



WRRC REPORT No. 4
WASHINGTON, D.C. 20008

annual report

JULY 1, 1973 TO JUNE 30, 1974



WATER RESOURCES RESEARCH CENTER



ANNUAL
REPORT

July 1, 1973 - June 30, 1974

Water Resources Research Center
Washington Technical Institute
Washington, D. C. 20008

August 1974

The work upon which this document is based was supported in part by the Office of Water Resources Research, U. S. Department of the Interior, under the provisions of Public Law 88-379, as amended.

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I. SUMMARY STATEMENT

This document comprises the first report covering a full year of operations for the center. Efforts have been devoted mainly to establishing the center as an entity developing advisory groups and other external relationship, and pursuing projects as funds have become available from various sources.

The tremendous growth which the District and the surrounding metropolitan area has experienced in the past several years has caused a corresponding increase in the need for public services and facilities. Among the more critical of these currently not meeting the demand are the ones relating to water uses-particularly for water supply, waste disposal, and recreation. The Potomac River and its tributaries are essentially the only surface water courses presently available to the District for satisfying its water resources needs.

The District covers a relatively small geographic area, 64 square miles, of which 12 percent is under water. Hence, its problems are intimately interwoven with those of the neighboring jurisdictions in Maryland and Virginia, and the solutions to these problems must necessarily take into consideration the entire metropolitan region. Needs for new knowledge and new tools are many and varied. Not the least of them are the institutional arrangements bearing upon the planning, managerial, financial, regulatory, and other policies.

Organizational matters continued to be of prime concern during this first year. Two advisory groups were appointed before the start of the Fiscal Research Year-- the Advisory Council and the Technical Evaluation Committee. Each of these had several meetings during the year to establish the organization and functions of each one, review programs and projects, and generally become more closely involved in the affairs of the Center.

The role of the Center and Washington Technical Institute in solving the water resources problems of the area are slowly emerging. One important result has been the development of relationships which, hopefully, will effectively knit together the District's Academic Community in efforts directed toward solution of these problems. A representative from each of the academic institutions serves on the Technical Evaluation Committee.

The Center was excluded from the basic allotment provided to nearly all other centers under the initial Allotment Program funding for FY 1974. However, an allotment of \$10,000 was provided in June 1974 from Allotment Program funding released by OMB at that time.

Two projects, funded by the Department of Environmental Services of the District of Columbia, were completed and Reports published. In addition, three projects funded in whole or in part by the Office of Water Resources Research were initiated and/or pursued during the Fiscal Year. These projects are discussed below.



Figure 1. - RESEARCH ADVISORY COUNCIL, Water Resources Research Center

Left to Right: Mr. C. C. Johnson, Jr., Father J. P. Whelan, Mr. R. A. Canham, Mr. C. Spooner, W. C. McKinney, Dr. B. H. Alexander, Mr. P. V. Freese, Ms. A. T. Harris, Dr. C. L. Dennard (President, WTI), Mr. D. Geller, Mr. W. E. Trieschman, Mr. P. W. Eastman, Mr. L. F. Bohraus, Mr. R. C. Palange.

II. PROJECT ACTIVITIES

"An Assessment of the Use of Potomac Estuary Waters and AWT Effluents for Emergency Water Supply.(Funded by the District of Columbia Department of Environmental Services.)"

The Washington, D. C. area is experiencing continued Resistance from public and, private sectors to the development of upland dams to supply future metropolitan water needs. A result of this resistance is a heightened interest in the exploration of alternatives, one of which is direct or indirect reuse including the use of the Potomac estuary. This project was designed to study and evaluate the reuse of treated wastewater and of estuarine waters for domestic consumption, through the examination of laws, regulations and attitudes, both in the United States and abroad.

Previous studies are very cautious and guarded about direct reuse for domestic consumption. However, these studies give the impression of endorsement of reuse for domestic consumption, conditional upon additional research to insure safety and reliability. It was found that professional and lay opinion would generally weigh against direct reuse of wastewaters regardless of the adequacy of treatment and monitoring practices. Furthermore, only one significant instance of direct reuse is discussed in the literature. Indirect reuse is practiced in many locations and appears to be feasible for Washington.

