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PROCEEDINGS

Incodel Annual Conference
Pocono Manor, Pennsylvania
October 17-19, 1960

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

PROCEEDINGS

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POCONO MANOR, PENNSYLVANIA

OCTOBER 17-19, 1960

C O N T E N T S

FOREWORD

CONFERENCE PROGRAM

REGISTRATION LIST

FOREWORD

Incodel's 1960 Delaware River Basin Water Resources Conference was held at Pocono Manor Inn, Pocono Manor, Pennsylvania, October 17-19, 1960.

In attendance were about 250 federal, state and local governmental officials, industrial and business represenatives and members of the League of Women Voters from the Delaware River Basin and nearby areas.

The Proceedings of the Conference are divided into two sections, as follows:

Conference Program

Registration List

The section on Conference Program includes a copy of most of the reports, in their entirety or in digest, which were given at the Conference sessions. The Conference Program for these sessions is presented at the beginning of this section.

The section on Registration consists of a list of all persons who attended the Conference and filled in a registration card.

Interstate Commission on the Delaware River Basin
and the
Delaware River Basin Advisory Committee

PROGRAM

DELAWARE RIVER BASIN WATER RESOURCES CONFERENCE
Pocono Manor Inn, Pocono Manor, Pennsylvania
Monday - Wednesday, October 17-19, 1960

MONDAY FORENOON - OCTOBER 17, 1960

Francis A. Pitkin, Chairman, Interstate Commission on the Delaware River Basin, presiding.

10:00 A.M. INCODEL ANNUAL REPORT

Robert V. Everest, Administrative Assistant, Incodel.

10:20 A.M. LEHIGH UNIVERSITY INSTITUTE OF RESEARCH PROJECTS

A. Utilization of Cement Stack Dust

George R. Jenkins, Associate Director.

B. Water Quality Monitoring

Basil W. Parker, Head, Department of Biology.

11:00 A.M. WATER QUALITY SURVEYS IN TIDAL DELAWARE RIVER

Lester M. Klashman, Regional Program Director, Water Supply and Pollution Control, U.S. Public Health Service.

11:30 A.M. GENERAL DISCUSSION

MONDAY AFTERNOON - OCTOBER 17, 1960

James Kerney, Jr., Executive Vice President, Water Research Foundation for the Delaware River Basin, presiding.

2:30 P.M. PROPOSED COMPACT FOR MANAGEMENT OF DELAWARE RIVER BASIN'S WATER RESOURCES

A. Report on Current Status

John P. Robin, Chairman, Delaware River Basin Advisory Committee.

B. Selected Viewpoints

C. General Discussion

TUESDAY FORENOON - OCTOBER 18, 1960

John C. Thompson, Executive Engineer, N.Y. State Water Power and Control Commission, presiding.

10:00 A.M. ARMY ENGINEERS DELAWARE RIVER BASIN SURVEY

A. The District Engineers Report

Colonel T. H. Setliffe, Engineer, Philadelphia District.

B. Let's Not Overlook the Value of Recreation

Cecil E. Heacox, Secretary, New York State Department of Conservation.

C. Tocks Island - A National Recreation Area

George H. Thompson, Chief, Branch of Recreation Survey, Region V, National Park Service.

TUESDAY AFTERNOON - OCTOBER 18, 1960

Clayton M. Hoff, Executive Vice President, Brandywine Valley Association, presiding.

2:30 P.M. PROGRAMS OF THE BASIN'S WATERSHED ASSOCIATIONS

A. Brandywine Valley Association

Peter J. Short, Jr., Director - Brandywine Water Supply and Flood Control Project.

B. Neshaminy Valley Watershed Association

Edward A. Miller, Executive Director - Flood Plain Studies.

C. Wissahickon Watershed Association

Paul M. Felton, Executive Director - Problems of Pollution.

D. Red Clay Valley Association

Howard G. Tennent, President - Hydrologic Studies.

E. Stony Brook - Millstone Watersheds Association

Malcolm Crooks, Executive Director - Implementation of Public Law 566.

F. Delaware River Watersheds Association

John T. Carson, Jr., President - Liaison in Watershed Work.

TUESDAY AFTERNOON - OCTOBER 18, 1960 (continued)

4:00 P.M. GENERAL DISCUSSION

TUESDAY EVENING - OCTOBER 18, 1960

7:00 P.M. ANNUAL DINNER

COORDINATED WATER RESOURCES DEVELOPMENT

Harvey O. Banks, Director, California Department of Water Resources; Chairman, Interstate Conference on Water Problems; President, Association of Western State Engineers.

WEDNESDAY FORENOON - OCTOBER 19, 1960

Norman C. Lack, Vice President, Water Research Foundation for the Delaware River Basin, presiding.

10:00 A.M. VIEWS OF WATER RESOURCES ASSOCIATION OF THE DELAWARE RIVER BASIN

Charles R. Bensinger, President.

10:30 A.M. THE WOMEN HAVE THE LAST WORD

Mrs. Henry J. Hersey, Water Resources Committee, Inter-League Council of the Delaware River Basin, League of Women Voters.

11:00 A.M. CONFERENCE SUMMARY

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

INCODEL ANNUAL REPORT

Robert V. Everest
Administrative Assistant, Incodel

October 17, 1960

INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

INCODEL ANNUAL REPORT

Incodel Annual Business Meeting
Pocono Manor, Pennsylvania
October 17-19, 1960

We of Incodel are delighted that this 1960 Delaware River Basin Water Resources Conference is being jointly sponsored by the Interstate Commission on the Delaware River Basin and the Delaware River Basin Advisory Committee. This is the second successive year that our two organizations have affiliated for this annual meeting. Through this means we have been able to arrange what we believe is an informative program for all of the diversified interests represented here.

ARMY ENGINEERS SURVEY

Many of you may recall the excellent presentation of a progress report made last year by Colonel T. H. Setliffe, Philadelphia District Engineer of the U. S. Army Corps of Engineers, on the three year, two million dollar comprehensive survey of the water resources of the Delaware River Basin. This survey was undertaken as a result of the urgent need for a water control plan that was so vividly reaffirmed by the havoc created by the disastrous floods of August, 1955 caused by Hurricanes Connie and Diane. It has been performed by the Philadelphia District of the U. S. Army Engineers in close association with federal, state and municipal agencies concerned with the problems of the Delaware River Basin - including, of course, Incodel.

The report of the District Engineer resulting from that survey has now been completed. We are pleased that Colonel Setliffe is to be with us again this year to inform us of his findings, conclusions and recommendations.

Members of the Incodel staff have spent a substantial portion of their time and effort during the twelve months since the last annual meeting in reviewing and appraising preliminary drafts of the final report and of the twenty-four Appendices upon which it is based.

It appears to us that the Army Engineers have developed a physical plan that will, when put into effect, substantially resolve many of the problems regarding the control, development and utilization of the water resources of the Delaware River Basin.

INTERSTATE FEDERAL COMPACT

Turning again to last year's Conference, those of you in attendance will probably recall the report given by James Kerney, Jr., Executive Vice President of the Water Research Foundation for the Delaware River Basin and Incodel's Vice Chairman from New Jersey. Mr. Kerney then informed us that the Governors of the four Basin states and the Mayors of New York City and Philadelphia, at a meeting in Philadelphia two weeks earlier, had directed the Delaware River Basin Advisory Committee to prepare a draft of an interstate-federal compact to create an agency with appropriate powers to administer a comprehensive plan for the control and development of the water resources of the Delaware Basin. The objective of this directive was to implement the recommendation of the Water Research Foundation that "every effort be made to complete a compact among the States of New York, Pennsylvania, New Jersey and Delaware, and the Federal Government - - - with all reasonable speed in order to eliminate the necessity for a Federal agency as a transitional step in such water resources administration". Such a transitional step, perhaps you may remember, was proposed in the report financed by the Ford Foundation and submitted to the Water Research Foundation on September 1, 1959 by the Syracuse University Research Institute under the supervision of Dr. Roscoe C. Martin.

Incodel is pleased to have Mr. John P. Robin, Chairman of the Delaware River Basin Advisory Committee, on this Conference program to make a report on the current status of the proposed compact for the management of the Delaware River Basin's water resources.

During the past year members of Incodel and of its staff have been afforded opportunities to work with representatives of the Advisory Committee on its assignment "to complete a compact - - - to establish the most effective administration for the water resources of the Delaware River Basin - - - ".

WATER POLLUTION CONTROL PROGRAM

Other activities in which the Commission has been engaged during the past year consist largely of the continuance and extension of projects in the field of water pollution control that were undertaken as a result of the enactment of the Federal Water Pollution Control Act of 1956. Under the terms of this Act, federal funds have been made available to state and interstate agencies for the improvement and expansion of their water pollution control plans. Incodel has used its share of these funds and its own resources for the prosecution of seven separate but directly related projects. A brief explanation of each of these follows:

First: Incodel has maintained an up-to-date inventory of the various sources of water pollution in the Basin. This inventory shows that about 90 percent of the urban communities served by public sewers have installed sewage treatment facilities. Similar progress has been made in regard to the installation of plants for the treatment of industrial wastes.

Incodel has urged, and will continue to urge, the administrative officials of the water pollution control agencies of its four supporting state governments to require those municipalities and industries which are delinquent in meeting their responsibilities in controlling water pollution to install the necessary facilities.

Second: The inventory of sources of water pollution led Incodel into extended studies of water pollution control and water supply problems in the suburban regions of metropolitan areas where, it was found, approximately one-third of the population of the Delaware Basin is serviced by on-site facilities. About 60 percent of these persons reside in new housing developments in the four counties of Southeastern Pennsylvania adjoining Philadelphia - - - Bucks, Montgomery, Delaware and Chester Counties.

Incodel has expended much time and effort in urging and assisting the responsible officials of these Counties, and of their political subdivisions, in investigating their respective water pollution control and water supply problems. This activity, to a large extent, has been successful and productive. It has resulted in the construction of several new sewerage systems.

Another outcome has been the preparation of a comprehensive water pollution control and water supply program for Bucks County under the auspices of the County Planning Commission and the County Health Department; also the preparation of a metropolitan Philadelphia five county sewage collection and treatment program under the sponsorship of the Metropolitan Study Commission. The Commissioners of Montgomery County are now embarking upon the preparation of a comprehensive, county-wide water pollution control and water supply program.

Third: A research project, being prosecuted by the Lehigh University Institute of Research for Incodel under a contractual agreement, represents another aspect of water pollution control. The objective of this research is to determine if stack dust, a waste product of the cement industry, can be used practicably for the neutralization and reclamation of acid streams, lakes and ponds. We are pleased to report that the prospects appear to be promising.

Dr. George R. Jenkins, Associate Director of Lehigh University's Institute of Research will report on this project this morning.

Fourth: A second research project to develop an automatic and continuous water quality monitoring system on the upper Delaware River is another current Incodel activity. This program reflects an effort by Incodel to improve water pollution control through increased and continuous knowledge of river quality and conditions. The research phases are being prosecuted for Incodel by the Lehigh University Institute of Research, Bethlehem, Pennsylvania.

Dr. Basil W. Parker, Head of the Department of Biology at Lehigh University, will present a complete report on this project this morning. Incodel is proud of the results of this work. It has received nation-wide recognition and we commend Dr. Parker and his staff for their excellent services.

Fifth: Incodel has participated, with the State of Delaware Water Pollution Commission, in a water quality survey in the Tidal Delaware River extending from Trenton, New Jersey to the Delaware Bay.

The main objective of this survey is to establish a procedure for securing a better knowledge of the existing and probable future quality of water in the Delaware River estuary and of the influences which affect that quality. The aim is to produce yard-sticks, if possible, for the prediction of future water quality conditions and for the economical installation of facilities to meet such conditions.

The procedure employed in the tidal estuary survey has become known as the "same-slack method". Briefly, it involves the use of fast moving motorboats equipped for the speedy collection of samples of water from 15 sections in the 87 mile stretch of River between the Bay and Trenton. At every section, the samples are collected at the same stage of tide, either high water or low water slack. At the end of the five hour run, the samples are transferred to a station wagon and rushed to the laboratory for immediate analyses. This method of sampling under substantially the same conditions of weather, tide and stream flows in the estuary, eliminates many variables and adds validity to the results of the survey.

Sixth: Incodel has spearheaded a project involving a series of experiments on a model of the tidal Delaware River at the Army Engineers Waterways Experimental Station at Vicksburg, Mississippi. This activity supplements the same day, same slack water sampling program just referred to. It is a joint venture of Incodel, the Delaware Water Pollution Commission, the Departments of Health of New Jersey and Pennsylvania, the City of Philadelphia and the U. S. Public Health Service.

The experiments were designed to determine the time of transit and to trace the dispersion of simulated pollutants in the river model. Solutions of dye were released into the model under controlled circumstances and various conditions of stream flow in order to follow the movement of simulated pollutants. Fourteen separate tests were made. Significant and reliable data are being obtained from this work.

Seventh: A biological survey of the Delaware River was instituted by Incodel in February of 1957. The survey has been continued in fiscal years 1958, 1959 and 1960. The purpose of this project was to determine the quality of the waters of the Delaware River tidal estuary from Trenton to the Bay as measured by their ability to support aquatic life. The research activities have been carried out by the Philadelphia Academy of Natural Sciences.

The program employed three procedures: (1) a diatometer survey (2) biological surveys, and (3) fish studies. These were supplemented by two twenty-four hour dissolved oxygen studies at two selected cross-sections in the River.

The diatometer studies measured the condition of the diatom flora in the River bi-weekly from May through October of each year of the study.

The biological surveys called for the collection and study of all types of organisms in selected areas of the River. This study was conducted at four strategic locations on the River.

The fish studies called for the collection of fish samples at three stations of the diatometer survey.

The dissolved oxygen (DO) determinations were made "around-the-clock" in order that the fluctuation of the concentration of oxygen in the River might be measured.

During the Conference session this morning, Mr. Klashman will enlighten you further about these tidal River surveys.

TRAINING AND PUBLIC RELATIONS

In addition to these specific projects, Incodel has participated through its staff and its consultants in training programs in the field of water resources. Members of the Commission and its staff have also been active in various seminars, meetings and educational programs sponsored by other groups and organizations. In addition Incodel has conducted several technical seminars of its own.

The Commission has likewise been engaged in public relations efforts especially designed to stimulate interest and support for the implementation of the overall Incodel water pollution control plan and related projects. This program calls for a considerable number of speaking engagements by Incodel representatives, and involves the preparation of many brochures, maps, manuals, photographs, drawings and publicity releases.

Incodel's chairman during the past year served as the first president of the Interstate Conference on Water Problems. The Commission's executive secretary is one of this agency's consultants. The Interstate Conference is composed of officials of state governments from all parts of the nation who have banded together for the purpose of effectuating more effective relationships between the states and the federal government in the field of water resources development. It is serviced by the Council of State Governments. We are pleased that Harvey O. Banks of California, now president of the Interstate Conference, is to be the speaker at the dinner session of this meeting.

CONCLUSION

This resume' of Incodel activities of necessity only hits the highlights. We look forward to an even busier period in the ensuing year.

In closing, it seems appropriate to remind you that only a month ago Hurricane Donna forged her erratic way up the eastern coast of the United States. Fortunately, Donna did not strike the Delaware Basin with the same catastrophic fury as her sister Diane did five years ago. However, Donna, we hope, did prove that positive, constructive action is needed right now to advance plans and projects for the control and utilization of the Water resources of the Delaware River Basin. We of Incodel are ready and willing to dedicate our continued and complete cooperation to this task.

# # #

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

LEHIGH UNIVERSITY INSTITUTE OF RESEARCH PROJECTS

A. Utilization of Cement Stack Dust

Dr. George R. Jenkins, Associate Director.

B. Water Quality Monitoring

Dr. Basil W. Parker, Head, Department of Biology.

October 17, 1960

Report to the Interstate Commission on the
Delaware River Basin, 1960

Incodel-Sponsored Research at Lehigh University

NEUTRALIZATION OF ACID WATERS

1. The Problem

The Pocono Plateau shares with many other regions - considerable parts of New Jersey, New England, and the Great Lakes district - the distinction that most of the natural water bodies are acid, frequently brownish in color, and low in productivity of desirable organisms.

This natural condition is derived first from the absence of rocks containing soluble minerals which in normal weathering yield ions of such elements as Calcium, Magnesium, Potassium and Phosphorous as well as trace amounts of other elements essential to organisms. Soils developed on such rocks are acid with respect to the mineral matter. In addition, vegetation develops a soil-humus complex that is also highly acid. Water percolating into such soils dissolves humic acids and may take on brown coloration. Consequently, run-off and base-flow water of streams and lakes has these properties, which inhibit the growth of many organisms, except particular aquatic plants that thrive in shallow acid waters. In the absence of microbial action the environment is favorable to accumulation of vegetative debris. Under these circumstances, the natural water bodies are deficient in the micro-organisms that lie at the base of the food chain which supports the heirarchy of organisms. Obviously, the sport fishes which are for many the apex and desirable end-product of the chain, are restricted in numbers per unit area or volume by the limited base, and usually stunted to a remarkable degree, (in Deep Lake, perch 6 years old were under 4 inches in length). Similarly, this is simply diagnostic of the broader problem that these waters are lower in productivity and quality for other uses than waters of many other environments.

