national pollution control laws and programs means that many of the steps taken in the basin are firsts. One major step under way stands out. That is the innovation of equitably dividing the waste assimilative capacity of a river among those who discharge wastes to it.

In 1967 the four-state Delaware valley community, acting through its Basin Commission, cleared the way for the abatement stepup by adopting comprehensive pollution control Standards for the interstate river. The Delaware, heavily overworked and highly polluted in its urban-industrial tidal stretch from Trenton to Wilmington, was earmarked for extensive cleanup over the coming years. The Standards, in effect the pollution abatement law of the basin, established a combination of stream quality objectives and protected river uses including continued public and industrial withdrawals, improved fishery environment, and recreation (including water-contact sports) — all reconciled with continued use of the river for waste disposal under dramatically upgraded treatment levels. The Standards were approved by Washington in 1968 for their conformance with federal law.

The Standards will necessitate chopping daily oxygen demand by wastes discharged to estuary waters from present levels in excess of 1,000,000 pounds down to 322,000 pounds. Industries and communities now produce a daily raw load of 2,500,000 pounds, but treatment removal of organic material cuts this to about 1,000,000 before it is discharged to the river.

1968 Action

Two principal followup actions toward achieving the Standards' goals were pressed this year.

First came adoption of Regulations providing the blueprint for attaining the objectives. These include the assignment of the maximum allowable oxygen-consuming wasteload to each of four zones of the estuary — an 86-mile stretch reaching from the head of tide at Trenton to the upper end of Delaware Bay at Liston Point, Del., below Wilmington. The Commission's unanimous adoption of the Regulations at the annual meeting in New York City carried the weight of the personally-cast votes of the Basin State governors and the Secretary of Interior acting collectively as Delaware Basin Commissioners. (Governor Terry was ill and did not attend, but his concurrence was registered by Delaware's Alternate Member, Harold L. Jacobs.)

With adoption of the implementing Regulations behind it, the Commission's water quality staff turned to a critical phase in estuary cleanup — effecting compliance by individual polluters. (This phase is described in the sections on Allocations and Basinwide Regulations.)

Another major estuary water quality action during the year was the contracting with the three estuary states for surveillance and analysis of the estuary, its tributary waters and waste discharges along the tidal stretch of the river through an extensive sampling program.

As the year drew to a close, the Commission was preparing to enact an important long-range program to promote the consolidation of industrial and municipal waste collection and treatment systems within sub-regions of the Delaware Basin both in and outside the dynamic estuary area.

(Separate sections follow this chapter on discharger allocations, the water quality Regulations, the surveillance-sampling program and regionalization of waste treatment.)

Estuary cleanup under way; Udall, Governors restate Delaware commitment; Costs, timetable and community accord discussed

Community-DRBC Cooperation

It is the Commission's policy to settle on a cleanup program that combines effectiveness, economy and efficiency. So, as with its selection of Standards and the forging of implementing Regulations, the staff has consulted and cooperated with the estuary's industrial community and municipal dischargers in determining the allocations. Industries and communities, which have largely accepted the cleanup program, have been helpful in many efforts.

For example, the Commission staff sought and received during the year assistance and recommendations from industry and others on three key phases of the pollution abatement program — joint municipal-industrial waste treatment, financial incentives to cleanup, and seasonal variations in operation of waste treatment plants.

Timetable

At the time of adoption of the Standards in March 1967, the Commission envisioned an implementation timetable that would have had substantial numbers of dischargers in compliance with the high level treatment requirements within their zones by 1972. However, the effect of cutbacks in domestic expenditures on federal waste treatment grant schedules will present obstacles to many dischargers. Nonetheless, the Commission looks to the 1970s to bring a marked improvement in the estuary's water quality.

Under the Regulations, each discharger is submitting his own anticipated compliance schedule, which must be considered on its merits by the Commission staff.

Costs

The estimated cost — public and private — of upgrading treatment during the first 20 years, the period of sharpest improvement, is about \$500 million. When the Commission enacted its Standards in 1967, cost estimates for estuary abatement were \$245 million for this period, based on 1964 construction costs and pollution levels as used in the federal Study of the estuary. The present program encompasses a far broader spectrum of waste treatment and takes in more than twice the number of dischargers than the earlier package. It also reflects considerable general regional growth.

The estuary and each of its four zones has a limited assimilative capacity, so the constantly increasing raw load volume must be offset by higher degrees of treatment. Two of the new cost factors are keyed to this.

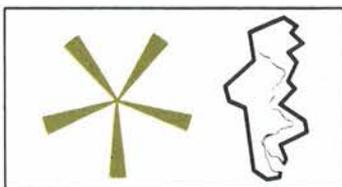
One will be \$140 million for new collection and treatment facilities and improvements necessitated by industrial, urban and suburban growth in the tri-state estuary region. Secondly, dischargers initially will have to treat at about 5 percent above the earlier requirements to compensate for additional raw loads, at an extra cost of \$49 million.

The cost of treatment by types of processes and for varieties of pollution not covered by the federal study will cost \$92 million. These include chlorination for public health, acidity-alkalinity control, instream aeration and debris control.

Commitment Reaffirmed

The Commission's policy commitment to the estuary cleanup — and its costs — was re-enunciated by Secretary Udall and the governors at the 1968 annual meeting.

Secretary Udall noted that the 1966 Federal Water Quality Act looks with "special favor on such river basins organized as the Delaware River Basin Commission" by providing 55 percent of the cost to qualifying municipalities in federal grants "to ease the pain a bit." About two-thirds of the estuary's waste load is municipal.

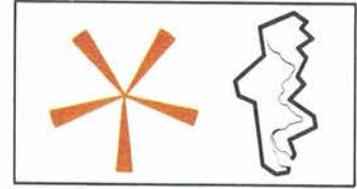


Water Quality Discharger Allocations

**Polluters must share river's waste consumption capacity;
Sharp load cuts ordered; Many contest allotments**

For the first time, the ability of a major river to assimilate wastes, in effect, has been divided among the communities and industries that discharge their sewage and liquid wastes into it.