The contrast between what constitutes direct or indirect reuse is clear in some cases, but not very distinct in others. Nevertheless, although the definition of indirect reuse is very vague, it apparently is not as onerous as direct reuse, and it is officially tolerable and at least marginally acceptable from a public health standpoint. This is a matter of necessity in the U. S. as indirect reuse is basically an existing condition in many densely populated regions.

The report presents guidelines for establishing criteria for safeguards in reusing estuary waters. Until viral and bacterial measurement techniques are improved, physical chemical monitoring is suggested to use for decisions concerning operating criteria. Such criteria would include: free chlorination, turbidity control, ammonia monitoring, pH adjustment, and high energy mixing at the point of chlorination followed by high contact time. Other specific concerns are addressed such as acute and chronic toxicity, storm water overflows, and public relations.

A report has been prepared on this project, and is available for distribution.

Evaluation of the Use of Pricing As a Tool for Conserving Water (Funded by the District of Columbia Department of Environmental Services.)

Present water consumption patterns indicate that there is a need for more rational pricing policies and practices for water services. The objective of this study was to determine the effectiveness of adjusting water prices to conserve the use of public water supplies in the domestic, commercial and industrial sectors. Although the project was primarily a literature survey on pricing as a tool for conserving water, a number of interviews were conducted with water suppliers in selected areas of the United States, as well as with all the major water suppliers in the Washington Metropolitan Area. Empirical data were also gathered on historical state structures and consumption patterns in the Washington Area.

The study showed that, historically, the economics of Water supply has been oriented toward the provision of low cost water to consumers, with very little thought given to pricing principles and policies which could govern the efficient use and development of municipal water resources. Although this has not been a serious problem in the past, the problem is becoming increasingly important with the growing competition for existing water supplies by all users.

The Washington Metropolitan Area data showed that price increases do have an impact on reduction of water consumption. An analysis of these rate increases indicated that twelve out of eighteen rate increases resulted in per capita consumption decreases. The study also showed that the water demand in the Washington Metropolitan Area is price elastic, i.e., sizeable price increases are necessary to effect a much smaller reduction in consumption. Consumption reductions, however, were only temporary in nature.

The report proposes the use of demand management through price policy as a tool for rationing the existing supply. There is conclusive evidence that demand curves For industrial, agricultural, and some domestic uses are significantly price elastic, which means that rational pricing could reduce the consumption of water absolutely for a consumer or cause a shifting or reallocation to a more efficient use. A two-part rate structure

is also proposed in order to cover the off-peak winter period and the summer peak, period. The winter rate should be on an increasing block rate schedule, with the summer period having a peak load rate surcharge in addition to the normal winter rates.

The report points out that although water pricing would be an effective means of reducing water use, it should be used in combination with other measures. Foremost would be an effective public information program to encourage conservation. Other means would include modified plumbing fixtures and codes, water reuse/recycling, water use restrictions, and leak detection and correction.

A report was prepared on this project, and is available for distribution.

"Identification and Analysis of Critical Water Problems Facing District of Columbia and its Metropolitan Area and Determination of Essential Research Requirements." (Grant No. 1431-0001-9080, Project No. X-136, Office of Water Resources Research.)

The objective of this project was to (1) determine the major water-related problems in the District of Columbia Metropolitan Area and alternatives for solutions; and (2) identify the research that is needed to assure reasonably certain prospects for resolving the more significant of those problems in a cost-effective and timely way.

In order to focus attention on these problems a Symposium titled "Water Resources Needs Facing the District of Columbia" was held at the Washington Technical Institute on June 20, 1974. The Symposium brought together, both as speakers and audience many of the area's leading administrators whose decisions bear directly upon the filling of the water resources needs of this area. The speakers covered a variety of subjects, including the planning and implementation of state water resources programs, legal and technical problems in achieving water quality goals, U. S. Corps of Engineers water resources planning, and urban runoff problems.