Obviously, there would be significant gains for human interests if the complex of conditions could be altered. Since the origin of the problem rests in mineral deficiency, it seems appropriate to consider the possibility of adding mineral matter. In order to do this, it is apparent that we must obtain a large supply at nominal cost since we are concerned with

extensive areas, huge volumes of water, and potential gains that have less economic value than soil amendments as practiced in agriculture for example. Fortunately, in the Lehigh Valley, such a source of material exists in the form of great accumulations of stack dust, the waste product of portland cement manufacture, and a nuisance to the industry.

In 1957, therefore, a research program was undertaken to determine whether or not cement mill stack dust waste might be used to make significant improvements in typical Pocono water bodies. This project was directed initially by Dr. F. J. Trembley, and since 1959 by Dr. B. W. Parker, and the research has been done by various members of the Department of Biology at Lehigh University.

II. Procedures and Status

At the 1958 meeting of Incodel at Atlantic City we were privileged to report preliminary results of the studies and to reveal some of the questions which were emerging as part of the broad problem. In this current report, it is appropriate to refer occasionally to the 1958 report and indicate subsequent developments.

1. Laboratory studies were undertaken, using collected samples of Pocono waters. These were placed in battery jars, along with various thicknesses of bottom materials also collected for the purpose. Untreated control samples were retained for comparison with variously treated ones. By 1958 it could be reported that the results were highly favorable. Acid water and combinations of mud-water systems could be neutralized, and the miniature systems provided data for estimating rates of application of stack dust appropriate to a given natural system.

In 1959, the tests had shown evident improvements in water quality in the treated samples. There were significant increases in primary production of micro-organisms and the appearance of insect life, mostly midges. Experiments were carried out to determine some effects of very heavy applications of stack dust, which showed the possibility that waters might temporarily become so alkaline as to be injurious to fish. This, of course, would be of no concern to a lake for which reclamation is planned by removing the resident fish population, but is an important consideration in treating waters carrying desirable fish populations.

In 1960 the laboratory tests were discontinued in order to give full

attention to field studies.

2. Field work was actually initiated in 1957 when biological and chemical assays of Deep Lake were begun prior to any treatment.

A. Study and treatment of Deep Lake have continued throughout the period. The treatment of the lake has been as follows; through cooperation of the Pennsylvania Fish Commission, the lake was treated with Rotenone in August of 1957 to remove trash and stunted fish. Thereafter, stack dust was applied in June, 1958 (8,000 pounds), March, 1959 (2,200 pounds), August 1959 (5,000 pounds) and in August, 1960 (4,000 pounds). Continuous surveillance showed improvement of chemical characteristics as marked principally by shift from very acid water to neutrality, and a marked increase in micro-biological activity. Deep Lake was restocked by the Pennsylvania Fish Commission with 3,200 fingerling brook trout in December, 1959, and posted for the 1960 season as a "Reclaimed Lake". It was subsequent to this that the last application of stack dust was made and at that time trout of six to eight inches length observed, and further observed several days after the treatment displaying no effects of shock. Thus, the lake has been converted from a very clear, unproductive body of acid water supporting a very small population of organisms including some severely stunted perch and trash fish. As an index of its status, a Secchi Disk could be clearly seen resting on the bottom in 21 feet of water. Currently, the water is nearly neutral at all depths, Secchi Disk extinction occurs at 10 to 15 feet, there is a continuous green coloration of the water, plankton counts during summer months are holding at levels several times those prior to treatment, and trout are thriving.

B. Round Pond is a lake of about eight acres size and maximum depth of thirteen feet. It has a small tributary watershed with no identifiable stream inlet and no natural outlet except by overflow culvert to Big Boulder Lake. It was selected for study because its bottom, unlike the mud bottom at Deep Lake, is covered by an accumulation of undigested fibrous plant material. Prior to any treatment, it was also an acid, clear water pond with the further condition that it showed essentially uniform dissolved oxygen content with depth.

Resident fish were killed in 1957. Stack dust applications were made in May, 1959 (6,400 pounds) and August, 1959 (5,000 pounds). The observed changes have been similar to those of Deep Lake except for sharp

reduction of dissolved oxygen content near the bottom. There are probably two contributing causes. On the one hand, the micro-biological bloom has been heavier than in Deep Lake, Secchi Disk extinction occurring at five to ten feet. This provides heavier shading of the deeper water and a "rain" of planktonic debris with biological oxygen demand settling toward the bottom. On the other hand, improved environment has probably stimulated biological digestion of the bottom organic matter and developed an oxygen demand.

There has been no deliberate restocking of Round Pond. Fish may reach it from Big Boulder Lake or it may be restocked in due time. Meanwhile, it is interesting to note that stack dust treatment has improved its organic productivity and delayed the extinction of the pond since the rapid encroachment of vegetation from the sides and accumulation of dead plant materials on the bottom have been halted.

C. Not a formal part of the field studies conducted under the project, but pertinent, are the observations of six private lakes which have been variously treated. All have shown improvements in chemical and biological properties similar to the conditions at Deep Lake and Round Pond.

D. Field study of Pocono streams was reported as desirable in 1958. This phase was actually undertaken in the summer of 1959, with study of Deep Run in Pocono Preserve. Originally it was intended to make a comparative study between Deep Run as treated and Davey Run as a control. However, the first part of the investigation, a detailed analysis of each segment of stream so as to classify environments based upon water flow, bottom conditions, amount of sunlight, water temperature, and stream vegetation, showed that Davey Run is not comparable to Deep Run. Therefore, detailed attention has been given only to Deep Run and a lesser observation program carried on for Davey Run. The detailed survey of 2,500 feet of Deep Run established five zones of three types of environment. These were each sampled carefully to establish the pretreatment population of organisms, micro and macro. Meanwhile, a dispensor, consisting of a hopper and a motor-driven worm screw was developed and installed to apply small known quantities of stack dust to the stream. It was started in operation in August, 1959, and operated intermittently, and with various difficulties,

for a total of 40 days up to mid-April, 1960. During this time, surveillance of chemical conditions and the biotic assemblages was maintained.

The conclusions reached are as follows:

1. It is clear that a dispensing system can be developed to control the chemical conditions of such a stream. Even if the charges are intermittent, they may cause a "slug" of alkaline water to pass down the stream but retain enough residual effect to maintain satisfactory chemical quality.

2. There is considerable evidence, although not now considered conclusive, that neutralizing the water contributes to increased rates of growth of organisms, and that shifts in the species complex may occur.

3. The evidence clearly indicates both the value and the complexities of continuing the study of consequences of stack dust applications to streams. It is first imperative to develop a reliable dispensor system and then to develop a series of definitive experiments, the techniques for which are now established.

III. Conclusions and Prospects

It is appropriate to consider very briefly the objectives of scientific endeavor before concluding with respect to the status of this research. On the one hand, imbedded deeply in our culture, is the belief that the mission of science is to help man to "conquer nature". On the other hand, most scientists are likely to attribute their purpose to "understanding nature".

In these connotations, it seems fair to state that this research project has now established the general objective of "proving" that we can modify the natural state of these acid waters to the apparent benefit of man. Thus we may have contributed in very modest degree toward the conquest of nature. At the same time, while we believe that it is clear that some portions of the research procedures and results are well understood, it would be most inappropriate to claim that we have fully explored and truly understood the natural systems involved. To the contrary, there is much left to do in this area of research.

1. The systems that have been studied to date need to be continuously observed in the future to determine such critical considerations as the rates at which chemical conditions will change, the appropriate measures to be taken to maintain a given chemical status, and, most important, the

long-term biological consequences of such a chemical condition. By necessity, the measures of biological response have been applied for too short a time and to too few situations to provide a firm assessment.

2. Studies should be extended to systems that have not yet received attention. Two of these are of major importance.

A. In 1958 we indicated plans to apply neutralization to acid mine waters. Unfortunately, changes in mining activity as well as demands of the other research on available personnel, have interfered with pursuit of these plans. Nevertheless, this should remain in high priority for future attention.

B. There is strong reason to believe that highly useful results might be achieved by treating an acid swamp or bog area and its tributary watershed. This should be undertaken with provision for adequate time for microbial digestion to consume the accumulated vegetative debris under the changed environment. This idea has been partially tested under conditions requiring quick results. One or more sites should be selected for a longer-range and more thorough experiment.

3. Finally, the research should be pursued through study of a wider range of initial conditions. This should be for two purposes. The first is simply that of scientific desire to increase our understanding. The second is the very practical purpose of establishing sufficient information that this work can be translated from scientific study to technology, where it may be added to the tools of fishery biologists, water supply engineers, and other technologists to apply to a myriad of situations and problems. It has been very well said that development of a technique is relatively easy but its diffusion to the uses of society is often very difficult and slow. We would hope to contribute to effective diffusion of the techniques under study by carrying the research far enough to be able to supply practically applicable guides for the use of technologists.

WATER QUALITY MONITORING

Members of the Water Resources Research Council of Lehigh University, under contract to Incodel have, since April 1957, been working on an automatic system for recording water quality. Thus work was done in three

stages. The first was a search of available instrumentation. The second dealt with laboratory testing of the commercially available sensing and recording instruments and developing new elements. The final phase was the construction and operation of a Water Quality Monitor Station on the Delaware River at Riegelsville, N. J. which has been in service since late August, 1958.

It is the purpose of this report to Incodel to summarize the extensive technical reports with particular emphasis on objectives and results. Thus we do not propose to discuss the detailed aspects of principles of sensing or recording elements or to dwell upon the electrical, hydraulic and instrumental problems of water quality monitoring. It is relevant at this point to note that our basic plan was presented at the annual Incodel meeting in 1957, and was supplemented by a progress report at the Atlantic City meeting in the fall of 1958. At the 1959 meeting of Incodel we exhibited in graphical form some of our significant findings and discussed these with technical personnel of various governmental agencies. We have also participated in two Incodel Technical Seminars, one at Lehigh University on 17 and 18 June 1959 and the other in Philadelphia on 10 and 11 March 1960. B. W. Parker presented a brief account of automatic monitoring at the Ninth Annual Conference of the Pennsylvania Department of Health at University Park on 16 August 1960. B. W. Parker and A. R. Morris participated in an Incodel Water Quality Committee Conference at the Incodel office on 7 July 1960. This meeting dealt with the proposed eleven station network from Hancock, New York to Trenton, New Jersey on the main stem of the Delaware River.

Referring to the meeting of June 1959, we were invited by Dr. C. H. J. Hull of Johns Hopkins University to present a report on water quality monitoring to the Sanitary Engineering Division of the American Society of Civil Engineers. This was published in the 20 July 1960 issue of the Journal of the American Society of Civil Engineers under the title of "Automatic System for Monitoring Water Quality".

In February 1960, B. W. Parker participated in Cincinnati, as a consultant, in a conference to plan a Symposium on Water Quality Measurement and Instrumentation. This symposium was planned to invite both research workers and instrument manufacturers to exchange ideas and to present

possible instrumentation for nearly twenty parameters indicative of water quality. This Symposium, entitled "Water Quality Measurement and Instrumentation", was held in Cincinnati during 29-31 August 1960. B. W. Parker and A. R. Morris presented a report entitled "Automatic Surveillance -- An Operating System". In the limited time available, it was possible to present only the highlights of the extensive Incodel sponsored research program. It is however pertinent to report that there was substantial interest at the national level in this research, and that we had many inquiries for technical information.

Some of the graphs shown as lantern slides at the 1960 Incodel meeting were presented at the Symposium in Cincinnati on 30 August 1960, and a more detailed technical account of the findings was presented. It is relevant to note that there exists, at this time, adequate instrumentation to detect an unusual departure from the normal river conditions at the Riegelsville Monitor Station and to activate the sampling mechanism so that a substantial volume of water is available for detailed analyses by appropriate authorities. It is thus evident that one aspect of the Incodel Monitor Program is to notify water plant operators of abnormal river conditions and to enable them to revise operating conditions. That this feature is of value is illustrated by the existing water use of 3.5 billion gallons per day in the Delaware Basin, and the projected use, fifty years hence, is estimated at 14 billion gallons per day.

The automatic sampling of the river twice each hour and around the clock is in distinct contract to the conventional method of "grab" sampling which indicates momentary results. An alternate is the manual "pooled" sample, which furnishes an average only upon analysis and may conceal significant variations in waters subject to intermittent pollution.

Of the many variables suitable for automatic recording, we initially chose four. There existed, in 1957, reliable methods for measurement and recording of temperature, specific conductivity, and pH, which is an index of relative acidity or alkalinity. The fourth variable, oxygen, was not readily recorded at that time with completely dependable instruments. Two different approaches to measurement of oxygen concentration were under development. The method initiated at the Taft Center, U.S.P.H.S. depends upon precise, expensive instrumentation and maintenance, but is not subject

to the errors of certain alternate methods. These considerations are balanced by the relative simplicity of the "polarographic" methods. Two of these were investigated at Lehigh. The dropping Mercury electrode was developed, found suitable, but also expensive to operate and to maintain. The Carritt-Kanwisher electrode for oxygen measurement appears, in our experience, to be the most stable method. Certain errors are inherent, but we have corrective measures.

We had originally planned to record turbidity as an index of suspended materials in the river. In 1957, there was available an expensive instrument for this measurement which required constant attention and cleaning. In 1959 there became available a new approach to turbidity measurement which removed the previous difficulties and was considerably less expensive. This new instrument was installed at the Riegelsville Monitor Station in November 1959 and has added considerably to our understanding of natural variations of suspended solids in the river. It is expected that this study will result in a doctoral dissertation from Lehigh University.

The sixth variable now being recorded at the Riegelsville Station is sunlight intensity. This is measured by a Pyrheliometer, the standard instrument used world-wide by meteorologists, and is recorded in terms of the "solar constant". We thus have data comparable to other investigators in this field. The primary reason for measurement of sunlight intensity is for the purpose of relating these data to the recordings for oxygen content. Sunlight provides the energy for the "photosynthetic" process in submerged aquatic rooted plants and floating algae. Chemical energy is stored by these growing plants and oxygen is liberated into the water for use by oxygen consuming animals. It is also relevant to note that in the absence of sunlight these same green plants consume oxygen. However, in the presence of sunlight the liberation of oxygen is in excess of oxygen utilization by these plants.

It is clear from the foregoing that the Incodel Monitor Station thus has two objectives. The first is automatic detection, sampling and warning when the norms are exceeded. The second is the assembly of basic data on water quality for the National Water Quality Network and specific information for studies in the complex biology of rivers. The major effects on rivers are threefold, and are divided first in terms of chemical determinations; second, the measurement of biological variables; and third, the

influence of meteorological and hydrological conditions on the chemical and biological characteristics. All of the foregoing variables may be further complicated by the introduction of man-made contamination. It is one of our objectives to so adjust each Monitor Station as to make due allowance for limits of natural variations in water quality parameters, and to provide for sampling and warning when these limits are exceeded.

These concepts were illustrated by the graphs presented at this Incodel meeting. Briefly, the various measurements were explained and their major interactions noted. For specific conductivity it was evident that meaningful departures had occurred and these were attributed to discharges of industrial wastes.

Of the twenty-odd variables indicative of water quality which may be measured by automatic means, we have thus selected six which we presently consider most diagnostic of water quality. More of the other variables are applicable to specific industrial wastes. For example, there are methods for detection of cyanide from electroplating wastes; phenols and cyanides from the steel industry; radioactive contaminants from either laboratory or industrial use of the by-products of reactors, and several mechanized chemical analyses applicable to the operation of water purification plants or sewerage treatment plants. Examples are the determination of "free" chlorine, total hardness, fluoride or chloride ion, and measures of the relative mineral content of water. A special example of a Monitor Station is the one we are designing for the Pennsylvania Department of Health and for installation at Williamsport, Pennsylvania for the measurement of oxygen concentration and for the detection and warning upon the release of acid mine waters into the Susquehanna River. Such measurements, it is hoped, will help to pin-point fish kills in the river and to locate the principal sources of such acid contamination.

The Riegelsville station thus operates for the continuous measurement and recording of the six parameters previously described. This station also serves to test new instrumentation and circuitry for possible application at other monitor sites. Three examples of such investigations are (1) improved recording of temperature within the river flow; (2) recording of approximate times of start and stop of rain or snow fall since these conditions are pertinent in the interpretation of data; (3) provision for

automatic shut-off of certain control and recording circuits when it is necessary to remove the pump assembly from the river due to ice or excessive high water flow.

Reference is made to the slide which depicted an eleven station network of monitor stations from Hancock, New York to Trenton, New Jersey. Of these two are now under active construction. One is above Martin's Creek, Pennsylvania at the site of the steam electric station of the Pennsylvania Power and Light Co. This company is also ccoperating with the National Water Quality Network in the collection of fundamental data on water quality. To be included in the operation of the Incodel monitor station here is the Carbon Filter Sampling Facility of the Public Health Service. This special equipment collects samples for analysis of trace man-made organic contaminants such as synthetic detergents, petrochemicals and by-products of organic chemical syntheses. The second new monitor station is at Montague, New Jersey, across the river from the gauging station maintained by the U.S. Geological Survey and in compliance with the Supreme Court decrees regulating the diversion of water from the upper Delaware drainage to the City of New York.

As the National Water Quality Network is to be the subject of another paper at this Incodel meeting, no duplication is presented here.