This is an administrative device that represents a new approach to fair distribution of the responsibility for maintaining an acceptably clean natural resource — and of the privilege of using it for waste disposal under a legal doctrine known as equitable apportionment.



Here is how it works:

The Delaware River Basin Commission, thanks to the Delaware Estuary Comprehensive Study, was able to establish a broad set of stream quality objectives to upgrade the river, or preserve it, for a variety of uses. The Commission determined that present oxygen consumption by pollutants (carbonaceous oxygen demand) must be dramatically reduced, then divided the estuary into four zones, each having a share of the waste-accepting capacity. Finally, each zone's capacity was divided among its dischargers. Within each zone, all wastes must be treated to the same minimum degree for removal of pollutants, whether the municipalities and industries or their raw wastes are small or large.

In June 1968, 81 public and industrial dischargers with 92 plants were assigned a maximum permissible oxygen-consuming waste discharge allocation by the Basin Commission in an action concurred in by the estuary states of Pennsylvania, New Jersey and Delaware. Within the allotted 20-day deadline, 21 dischargers representing 24 plants had filed applications for hearings later this year on their allocations.

New Ground

The allocation of loadings on the Delaware is the culmination of a series of events and activities that represent the breaking of new ground in several aspects of resources management — in law, science, administration and enforcement.

Already, the waste load allocation device is being applied elsewhere. Pennsylvania and New York, both signatories to the Delaware Basin Compact, have moved to use it on rivers in other parts of those states.

At about the same time as the Delaware Basin Compact — the first and, to date, only federal-interstate river development treaty — moved toward enactment, federal authorities responded favorably to requests from the river community for a technical investigation of pollution's causes and effects in the lower river.

Employing computers, that Study's scientists devised a mathematical formulation of the Delaware estuary. Utilizing this model, they were enabled in short periods to collect and analyze technical data involving water quality that earlier would have consumed decades or more. Hence, forecasts of conditions of the river for each of scores of circumstances programmed for the computers were obtained quickly.

By the time the Study neared conclusion two years ago, the Basin Commission had tooled up to exploit the findings in the formulation of a massive cleanup program for one of the most technically complex tidal rivers with serious pollution problems.

The river mathematical model, an untested approach early in this decade, has now become a proven mechanism for application to otherwise unsolvable problems. Approved for accuracy and concept by both scientific and industrial independent authorities, the computerized river model is now a widely accepted device.

Without the speedy results produced by the Estuary Study, the Basin Commission would not have possessed scientific data critical to its administrative judgments on estuary, zone and discharger pollution matters.

The Estuary Study was geared to produce findings on a number of parameters, with emphasis on the most significant measure of stream pollution in a heavily developed area — stream oxygen content. Expansion of these results to encompass acidity and other forms of pollution also has been accomplished.

Water Quality



Pollution control Regulations were adopted by unanimous vote at Commission's 1968 Annual Meeting.

Basinwide Regulations

Procedures set on assuring water uses, controlling effluents; Nontidal streams protected

In March 1968, at its annual meeting, the Basin Commission adopted broad Regulations with procedures for implementing and enforcing the water pollution control Standards enacted a year earlier for the four-state river valley.

The Regulations were designed to control the quality of industrial and sewage effluent discharges and, in turn, protect the uses for which the river's waters — tidal and nontidal — were reserved by the Standards. Water uses to be protected are water supplies for municipalities, industry and agriculture; wildlife, fish and other aquatic life; recreation; navigation; and controlled waste disposal where compatible with the other uses.

Under the Regulations, stream requirements vary within the basin, with higher dissolved oxygen mandated in the estuary when anadromous fish make their runs and in trout waters. Other criteria on which limits are imposed include alkalinity-acidity, water temperature, phenols, odor, detergents, fluorides, turbidity, radioactivity and coliform.

The preparation, review, public hearing and revision of the document represented a major part of the water quality branch's work during the year.

Zone Waste Limits Set

While covering the entire interstate network of the Delaware and its tributaries, much of the document focused on the tidal estuary from below Wilmington to Trenton.

Principal provision of the Regulations was to cut daily oxygen consumption of wastes in estuary waters by two-thirds to 322,000 pounds in conformity to the objectives in the Standards. Here is the breakdown of the 322,000 pounds as limited to each of the four estuary zones:

- Trenton to Pennypack Creek in North Philadelphia (25 miles)—18,600 pounds.
- Pennypack Creek to Big Timber Creek, opposite South Philadelphia in New Jersey (13 miles) — 144,800 pounds.
- Big Timber Creek to Marcus Hook on Pennsylvania-Delaware boundary (16 miles) — 91,000 pounds.
- Marcus Hook to Liston Point, Del., where Delaware Bay begins (30 miles) — 67,600 pounds.

Under the Standards secondary treatment levels ranging initially from 86 to 89 percent removal of oxygen-consuming wastes will be required to keep organic wasteloads within the zone limitations. This compares to current average treatment levels of about 50 percent. During winter months, treatment efficiencies down to 75 percent will be accepted for short periods if temperatures drop enough to affect treatment efficiency without stream impairment.

The Regulations specify procedures under which human wastes must be disinfected to destroy disease-producing organisms.

Each discharger soon must submit to the Commission through his respective state pollution control agency an abatement compliance timetable, including engineering study, construction schedule and operating starting date.

Where standards set by any of the four basin states are more stringent than the Commission's, state standards will prevail, since the Regulations are designed to implement and enforce state requirements where they are higher.

Water Quality Surveillance

States are contracted by DRBC to sample and analyze streams as check on cleanup effectiveness, enforcement

Without an alert water quality surveillance and sampling program, effective administration and enforcement of stream pollution abatement is impossible.

In late-1967, the Commission established an extensive sampling operation with the three estuary states of Delaware, New Jersey and Pennsylvania to gauge the cleanup effort's effectiveness by keeping constant check on effluents and stream quality.