A number of research areas were delineated by the speakers, including the following:

- (1) Criteria for establishing the role of member political jurisdictions in a multi-government situation. Such criteria should cover the

planning, financing, and construction of water resources projects, and should apply to both surface and ground waters.

(2) Solutions for dealing with interstate issues, which will remain valid despite political changes in any given situation. This should include new and improved regulatory approaches and techniques for enforcement of required measures, given the existing political jurisdictions and situations. Methodology for assuring adherence to established regional plans and priorities were also cited as a need.

(3) New standards and criteria for determining water resources needs, directed toward strengthening existing project justification processes.

(4) Criteria and methods for providing more substantive and effective citizen involvement in the decision-making process.

(5) New or modified measures for meeting short-term deficits in water needs, cover the legal, technical, and economic factors.

(6) Evaluation of ground and estuarine waters as potential sources for augmenting existing supplies. This should include potential health hazards (viruses, pesticides, etc.), dependable yields and related aspects, as applicable.

(7) Investigation of methods for reducing total water consumption.

(8) Effects of social, political, and economic mechanisms and factors on water quality standards.

(9) Improved methodology for operation and maintenance of water supply and wastewater disposal systems including sludge disposal, land application, and storm water runoff.

(10) Application of computer technology to analyze proposed changes in land use and to predict the environmental effects of such changes.

(11) New approaches and methods for control of erosion siltation and urban runoff. These should include, but not be limited to, the following:

- Dimensions of the problem and the basic causes.
 - Effect of sediments on stream quality.
 - Soil erosion control at urban construction sites and land undergoing development.
 - Control measures, such as on-site-detention, applicable at the point of origin.
 - Fate of urban pollutants subjected to impoundment.
- (12) Monitoring and information feedback procedures designed to be more responsive to the needs of the decision-maker.

These are, of necessity, broad categories that reflect the needs as expressed by the speakers of the Symposium. They are not intended to exclude other research needs which are known to exist.

The presentations and discussions at the Symposium will be included in a Proceedings document to be issued in early FY 1975.



Figure 2: Meeting of the TECHNICAL EVALUATION COMMITTEE, Water Resources Research Center.

Starting at end of table, at left and moving clockwise: Dr. M. W. Champ, Dr. B. T. DeCicco, Dr. T. T. S. Yang, Dr. C-L. Yen, Mr. H. C. Ways, Mr. R. C. Palange, Mr. D. R. Bates, Ms. M. Reff, Dr. Y. Gordon, Mr. R. B. Perry, Dr. A. J. Jones, Dr. J. E. Feir, Mr. F. M. Middleton. Dr. W. J. Thaler

“Survey Ecology, and Systematics of the Upper Potomac Estuary Biota: Aufwuchs Microfauna. Phase I”. (Grant Agreement No. 14-31-0001-4149, Project No. B-002-DC, Office of Water Resources Research)

This is the first phase of a proposed study to accurately identify to species and quantitatively study the microbiota of the Upper Potomac Estuary prior to the projected 1977 improvements in treatment plant effluents. The current project was initiated in January, 1975 and is due to terminate in December 1975.

In this first year, the aufwuchs microfauna are being collected at monthly intervals at five midriver sites located at points 3-1/2 miles apart between Roosevelt Island and Piscataway Creek, at up river sites at Key Bridge and Little Falls, and at the final sedimentation tanks of the Blue Plains Sewage Treatment Plant. These are shown in Figure 3. Inverted plastic petri dish bottoms (60 x 12 mm) are being used as the principal aufwuchs collection