Of the additional eight Incodel stations on the Delaware we are concerned with those two which will be above and below the reservoir to be created by the construction of the Tocks Island Dam. These are the Montague station, previously noted, and the proposed station below Delaware Water Gap. It is evident that the Montague station will serve to collect water quality data in the upper river prior to the erection of the Tock's Island Dam. With revision of elevation, this site may be useful in determining those parameters most relevant to fisheries management. The proposed Brodhead's Creek location below Delaware Water Gap may serve as an index of the effects of impoundment on the chemistry and biology of the river. It is also desirable to note that certain sites in the Delaware Basin are suitable for monitor stations under the sponsorship of the individual states or the municipalities most concerned.

Final mention should be made of a similar water quality network under the sponsorship of the Ohio River Valley Sanitation Commission. There has,

currently, been developed a portable water quality detection and telemetering unit for use on the Ohio River. The objectives of ORSANCO are the detection of pollution, telemetering key information and alerting water plant operators of abnormal river conditions.

A similar long term objective is to provide a telemetering system for the presently proposed eleven station Incodel Water Quality Network.

For The Institute of Research,
Lehigh University:
George R. Jenkins, Director

Department of Biology:
B. W. Parker
A. R. Morris

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

WATER QUALITY SURVEYS IN TIDAL DELAWARE RIVER

Lester M. Klashman, Regional Program
Director, Water Supply and Pollution
Control, U.S. Public Health Service.

October 17, 1960

WATER QUALITY SURVEYS IN TIDAL DELAWARE RIVER

Lester M. Klashman, Regional Program Director, Water Supply and Pollution Control, U.S. Public Health Service.

The first water quality survey of the Delaware River was probably carried out about 1799, when the early inhabitants of Philadelphia found their water supply inadequate to meet their growing needs. The famous engineer, Benjamin Latrobe, designer of the original Philadelphia Water Works, in conducting this survey, reported that the water of the Delaware was impure because of the action of the tide, the passage of the river over fetid marshes, and the contamination arising from ships, wharves, and public sewers.

Since that time, numerous surveys of the Delaware River have been made to collect water quality data for a variety of water uses. Today, more than 75 different groups are engaged in the collection of these data, including several Federal agencies, INCODEL, at least six State agencies, three consulting and research groups, and a number of municipal water and sewage works.

But why are we collecting all these data? Water works are responsible for the production of a safe potable water supply. They need adequate chemical, bacteriological and biological information to determine proper treatment procedures. Industry is interested because water quality may affect product quality. The temperature of the water used for cooling purposes has a dollar value for every degree of temperature. Agricultural users are concerned with the quality of water used for irrigation and particularly with the content of trace metals which may have a detrimental effect on crop production. Sewage works are vitally interested in the effect of the treated effluent upon the

stream and the downstream water users. State Health Departments and the U. S. Public Health Service are interested in protecting health. And, most important of all, you and I are interested, as ultimate users of this water, for drinking, cooking and other domestic uses as well as for bathing, fishing, boating, picnicking and just looking.

These needs have grown in recent years with the tremendous development of the Delaware River Basin. We believe that in the future, water quality will become one of the most important factors in the development of the Basin. The Corps of Engineers in their recent report (A Comprehensive Survey of the Water Resources of the Delaware River Basin) proposed reuse factors for some sections of the Basin as high as four (4) times in order to meet estimated future water use demands. In those areas, water will be subjected to four full cycles of use in its flow downstream. Under these conditions water quality becomes most important.

Surveys have progressed with the needs of the times. In Latrobe's time, a survey fundamentally consisted of a visual inspection of the stream for indications of floating sewage solids and other physical characteristics. Later, chemical analyses grew in importance. In the early 1900's we became more aware of the bacteriological problem. Today we are measuring radiation background, and with the carbon filter many of the new complex organic chemicals that are being discharged by our growing chemical and agricultural industries.

We have moved from visual inspection to sampling at odd intervals and now to the continuous sampling and recording of water quality data just discussed by Dr. Parker. The collection of water quality data has become as complex as our needs. We cannot afford to manage the water quality problems of today and the more complex problems of tomorrow with the tools of yesterday. The Public Health Service Sanitary Engineering Center at Cincinnati, Ohio has

been deeply involved in helping to develop new techniques. Their recent development of the carbon filter to determine the effects of trace organic chemicals so minute in quantity as to be undetectable under ordinary methods of analysis, as well as the work with the Hays Dissolved Oxygen Recorder are part of this effort.

The Public Health Service recently sponsored a conference of leaders in the fields of water quality measurement and instrument manufacturers to permit an exchange of views on the utilization of existing instruments and the development of new instruments. At this conference, the INCODEL program of continuous monitoring and the proposed program of the City of Philadelphia were among those discussed.

I think we all agree as to the need for collecting this information. Now, what is being done in the Delaware Basin?

In our recent work preparing the section on water quality for the Corps of Engineers report, we had occasion to review the past and current water quality data collection programs in the Basin.

In the headwater area, the City of New York Board of Water Supply has established and maintained a network of some 20 stations to monitor physical, chemical and bacteriological quality. These stations are shown on Slide I. Samples have been collected weekly from some of these stations for a period of twenty years. This represents one of the few long-term records of water quality available in the upper Basin.

We have available here details of the types of analyses and frequency of collection of this and other programs I shall discuss. Time does not permit coverage, but I shall be happy to discuss this information later with anyone interested.

In addition, since 1947 the Pennsylvania Department of Commerce State

Planning Board in cooperation with the U. S. Geological Survey and the Pennsylvania Department of Forests and Waters has maintained a monthly station on the Lackawaxen River in Pennsylvania. Chemical and physical analyses are performed. Recently, the New York Water Pollution Control Board completed an extensive survey of this Upper Basin area in New York State as part of its classification program for the State. Chemical, physical and bacteriological data were collected.

The section of the stream from Port Jervis, New York to Trenton, New Jersey has been surveyed several times for various purposes by both the States of Pennsylvania and New Jersey. Several stations are now maintained cooperatively by the Commonwealth of Pennsylvania and the U. S. Geological Survey.

(Lehigh River at Bethlehem and Delaware River at
Morrisville, Pennsylvania)

Routine monitoring of the stream is carried out by the water treatment plants of the cities of Easton, Pennsylvania and Trenton, New Jersey. The first operational station of the INCODEL network was located at the bridge in Reigelsville, New Jersey and has been operating for over two years.

As part of our work for the Corps of Engineers, we conducted a ten-week study of this area in 1957. Slide II shows the 19 stations at which samples were collected. We also maintained, with the cooperation of the local and State agencies, a station of our National Water Quality Network at the Easton, Pennsylvania Water Works. This station has recently been moved to a new location at the Martins Creek station of the Pennsylvania Power and Light Company. Slide III shows the network stations we operate in the northeast.

(Merrimac, two on Connecticut, one on Hudson,
three on Delaware, two on Susquehanna, one on
St. Lawrence, and one on Lake Erie)

The Martins Creek station is one of more than seventy-five stations located on the important streams of the Nation. For any of you who are interested, I have a limited number of copies of a pamphlet describing this network here.

In the section of the stream below Trenton, New Jersey, commonly referred to as the tidal section or estuary, we found many public and private agencies and organizations collecting water quality data. There were enough data available and being collected in the tidal section of the stream to permit us to evaluate the quality of the stream for the purposes of the Corps of Engineers report without the long, time consuming study we had originally considered. From Trenton, New Jersey to Wilmington, Delaware, a number of continuing sampling programs were under way. With the cooperation of the agencies involved we were able to collect all this information and adopt modern computer techniques in our analysis of this situation. Slide IV shows these stations.

The two major sampling programs in this area are the study of the Delaware Water Pollution Commission which in the past several years has been co-sponsored by INCODEL and the study undertaken by the City of Philadelphia with the cooperation of the U. S. Geological Survey.

The Delaware program has been under way since 1956 and consists of sampling runs made by boat at periods of slack current. This program has to date involved the collection and analyses of samples from stations covering the area from Fieldsboro, New Jersey to the Appoquinimink River in Delaware. More than 30,000 analyses have been completed to date covering chemical and sanitary characteristics. Delaware's competent Dr. Kaplovsky has reported on this work at earlier INCODEL meetings.

The City of Philadelphia - U. S. Geological Survey study has been continuing on a monthly basis since 1949. Samples are collected from cross

sectional points in the stream at eight stations in the estuary from the Burlington-Bristol Bridge to Marcus Hook, Pennsylvania. More than 25,000 analyses have been completed to date covering physical, chemical, and some sanitary characteristics.

Other studies currently underway in the estuary or recently completed are:

1. The J-D studies of the New Jersey Oyster Research Laboratory and the Delaware Bay Institute. These are quarterly sampling runs covering the Bay and the estuary and have continued since 1952.

2. The U. S. Fish and Wildlife Service has conducted several studies with relation to the effects of quality on the shad runs in the Delaware.

3. The U. S. Corps of Engineers, the New Jersey State Health Department, several consulting engineers and municipal agencies have also conducted studies.

Many industries also sample the waters of the tidal estuary of the Delaware River regularly to determine the quality and its subsequent effect upon their manufacturing processes. Some of these industries are:

Philadelphia Electric Company
DuPont
Sinclair Oil Company
Sun Oil Company
Radio Corporation of America and
Publicker Industries
Delaware Power & Light
Scott Paper Company
American Viscose Corporation
Tidewater

In 1959 the Public Health Service in cooperation with a number of local agencies undertook an extensive monitoring program of the radiological background in the tidal area in connection with the construction of the first nuclear powered merchant ship, the N. S. SAVANNAH, at the Camden shipyards of the New York Shipbuilding Corporation. This study involved the collection of samples of the water, soil, food, and air environment from stations in

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the tidal estuary for analyses for radiological content.

The Public Health Service in cooperation with the City of Philadelphia also maintains two stations in the Philadelphia area on the National Water Quality Network. These stations are located at the Torresdale Plant of the Philadelphia Water Department on the Delaware River and at the Belmont Treatment Plant on the Schuylkill River. These stations have been in operation for some time and are contributing to the seventy-five station network mentioned before.

The City of Philadelphia in cooperation with the U. S. Geological Survey plans to set up several continuous monitoring stations in the estuary to serve the growing needs of the Water Department for knowledge of the changing character of the water it uses. These stations will give information on dissolved oxygen, conductivity, temperature, pH, and possibly turbidity. Also, the U. S. Public Health Service has been asked by the City of Philadelphia to assist them in the overall design of this network of stations and the development of methods for the reduction of the collected data.

This analysis and reduction of the collected data raises new problems in the area of water quality management.

I should like to close by reading the Public Health Service Recommendation No. 4 contained in our report on water quality submitted for inclusion in the Corps of Engineers recent comprehensive report:

"For the efficient utilization of the data a central depository should be initiated where all basic data of common interest in water resources development would be referred for compilation and reduction. Further, the responsibility for the continuous collection of all these basic data should be undertaken on a cooperative basis by those Federal, State and local agencies concerned with this need."

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

PROPOSED COMPACT FOR MANAGEMENT OF DELAWARE RIVER BASIN'S WATER RESOURCES

Report on Current Status

John P. Robin, Chairman, Delaware
River Basin Advisory Committee.

October 17, 1960

PROPOSED COMPACT FOR MANAGEMENT OF DELAWARE RIVER BASIN'S WATER RESOURCES

A DIGEST OF THE REPORT ON CURRENT STATUS

by John P. Robin, Chairman
Delaware River Basin Advisory Committee

John P. Robin, Chairman, Delaware River Basin Advisory Committee, began his report by stating that the Advisory Committee would hold its 35th meeting on the formulation of a proposed compact for the management of the Delaware River Basin's water resources during the current conference.

He then presented a brief explanation of the circumstances culminating in the directive to his Committee to draft an interstate-federal compact. It was stated that Drafts A,B,C and D had been written and discarded; that, at the present time, Draft E was being prepared. Mr. Robin expressed the hope that this latest draft would be acceptable and ready soon.

Pointing out that this was the first attempt to formulate a compact of its kind, Robin stated that, with good fortune, it would be ready for consideration by the Legislatures of the four Basin states during their 1961 sessions.

Robin said that the Advisory Committee felt that it would be in the best interest not to discuss the finer points of the proposed compact in detail at this time. While regretting this circumstance, he held out the promise that the entire proposal could be expected to be presented to the public within a very short time.

Robin's presentation continued essentially as follows:

The Delaware River Basin is small in area, but has a great productivity and a great population with much future growth predicted.

Therefore, it is more than ever important to use the resources of this River Valley for their natural contribution to its people.

The Advisory Committee has an extremely delicate, extremely complex political problem. In order for this compact to be accepted, and therefore to become law, it has to pass the legislatures of four states, or eight separate legislative bodies. It must have the approval of four governors. It also has to pass the Congress and be approved by the President of the United States. Fifteen separate political entities must approve the compact in order to make it effective. Normally, under these circumstances, one might be tempted to say, if you want it to be effective, dilute it, water it down, make it meaningless, make it a planning organization, make it a name and nothing more. We have resisted that course. We are trying to make a strong compact instrument, something that will be truly effective; that will, for the people of this valley, for the people who derive benefits from the waters of the Delaware, become an instrument to secure their progress in the years to come. Accordingly, we are not taking the easy course, we are taking what I think to be the hard course. We are hoping, however, that we can reconcile such problems as still remain, come forth with an agreement which we can enthusiastically support in all six jurisdictions, one which we think the public will accept as being forward looking and progressive and intelligent in its approaches, and one which our strong combination of chief executives in this region and our strong supporters in the Congress can turn into an instrument which will be greatly to the benefit of the people of this area, and therefore of the people of the country.

I would like to pay tribute to by colleagues of the Delaware River Basin Advisory Committee; Commissioner Wilm, Commissioner Ford, General Lack, Commissioner Bontempo, and Commissioner Rafsky. The states and cities they serve are certainly fortunate in having such good representation. These men and their associates have come to meeting after meeting. They have gone laboriously over problem after problem. We think that we have crossed many difficult hurdles successfully. We think the road as it remains will be likewise overcome.

We are all available for your questions, but you may find that our answers would not be ruled responsive in a court of law. It is not that we are attempting to be secretive; it is simply that for a job like this to be accomplished we have to retain some room to maneuver. We have to retain the right to change our minds, we have to be able to negotiate, we have to report from time to time for further instructions. You can understand that we are not a free agent until we have produced a document to which we can all subscribe. So, I will apologize in advance if our replies to your questions are less detailed than you would like at this time. In a very few weeks I would hope, and certainly, in a very few months, you will have full disclosure.

Mr. Kerney, presiding at this session of the conference, opened the question and answer period with the following remarks:

"The difficulty that Jack Robin has explained to you is a prime difficulty in the rather delicate negotiations that have to go on in the drafting of a compact of this type. For example, there is at least one section of the compact draft which in the last two months has had between ten and fifteen revisions.

"This is the kind of careful detailed drafting, after and during negotiation, that makes the job of the Advisory Committee so delicate and difficult at this particular moment. There are delicate differences in the interests involved between the up-basin and down-basin groups, there are differences which have caused a great deal of litigation in the Supreme Court; there are differences that all of you are aware of; differences that are very difficult to overcome. I think they are being overcome, but the stage in which the drafting now is, is a stage where it is most difficult for these gentlemen to talk publicly about what they are doing.

"Perhaps, however, some of you may have questions that can be answered. If you would like to propound them, I am sure that Mr. Robin and his associates will have no hesitancy in answering when they can, and telling you that they can't when they feel they can't. If there are specific questions that any of you may have, I will be glad to field them and pass them along, as hot as they may be."

Mr. Robin's answers to questions propounded from the audience were substantially as follows:

A. It is the opinion of the Committee that a compact which provides for active federal participation <u>is</u> constitutional.

B. As presently proposed, the compact would not become effective unless and until the four states <u>and the Federal Government</u> enact it.

C. The Committee is unable to discuss areas of grievance regarding the compact at this time.

D. As presently proposed, there would be no provisions in the compact which would affect the Corps of Engineers activities in the prosecution of navigation projects.

E. In the compact, the Committee is attempting to provide for water resources development that would be in the interest of flood control, water supply, water quality, recreation and other related multiple purposes.

F. The four states should reach agreement among themselves before expecting the Federal Government to become a party to it.

G. Interested persons can be helpful in attaining the desired objectives by joining in the work of the Water Resources Association, or of other groups desiring to promote the effective development of the water resources of the Delaware River Basin.

H. The Compact Committee anticipates that the provisions of the proposed compact will be made known to the public at a time to be determined by the chief executives after their review but before the compact goes to the Legislatures.

I. An interstate-federal compact is more apt to be successfully negotiated now than in 1922 because of the more complex and pressing water problems, greater federal interest, the existence of bodies and groups working toward Basin-wide development and a better enlightened public.

J. The Committee can not go into detail regarding the proposed organizational pattern of the compact commission other than to state that it will have representation from the four basin states and the Federal Government.

Mr. William Rafsky, representing the Mayor of Philadelphia, concluded the question and answer period with the following statement:

"I have a feeling that if I were sitting out there I might feel as if I were being teased and cheated. Although I may not help you very much, I thought I would like to say these few words.

"I would say that, based on the discussions we have right now, that any jurisdiction going into a compact of this kind has to weigh what it gives up in terms of the advantages that it would get. I think I can safely say that anyone who participates in this compact will get far more in terms of the benefits and the potential worthwhile things than they would give up in the sense of maintaining responsibilities and jurisdiction.