Under contracts with the Commission, the three states collect and analyze wastes from about 45 big industrial and municipal sewage treatment plants as well as the waters of 25 tributaries from Trenton to Delaware Bay.

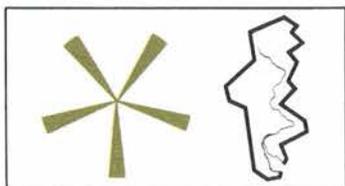
Also under Commission contract, Delaware's Air and Water Resources Commission is making weekly boat runs over a 75-mile stretch of the river from Reedy Island near Delaware City, Del., to Fieldsboro, N. J., taking channel samples at 17 points.

The boat runs are made in a 34-foot cabin cruiser, custom-built for the specialized work. The vessel must move at brisk speeds to permit collection of enough samples at slack water — the brief period of no water movement just prior to change of tide. It carries up to five members of the agency's staff doubling as crew and water technicians. Some tests are performed on board, with more to be added with installation of new equipment.

The cooperative work represents the first continuing, coordinated sampling-analysis program of the lower Delaware and its tributaries on a regional scale and regular schedule with standardized procedures, although other state and federal sampling has been conducted.

Samples are tested in state laboratories for a wide variety of pollution factors, including dissolved oxygen, temperature, acidity, turbidity, odor, bacteria, hardness, radioactivity, organic load, minerals, toxics and alkalinity.

The operation complies with a Delaware Basin Compact requirement that the Commission avoid duplication where state and federal facilities are available to perform necessary work.



Custom-built cruiser makes weekly runs over 75-mile reach of the Delaware estuary to collect channel water samples as part of pollution control surveillance operation.

Regionalism Policy

All projections point to continued growth in population, industrialization and spare-time activities in areas throughout the four-state Delaware River Basin. If pollution is to be controlled, there must be higher degrees of treatment as raw waste load volumes increase along a river system whose assimilative capacity is limited.

Technical efficiency and economy in waste collection and treatment thus are destined to become more vital than ever to the industries and communities that must bear the costs. It is a precept of the waste disposal business that both these advantages are best found through consolidated systems where there is a logical region to be served.

Some consolidated systems already are operating in the Delaware valley, notably Philadelphia's three separate regional operations and Wilmington's. However, the Commission has identified many additional regions as highly prospective candidates for regionalization, under which it may be possible to bring up to 100 major discharge points into perhaps a dozen separate high-efficiency operations.

In direct response to both the problem and the prospective sub-regions, the Basin Commission adopted, following public hearing which produced broad endorsement, a new policy under which it can require collection and treatment on a regional scale and itself finance, build and operate such facilities. (Adoption actually occurred shortly after the end of the 1968 fiscal year.)

Bolsters Abatement Drive

The regional policy represents an enlargement upon the basinwide pollution control Standards of 1967 and implementing Regulations of 1968. Also, its enactment foretells the Commission's utilization of its powers of financing and construction for the first time.

Under the policy, "the use of water pollution control facilities providing optimum combinations of efficiency, reliability and service area will be required throughout the Delaware River Basin to the maximum extent feasible." It further provides that the Commission, with its bonding powers, step into development and operation of such facilities "where other appropriate agencies do not provide such services."

Governor Shafer has said he hopes the Commission's bonding authority can be employed to finance vital regional facilities. He cited advantages in using revenue bonds supported by service contracts for large consolidated works and favored Commission bonding as a device to regularize the flow of federal grants into the basin for maximum early funding.

The Commission is to cooperate with and strengthen the hand of state officials in their efforts to secure conformance locally to a regional approach. Where the Commission enters the picture as an operator, it will contract to provide services to agencies, municipalities and industries.

Federal pollution grant programs, enacted and proposed, are geared to promote regional facilities.

Advantages of Consolidation

Commission studies show that per capita costs for building sewage plants for 500,000 people is only 60 percent that of a facility serving 50,000 persons and that the smaller system costs nearly twice as much to operate for each person served. Further, large central treatment facilities present less contro-

Centralized collection and treatment mandated for economy and efficiency; DRBC involvement seen

versity over site location, larger plants can better handle industrial discharges, sludge disposal is cheaper and easier, and large-plant handling reduces organic waste demands on the smaller streams.

The Commission will weigh these factors in determining if an applicant's project should become part of a regional system:

Building and operating costs for various size systems; capability of handling industrial wastes with and without expensive pre-treatment; ability to assimilate high peak flows and temporary shock loads or cope with emergency conditions; sludge disposal capability; transmission distance, land use and other site location factors, and the effects on receiving waters.

Some Regional Prospects

Steps toward developing a single system to serve a group of large and small dischargers on the New Jersey side of the river in Gloucester and Salem Counties are already under way. Preliminary regionalization talks also have developed among the Commission, the state and officials and industries of Delaware and Chester Counties in Pennsylvania. Also, Burlington and Camden officials have regional sewerage studies under way in their respective counties. Other possibilities along the tidal estuary include the Trenton area and Lower Bucks County.

Application of the new policy, however, extends far beyond the tidal stretches.

Lehigh and Musconetcong Rivers

Nontidal areas inviting examination for prospective use of the policy can be found along the Musconetcong River, a fast-growing area in Northwest Jersey, and on the highly-developed Lehigh River in Pennsylvania.

From its inception, the Commission had encouraged sponsors of new waste treatment operations to set up regional facilities with their neighbors, but such efforts often were frustrated by late arrival of project review applications and absence of a strong formal policy. It is now required that any agency or industry must submit plans to the Commission for review upon completion of preliminary engineering.

Tocks Island Region

One nontidal area where a regional waste effort got under way in advance of adoption of the new policy is the string of six counties in three states surrounding the Tocks Island reservoir and Delaware Water Gap National Recreation Area. In the face of these projects now in development, the area's present good water quality environment can be protected only by early preventive work.