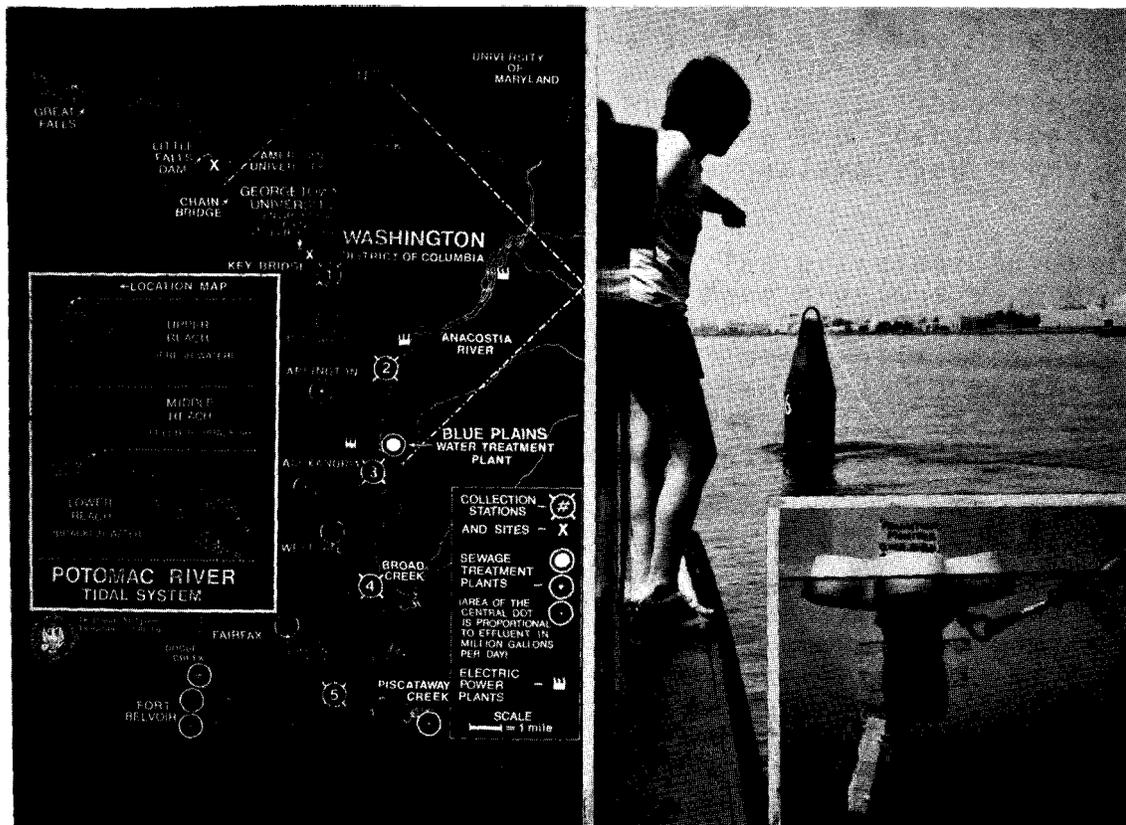


Figure 3. - Potomac River location map and photograph of sampling location No. 3. Right panel shows Ms. Lizina Lee, graduate student assistant, pointing to Coast Guard buoy at sampling point. Note side view of sampling float at lower right, with hook to buoy line.

substrata. When capped, these serve as water-filled chambers for counting and identifying the collected aufwuchs.

Biotic data are being compared to the extensive monthly abiotic data collected at these same sites by the EPA Annapolis Field Station. Links in the food webs will be constructed using direct observation, predator-prey numerical studies, microcompression of digestive chambers, and radioisotope tracer methods. Identification aids will be prepared.

Major goals will be the differentiation of the abiotic and biotic controls on population numbers and species diversity, and determination of the seasonal changes in species diversity and species dominance in these aufwuchs communities.

The sampling device consists of a float, shown in Figure 4. with cover slides attached to serve as surfaces on which the organisms attach themselves over a period of time, usually a month. The device is then brought to the laboratory for counting and identification of the organisms, and other processing.

The principal investigator had done previous work on the Potomac River in 1970 and 1971. Thus, the preliminary data from the first six (6) months of the current project can be compared to previous results, and the changes noted.