"I thought I would say this because, coming from a municipality which has jealously guarded its own jurisdiction and has fought hard and long with the state to get its own home rule charter, it seems to me, as I weigh the balance sheet, even at this stage of the game prior to the consummation of the compact, that there are so many advantages and so many worthwhile things that will come of it, that there is no doubt in my mind, and I am sure there will be no doubt in yours when you see it, that this will be a great advance step for all of us."

# # #

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

ARMY ENGINEERS DELAWARE RIVER BASIN SURVEY

A. The District Engineers Report

Colonel T. H. Setliffe, Engineer,
Philadelphia District.

B. Let's Not Overlook the Value of Recreation

Cecil E. Heacox, Secretary, New York
State Department of Conservation.

C. Tocks Island - A National Recreation Area

George H. Thompson, Chief, Branch of
Recreation Survey, Region V, National
Park Service.

October 18, 1960

Presentation by
Colonel T. H. Setliffe, District Engineer
U. S. Army Engineer District, Philadelphia
before a joint meeting of INCODEL and the
Delaware River Basin Advisory Committee at
Pocono Manor
18 October 1960

My talk today will be in two parts.....First.....Since many of you attended one of the four Public Hearings or Public Hearings in Reverse which we held throughout the Valley to explain the study and its recommendations.....I will only cover the background and results of our efforts during the past three years to find a solution to the water problems facing our basin. (PAUSE) In the second part I will cover in more detail one very important facet of our study .....flood plain zoning. (PAUSE)

Now.....Part one....a brief review of what we have done since early 1956 when Congress directed

VU GRAPH ON #1

the Philadelphia District to make a truly comprehensive study of the water resources and needs of the Delaware River Basin.

VU GRAPH OFF

This survey is not just another paper exercise. Consider if you will these two very important facts.....First.....

VU GRAPH ON #2

population and employment in the valley and its service area is expected to double during the

next fifty years....in other words, the population will grow from the present 21 million persons to some 42 million by the year 2010. Employment will rise from 9 million to 18 million during the same period. (PAUSE) The second fact is that the amount of water available to sustain this growth will be about the same as it is now. The paramount issue thus becomes.....where will we get the water we will need? Our report provides the answer.

VU GRAPH OFF

Working through the Coordinating Committee which was organized by the District Engineer..we found that by the year 2010, we will be taking 14 billion gallons of water from the basin every day....more than four times our present rate of withdrawal. But even after we take into account the amount of water available from all sources.....we will still be one billion..four hundred million gallons short of our daily minimum needs.

VU GRAPH ON

To refresh your memory.....it would take 70,000 tank cars delivered daily to the Basin to provide 1.4 billion gallons.

VU GRAPH OFF

This then, is the problem of water supply. As you know, we also determined flood control..... recreation....and power needs. (PAUSE) What is our plan to satisfy the needs of the basin? We recommend a total of 58 dams throughout the basin. Eleven of them will be major water control structures with provision for water supply....flood control....recreation....and power.

VU GRAPH ON

Only Hawk Mountain and Tocks Island have power.

All have water supply.

All have recreation.

All except Hawk Mountain...Newark...and Christiana have flood control. Eight other sites have been selected for water supply when needed.....but with their initial development being for recreation. They are.....

(FLIP)

Paulina...

Hackettstown....Pequest....New Hampton....Tohickon.....Newtown.....Evansburg.... and French Creek. (PAUSE) A word about these eight sites.....In recent years we have become increasingly aware that before many authorized projects can be constructed, whole communities and industries are developed in the impounding area and the projects become uneconomical. In other words....according to our Benefit-Cost-Ratio....where the cost exceeds the benefits...no project. (PAUSE)

In our plan there are also 39

(FLIP) smaller projects selected for sub-basin development.....all having flood control as a main purpose. Except for three, all these can be constructed under existing small dam authorities of the Secretary of Agriculture and the Chief of Engineers. And, of course, there are the seven

(FLIP)

historical sites selected for further recreational development.

VU GRAPH OFF

When are the dams required? This

VU GRAPH ON

is what we consider to be a logical sequence of development for the eleven major control projects....the horizontal line represents time.....from 1956 through 2010. (PAUSE) The vertical line indicates the basin needs.....measured in billions of gallons.....the diagonal black line indicates the years by which the dam should be in operation if the increasing needs of the basin are to be satisfied. From this chart then, you can see that.....

	NEEDED BY
Beltzville	1965
Blue Marsh	1968
Trexler	1973
Prompton	1974
Tocks Island	1975
Newark	1978
Christiana	1980
Aquashicola	1981
Maiden Creek	1982
Bear Creek	1989
Hawk Mountain	2001

I'd like to point out also that.....as we have discussed before....it takes ....on the average,...some 5 to 10 years to get the money and build the project.

VU GRAPH OFF LIGHTS ON

Now....a word about the cost of the projects.....

The total cost of the eleven major control projects will be about 332 million dollars.....without the pumped storage hydroelectric features at Tocks Island.... which could add some 55 million dollars to the project. The 39 small projects will cost about 10 million dollars. The 8 recreation-water supply sites will cost about 119 million dollars. The grand total without power is about 461 million dollars. (PAUSE) The next, question, naturally...is who pays for what? The cost of providing flood control benefits is borne by the Federal Government .....PAUSE) Water supply is the responsibility of state and local interests.... (PAUSE) recreation benefits may be provided by the Federal Government if they have wide regional significance.....Tocks Island...for example. Otherwise they are the responsibility of state and local interests. (PAUSE) Costs allocated to power are borne by the Federal Government and are recouped through the sale of power.

This has been a brief summation of the plan we have recommended to satisfy the water resource needs of the Delaware River Basin and service area. Now..... what is the current status of this report? We are now on the final draft..... which reflects review comments by the North Atlant Division (General Lipscomb) and those of General Itschner's staff. The final draft should be completed before the end of next month.....checked out once more.....then printed. Maybe I can send the printed version to General Lipscomb for a New Year's present. General Lipscomb will issue a public notice when he forwards it to the Office, Chief of Engineers. From there, it goes to the Board of Engineers for Rivers and Harbors. After incorporation of any changes found necessary by the Board's review, the Chief will forward his report and all supporting papers to interested

Federal Agencies, to the Governors of the four states, and the Mayors of New York and Philadelphia for review and comment prior to submission to Congress. (PAUSE) So much for Part One of my presentation.....Now...Part Two.....a closer look at the problem of flood plain zoning.

But first.....because the memory of man is so terribly short.....a reminder of the reason why.....

HIDDEN VOICE ALONE FILM IN

On the 18th of August in '55....it was raining, as a weakened Hurricane Diane moved across the valley. But the earth....already saturated by the rains of Hurricane Connie the week before.....could abosrb no more.....the result..... floods.....the most damaging floods of record ever to strike the valley. Property damage.....over 100 million dollars....over 100 dead...many of them women and children.....This was the Delaware Valley only 5 years ago.....(PAUSE)

FILM OUT

Much of the damage caused by those floods happened in what is called the flood plain area. (PAUSE) Exactly what is a flood plain? Simply stated, it is an area into which a river overflows during times of flood. Nature has not changed over the years.....rivers still flood.....but...in many cases the flood plains have become crowded with towns and cities and industries seeking room for expansion. The result is often catastrophic. For example.....

VU GRAPH ON

This small creek -- Bushkill, near Easton -- has a flood plain.....now occupied by these buildings.....this

(FLIP) is the high water mark during the '55 flood.

VU GRAPH OFF

Here's another example.....Raubsville, along the Delaware below Easton.....

VU GRAPH ON PHOTO

of what can happen to a building in the flood plain zone.

VU GRAPH OFF

Obviously a partial remedy is control of the flood waters by temporary detention of the water in reservoirs.....which has proven to be the most universally effective method of controlling floods. This we are doing right now.....

FILM IN HIDDEN VOICE

Since early 1956, we have begun construction of three flood control dams and two levee-floodwall systems. (PAUSE) This is Bear Creek Dam across the Lehigh River. Started 13 May 1956....this 3,000 foot dam is now nearly complete and has already prevented flood damage this past spring.

ALLENTOWN

This is the recently completed flood control system at Allentown.....it too prevented flood damages earlier this year.

BETHLEHEM

At Bethlehem, on 24 June of this year, we began Phase One of a flood protection system that will include levees.....four pumping stations.....and a flood wall that will run along the south bank of the Lehigh River from the Hill to Hill Bridge to a point 1,000 feet south of the Minisink Trail Bridge.....and benefit the many thousand of persons who live in the area and suffer a loss of income whenever the Bethlehem Steel Plant is flooded out. These three projects comprise

our overall plan to protect the Lehigh Valley from floods.

JADWIN

The other two dams are in the Lackawaxen River Basin. Jadwin Dam....was dedicated 19 August '59. It rises 112 feet above Dyberry Creek near Honesdale.

PROMPTON

The third dam is Prompton.....across the Lackawaxen near Honesdale. It is nearly complete. Both Jadwin and Prompton have also prevented flooding.

(FILM OUT)

I would like to draw attention also to the extensive flood control program of the Commonwealth of Pennsylvania which is being carried out under the direction of Doctor Maurice K. Goddard....Secretary of Forests and Waters. Doctor Goddard has worked....and still is working very closely with the Corps of Engineers. To cite just a few examples of the work being done by the State..... the levees at Weissport.....the new concrete channel to carry Roaring Brook through Scranton.....and the flood protection works for the Stroudsburg area. The Federal Government is cognizant of the increasing use and development of the flood plains of the rivers of the United States and the need for information on flood hazards to serve as a guide to such development. Last July, the Government took an important step to assist in the utilization of the flood plains. This was the passage of Public Law 86-645 -- the Flood Control Act of 1960.

VU GRAPH ON

Section 206 of this Law authorizes the Chief of Engineers to provide information on floods.....general criteria for guidance.....and engineering advice to states

or responsible local governmental agencies. In other words, we can extract pertinent information from the voluminous data in our files.....supplement the data where necessary.....and put the material in usable form for state and local governmental agencies...and for private engineering firms they may employ.

VU GRAPH OFF

How can this service be obtained?

VU GRAPH ON

To obtain this service, a state or responsible local governmental agency must request the necessary survey and study for a specific locality.....and bear in mind that the approval of the Chief of Engineers is also necessary. (PAUSE)

VU GRAPH OFF

Another very important fact in connection with this new service.....The law authorizes the use of a maximum of

VU GRAPH ON

one million dollars in any one fiscal year....for the total program.

VU GRAPH OFF LIGHTS ON

To reiterate.....Section 206 of Public Law 86-645, copies of which are available in the rear of the room, authorizes the Chief of Engineers to compile and disseminate information on floods and flood damage.....including identification of areas subject to inundation.....upon the request of a state or responsible local governmental agency....and upon the approval of the Chief of Engineers. Remember also that a maximum of one million dollars will be made available for

this year for the entire nation.

Let's take another look at what can happen to a structure in a flood plain.....

VU GRAPH ON #9 RAUBSVILLE LIGHTS ON

This could just as well be a factory -- or some small business encroaching a flood plain. In any event, this home was not protected.

VG OFF

I shall quote from another speaker..... "It is in connection with local protection projects that we in the Corps of Engineers most frequently encounter problems of channel encroachment.

"Anything that impedes the flow of water is a channel encroachment and these encroachments are a major contribution to the enormous costs of floods, particularly in highly developed and industrial areas. There were many instances of this when Hurricane DIANE hit the northeast in 1955.

"When flood waters demand a greater channel they cannot be denied and obstructions intensify the river rise to disaster proportions."

Three feet of water doesn't sound like much until it's in your home lapping at the tubes of your TV set and on the legs of your wife's grand piano, as it is doing in this house.

Flood plain zoning does not prohibit the use of land, but defines the types of use. I am sure that it is obvious to you that people should not live where floods can endanger life and wipe out their possessions, and certainly structures should not be permitted which will interfere with flood

flow and increase flood damage.

However, the land can be used for many beneficial purposes, such as public and private recreational facilities. By this I mean golf courses, public parks, drive-in theatres, and athletic fields. Transient amusement enterprises are ideally suited for such areas - for example, circuses and carnivals or county fairs. Parking lots and used car lots could be allowed, and agricultural uses for orchards, farming and grazing may be practicable. These areas also make excellent wild life preserves.

Certain manufacturing and storage buildings, compatible with the hazards involved, could be permitted. For instance, flood damage to concrete and clay products would be minimal - and certainly such products could not float away. Buildings raised above the flood level, with adequate first-floor flood proofing protection might be allowed in some cases. However, the decision as to what is to be permitted in flood plains is entirely a local responsibility, geared to suit individual and community requirements.

I have just quoted from pages 4, 5, and 7 of an address given 16 August by General Lipscomb to the 1960 Public Works Congress & Equipment Show, American Public Works Association in New York.

Because my remarks have been introductory only, there are copies available for those who would study this problem further.

It seems clear that we must all begin to recognize the need for increased attention to flood plain zoning.....It's needed NOW in view of expected population and industry expansions. It can cut down flood losses in economical fashion.

FLOOD PLAIN ZONING ----- We all need to know more about it.

"LET'S NOT OVERLOOK THE VALUE OF RECREATION"

by Cecil E. Heacox, Secretary
N. Y. State Conservation Department

The very fact that George Thompson and I are on the program this morning is pretty good proof that we are not overlooking the value of recreation in the water resource development picture of the Delaware River Basin.

Those of you who have been attending these meetings know that Incodel has always given thoughtful consideration to conservation and recreational values.

The population explosion of the last few years is one of the most astonishing trends of our times. Equally astonishing is the trend of Americans to the outdoors. That's good. Outdoor recreation is a balance wheel--a fine safety valve--for the pressures we all face today.

Relaxation in the outdoors is no longer a luxury: it's a necessity if we are to more than merely exist. Our American way of life is based on more than mere survival.

How can you measure this kind of value? How can you put a price tag on the mental and physical benefits of recreation? Such benefits simply can't be measured in dollars and cents. Probably, for this reason, we tend to think of them as idealistic and visionary.

Although you can't put a price tag on the health benefits of recreation, the pursuit of recreation is big business. In the Delaware River Basin alone, it is a multi-million dollar industry. Just think of the boats, trailers, sports clothes, water skiis, fishing tackle, and hunting and camping equipment bought by the outdoor public. Hotels, motels, transportation costs are certainly a tremendous dollars and cents

investment that should give outdoor recreation top economic significance.

What better motivation can you have--double-barreled motivation--a multi-million dollar industry and the great health values of outdoor recreation. Then, why doesn't recreation get a better break, especially in this age when multiple use is an accepted concept in water resource development?

Perhaps it's the fault of recreation.

It may be that in the past the recreational planner has been too vague and too impractical in his approach; too inclined to picture his job in terms of a happy angler landing a fish, or more likely, some shapely gals in bikinis.

Yet the less tangible values of outdoor recreation can be blueprinted on a drawing board just like other engineering details. For recreation planning is also becoming a science. Not, of course, as exact a science as engineering.

When an engineer visualizes a reservoir project, he sees the general physical set-up--the basin that holds the water. In his mind's eye, he sees the shovels and the bulldozers making the big hole. He gets a picture of the concrete core wall. He sees the continuous back and forth movement of sheepsfoot rollers as a rolled earth dam is built up layer by layer. He sees the heart of the reservoir: the release work, the stop shutters, the Venturis, the valves which one day will be turned on so the reservoir can fulfill its purpose as a working unit.

The engineer is a practical guy. He faces his problems with a down-to-earth approach. The recreational planner also must have a practical down-to-earth approach if he is to be successful.

In most cases, fortunately, the recreational planner can talk the engineer's language if he tries. We can approach our problems in just as sound and practical a manner. Instead of thinking of recreation as an added dividend to be considered after the reservoir is built, we must consider recreation in the planning stage when the other engineering data is being worked up.

Actually we should start even before that--when land is being acquired. The conventional, uniform margin of 500 to 1000 feet is not always enough when a campsite or a picnic spot is being considered.

Now what, for example, should be on the recreational blueprint?

It is surprising that a simple but vital facility like a parking area is often overlooked until the reservoir has been completed and it's too late, or too costly, to make satisfactory changes. Because of the very nature of water-based recreation, people come by car with a picnic basket, a fishing rod or a boat.

All too often no parking places have been planned. People park along the main highway and become a dangerous traffic hazard. The recreational planner should have these parking areas spotted on his work plan. Often terracing is needed which can be done best during the excavation period. The steep banks of a reservoir near the dam often need serpentinelike roads, using the railroad switchback principle, to lead to the water's edge. Here again, these roads should be on the work drawing with all engineering details included.

Boat launching ramps--no longer mere drawing board dreams--are practical installations. Launching ramps should be spotted and planned in the blueprint stage so they can be constructed before the reservoir fills.

Picnic areas and campsites, like parking areas, need relatively level ground. Such areas can be built properly only during the excavation period when it is relatively easy to level off a suitable site.

Fishing piers extending out into the reservoir are also practical installations--Dr. Trembly mentioned them at an Incodel meeting a few years ago--should be on the reservoir blueprint.

If certain species of fish are in the stream below the dam, fish ladders to get the fish up into the reservoir must be designed in advance. And also facilities for returning them, because here, too, what goes up, must come down, and you like to have these finny little fellows all in one piece.

If waterfowl are included in the hunting opportunities of the project, some planning must be made for a satisfactory combination of points, coves and properly located duck blinds.