The three-year Tocks Island Region Environmental Study (TIRES) was initiated in 1966 with cooperation of federal, state, regional and local government agencies with interests and responsibilities in the region. It has entered its final year and soon will produce recommendations for a waste-water collection and treatment system from among five alternative networks under study. The recommended system logically could be built and operated by the Commission under the scope of the new regionalization policy.

Research

Investigations progress to aid in fisheries, water supply and pollution control work

Essential to any sound policy formulation in water resource management is the accumulation of reliable and complete scientific and statistical information. A good deal of the effort in the Commission's planning and program activities goes into time-consuming research and its evaluation. This work is performed by the Commission staff and through contractual arrangements.

Much of the research activity is linked with the Commission's basinwide pollution abatement effort. A large part also deals with the complex biological problems involved in sustaining a healthy fishery in areas where dam construction, waste discharges and other activities of man tend to alter the natural aquatic environment. Some of this work, too, touches on water quality. Still more research and data collection involves perpetual updating of available facts on precipitation, groundwater and runoff, all vital to effective resource management. The fisheries activities largely fall into the 10-year program adopted last year on recommendation of the Fisheries and Wildlife Technical Assistance Committee:

Following are 11 of the fact-finding projects under way:

Tocks Island Fishery

The water level of the Tocks Island reservoir would rise and fall several feet daily under a utility-sponsored pumped-storage electrical generating proposal for Kittatinny Mountain. A Commission biological research team is using four specially built two-acre ponds near the mountain to determine if fish spawning would be inhibited by the fluctuations. After a year of study, no noticeable harmful effects turned up in these preliminary findings:

One hundred adult sport fish (bluegills, pumpkinseeds, and rock and largemouth bass) were put in the waters of each of a group of fluctuating and non-fluctuating ponds for comparison of the nesting results. In the fluctuating water, the fishes built their nests safely beneath the lowest water level, avoiding locations sometimes left out of water. No significant difference in the number of nests was found in either type pond, and large numbers of healthy juveniles were produced in both. In addition, 1000 fathead minnows were placed in each pond as food for the game fish, and they too avoided nesting in the fluctuating water zone. Next year, non-nesting species will be tested.

Advanced Waste Treatment

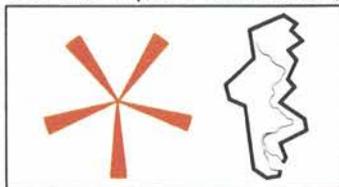
The pursuit of breakthroughs in advanced waste control techniques to improve efficiency and economy is especially vital to the Delaware and other bodies of water with severe pollution problems. The Commission is studying the feasibility of design, construction and operation of a 100,000-gallon per day model of a regional treatment plant to shed light on the problems of handling an unusual variety of wastes.

Nitrification

Another process that consumes Delaware estuary oxygen in large quantity is nitrification. The Commission's estuary cleanup is now geared largely to treatment of the carbonaceous but not nitrogenous content of waste discharges to the river. The Commission, looking ahead to controlling this type discharge, has contracted with Hydrosience, Inc., of New York to evaluate the nitrification process with respect to quality standards and future treatment requirements. This will involve a computerized model of the river.

Bristol Oxygen Sag

Drops in water dissolved oxygen content are usually readily traceable to biological activity spurred by heavy organic waste discharges, as in the Delaware around South Philadelphia. However, an oxygen sag that occurs in the river each summer in the vicinity of Burlington-Bristol has the experts concerned,





Commission biological research team nets sport fish from specially-built pond near Delaware Water Gap in study of effects on fishes' spawning from reservoir fluctuating water levels.

since the waste load there is not heavy enough to cause the dip. A study into the cause of this sag therefore has been launched by the Commission's water quality branch.

Watershed Quality and Supplies

Waste loadings along the Delaware's principal tributaries for the coming 30 years were projected to provide knowledge needed to plan future flow dilution and reservoir storage. This information will be used in a program to alert local areas up and down the Delaware to the water quality and supply problems they face unless they join in or undertake preventive action.

Estuary Tributaries

A biological pollution research program scheduled for completion in 1969 is investigating the fish and plant environment in 45 Delaware tributaries on both sides of the tidal stretch of the river from Trenton to the ocean. This work has the dual purpose of determining the effects of the tributaries on the river and providing a yardstick for measuring future changes in tributary quality. The study is similar to one published this year by the Commission and Pennsylvania on the Lehigh River that found a close correlation between pollution and poor fish environment.

Shad

A broad investigation into Delaware shad migration problems was begun with explorations by field crews comprising the study's federal coordinator and state biologists. Spawning was observed and eggs and juveniles were netted. A considerable number of juveniles were collected this summer, but total production appeared below that of prior years. Sportfish and commercial catches above Trenton were disappointing. Plans developed for an anadromous fisheries laboratory near Lambertville staffed by the coordinator and other biologists. The program will be expanded in 1969.

Plankton

In an effort to more adequately understand the biological condition of the Delaware River, the Commission has contracted with the Philadelphia Academy of Natural Sciences to inventory plankton (microscopic floating plant and animal life) between Trenton and Easton. The abundance and types of these organisms are important biological indicators of the health of the river, and the findings will be a help in monitoring and evaluating the impact of pollution and other stream alterations.

Fish-Temperature

Still in progress was a three-year project to establish the water temperature tolerance of four fish species (striped bass, shad, blueback herring and white perch) and how varied levels of pollutants, oxygen and salts affect them. The tests are being conducted at Rutgers University in tanks simulating conditions in the river.

Basin's Water Yield

In its final stages is a cooperative study initiated last year to reevaluate the long-recognized "reliable" water yields of the Delaware watershed in the wake of the 1961-66 drought experience. Since the Delaware, with a relatively fixed water crop, inevitably will be confronted by demands of continued growth in population and industrial production, accurate available water knowledge is essential.