In terms of overall diversity prevalence, and biomass, peritrichs appear to be the most important group of organisms in the aufwuchs microfauna of the upper reach of the Potomac River.

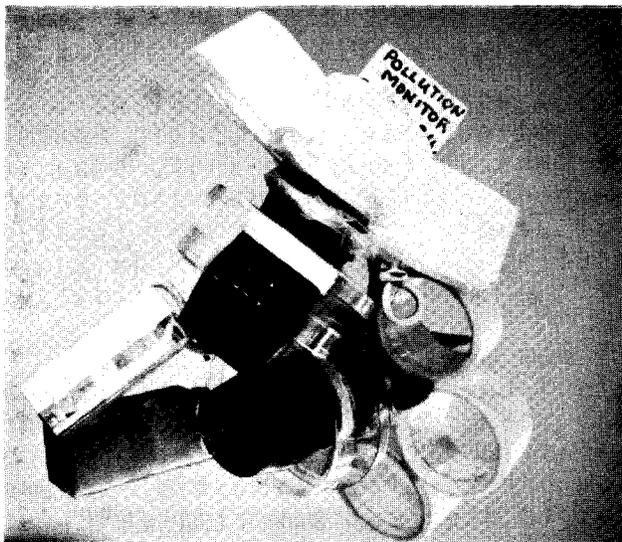


Figure 4. - Sampling float (mirrored) with ring of six sections of Styrofoam cups holding six plastic petri dish bottoms, below it the top of a petri dish and bottom protecting 6 pairs of back-to-back covers clips held inserted in slices in a cup bottom. The float is held together with wire, weighted with rubber stoppers. It carries a slide box with one side cut away and containing 12 plastic and 12 glass cover slips. Cellulose foam is wedged between the Styrofoam cup sections.

Below Blue Plains, the floats in the river are usually completely covered with peritrichs. These serve as food for rhabdocoel worms (*Stenostomum* and *Macrostomum*), oligochaete worms (*Chaetogaster*, certain chironomid arve, pulmonate s.nails, notommatid rotifers, suctoria such as *Tritho hrya epistylis* which

eat peritrich migrating eat peritrich migrating telotrochs, and holotrich predators such as Trachelius ovum, Amphileptus, and Lacrymaria, and Presently the suctorian iophrya rotunda, and related species dominate in the entire upper reach of the Potomac River. In 1970, they were found only above Roosevelt Island. Their coming to dominance has coincided with the disappearance of scores of other suctorian species.

In 1970, suctoria were absent from below the Blue Plains Sewage plant, believed due to chlorine, low DO, heavy metals, or some other physical or chemical conditions. Now, it has been found that Paranema trichophorum can easily eradicate Heliophora erhardi from cultures. Thus, it is postulated that the conditions which favor this flagellate allow it to eliminate the suctorian.

In the summer of 1970 and 1971, site 3 below Blue Plains was dominated by peritrichs and their predators such as Chaetogaster and Chironomus. This summer, the same site had many different chironomids, gammarids, pulmonate snails, suctoria, testate amoeba, diatoms, rotifers and many species of grazing ciliates. In 1970, this was the type of recovery fauna at stations 1 and 5. This indicates a significant improvement in the indicator community.

The Principal Investigator is Dr. Donald M. Spoon of Georgetown University, Washington, D. C.

"Feasibility of Alum Sludge Reclamation" (Grant No. 14-31-00014052 Project No. A-001-DC, Office of Water Resources Research)

The Blue Plains Wastewater Treatment Plant, serving a major portion of the Metropolitan Washington Area, is presently undergoing extensive expansion and upgrading. Alum is receiving major consideration for use in the removal of phosphates. Sludges containing high concentrations of alum are presently discharged from the Dalecarlia Water Treatment Plant, also serving a large part of the Metropolitan Washington Area.