A good bathing beach needs a sloping shore. The very nature of a reservoir and the engineer's goal of maximum carrying capacity rules out gently sloping shores except possibly at the flow line of the upper end. To build a satisfactory bathing beach, the ground should be prepared when excavation is taking place.

For maximum fish production, shoal areas are needed for spawning and to produce fish food. Here, it is absolutely necessary that these areas be built before the reservoir fills.

All these things should be in the work plan.

Controlled flows below reservoirs to protect fish life are an accepted reservoir management measure today. What may not be known is that flows of this type may need special valves and other apparatus in the outlet chamber.

New York City's new reservoirs in the Catskills offer a striking example. Rondout, Neversink, Pepacton and Cannonsville were designed to take care of flows ordered by the Supreme Court.

Some time after the Supreme Court decision, the N. Y. S. Conservation Department negotiated a separate agreement with the New York City Board of Water Supply since the Supreme Court requirements were not always adequate for conservation purposes. It was then found that special pipes, gates and valves were needed to take care of these conservation flows.

I'd like to point out that all of us in the N. Y. S. Conservation Department are very grateful to the New York City Board of Water Supply who assumed the entire responsibility of redesigning the release works, drawing new specifications and arranging for additional bids--all at the expense of New York City.

The examples I have cited are obvious and I hope readily understood. Other problems as fluctuating water levels in the reservoir itself, the control of water temperatures in releases below dams and sanitary control around reservoirs--these problems are more complex, but I am confident that here too we can work out the answers if we put our minds to the job.

Another important reason recreation is so often the stepchild at the conference table is because we do not have a unified administrative command like the engineer and his staff. I have frequently used the term "recreational planner". Actually, of course, there is no such critter in the sense I've used it. A park manager, a forester, a game technician and a fisheries biologist--each gets into the act--each does his best to make a contribution from the viewpoint of his particular interest. Too often success depends on how aggressive and how articulate the repre-

sentative is, rather than the inherent value of his recommendations.

In my opinion, we must develop a new species--an over-all recreational planner--who can sit down at the drawing board with the engineer and develop the kind of detailed blueprint we have been talking about.

Finally, I'm sure we are all aware that the most basic of all reasons why recreation has not fared better in water resource developments is simply a lack of money. Recreation has never been able to ante up in such a high stake game as, for example, a multi-million dollar reservoir.

We do know the old belief that reservoir recreation should be subsidized by the operators just hasn't worked. At least, recreational facilities never get fully developed on this basis. In my own experience, I might say that it is encouraging to note that the principle: "Beneficiaries should pay for benefits received" is being accepted more and more by the recreational public. Obviously this is not the whole answer or, in some cases, fees would be like those at our swankiest country clubs.

I'll have to leave the answer to these financial problems to the experts.

Here again, the point to stress is that the underwriting of the costs of recreational facilities must be determined in the very beginning or complete development will never be realized.

To sum up--

In order for recreation to have a full partnership in water resource developments:

1. Recreation must be considered during the planning stage--not after a reservoir is finished.

2. Recreation must provide a detailed blueprint of areas and facilities similar to the work drawings of the engineer.
3. Recreation must provide a unified over-all administrative command to plan all aspects of recreation in the same way as the engineer and his staff.
4. The cost of underwriting the construction of recreational facilities must be determined in the very beginning of project planning.

We will all agree, I am sure, that these are valid requirements for successful recreational planning. But the most important ingredient that makes these approaches workable is cooperation and understanding between all the people and agencies involved.

If we do these things, the value of recreation, in my opinion, will not be overlooked in the future.

# # #

"TOCKS ISLAND - A NATIONAL RECREATION AREA"

by George H. Thompson, Chief,
Branch of Recreation Survey,
Region V, National Park Service

The National Park Service is pleased to have the opportunity to appear on your program today and to talk about the proposed Tocks Island project, a subject I know is of interest to all of us here and one which we will be hearing a great deal more about as time goes on. As you know, it is the key project in the development plan for the Delaware River Basin which the forthcoming Army Corps of Engineers report will recommend. It is also significant to note that the proposed Tocks Island project is the only one in the recommended plan which provides for flood control, water supply, power and recreation. All of the other eighteen projects will have three or less than three purposes. However, all of the projects have recreation as one of the purposes.

Before getting into the topic assigned, I would like to take just a few minutes to call your attention to some of the features of the Delaware River Basin which we think are significant and to the findings of our recent study which are likewise significant. The Catskills, the Poconos, the Delaware Water Gap, and the Kittatinny Mountains are names that are widely known and spoken of frequently in connection with vacation travel and by those living nearby in connection with weekend and day outings. These are well known features. I wonder just how many that are acquainted with or have heard of these important features recognize or consider the fact that they are directly related to and interlaced with the Delaware River and its tributaries. It is this group of features and the natural resources they support plus the natural resources and historical values found in the Piedmont Plateau

Region and the Atlantic Coastal Plains Region to the south, including the Delaware Bay, which the National Park Service studied and analyzed in connection with the development of the recreation plan for the Basin.

There are few, if any, river basins of comparable size in the country which offer the wide variety of natural features important to recreation. Nowhere in the United States is there a river basin comparable in size to the Delaware that has as large a population concentration within and closely related to it. In the area defined in the Delaware study as the "Delaware River Water Service Area" there is recorded a 1955 population of over 21,500,000. This population is expected to reach 25,000,000 by the year 1965 and over 40,000,000 by the year 2010. This tremendously large population creates a continuing and constant demand on the outdoor recreation resources and facilities. An indication of the economic importance of recreation to the general area is the estimate that $60,000,000 were spent in 1956 for vacations within the Philadelphia Federal Reserve District.

In view of this great concentration of people within and adjacent to the Delaware River Basin, the greatest need for nonurban recreation is concerned with usable space. Space, in this instance, implies total acreage available, including both land and water. It refers to acreage capacity for absorbing large numbers of visitors on weekends and holidays as well as on day outings, and in areas of such size as to provide the desired setting. Studies which the National Park Service made show that no section of the basin, except in the Catskill Region of New York, approaches the minimum of 45 acres per 1,000 population which is considered the desirable minimum for this

heavily populated region. The topography of this usable land must, of necessity, be suitable and adaptable to a variety of uses and facility developments.

Today the availability of water is considered the most fundamental requirement in the development of nonurban recreation areas. This is not a new idea in recreation but an expression of a natural attraction which water holds for those who are seeking active or relaxing recreation pursuits. The oldest resorts and vacation centers in this country were located in close proximity to water, either lake, river or ocean. Although there are over 500 lakes, ponds, and reservoirs in the Delaware River Basin and the included study area having an aggregate surface area of some 53,000 acres, it was found that many of the lakes and reservoirs are sources of domestic water supply and hence closed to the public, while the shorelines of many of the others have already been taken over for private homes, summer cottages, and other shoreline uses which preclude their being considered for public recreation purposes.

The recreation plan for the Delaware River Basin, as set forth in our report, provides for the preservation of areas to be used primarily for intensive day use participation-type activities, also areas of natural and scenic significance, and historic sites. The report goes on to list the methods by which this can be accomplished. They are through the improvement and further development of existing parks and recreation areas, through the acquisition and development of new areas, and through the acquisition of so-called recreation land reserves with development to be deferred. The optimum development of existing publicly-owned areas consistent with the available resources is

the logical point of beginning. This would be followed by the acquisition and development of additional nonurban recreation areas capable of accommodating large visitor loads. This constitutes a very important part of the Basin recreation plan although new areas are also recommended in the plan because of their particular scenic, historic or scientific qualities. The last method mentioned involves the acquisition of so-called recreation land reserves. This may be defined as land and/or water areas of potential values that have been acquired and set aside for development at some future date.

The major water control projects contained in the recommended plan of development for the Delaware River Basin would increase the acreage of waters available for public recreation in the Basin by about 38,300 acres, and the land areas surrounding these impoundments for recreation would be increased by nearly 74,000 acres. This group of projects constitutes an important segment of the recreation plan because of their proximity to population centers and the fact that they would provide facilities to satisfy an annual visitor attendance of 23,600,000.

It is assumed that the administration of the recreation areas proposed in the plan would fall within the authority of existing governmental agencies now concerned with this activity. The role of the Federal Government in the administration of parks and recreation areas is generally confined to those areas having broad regional and national significance. The administration of areas of less than national significance and of primary interest to the residents of a particular state are considered the responsibility of state government and its political subdivisions. The plan as outlined in the report

suggests that the remainder of the areas except Tocks Island be administered by an appropriate agency of the respective state governments.

As I mentioned at the outset, the proposed Tocks Island project is the key project in the Corps of Engineers plan of development for the water resources of the Basin. It is likewise a key project in the recreation plan. The recreation report describes in considerable detail its magnitude and potential significance, its scenic and recreation values, the importance of the 11,000 acre lake for water-related recreation uses, the suitability of the surrounding lands for a wide range of uses and facility development, and the quality of the water of the river. It discusses its broad regional significance, the large population which the proposed recreation area will serve, the interstate character of the project area, the great need for a nonurban recreation area of its potential size in proximity to such a large population, and it points out the fact that such an undertaking would exceed the normal capabilities of the states directly concerned. These are among the factors which point to the need of Federal administration of the area to assure the fullest public benefit.

The recreation plan for the Tocks Island project is based on the following assumptions which are also of prime importance: (1) that the plan of operation as it pertains to water levels will not adversely affect the recreation values of the impoundment and adjoining lands; (2) that the project area will be administered as a management unit; (3) that public use will take precedence over all other activities within the recreation boundary; and (4) that all existing highways and roads within the recreation boundary except U.S. No. 206 will be

vacated and the portions of these roads within the boundary not needed for interior circulation, administration and protection will be closed or obliterated.

The recreation plan as presented in the report is not intended to be fixed but rather should be considered tentative, flexible, and subject to revision and modification on the basis of further studies. In connection with further studies, including detailed recreation planning, it is highly essential that the views and interests of all agencies concerned with conservation and recreation be recognized and considered in order that a well rounded and balanced plan be worked out--one that will meet the needs of the large population which the recreation area is to serve. It is also important that a suitable operational plan for the reservoir be worked out, one that will provide an attractive and relatively stable water surface at least during the principal recreation months of each year, May through September.

At this point I would like to explain the term national recreation area as it applies to areas that are administered by the National Park Service. As you know, within the National Park System there are several classifications of areas, 13 to be exact. In addition to our great National Parks, of which there are 29 in number, there are national monuments, national historical parks, national battlefield parks, national historic sites, national memorials, national cemeteries, national parkways, national seashore recreation areas, and the national capitol parks. Their combined total is 181. There are also three national recreation areas under the administration of the National Park Service but not included in the National Park System. They are

Coulee Dam, Washington, acreage 98,500; Lake Mead, over 1,900,000 acres; and Shadow Mountain, in excess of 18,000 acres.

One may ask what is the difference between a national park and a national recreation area. A National Park is a spacious land area essentially of primitive or wilderness character which contains scenery and natural wonders so outstanding in quality that its preservation intact has been provided for by its having been designated and set aside by the National Government (Congress) for the benefit, enjoyment, and inspiration of the people.

A national recreation area in the National Park System is an otherwise qualified reservation which can or must support, either temporarily or permanently, other forms of resource utilization not basically inconsistent with the protection of the predominantly wild and unspoiled natural conditions of national significance which the recreation area is established to conserve. They generally require less restrictive conservation standards and regulations; yet, where appropriate, adequately fulfill conservation objectives. (Examples: outstanding canoeing country; outstanding sea and lake shores.)

Essentially they are similar. Both are administered under the general laws and policies which apply to all units of the National Park System unless the Congress specifies otherwise. In general, a National Park might be large, might be less modified by man, and one requiring more stringent application of protective control to conserve the delicate balance of its natural qualities.

The kinds of national recreation areas that are not included or contemplated for inclusion in the National Park System but administered

by the National Park Service are reservoir recreation areas, possibly some seashore areas, and such areas as would be needed for a separate system of national recreation areas based primarily on population needs.

In the light of these two categories for national recreation areas, the use of the term national recreation area as applied to the Tocks Island project, which as recently appeared in print, could be construed to go beyond the language of the Park Service Official Report and might be misleading. The nature and extent of Federal financial participation and which existing Federal agencies, if any, will be assigned administrative and management responsibilities by the Congress and the President, have not been determined. The National Park Service has made no recommendations in regard to an administering agency and does not presume to say what course the Congress andthe President may see fit to authorize.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

PROGRAMS OF THE BASIN'S WATERSHED ASSOCIATIONS

A. Brandywine Valley Association

Peter J. Short, Jr., Director;
Presentation by Stewart Huston, Vice President and Secretary, Lukens Steel Company - Brandywine Water Supply and Flood Control Project.

B. Neshaminy Valley Watershed Association

Edward A. Miller, Executive Director - Flood Plain Studies.

C. Wissahickon Watershed Association

Paul M. Felton, Executive Director - Problems of Pollution.

D. Red Clay Valley Association

Dr. Howard G. Tennent, President - Hydrologic Studies.

E. Stony Brook-Millstone Watersheds Association

Malcolm Crooks, Executive Director - Implementation of Public Law 566.

F. Delaware River Watersheds Association

John T. Carson, Jr., President - Liaison in Watershed Work.

October 18, 1960

BRANDYWINE VALLEY ASSOCIATION

"BRANDYWINE WATER SUPPLY AND FLOOD CONTROL PROJECT"

by Peter J. Short, Jr., Director

Presentation by Stewart Huston, Vice President and Secretary, Lukens Steel Co.

Drought and floods have plagued the Brandywine Valley for the past many years. An adequate supply of water at the proper place, and at the right time plus relief from the ravages of floods, is the dream of the Brandywine Water Resources Committee and the Brandywine Valley Association.

The Brandywine Creek Basin comprises a large part of Chester County and small sections of Delaware and Lancaster Counties in Pennsylvania and a large segment of Northern Delaware including a portion of New Castle County and the City of Wilmington.

On the basis of predicted population and industrial growth for Chester County and Northern Delaware over the next fifty years, a plan has been developed to provide for adequate water supplies, flood control, conservation, and recreational needs of the residents of this rapidly expanding area.

In the next few minutes I would like to mention some of the events that lead to the development of our water control plan.

In 1954 the Brandywine Basin experienced a severe drought and, as a result, the Brandywine Valley Association called together representatives of the major water users in the Brandywine Watershed. Severe water shortages were reported by the more than fifty persons present from Delaware and Pennsylvania representing local governments, industry, agriculture, commerce, and interested farsighted citizens.

The Brandywine Water Resources Committee was given birth at this meeting. The first official action of the committee was to engage the Brandywine Valley Association to undertake studies of the projected water needs of the area for the next 25 years.

In the summer of 1958 a more serious drought occurred even before the water needs survey was complete. The preliminary studies showed that at least 50% more water would be needed in the next 25 years to fill the requirements of the people and industry in the Valley. Henry Rowan, Engineer for the Interstate Commission on the Delaware River Basin, suggested several sites for large reservoirs. Construction costs were not considered at this point.

In the fall of 1955 the scene changed from one of too little water to one of too much water. Two hurricanes, I am sure you will remember, "Connie" and "Diane", caused severe flood damage in the Valley. The Water Resources Committee was spurred into action to solve this added problem. Through the U.S. Soil Conservation Districts in both Pennsylvania and Delaware, the Committee turned to the United States Soil Conservation Service for a flood protection plan.

A study revealed annual flood damages of $673,000 were high enough to justify federal participation in a flood control project under Public Law 566.

The drought in the summer of 1957, the 3rd dry year out of the past four years, brought us to the realization that the water shortage was not just something of a freakish nature. The City of Wilmington, through its Water Department, placed heavy restrictions on the use of its water. Similar restrictions were imposed by the

City of Coatesville, and the Borough of West Chester. Lukens Steel Company obtained permission to syphon water from Icedale Lake rather than curtail operations. The farmers were drawing heavily on the stream with portable irrigation systems to save their crops. There just didn't seem to be enough water to go around.

The Brandywine Water Resources Committee, after reviewing the population and business growth records of the communities in the watershed, reached the conclusion that a multipurpose dam project was needed to provide water supply, flood protection, and recreational facilities for the population explosion.

The Committee turned to the Department of Forests and Waters of the Commonwealth of Pennsylvania. Secretary M.K. Goddard was asked to be a partner in a dam building project to save the communities in the Valley. Dr. Goddard agreed to help under the following conditions:

1. The local people would acquire the land and relocate the utilities necessary to implement the program;

2. The State could develop parks and recreational facilities around certain dam sites.

The Brandywine Water Resources Committee thoroughly agreed to the conditions laid down by Dr. Goddard. Governor Boggs of Delaware appointed a Delaware Water Resources Liaison Committee to work with Pennsylvania officials, and the project was off to a good start.

Secretary Goddard hired Bourquard, Geil and Associates to study:

1. Water needs of the watershed area for the next 50 years;

2. Select and recommend the best reservoir sites;

3. Prepare estimates of the costs for the development of the project.

At this jointure the local, state, and federal study became a coordinated effort. The final plan was to include water supply, flood protection, and recreation.

On January 12, 1959, the final study that was prepared jointly by the Department of Forests and Waters and the U.S. Soil Conservation Service was presented to representatives from Pennsylvania and Delaware.