Streamflows-Runoff

The Commission and U. S. Geological Survey are cooperating in a "runoff" data collection and analysis program under which the natural streamflows for 40 years — back to the 1920s — are being compiled to provide an uninterrupted record for predicting yields available from reservoirs and any other stream regulation work. Flows are being tabulated at 240 locations in the four-state basin, then adjusted to compensate for dams and other manmade interferences.

Two Major Reservoirs

Beltzville in construction stage; Tocks Island project, including park, moves ahead

Extensive benefits are in store for the Delaware Basin and its neighboring areas from two federal multi-purpose reservoir projects on which work is progressing. They are Beltzville, on a Lehigh River tributary, and Tocks Island, on the Delaware River.

This marked the second year of construction work by the Army Corps of Engineers on Beltzville, the more advanced project, located northwest of the Allentown-Bethlehem area.

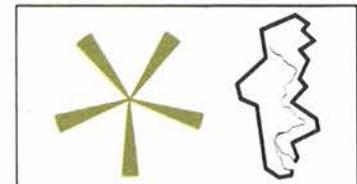
Massive earthmoving and construction activity is under way at Beltzville as work moves ahead on the dam embankment, intake tower and spillway excavation. Road relocations were completed. Diversion of Pohopoco Creek, the water source, through the outlet works is scheduled for Spring 1969, while completion of the job is set for the summer of the following year. This is a flood protection, water supply and recreation project.

Tocks Island Activities

At the site of the larger Tocks Island dam, to be built five miles upstream of the Delaware Water Gap, final planning and engineering work nears completion in preparation for start of construction in fiscal 1970, depending on fund availability.

Besides bringing the first national recreation area to the Eastern United States, this complex facility will provide flood protection which would have reduced greatly 1955 damages on the main stem. It will also add a major water supply source for growing metropolitan areas served by the river, permit regulation of river flows to approach year-round stream uniformity and help control salinity and pollution downstream, and, in addition, could help meet the region's expanding energy needs.

The latest preparations at Tocks Island by the Corps involve extensive geological explorations to determine rock composition at the outlet works and spillway locations on the New Jersey bank. This entails blasting and digging a horizontal 5-by-7-foot tunnel 700 feet into Kittatinny Mountain and four



Looking upstream through area where Beltzville dam is being built in the Lehigh valley, photograph (left) shows work progressing on intake tower and spillway. View from New Jersey side across Delaware River at southern tip of Tocks Island (right) pictures location of 160-foot-high dam which will be erected to create 35-mile-long reservoir.



vertical holes to depths of 289 feet into which geologists will be lowered in cages to make their observations.

To date, more than \$10 million has been spent or committed for land purchases in the Delaware Water Gap National Recreation Area, choking off land speculation activities. Purchase of the damsite is getting under way. The National Park Service has placed into operation a visitor information station on the Jersey side of the Water Gap and is building two other visitor areas across the river. The park will be well into operation in the early 1970s and the dam will start backing up the 35-mile lake in 1975, three years prior to scheduled final project completion.

Despite problems the reservoir and park encountered in Congress early in 1968 over cost escalation and speculation about effects on shellfish, appropriations were approved for both phases of the project to proceed. Also, the Delaware Valley Conservation Association, a group mainly of local residents set up to fight the project, lost a federal court appeal for reinstatement of its suit to have the entire Tocks Island development abandoned.

Both multi-purpose projects are major features of the Comprehensive Plan of the Basin Commission, which acts as a central coordinator during development to assure balance of all project phases and will participate in the projects' operation as part of a basin management program after completion.

Small Watersheds

New program readied to apply basinwide management concept on local scale; Urged by private groups

The Delaware River, stretching 330 miles from the Atlantic Ocean to Hancock, N.Y., is the product of scores of tributaries reaching into four states. Ranging from tiny creeks to the large Lehigh and Schuylkill Rivers, each in turn is created by its own tributaries and so on. This adds up to a vast gravity network of thousands of small-to-large, uninhabited-to-crowded drainage areas that make up the 13,000 square-mile Delaware Basin.

Any natural sub-basin viewed in terms of benefits it can produce or problems it can pose for those who use or live in it is regarded as a local watershed. This in reality is a small-scale river basin with a similar range of natural resource considerations — water supply, recreation, flooding, pollution, fisheries, soil conservation, wildlife and related land use.

The Commission in 1967 added to its planning functions beginning in 1968-69 a new program on local and regional watershed management and engaged a watershed planner with experience in the Delaware Basin to staff the effort. Addition of a small watersheds program to the Commission's technical operation was urged by the Water Resources Association of the Delaware River Basin, whose series of special reports to the Commission helped in the design of the program, and by the Delaware River Watersheds Association.

Applying its influence and skills as a multi-purpose agency, the Commission aspires to promote comprehensive natural resource programs in local watersheds. It will seek to interweave the activities of the many single-purpose agencies working on water-land matters at local-to-interstate levels, and assist and advise the many private watershed associations that have been organized in the basin. It will promote formation of others where they are needed.

Basinwide Benefits Seen

By guiding many local watersheds toward multi-purpose development in preference to more limited uses, the Commission would promote, in effect, good management of a series of sub-basins functioning for the benefit of the entire basin.

Here is an example of how the Commission could exercise leadership:

Federal-aid programs require local initiative for development of flood protection works in small watersheds. Where these facilities would protect communities outside the watersheds in which they are built, the Commission could represent the interests of downstream beneficiaries.