The purpose of the project is to explore the possibility of utilizing the alum in the waste sludges from Dalecarlia at the Blue Plains Plant. If a successful technique can be developed, considerable economic benefit could result. The total alum used at Dalecarlia, if recovered or otherwise made available, would supply about 25 percent of the needs at Blue Plains. It is expected that the results will point the way to more detailed research on the methodology which shows the most promise. Any acceptable methods developed will have direct application to operations affecting the utilizing and control of the water resources of the District of Columbia.

acceptable methods developed will have direct application to operations affecting the utilization and control of the water resources of the District of Columbia.

The project is scheduled to start September 1, 1974 and be completed on or before June 30, 1975. The Principal Investigator is Dr. Michael Goldman, Washington Technical Institute, Washington, D.C.

III. REPORTS

“An Assessment of the Use of Potomac Estuary Waters and AWT Effluents for Emergency Water Supply”, by G.K. Young and R.C. Palange. WRRC Report No. 1, October 1973.

“Evaluation of the Use of Pricing as a Tool for Conserving Water”, by M.H. Chiogioji and E.N. Chiogioji. WRRC Report No. 2, November 1973.

“Proceedings – Symposium on Water Resources Problems Facing the District of Columbia”, edited by R.C. Palange. WRRC Report No. 3 (in preparation)

NOTE: Copies of these reports are available upon request to Director, Water Resources Research Center, Washington Technical Institute, 4100 Connecticut Avenue, N.W., Washington, D.C. 20008

APPENDIX “A”

Research Advisory Council

RESEARCH ADVISORY COUNCIL

- * Dr. B.H. Alexander, President, Chicago State University, Chicago, Illinois
- Mr. L.F. Borhaus, Manager, Human and Social Resources Bureau Metropolitan Washington Board of Trade – Washington, DC
- Mr. R.A. Canham, Executive Secretary, Water Pollution Control Federation – Washington, DC
- Mr. P.W. Eastman, Executive Director, Interstate Commission on the Potomac River Basin- Bethesda, Maryland
- Hon. W.E. Fautroy, DC Delegate, US House of Representatives- Washington, DC
- Ms. W.A. Ford, DC City Council- Washington DC
- Mr. F.B. Francois, Metropolitan Washington Council of Governments- Washington DC
- Mr. P.V. Freese, American Consulting Engineers Council- Washington DC
- Mr. W.C. McKinney, Director, Department of Environmental Services- Washington, DC
- Mr. D.J. Snyder, III, Regional Administrator, US Environmental Protection Agency, Philadelphia, PA
- Mr. W.E. Trieschman, US Army Engineer District Baltimore, Maryland
- Rev. J.P. Whelan, Executive Secretary, Consortium of Universities- Washington DC
- ** Mr. R.C. Palange, Director, Water Resources Research Center – Washington Technical Institute – Washington DC

* Chairman

** Executive Secretary

APPENDIX “B”

Technical Evaluation Committee

TECHNICAL EVALUATION COMMITTEE

- Mr. D. R. Bates, Metropolitan Washington Council of Governments Washington, D.C.
 - Dr. M. W. Champ, Department of Biology The American University Washington, D.C..
 - Dr. B. T. DeCicco, Department of Biology The Catholic University of America Washington, D. C.
 - Dr. J. E. Feir, School of Engineering and Applied Science The George Washington University Washington, D. C.
 - *Dr. Yoram Gordon, Interstate Commission on the Potomac River Basin Washington, D. C.
 - Dr. A. J. Jones, School of Agriculture and Natural Resources Washington Technical Institute Washington, D. C.
 - Mr. F. M. Middleton, National Environmental Research Center U. S. Environmental Protection Agency Cincinnati, Ohio
 - Mr. R. R. Perry, Department of Environmental Services Washington, D. C.
 - Mr. H. C. Ways, Washington Aqueduct Division U. S. Corps of Engineers Washington, D. C. Dr. T. T.
 - S. Yang, Department of Engineering and Computer Sciences, Federal City College Washington, D. C.
 - Dr. C. L. Yen, Department of Civil Engineering Howard University Washington, D. C.
- *Chairman