The plan resulting from the study called for the construction of 12 dams and reservoirs. All the reservoirs would be in Pennsylvania above Coatesville and Downingtown. High up in the watershed, they would catch the water before it got out of control.

The reservoirs would collect and store up the run-off in the wet seasons when there is too much rain, and down stream releases would be made in the dry summer season when there is too little rain. The water would be made to work over and over again all the way to the sea.

The total cost of the project would be borne as a cooperative enterprise with local, state, and federal agencies participating in the cost of developing the program. The cities, towns, and local governments, as well as industry, agricultural interests and business would be responsible for acquiring the land and all easements and rights of ways for construction. The Department of Forests and Waters of the Commonwealth of Pennsylvania would pay for the cost of building reservoirs designed for water supply, recreation, and partial flood control.

The Soil Conservation Service of the United States Department of Agriculture would pay for the cost of construction of the smaller

flood detention dams and part of the cost of the channel work on Sucker Run at Lukens Steel Company.

The suggested distribution of costs was;

Federal (Soil Conservation Service)	$ 2,556,600
State (Pa. Dept. of Forests & Waters)	7,368,000
Local (the Brandywine Valley)	4,218,900
Total Cost	$ 14,143,500

When fully completed the project will provide:

1. Flood protection worth $150,000 annually;

2. Adequate water supply for the next 50 years;

3. Several lakes for fishing, boating, swimming, etc.

Because towns and industries are willing to go together on a project such as this, and because it is possible to use the water over and over again, there will be a savings of several million dollars compared to separate reservoirs for each town or industry.

In April of this year, the proposed distribution of local costs was presented to the major water users by the Brandywine Water Resources Committee. It is hoped that by the year's end each town and industry will indicate how it prefers to finance its share of the $4.2 million dollars to be raised locally.

The City of Wilmington and New Castle County are having special studies made to determine how much more water they must have from the Brandywine and how soon. Necessary legal arrangements between Pennsylvania and Delaware are being explored.

When the local interests have agreed upon financial arrangements, the next step will be to set up an organization to represent them in acquiring land. State and Federal agencies will then start designing reservoirs.

Construction of some of the smaller dams might begin in 1962. Construction of the larger, multipurpose reservoirs appears to be about four years away.

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NESHAMINY VALLEY WATERSHED ASSOCIATION

"FLOOD PLAIN STUDIES"

by Edward A. Miller, Executive Director

The program, activities, and interests of the Neshamany Valley Watershed Association covers a broad field. Similar to other watershed organizations we are vitally concerned about water supply, floods, pollution abatement, control of soil erosion, woodland management, habitat improvement for fish and wildlife, and the role we must assume for the betterment of our natural and human resources.

Our watershed, having a population of 100,000 people, is located in the Philadelphia Metropolitan Region encompassing 236 square miles with 14.4% in Montgomery County and 85.6% in Bucks County. Industrial, commercial, residential, and agricultural interests all have a very important place in our watershed, and each has a wide range of diversity.

Following the floods caused by hurricanes Connie and Diane in 1955 it was not difficult to realize that property damage exceeding a million dolars indicated considerable growth and development. Problems resulting from flood waters of the Neshaminy Creek were of major proportions, and it seemed unlikely that they would lessen of their own accord. Solutions of the flood problem were investigated and analyzed. Five courses of action were reviewed as follows:

1. Local protective works, such as dikes and channel widening, deepening and straightening. These operations were considered too costly for the degree of protection involved and could increase problems downstream.

2. Acquistion of flood plains and elimination of development in flood risk areas. The excessive costs to the local communitites rendered this approach impractical and unrealistic except on a very small scale.

3. Flood water detention dams. This program which can be carried out under P.L. 566 could provide many benefits as well as flood control. However, our watershed does not qualify for such a program as Bucks County is not a soil conservation district.

4. Flood warning system. The N.V.W.A. set up a warning system in cooperation with the U.S. Weather Bureau which provides notice to residents occupying the flood plains of flood dangers. However, this system does not reduce the flood danger or flood stages.

5. Flood plain regulations. It was believed that this program would be of great value even if it were possible to undertake all programs previously considered. Its costs would be relatively low, the damage factor could be prevented from increasing, it would supplement a future headwater flood control program, and it would provide valuable information for flood warning purposes.

In June, 1957 a flood plain study of the lower sixteen mile section of the Neshaminy Creek was undertaken by the N.V.W.A. Guidance, assistance, and cooperation were received from INCODEL, Bucks County's Planning Commission and Park Board, Pennsylvania Department of Forests & Waters, U.S. Geological Survey, U.S. Weather Bureau, and the U.S. Army, Corps of Engineers. Colonel Setliffe's reference to the Federal Government's Flood Control Act of 1960, Section 206, authorizing the Corps of Engineers to compile and disseminate information on floods and flood

damage, including the identification of areas subject to inundation, was very interesting, considering there are still about 40 miles of stream channel where flood plain studies should be made. Had this federal program been in effect three years ago the N.V.W.A. might not have had to pioneer their own program.

The objective of our flood plain study was to provide sufficient data about the flood plain area to local municipal officials, on which they could base land use regulations for flood risk areas.

The program included the following procedures:

1. Data collection. Local residents were interviewed, and historical records and newspaper accounts researched to collect as many high watermark references as possible. As the 1955 floods set a new record, it was possible to gather most of this information from local people still residing near the Creek. Bridges were measured to determine the distance from stream bed to under-clearance, bridge deck and guard rail. Measurements were also made to determine spillway height and top of dam from stream bed, above and below all dams.

2. Profile survey. Beginning from an established point of elevation based on mean sea level (m.s.l.) a level survey was made which included all high watermarks, bridge decks, and tops of dams. With our previous measurements, all relative to the stream bed, it was possible to plot the stream bed elevations at all bridges and dams when the field notes were plotted on profile paper.

3. Computation. Using data recorded at the U.S.G.S. stream gaging station near Langhorne, flood frequencies and stage/discharge relationship were determined. Results were correlated with the profile data.

4. Report (phase I). All information that had been collected or computed at this point was made available in the report entitled, "Flood Plain Study of the Neshaminy Creek, Lower Bucks County, Phase I, July 1958". The objectives of the report were; to create an awareness of the constant flood danger; to encourage local communities to support further field investigations leading to a complete report of the lower area of the Neshaminy Creek; and to encourage cooperative planning of all affected municipalities. The report was distributed to local officials and all interested individuals and agencies.

Following several meetings with local officials, four townships along the lower section of the Neshaminy Creek agreed to finance a cross-section survey that was needed for completion of the flood plain study. The townships of Bensalem, Bristol, Lower Southampton, and Middletown paid for this work according to the length of stream channel in their municipality.

5. Cross-section survey. Cross-sections were determined at twelve locations in the lower sixteen mile section. Surveys were tied into same mean-sea-level datum as was used for the profile survey. Locations of cross-sections were determined by effects of topography, stream encroachments, tributary influences, land use, high damage areas, and development potential. Field notes and data were plotted to show 50-year flood water surface elevation, and changes-in-grade, to a minimum of 30 feet above stream bed. The 1955 flood of record did not exceed 25 feet above stream bed at any knownpoint in the lower area.

6. Calculations. For each cross-section, calculations were made to determine mean depth, cross-section area, slope, wetted perimeter,

hydraulic radius, velocity, friction coefficient of stream channel, and discharge for floods of various frequencies. Stage/discharge graphs were constructed for each cross-section, and information was checked by area/discharge formulas and U.S.G.S. regional data.

7. Mapping. Using stream valley property maps prepared by the Bucks County Park Board and transposing topographical data from U.S.G.S. quadrangle maps, provided us with base maps for delineation of the floodway based on a 50-year flood. As the U.S.G.S. contours were at 20 foot vertical intervals, it was necessary to interpolate one foot intervals to a height at least 30 feet above stream bed. The cross-sectional data provided the necessary vertical control and tie-in to the U.S.G.S. contours. The requirement for a greater degree of accuracy than was employed with the 20 foot contour intervals made it necessary to check and adjust topographic features stereoscopically with aerial photographs. After the 50-year flood was plotted on profile and the inundated area delineated on the base maps, field checks were made to make sure inundation limits were sufficiently accurate.

Two floodlines were shown on the maps. The modified floodway lines indicate the limit of inundation from a 50-year flood. The lines indicating the open floodway were determined on the basis of depth and velocity of flow. The open floodway indicates the area of maximum danger to life and property during a 50-year flood, where the water depth would be 8 feet or greater, or the velocity of flow would exceed 6 feet per second, or about 4 miles per hour. The open flood is, coincidentally, the approximate limit of flooding from a 5-year flood.

Each township that helped underwrite the second phase of the flood plain study was provided with a set of the Flood Risk Maps for their use in establishing land use regulations in their respective flood plains. Middletown Township expects to adopt a flood plain zoning ordinance based on their maps within the next month.

The Bucks County Planning Commission provided the townships with a model flood plain zoning ordinance to supplement the flood risk maps.

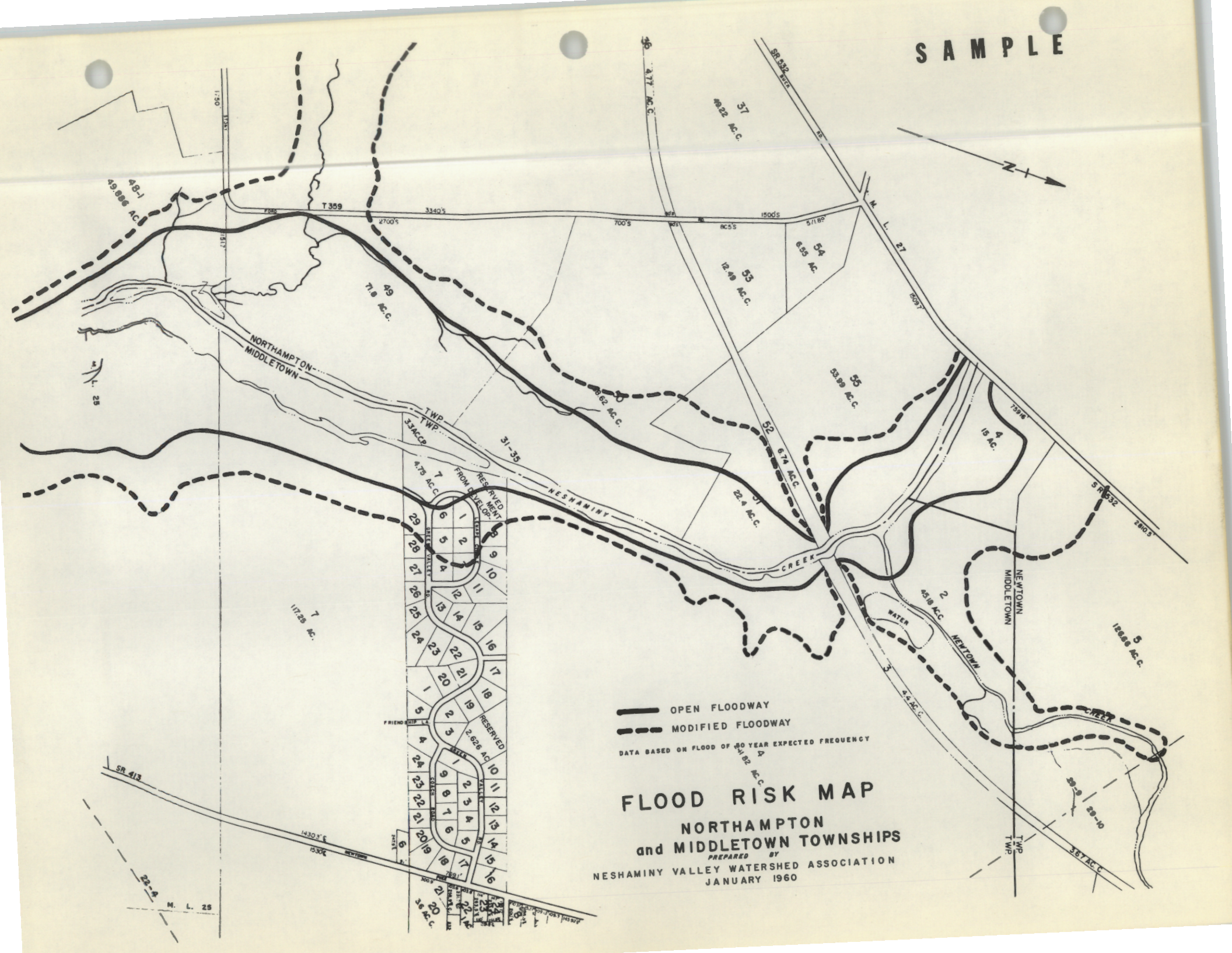
The N.V.W.A. is, at present, preparing for final draft a "Report of Procedures" concerning the flood plain study that has been completed. Many of you have reviewed our preliminary draft and have made many helpful suggestions.

Our cost-estimate of this flood plain study ammounted to approximately $250 a stream mile. Cost-estimates include time contributed by many individuals who were not paid and a fair value is reflected in the total cost-estimate. Costs of the stream valley property maps were not computed, as these maps were made for general planning and tax purposes, and not specifically for the flood plain study.

I would like again to express appreciation for the cooperation and assistance we received from the many federal, state, and local agencies, organizations and private citizens. One of the main things we have learned through this study is that assistance and help are usually available from the busiest offices if there is a willingness to do some work yourself.

# # #

SAMPLE



FLOOD RISK MAP

NORTHAMPTON and MIDDLETOWN TOWNSHIPS

PREPARED BY

NESHAMINY VALLEY WATERSHED ASSOCIATION

JANUARY 1960

DIGEST OF TALK

WISSAHICKON WATERSHED

"PROBLEMS OF POLLUTION"

by Paul M. Felton, Executive Director

The Wissahickon Watershed is a sixty-four square mile suburban rural area situated in Montgomery and Philadelphia Counties. The twenty-three mile Creek has its source near Lansdale and its mouth at the Schuylkill River near the Philadelphia City Line and Ridge Avenue.

Because of the excellent transportation facilities connecting to Central Philadelphia, this beautiful "Country" has been a natural choice for industry in its decentralization movement away from crowded center city. Industry is being followed by residential development at an alarming rate.

With this urban sprawl comes the need for more and larger sewer treatment plants to clear up on-lot sewage treatment failures found widespread in this heavy clay soil area.

Detergents project a dramatic show in the tributaries and the Wissahickon with more frequent queries by residents when giant mounds of detergent foam float across highways. The movement of silt from farms, urban developments and new roads is filling the stream channels, destroying fish habitat and abetting floods.

Heavy pumping of groundwater by local authorities along with destruction of rain retarding natural cover has resulted in low summer stream flows emphasizing the pollution effect on the main stream.

The Wissahickon Valley Watershed Association, working with the Soil Conservation Service and other conservation agencies, is endeavoring to inform the local residents of the many pollution problems and is

promoting landowner and municipal action to clean up all pollution in the watershed and restore the valley to its former beauty, while at the same time presenting Philadelphia with the Wissahickon's share of cleaner drinking water.

# # #

RED CLAY VALLEY ASSOCIATION

"Hydrologic Studies"

by Dr. Howard G. Tennent, President

The Red Clay Watershed covers fifty square miles in Pennsylvania and Delaware, lying immediately west of the larger Brandywine Valley. The dry years of 1954 and 1955 caused serious water shortages for the Borough of Kennett Square, Pa., and for an important industrial operation in northern Delaware, both dependent on Red Clay Creek for their supply. The rapid transition from rural to suburban character occurring then in much of the Valley (and still continuing) suggested that increased demands for water would arise. Lack of adequate information about the area's water resources was becoming painfully apparent to those responsible for meeting its needs for water.

Consequently, in 1955 the Red Clay Valley Association and the United States Geological Survey undertook a unique cooperative experiment in water resources data-gathering. The purpose was to determine by means of six strategically located rain gages how much water fell in the Valley, and to find out what happened to the water by observing the height of the water table (fourteen wells) and the volume of stream flow at a pre-existing flow gaging station near the downstream end of the creek. The estimated cost for five years of such a survey was $5,000, to be shared equally by the USGS and the Association. The latter formed a Business and Industry Committee which was successful in soliciting pledges totalling $2,500 from about thirty organizations concerned with the Valley's water resources. The Association also assisted in locating wells and volunteer observers for the data collection. The USGS did all the technical work - installing gages and recorders, training observers, and collecting and analyzing the data.

Since the USGS was not able to enter into a formal contract with a voluntary organization such as the Red Clay Valley Association, the Chester County Soil Conservation District, a legal subdivision of the Commonwealth of Pennsylvania, stepped into the breach and signed the actual contract when the Association's pledges were obtained.

The information for the first five years has been acquired, and is now being studied by the USGS. No final report has been issued, but some interesting general conclusions can be cited. Total rainfall for the five years closely approximated what would be considered "normal", judging from long-term records of nearby Weather Bureau stations. There was no definite net change in the ground water level over the five-year period, though there were marked fluctuations during that time. Slightly less than half the water that fell in the Valley ran off in the stream, the remainder being returned to the atmosphere by evaporation and transpiration.