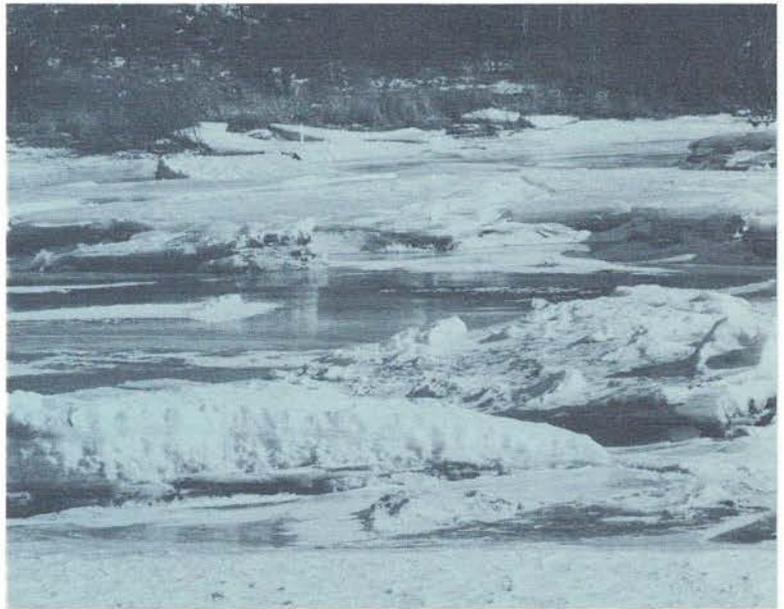
An early responsibility under the program is consulting with appropriate agencies to develop a watershed comprehensive plan encompassing, among other things, existing and planned local developments under the federal Watershed Protection and Flood Prevention Acts. Typical of such programs are those on the Brandywine and Neshaminy Creeks in Pennsylvania and Assunpink Creek and Paulins Kill in New Jersey. The plan also will incorporate studies, such as those in progress on the Musconetcong River in New Jersey and Schuylkill River in Pennsylvania, and projects by state and other authorities, such as the Nockamixon State Park and reservoir in Pennsylvania.

Early priority tasks include establishing working contact with local planning agencies and other public and private groups and taking inventory of conservation problems by watershed.

Groundwater Program

The Commission retained the services of a noted consulting hydrologist to assist the staff in its groundwater program. He is investigating the status of existing groundwater knowledge in the basin, the need for additional information, and procedures for needed management and control of the groundwaters.

Some sections of the basin, particularly the coastal plain, have extensive groundwater supplies with large development potential. Most upland areas have less abundant supplies. In both sections, more specific information is needed on these resources' location, conduct and available yields, including facts on possible waste and salinity intrusion, effects of overuse, and effects of groundwater use on surface supplies.



Sustained sub-freezing conditions early in 1968 produced this rugged but beautiful view a short distance below Barryville, N.Y., on upper Delaware.

River Conditions

Heaviest precipitation since 1960 brings first full year of recovery from drought

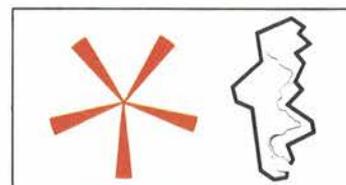
The 12 months ending June 30, 1968 marked the first full year of recovery from the prolonged and record drought of the 1960s.

Only four months after the Commission formally terminated the drought emergency in March 1967, the year covered by this report commenced in the midst of a long period when levels of precipitation, streamflows and reservoir storage were back to normal — or better. The year began and ended with reservoirs overflowing, and its precipitation total of 50 inches was 11 percent better than the long-term average in addition to being the heaviest in seven years. Dilution from heavy flows in Fall 1967 helped improve the quality of water in the polluted estuary below Trenton.

Severe cold weather of January to March brought about picturesque freezing conditions, especially in the mountainous upper basin. This meant a drop for that period of flows, but they were replenished by the spring thaw.

Average flows in the Delaware at Trenton were not quite up to the long-term normal, but this was because precipitation went largely to recharging groundwater levels, which finally were healthy again after years of spotty readings.

Two dry spells early in 1968 brought dips in streamflows (new lows were recorded for two dates in April at Trenton) but were followed by quick recoveries. There was some flooding of Pennsylvania and New Jersey tributaries in May and June, but damages were light.



"Save Sunfish Pond"

Lake's preservation was assured in power scheme fight;
Alternative plan debated



Artist's rendition shows Sunfish Pond preserved in natural state. Alternative plan to using Pond for generating power pictures other reservoir, built larger than planned earlier, behind forested dike.

A small lake that was virtually unknown until the mid-1960s and even unseen except by hardy hikers of the Appalachian Trail has exploded into a symbol of the battle between 20th Century "progress" and natural splendor preservation to the cry of "Save Sunfish Pond."

The lovely 44-acre lake, which developed into a vocal issue at an August 1967 public hearing, sits 1,080 feet high atop Kittatinny Ridge just west of Blairstown in Warren County.

The battle developed over the proposed use of the pond as an upper reservoir in the expanded Kittatinny Mountain pumped storage generating system of three New Jersey electric utility companies. Under the plan, Sunfish Pond would become one of two new mountaintop reservoirs added to a third one nearby that has been operating since 1966. Land for all three was acquired by the companies from New Jersey. Kittatinny Ridge was found to be an attractive pumped storage site in the Army Engineers' report on Delaware valley project needs in 1960. (Upper and lower reservoirs are needed for exchange of water to produce energy for peak-demand hours by pumped storage.)

The volume and intensity of concern over Sunfish Pond's future at the 1967 hearing resulted in an immediate directive by the Basin Commission that the utilities search for an alternative to using Sunfish Pond. The 1967 hearing involved an amendment in the Commission's Comprehensive Plan to redefine the pumped storage authorization at Tocks Island reservoir. The utilities would make use of water at the Tocks Island dam, to be located just below Kittatinny Ridge on the Delaware River, in a manner not now included in the Commission's Plan.

Alternative Plan Disclosed

The new studies indicated that Sunfish Pond could be left undisturbed through construction of the other new upper reservoir with higher dikes or by covering a wider area than planned earlier, in either case compensating for the loss of storage in Sunfish Pond.

Staff contended a suitable alternative arrangement could be achieved while preserving the prospective substantial public benefits from the project. The project could make available low-cost electrical power to pump Delaware River water from the basin for use in Northeast Jersey, and similar arrangements could benefit areas in Pennsylvania. Also, the collection and treatment of sewage and industrial wastes could be made less costly to industry and the basin generally from cheaper energy available through the project.

The Commission staff said it would press for a rigid set of conditions and restrictions, in addition to a flat prohibition against using Sunfish Pond, if the utilities' application were approved, including protection of the pond's watershed, restoration of landscape in keeping with the natural environment, minimum disruption of the surroundings even during construction, underground installation of transmission lines and the water tunnel, payment by the utilities for fish studies or remedies necessitated by the hydro-power installation, and operation of the pumping and generating system in accordance with Delaware River flow schedules and other management procedures.

The Lenni Lenape League, key group in the opposition to disturbing Sunfish Pond, indicated it would oppose even the alternative plan, criticizing the Commission for its stress on economic benefits to the basin.

At the close of fiscal 1968, key issues involving the project and Sunfish Pond were still unresolved: The Commission had not acted on the redefinition of the Tocks Island project, which it must do before the pumped storage proposal can be decided upon. Nor had the final outcome become known on a New Jersey legislative proposal, already approved by the House, to reacquire from the utilities Sunfish Pond and other land on the ridge. In addition, a change in the federal authorization of the Tocks Island project could be necessary to permit the pumped storage development.

Lambertville-New Hope Dams

Work ending on rebuilt structures in bistate project to preserve a lake-on-the-river

This year brought assurance that future generations will continue to enjoy the 130-year-old lake-on-the-river that helps make the New Hope-Lambertville area a popular outdoor recreation and tourist attraction.

Reconstruction of the 19th Century wing dams that back up the busy recreation pool neared completion as the report year ended, with work scheduled to be finished in Fall 1968.

The dams were built originally to create the pond from which water was pumped into the branches of the old Pennsylvania and Delaware-Raritan Canals, which still parallel both sides of the river through the area.

Later employed for industrial power, logging and barging between the canals, the pool gradually came to be used almost exclusively for recreation as its older values became outdated. Eventually, the dams fell into disrepair from decades of neglect and exposure. Parts of the New Jersey wing washed away.

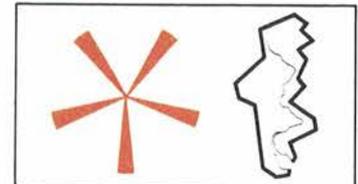
The Delaware Valley Protective Association spearheaded a drive for restoration of the dams in recent years and gained widespread civic support. At the Basin Commission's 1965 annual meeting, Governor Richard J. Hughes of New Jersey and then-Governor William W. Scranton of Pennsylvania announced that the Commission would supervise a bistate restoration project on the dams.

A preconstruction study indicated that loss of the "lake" might mean a drop from \$3 million to \$1 million in waterfront property values and a corresponding tax yield drop, but that direct recreation benefits alone might exceed the cost of restoration, if the dams were rebuilt.

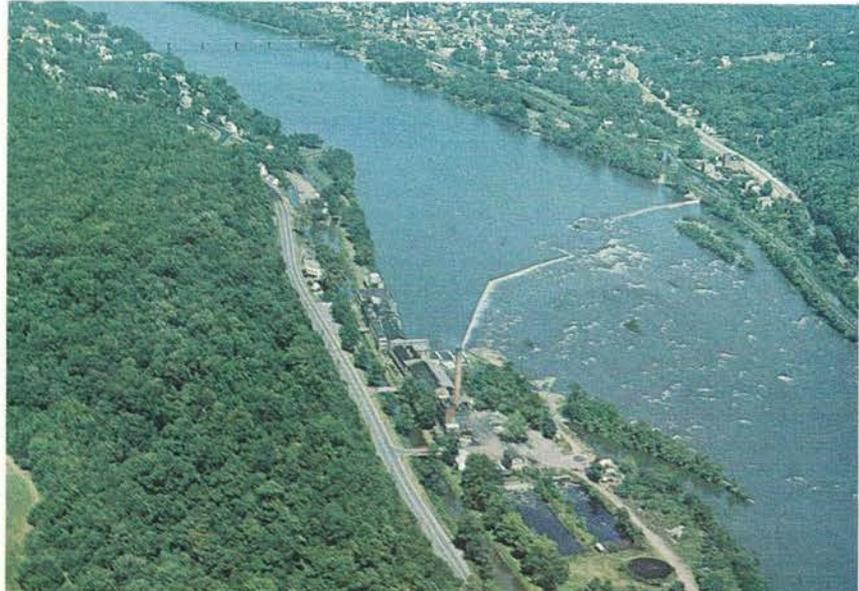
Work began in 1967 on the \$395,000, two-year restoration project, administered by the Basin Commission.

Reconstruction of the dams to a higher elevation than before will restore the old recreation pool for swimming, boating, skiing and fishing. Also, the free-flowing midstream river passage is being narrowed from 450 to 300 feet.