The Borough of Kennett Square was one of the contributors to the Association's share of the project. Its contribution proved to be an unusually profitable investment. In 1958 the Borough was about to approve construction of a $150,000 reservoir to augment its water supply when those active in the water resources research program suggested that the geology of the area was such that the needed additional water might be obtained by drilling wells in a favorable location. Though concerned about the consequences of delay if the wells were not successful, the Borough Council met with geologists from the USGS and on the basis of their evidence decided to drill two or three wells at recommended sites. The first well proved highly successful, with an estimated flow of 500 gallons per minute, or more than the Borough needed! Thus it saved roughly $135,000, dramatic proof of the value of knowledge of water resources and of the usefulness of watershed associations.

The partners in the research are now considering another program designed to gather information about the distribution of peaks and minima in flow at various points in the stream, and about water quality. If solutions to technical problems in getting useful data of this sort appear to be in sight, the experiment will be continued.

STONY BROOK-MILLSTONE WATERSHEDS ASSOCIATION

"IMPLEMENTATION OF PUBLIC LAW 566"

by Malcolm Crooks, Executive Director

Let us stand back for a moment and view from a distance the work we are doing in natural resources. Why are we trying to do a better job of managing our natural resources? Why are we building flood control dams, water supply reservoirs, encouraging the establishment of farm land conservation practices? IT'S FOR PEOPLE! Then if it is for the people, I say, let it also be by the people. The local people in the watersheds and in the major river basins must be allowed to take an active role in the decisions of the how, where and what of the natural resources improvements which will be made in our watersheds and river basins.

There is one point I want to make today and that is it's the people who count, and you can count on the people when they are well informed and working for a cause they believe in.

I would like to give you an example of people making decisions and planning programs to improve their own local natural resources. The example I give you is the Stony Brook-Millstone Watersheds Association. In 1949 a group of people in central New Jersey, in the Princeton area, organized to try and do something about their erosion, water, forestry, and wildlife conditions. They hired a full time staff member to advise them and to give them a continuity to their efforts. After five years of working in this direction, Public Law 566 was enacted authorizing the U.S. Department of Agriculture to cooperate with local organizations for the purpose of controlling damage from flood waters.

The purpose of the Stony Brook 566 Project, as far as the economic justification is concerned, is for the control of erosion and reduction of sediment in the Stony Brook Watershed. However, as far as the local people were concerned they saw this project as accomplishing these goals, but in addition, adding to the conservation of water, bolstering the water table, improving recreational opportunities, providing water for fire protection and irrigation, as well as a possible potential for water supply.

The official goals (i.e., erosion control and reduction of sediment) would be achieved by two methods: 1. application of land and water conservation practices, such as contouring, strip cropping, tree planting, water diversion, etc.; 2. structural measures which would supplement the land treatment programs. Nine conservation reservoirs are planned for the Stony Brook project.

The land treatment phase began in the Fall of 1956. The structural phase started in the Fall of 1958. Now, three, or one-third, of the reservoirs have been completed and forty percent of the conservation practices, which were deemed practical to establish in the project period, have been established.

Local Responsibilities

Local responsibilities in the 566 program are substantial but not overwhelming. They are: 1. easements; 2. contracting. This phase has not run as smoothly as we would have hoped. There have been conflicts of policy between the contracting agency and the contracting procedures as established by the Federal Government. I would suggest that it might be appropriate for the state to furnish a contracting officer who could

work from one project to another within the state and thus attain a more happy solution to this local responsibility. 3. Operation and maintenance. It's easy to accept these responsibilities but a great deal harder to carry them out because they are responsibilities which will be held for many, many years to come.

These three are the local responsibilities which are outlined under the 566 Act. However, I would like to add two additional ones. The first is coordination. In the Stony Brook project there are 18 different federal, state and local groups which are teaming together to accomplish the goals of the program. Certainly a coordinator is needed to get the maximum functioning of all these different groups.

The other responsibility which I think local people should assume is to see that the conservation work - land treatment - is accomplished as expeditiously and as fully as possible.

State Responsibilities

I don't have time now to go into state responsibilities but I believe the state should assume far more responsibility for watershed management than they have in the past. I'm thinking not only in terms of 566 programs but also for watershed programs of different justification than is possible under 566. It is obvious to all of us, of course, that watershed management is important for many other reasons than solely for flood control.

The Job Ahead

What's ahead of us in the Stony Brook in our 566 program? Well, first of all we have six more dams to build, then the remaining sixty percent of the soil conservation practices to establish. The

state will acquire at least two of the reservoir sites for public fishing and recreation areas.

We hope to convince the county to purchase at least one of the reservoir sites for a county recreation area.

A mursery is using water for irrigation from one of the reservoirs and we want to encourage more of this type of use from the dams.

We are working with the county fire marshal and with local fire chiefs toward the installation of stand pipes and rock base roads to the reservoirs so that the water may be used for local fire control.

We are now working on a fish and wildlife amendment which will include four specific improvements: a. renovation of an old mill dam to improve the fishing potential; b. special structures for stream channel work for fish management; c. stream bank stabilization at several key points along the main branch of the Stony Brook; d. the possible establishment of a waterfowl marsh. These four specific areas of improvement are all structural in nature and supplement the day to day fish and wildlife program that is being carried out by the establishment of farm ponds, wildlife plantings, hedgerow management, etc.

The Watersheds Association is now studying a method of procuring water from a combination of use of Delaware River water and impoundment of a small watershed adjacent to the Stony Brook. An integral part of this water supply network would be the use of one or more of the conservation reservoirs in the Stony Brook to serve as storage reservoirs.

We are now carrying on research which is connected to the 566 program and anticipate further work along this line. Four separate studies could be involved: a. the existing rainfall and sediment

project in cooperation with the U.S. Geological Survey has as one of its objectives the analysis of the effects of the 566 project on sediment production in the Stony Brook; b. we hope to institute a trap effeciency study on one of the reservoirs in which the amount of sediment trapped by these dams would be measured. This would give engineers important information which is necessary in the design of irrigation dams, water supply reservoirs, as well as structures which are similar to those being built in the Stony Brook; c. a Rutgers University graduate student has just initiated a biological succession study on one of the reservoirs; d. we are hopeful that a gound water hydrology professor at Princeton University will take the leadership in a study of a ground water recharge potential of reservoirs such as we are building in the Stony Brook.

We hope to use the improvements which have been made under the 566 program as a part of our conservation education program in the Millstone Watershed. We will show youth groups as well as adult groups the reservoirs as well as the various soil and water conservation practices which have been established. We feel there will be a great impact on people when they see the extensive work which is being accomplished in their local neighborhood.

I have just outlined thirteen potentials which the Stony Brook people are realizing because they have been acting in the planning and implementation of this 566 program. From the first this has been <u>their</u> program.

I think you will agree the program has breadth. Why? There are two reasons, first, the 566 legislation was written with this in mind;

second, local people through their watershed association have seen the opportunity through 566 to fulfill many community needs.

Government officials and outside experts are important to conservation programs but they simply cannot make the wise decisions for local people that these people can make for themselves.

As you can see, I believe in democracy. I have seen it work and work well in the Stony Brook-Millstone Watershed. And so I come back to my introductory thought "It's the people who count and you can count on the people when they are well informed and working together for a cause they believe in".

# # #

DELAWARE RIVER WATERSHEDS ASSOCIATION

"LIAISON IN WATERSHED WORK"

by John T. Carson, Jr., President

Organized as a federation of watershed associations in the Delaware River Basin, the Delaware River Watersheds Association, Inc. is a little over a year old. Meeting monthly, its members all benefitted greatly by being able to share experiences and problems.

The stated purposes of the D.R.W.A. are:

a. To share knowledge and experience for the mutual benefit of all watershed groups;

b. To analyse problems which affect watersheds in the area and make recommendations;

c. To foster the watershed approach to resource development;

d. To assist when requested with the formation of new watershed organizations.

Membership in the Association is open to those actively engaged in watershed organizations. The present board of directors represents six watershed organizations whose combined areas are about 1000 square miles, or 1/12 of the Delaware Basin. These watersheds are: the Brandywine, the Neshaminy, the Red Clay, the Stony Brook-Millstone, the Tohickon, and the Wissahickon.

During the past year, we have met in five different watersheds, investigating first hand a particular problem or project. In the Wisahickon, we inspected the proposed P.L. 566 flood detention sites and discussed the problem of land acquisition in a densely settled suburban community. In the Stony Brook, following an inspection of three completed

sedimentation control reservoirs, we discussed the problems of red tape and cost of P.L. 566 projects. The comprehensive Brandywine Flood Control, Water Supply, and Recreation Project was explained in detail, the proposed sites inspected, while the ensuing discussion was largely concerned with methods of getting different municipal, county, and state officials to cooperate in moving the program into actual implementation. In the Neshaminy, three meetings have dealt with flood warning systems, and flood plain mapping and zoning. In the Tohickon, the focus is on recreation projects.

Since there has been a lot of misunderstanding about what a watershed association is and does, it seems worth while to state here what we believe our job to be.

1. To collect basic data on natural resources, and to foster research.

2. To inform the public on the need for and methods of conservation development of these resources.

3. To serve as a catalyst and stimulant to people and agencies to work cooperatively on resource development.

Furthermore, those of us who are in watershed work have certain beliefs in common which are worth stating:

1. That most people are overwhelmed with the magnitude of the problems facing the entire basin, and can only comprehend them as they are broken down into smaller local units. The logical unit, we believe, is the sub-watershed.

2. That local people should feel the primary responsibility for solving their own problems, with help from the state and federal government only as needed.

3. That the answer to the resource problem lies in planning to meet local needs on a subwatershed basis, with coordination and overall integration between them.

4. That all natural resource problems are ecologically interlocking. Planning for flood control without also developing water supply is short sighted; paying for flood control structures without, at the same time, controlling flood plain development is self defeating; forgetting to preserve "Open Land" for recreation, insoak, and aesthetics is inviting "suburbicide".

In short, we believe that our primary job is to get cooperative action, on a local basis, from all diverse interests: agriculture, industry, sportsmen, conservationists, etc. If this can be done on the local level, we will have the firm, broad base of support for the larger, basin-wide projects.

# # #

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

COORDINATED WATER RESOURCES DEVELOPMENT

Harvey O. Banks, Director, California Department of Water Resources; Chairman, Interstate Conference on Water Problems; President, Association of Western State Engineers.

October 18, 1960

COORDINATED WATER RESOURCES DEVELOPMENT

Harvey O. Banks, Director, California Department of Water Resources; Chairman, Interstate Conference on Water Problems; President, Association of Western State Engineers.

I am deeply appreciative for the opportunity to visit the Delaware River Basin and to become better acquainted with the various activities of the several water agencies operating in the Basin.

I should warn you that I'm going to talk about my home State tonight. But I will talk about it for the basic reason that we in California have been engaged in one aspect or another of water development at the State level for some 85 years, since 1875 when the first State Engineer was appointed to study the water resources of the State. We have made a lot of mistakes - we are still making mistakes. We have met a number of water problems, some of which we have been able to resolve; but not all of them, by any means. However, it does seem to me that from our experience, both good and bad, there may be some phase of my discussion that could be of help to you in your work here.

To understand our situation, I should take a moment or two to describe the hydrology of the state. We are a State ranging in water resources from Rain Forest in the northwestern portion, to extreme aridity, with one or two inches rainfall per year, in the southeastern portion. We do have enough water within the State to satisfy our ultimate needs if we can get on with the job of developing it, but we suffer from extreme maldistribution, both areally and with time. About 70 percent of the State's water resources are in the northern third while about 75 percent of the present and future water demand of the state lies in the southern two thirds. So we have the job first - of controlling and conserving water in this northern third where it occurs in surplus and second - of transporting those surpluses to the areas of deficiency in the west and south which involves the use of aqueducts in the order of 500 to 600 miles in length.

In addition, we have a bad time distribution with respect to our water resources. Nature wasn't very kind to us in that most of our run-off occurs during the winter and spring months as the rains come and the snow melts. We are also subject to extreme droughts, both occuring on an annual basis. Last year and this year are good examples. We had a precipitation in the order of 40 to 50 percent of normal and yet had extreme flood periods when run-off aggregated to two and one-half times the normal. Southern California, for instance, is in the fifteenth straight year of drought, starting in 1944-45. Near normal rainfall occured only twice in these fifteen years, but a continued deficiency has been sustained through that fifteen year period. When this will end, we don't know, This complicates the problem.

At the present time, to quote a statistic or two, we are using about 22 million acre feet a year. With full development of the land resources of the state, that figure will rise to about 55 million acre feet per year for consumptive purposes. Our total water supply on a mean annual basis is about 71 million acre feet. We will have to achieve a fairly high degree of conservation to meet the ultimate needs. At the present time, much of our economy is based upon the mining of ground water, particularly in Southern California and the Southern San Joaquin Valley. In other words, we are taking out more ground water than is being put back by nature to the tune of roughly 5 million acre feet per year. This is a sizeable over draught. This has resulted in some of our coastal ground water bases being subjected to severe sea water intrusion. In Southern California, for instance, in the Vernon area of Los Angeles, they are now pumping from about 110 feet below sea level, static ground water level. Now, that is bad enough in itself, but, when we look at the future, it frightens me. Population projections of what I consider my fair state go something like this: the present population of about 15.5 million will grow by 1980 to about

28 million, by the year 2000, to about 42 million; by the year 2020, to about 56 million. Where we are going to put all these people I don't know. It is just too many people. What this population explosion means water-wise is that the water use in the state will increase by over 28 percent in the next 15 years. So you can see that we face a fairly critical water problem in the State of California today.

The State organization you might be most interested in, because we have consolidated many of our water agencies and streamlined our organizational pattern, is the principal water agency in California today. That is the Department of Water Resources which I have the honor to head. This Department now has about 1800 personnel. It has responsibilities in the field of water ranging all the way from the time the water is in the clouds as water vapor until it wastes into the sea as flood run-off, or as spent water in the form of sewage and industrial waste. In addition, our Department has certain responsibilities with respect to our saline coastal waters. I think I am correct in saying that my Department has a broader scope of responsibility and activity in the water field than any other agency of its type in the world.

We also have state and regional water pollution control boards which handle the matter of preventing pollution through the disposal of sewage and industrial wastes. The State Water Rights Board is an independent agency which handles the matter of acquisition and adjudication of water rights. These are the three principal agencies dealing with water in the State.

The Department of Public Health and the Department of Fish and Game have certain minor responsibilities in connection with their specific fields, and the State Soil Conservation Commission handles Public Law 566 projects, comprising the small reclamation and flood prevention projects.

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That is the organization that we have set up. Formerly, we had about twice that many agencies. In 1956, the system was reorganized extensively, and a great many boards and commissions were eliminated or streamlined into straight line activities.

The first attempt at project formulation at State level was what you may have heard of as the State's Central Valley Project, a project to move water from the Sacramento Valley to the San Joaquin Valley or, from north to south. Unfortunately, about the time the State was ready to build, it was in the depths of the depression. I hate to say this, but California bonds at that time were not worth very much. As a result, the actual construction of the Central Valley Project was taken over by the Bureau of Reclamation in 1935, and this group has been working at it continously ever since. There is a great deal of work yet to be done.

In 1947, recognizing the explosive growth of population, the Legislature directed the State agencies to undertake a further study of the water problems of the State and to come up with a master plan for their development. We made a complete restudy of the future water requirements for the entire State and formulated a master plan for the development, control, conservation, distribution and utilization of the State's waters for all uses. This is what we call the California Water Plan. It is a master plan. It is not a construction proposal in any sense of the word. But it has been adopted by the Legislature as the master plan and it has proven extremely useful in achieving coordinated water development by all agencies - federal, state, local and private - throughout the State.

Regarding the matter of construction at the State level, we embarked, at the same time we began the formulation of the master plan, on the studies of what we now call the Feather River and Delta Diversion Projects. This is

a project to divert water from the northern third of the State and move about four million acre feet per year to the south. This program was authorized by the Legislature of 1951 and reauthorized in 1955. We are now actively engaged in construction. By the time we get done, including all the extraneous works at present day price levels, it will be about a 2.1 billion dollar project. In the prosectuion of this plan, I would like to point out that we have given great consideration, and attached great importance, to the enhancement of the recreational resources of the State including the enhancement of our fishery resources.

Incidentally, I am greatly intrigued by the recreational plan that is being proposed for the Tock's Island project. I think it is a splendid thing.

At the present time we have some construction activities and projects in progress. We will soon complete one dam and next year we will complete one aqueduct. To date, the Legislature has appropriated about $149 million for this purpose. On November 8, a 1.75 billion dollar general obligation bond issue will be voted on. Whether it will pass, I have no way of knowing. At the moment, or when I left California, it looked fairly favorable.

One and three quarter billion dollars may sound like a lot of money. It is a lot of money; but it is to finance a construction program extending over approximately 25 years. When you reduce that figure to an average annual expenditure, the State's total water program including everything, - administration, pollution control, everything - runs about $120 million a year.

Now, in formulating this project and the attendant bond issue, I should mention that the bond issue bill passed the Legislature after about eight years of acrimonious controversy. We have run into a number of conflicts in which you may be interested. I know you have some here. I doubt that you have them all.

We have on our statute books in California what we call a County of Origin

Act. This act, in effect, says that any county wherein surplus waters originate, has a first right to that water for its future needs. What this means is that nobody can acquire a firm right to water outside of a county of origin. This poses some real problems in these large export projects because it means that there is no such thing as a firm right to water. Personally, I think this is a good thing. But it does create real problems on a water rights standpoint.