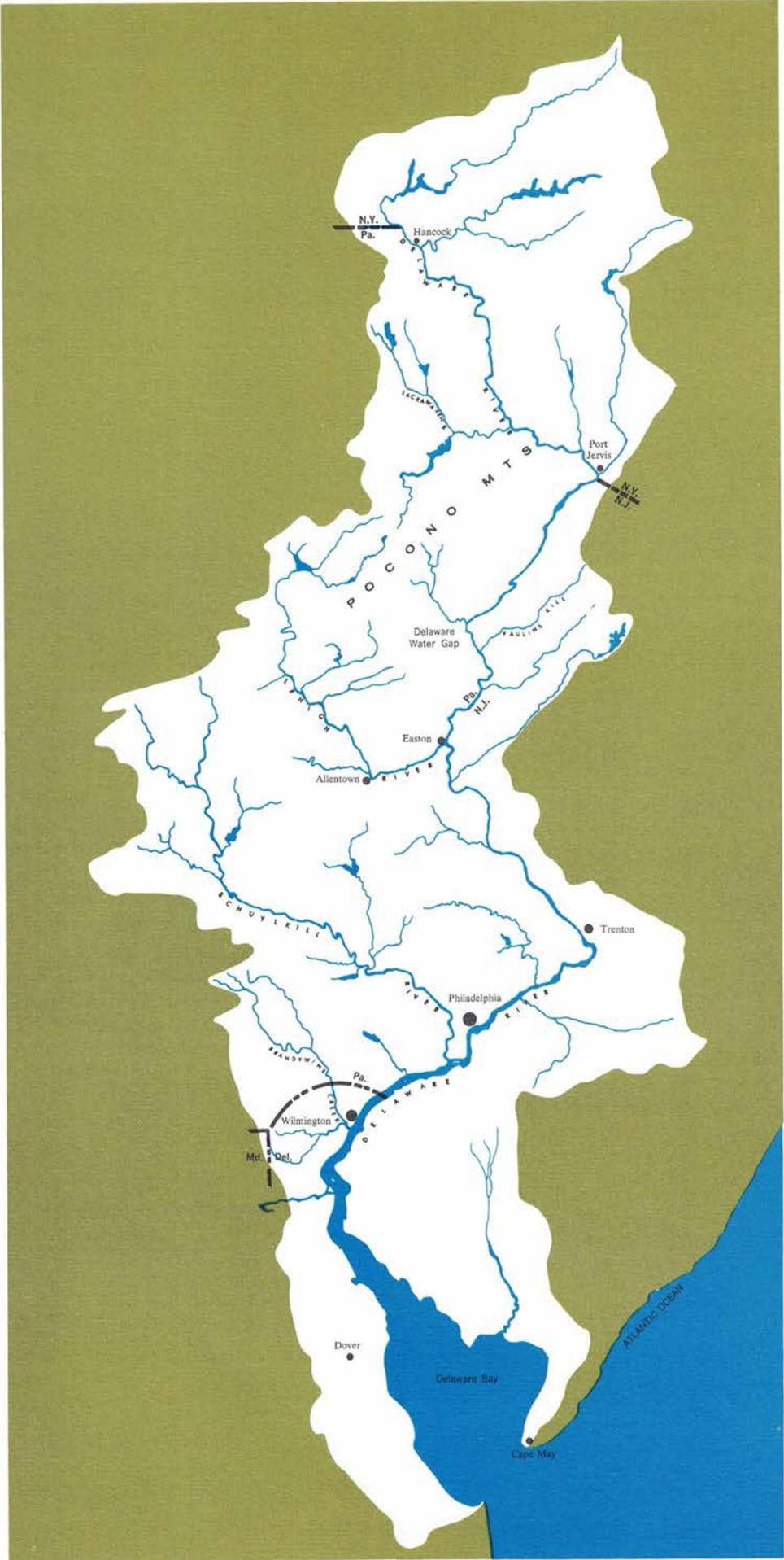
Engineers report that less frequent flooding after construction of the Tocks Island reservoir on the upper Delaware will cut wing dam maintenance costs. Also, stream regulation from Tocks Island will produce a more uniform pool depth behind the wing dams.



BEFORE AND AFTER — 1966 photograph (lower left) reveals disrepair of wing dams after decades of neglect. Color picture shows reconstruction nearing Fall 1968 completion.



Delaware River Basin



Financial Summary

Budgetary

1968 REVENUES

Budgeted	Received
Delaware 58,000	58,000
New Jersey 233,500*	233,500*
New York 192,500	192,500
Pennsylvania 238,500*	238,500*
U. S. 134,000	134,000
Public Health Service Grant 250,977	250,977
Miscellaneous 1,500	2,005
Working Reserve 0	0
TOTAL 1,108,977 505**	1,109,482
1,109,482	

By Organization

By Program

WATER SUPPLY	56,000	73,001
WATER DEMAND	65,000	30,598
RECREATION	31,000	42,615
POWER	39,000	32,595
PROJECT REVIEW	143,000	90,968
WATER QUALITY	547,977	439,085
COMPREHENSIVE PLAN	140,000	200,634
FLOOD LOSS	12,000	7,816
BASIN OPERATION	73,000	72,632
TOTAL	1,106,977	989,944
Capital Program	2,000	2,000
Excess Appropriations over Expenditures	—	117,033**
GRAND TOTAL	1,108,977	1,108,977

1968 EXPENDITURES

Appropriations	Expended
Directorate 142,337	158,748
Administrative Division 103,129	110,350
Planning Division 861,511	720,846
TOTAL 1,106,977	989,944
56,000	73,001
65,000	30,598
31,000	42,615
39,000	32,595
143,000	90,968
547,977	439,085
140,000	200,634
12,000	7,816
73,000	72,632
TOTAL 1,106,977	989,944
2,000	2,000
—	117,033**
1,108,977	1,108,977

*Includes \$1000 appropriation for Capital Budget

**Unencumbered balance allocated as follows:

- (1) To support Fiscal 1970 Budget—112,600
- (2) Transferred to Working Reserve—4,538

The records of the Commission are independently audited each year as required by the Compact.

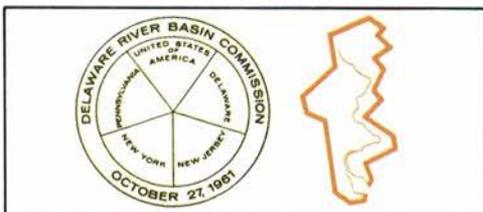
Non-Budgetary

	Funds Available	Expenditures	Unexpected Dedicated Allotment
Tocks Island Region Environmental Study	113,883	72,451	41,432
Wing Dam	480,472	282,556	197,916
Tocks Island Fish Research	127,715	42,149	85,566
TOTAL	722,070	397,156	324,914



This covered bridge, at a site to be flooded by the Beltzville reservoir, will be relocated over a small stream in the project's Twinflower Recreation Area.

Color photography by James M. Staples and Leigh Photographs



Delaware River Basin Commission
25 Scotch Road • Trenton, N. J.