This is the essential conflict which some of you may have read about in the papers. Southern California does not look with any great enthusiasm upon paying their share of this works when they cannot acquire a firm right to the water. On the other hand, the Northern portion does not desire to give up water which may be needed in the future. Understandably, Northern California is very much interested in keeping the County of Origin Act intact and operative.

That is one of the fundamental conflicts that we have had. I don't know whether you have had similar experience here or not.

We have also had many other conflicts for water. We have had conflicts between urban use and irrigation use. We have had conflicts between the use of water for fish and the use of water for irrigation. We have had conflicts between the use of reservoir storage space for flood control and its use for conservation. We have those in the State who would like to use the State water program to promote social and economic reform, particularly through the imposition of a land limitation act. But, over and above all of these things, comes the real basic conflict. Who is going to have the financial and economic advantage of the next block of cheap water, and who is going to have the political power that goes with the control of distribution of that water? I have no way of knowing whether you, in this area, have been confronted with these problems or not, but I would hazard a guess that you may in time. The matter of

political and economic control is one of extreme importance.

I do not want to give you the impression that the State of California is trying to solve all of its water problems by itself. Our program is intended to be a cooperative program, with the State supplementing the activities of the federal agencies and the local agencies. As a matter of fact, over the next 20 to 25 years, the federal agencies have in the stages of planning and investigation, projects of their own which will aggregate about 3 billion dollars on their own. So, we are not trying to "go it" alone. We love the federal agencies very much. We hope they continue.

But why did the State get into this field? Why did we feel that it is necessary to get into the construction field? Well, the first answer, of course, is that construction of water development facilities just simply was not keeping up with the demand. That is the basic point. Secondly, and possibly of more significance in the long run, the scope of federal programs is not sufficient under present policies of the Congress to solve all the water problems of our State. Finally, the rate of federal appropriations is not sufficient to keep up with our demands. As a matter of fact, today, we are getting only slightly more construction work by the federal agencies than we did in 1950-51 when you adjust for the cost indeces.

We were told in Congress last year that there was absolutely no hope of California getting any significant increase in federal appropriations. The words used were, "You have been getting too much, too long, and there are lots of other people in these United States". We don't agree with that, but I don't know what we can do about it.

I would like for a few moments to discuss the matter of federal-state relationships and some of the problems we have run into. I will apologize in advance, to Colonel Setliffe and other representatives of federal agencies

here. I do not mean to be critical of a specific federal agency. All of them are doing magnificent work. What I have to say concerns the fundamental policy of the United States as expressed by Congress. The most serious problem in federal-state relationships is this: There is no clear cut definition of the extent to which we can look to the federal government for water development and have reasonable confidence that it will fulfill that degree of responsibility. There is no such thing as a clear cut federal water policy. In fact, Congress has the unfortunate habit of adopting policy for each new project when it comes before them. There is no real way for a state to determine where it should fit into this total picture until sometime, we hope, Congress will get down to work and define what is the federal responsibility regarding water, and take steps to implement that responsibility so the states have something to carry on with.

Each federal agency operates under different statutes and with different objectives. This leads to a matter of gross competition between agencies in many cases. For instance, in one case in our state, the Bureau of Reclamation, the Forest Service and the Fish and Wildlife Service are in direct competition for the same water. Now who is going to win I don't know, but this is the sort of thing that should not happen.

A second problem in federal-state relations is the matter of water rights. Historically, it has been considered that the states are the logical agency to administer water rights. Congress has passed many acts, starting with the Desert Land Act of 1877, the Reclamation Act of 1902, and others, which apparently indicated that Congress intended for the states to administer water rights. However, some of our recent Supreme Court decisions cast doubt upon that. It begins to appear that, in the opinion of the Supreme Court, water rights are in fact

a federal responsibility and that the Federal Government may well own all of the water. This seems to be the case at least in the Western States where we have so much federal land. This is of great significance to us as states and as interstate agencies too, because the United States today has no machinery for the administration of water rights.

It has been significant to me that the operating agencies of the Federal Government, that is, the Department of Agriculture, the Corps of Engineers, the Bureau of Reclamation and other agencies that actually develop water, do not share the view expressed by the Department of Justice that the Federal Government owns and controls the waters of these United States.

In one case in California, the Department of Justice maintains that the U. S. owns all of the water of the State by virtue of the treaty of Guadalupe-Hidalgo by which the U. S. acquired our particular territory from the Mexican Government back, I believe, in 1848. The Department further alleges that when the U. S. builds a reservoir and closes the gates on it, by that action, all of the water rights necessary are acquired for that project by process of condemnation. This is a very serious thing. I have hoped, and worked rather vigorously, to get some federal legislation that would clarify this matter. I now think it is impossible. I believe we will have to negotiate these things with the various federal agencies concerned with each problem. This is the route which we are taking with the Corps of Engineers, the Bureau of Reclamation, the Department of Agriculture and others in our State.

Over the years, we have been developing a high degree of coordination between the federal agencies and the state agencies in California. We have set up a four agency committee composed of myself, the Division Engineer of the Corps, the Regional Director of the Bureau of Reclamation and the State Soil Conservationist, to coordinate the planning and other activities of our

four agencies. This Committee has been very successful, and we are doing something that had not been done before. Our Committee has succeeded not only in harmonizing the activities of the state with the federal agencies, but also in harmonizing the activities of the three federal agencies concerned. While the three federal agencies knew each other beforehand, they rarely met to discuss their mutual problems. I am pleased to note that coordination of activities is one of the main objectives of the proposed Northeastern Water and Related Land Resources Compact. I hope that Congress will act favorably upon this proposal.

California is subject to repayment contracts on some projects with water conservation features built by the Corps of Engineers. The federal government is contributing to the flood control features of our large reservoir in Orville. We have a joint venture between the State and the federal government in a $450 million project on the West side of the San Joaquin Valley. The Bureau of Reclamation will build a project that will be used jointly by that agency and the State. As construction proceeds, the State will pay its share of the costs.

We have been very fortunate in being able to institute mechanisms for the maintaining of joint action and coordination with the federal agencies. One of the reasons we have been able to do that - and let's put it very bluntly and very frankly - is that we have had money to put into projects. Had we not had money to put into these things, I don't think we would have achieved what we have in the direction of comprehensive and coordinated water development.

There are, of course, many differences between our problems in California and yours here in the Delaware River Basin. The common denominator, however, is that projects of very substantial magnitude are required to make the maximum beneficial use of the water available in both areas. The basic approach of

establishing relationships with the federal government through agreement would appear to be applicable in the Delaware Basin. There is, of course, another significant difference in the two situations. Here, there are involved four states and the federal government, while we had no other state to deal with. As a result, you have been considering an agreement in the form of an interstate compact.

Historically, interstate compacts have been used most often to allocate the waters of interstate streams and lakes among the states in which they are situated. The only other alternative through which such allocations could be accomplished would be by litigation among the states or among the owners of water rights. The experience in such litigation has been that the decree seldom satisfies any of the states that are bound by it and that development ceases during the many years consumed by such a lawsuit. It is virtually impossible in a court decree to cover all of the possibilities that may arise in connection with the use of water from an interstate stream or lake. Moreover, it is extremely difficult to provide for the future in such a decree. Also, it has proven much more difficult to obtain modifications of judicial decrees to meet changing conditions. There is a natural reluctance of the states to yield any of their judicially established rights in the give-and-take of negotiations.

By contrast, the initial allocations made by an interstate compact will generally be more satisfactory since they must be approved by the legislatures of all the states that are parties. It is possible to provide for more contingencies in the original document; and recent interstate water compacts have frequently established continuing commissions to administer their provisions. Such a commission would start working out the solutions to problems before

they have become aggravated. If revision of an interstate compact is required, the commission will have on hand the factual data and can assist materially in the negotiation of any amendments.

As is by now well known, there is an all-out controversy in progress as to whether federal agencies and licensees should have to acquire water rights in accordance with state law. In connection with interstate streams, those opposing state authority say, "acquire water rights under which state law", and this may be a good question. In the absence of an agreement, it may be impossible to meet the requirements of the laws of all of the states on an interstate stream or body of water. Through an interstate compact, cooperation on an interstate stream can be obtained with the Federal Government on the basis of federal compliance with the compact, which can be assured through congressional consent to it. Any special terms that are needed to handle particular federal interests equitably can be included in the compact.

It is feasible for a commission established under an interstate water compact to construct and operate as well as to plan water resources projects on a regional basis. This offers the possibility of accommodating both state and federal interests on interstate waters in an effective and equitable manner. The New York Port Authority has constructed and operates major transportation facilities under terms of an interstate compact.

An illustration of what an interstate compact can accomplish is provided by the Klamath River Basin Compact (Act of August 30, 1957, 71 Stat. 497) entered into by the United States and the states of Oregon and California in 1957.

The Klamath River is the major stream flowing both in California and Oregon. The purposes served by the compact include provisions concerning domestic water supplies; the development of land through application of

allocated water to irrigation; the protection and enhancement of fish, wildlife, and recreational resources; the use of water for industrial purposes and hydroelectric power production; the use and control of water for navigation and flood protection; and water pollution control. The orderly, integrated, and comprehensive development which the compact undertakes to accomplish will serve a range of requirements embracing local, state, and national interests. To secure intergovernmental cooperation and comity and to avoid causes of present and future controversy with respect to these interests, the compact provides for equitable distribution and use of Klamath River Water among the two states and the Federal Government. It establishes preferential rights to the use of water for anticipated ultimate requirements for domestic and irrigation purposes in the Upper Klamath River Basin in Oregon and California and prescribes priorities in uses and methods of water distribution to accomplish the purposes described in the compact.

A particularly knotty problem existed on the Klamath River because of the need for accommodating proposed hydroelectric power development by The California Oregon Power Company and potential demands for irrigation water by users relying upon the river as a source of supply. There was a possibility that under existing federal case law the Federal Power Commission could have granted a license for power development to the detriment of other necessary water uses, which might have been upheld in litigation. Through negotiations between the federal, state, and private agencies involved, the issue was resolved by including a provision in the compact which subordinates the use of water for hydroelectric power generation to uses for domestic and irrigation purposes but which requires return flows of water resulting from such uses to reach the river at a point which will enable the generation of power to be accomplished.

The United States Bureau of Reclamation has for many years been developing a reclamation project utilizing the waters of the Klamath River. A major federal wild fowl refuge in the Pacific Coast Flyway and Indian reservations are also involved.

At the time of the approval of the Klamath River Basin Compact by the Congress, questions were raised as to whether the Federal Government should be bound by its terms. Through the insistence of the two states, the consent legislation includes the Federal Government under the compact. The compact established a continuing commission composed of representatives of the two states and the Federal Government.

Economical and orderly water resources development will best be assured through equitable representation of the state and federal interests involved. Such representation and development are provided in the Northeastern Water and Related Land Resources Compact which was presented to the 86th Congress for approval. The compact would empower the commission which it establishes to coordinate the collection and interpretation of basic data; investigation and planning of water and related land resources projects; and programming, which includes scheduling of water and related land resources construction and development. The commission could take binding action with respect to those matters only with a majority of the state representatives and a majority of the representatives of federal agencies concurring. This compact was ratified by four of the New England states. A bill which would have given congressional consent to the compact was reported to the House of Representatives. This was the extent of congressional action. The concept of coordinated water resources development contained in this compact provides a workable pattern for federal and interstate activities in this field throughout the nation.

In connection with the interstate compact which is under consideration by the Federal Government and the states of the Delaware River Basin, I think that I can say that our experience in California indicates that this is a promising approach. Although, in our case, only one state is involved and the consent of the Congress is therefore unnecessary; nevertheless, there are more similarities between the agreements we have made with the Federal Government and an interstate compact than there are differences.

If the Delaware River Basin pursues the interstate compact road, I would like to sound one note of caution and realism. It is unlikely to be satisfactory from the states' point of view unless they are equal partners with the Federal Government. Our experience has shown that one cannot expect to have a significant voice in a project if the Federal Government is paying all of the bills. It has been only since we have started spending money on construction and have had the prospect of full financing through the proposed bond issue that negotiation and agreement on the basis of equality has been possible. Without carrying their share of the financial participation, the states cannot hope to have an equal voice in the development of a river basin. With this prerequisite, there seems to be nothing to prevent an interstate commission under the authority of an interstate compact which is binding on the states and the Federal Government from proceeding to plan and construct a basinwide water project or a series of projects.

Is basinwide water development too big for state participation? No, quite the contrary. Basinwide water development is too big -- too drastically important to their futures -- for the states not to participate fully!

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

VIEWS OF WATER RESOURCES ASSOCIATION OF THE DELAWARE RIVER BASIN

Charles R. Bensinger, President.

October 19, 1960

"VIEWS OF WATER RESOURCES ASSOCIATION OF THE DELAWARE RIVER BASIN"

by Charles R. Bensinger, President

I'm delighted to be here this morning to present the "views" of the Water Resources Association of the Delaware River Basin. I say delighted because, as I see it, my job here will be very brief. The Association's views, very few in number, are hardly novel and therefore won't require much exposition on my part.

The Association's views on water resources developments in the Delaware Basin can be summed up in several fairly brief paragraphs.

The Association very strongly hopes that the Army Engineers comprehensive plan...a document that we have all heard Colonel Setliffe eloquently and forcefully explain many times...will be reviewed and therefore completed as expeditiously as possible. I say this for two reasons, one of which is selfish. The Association is an educational and informational agency and our activities would be greatly simplified ...and made far more effective...if we could eliminate such words as "tentative" and such phrases as "may recommend" or "apparently will propose".

The Association would like to see the plan completed for another and far more important reason. We all know that there's a limited number of reservoir sites and that many good sites have already been lost in the surge to the suburbs and exurbs. It would be tragic if the Engineers plan had to be extensively re-evaluated soon after completion simply because timely action had not been taken to acquire reservoir sites. Timely action will be very difficult indeed if the official review process extends far beyond the expected six months. Lest we forget, the far longer legislative process cannot begin until the review process ends.

If the Engineers plan must be re-evaluated in the future, who will do the re-evaluation? Who will collect the data, locate the reservoir sites, design the new dams? If the Engineers plan is accepted and acted upon by the Congress, who will build and operate the dams? Will the dams be operated as a single, unified system? To answer these and many other questions...and perhaps even the thorny question of allocation...the Association strongly hopes that the Four Basin States, as represented on the Delaware River Basin Advisory Committee, will soon present us with a draft of an interstate-federal compact.

The Association's hopes stem from the very nature of our organization.

The Association has two basic reasons for being. The first is to "let the public know", to inform the residents of the Delaware River Basin and Service Area that there is a water problem, and to thoroughly explain the proposals that are being made to solve this problem.

The second reason for being is, perhaps, even more basic to a democratic society. It is to provide the means through which the citizens of the Basin can examine, weigh and fully evaluate the proposals that may solve our water problem. In this way, and only this way, does legislative action reflect the wishes and needs of the people.

I'm sure that most of you are familiar with our efforts "To let the people know". We now have 101 copies of our film-strip entitled "Too Much or Too Little" and these are being circulated to

schools, universities, libraries, museums, government agencies and others. The film has been and will be shown, upon request, to civic associations, conservation groups, garden clubs, women's groups of all kinds, youth groups such as the Boy Scouts, watershed associations, service clubs and, indeed, to any group that is willing to sit still for 16 minutes and watch.

In the past year, we have also distributed over 200,000 pieces of literature. We have distributed over 40,000 copies of the pamphlet "Too Much or Too Little" alone.

The Association very recently activated its speaker's bureau fully. We have over 50 members who are ready and willing to fill speaking engagements. Sixteen of these have been trained and several have already been used. In the past year, members of the staff and the speaker's bureau have addressed over 100 different organizations.

The Association has also been active in radio and TV. The Army documentary film "Operation Noah" was shown, under the auspices of the Association, on major TV stations in both New York and Philadelphia in the last six months. Taped radio shows initiated by the Association have been or will be used by at least 30 radio stations throughout the four-state area in the next two months.

Through these activities and many others, the Association is faced with the problem of trying to answer questions that are largely unanswerable until the finished comprehensive plan and an interstate-federal compact are realities. How do we answer port groups that want to know what, if any, jurisdiction the basin agency

will have over navigation? How do we answer the residents of the Tocks Island area that want to know how soon their properties are going to be purchased and by whom they will be purchased? How do you answer the fishermen who want to know how proposed dams will affect the trout or bass or blue gills on the Broadheads or the Wissahickon or the Pohopoco? To be sure, we do answer these questions, but our answers will be far less vague and conditional and therefore more effective only when the comprehensive plan and the compact are publicly available documents.

These views...as limited as they are and as superficial as they must be under present circumstances...can probably best be summarized in the form of a request to the Army Engineers, all other officials concerned with the comprehensive plan, and the members of the Delaware River Basin Advisory Committee. Please, gentlemen, make haste. Reasonable haste, to be sure, but haste nonetheless. It will be tragic if the problem of too much water or too little water in the Delaware Basin is acted upon too late.

Before I finish this very brief editorial, I'd like to make one more point.

There's a slogan that's still current around Madison Avenue in New York City to the effect that "it pays to advertise". On behalf of the Association, I'd like to place my ad with you since all of you are deeply concerned about developing and controlling the water resources of the Delaware. If you'd like to see our film or have it shown to a group...if you need any literature on the Delaware for a meeting or study group...if you know of groups looking for speakers

...if you're looking for information on the Engineers comprehensive plan...please call on us and have your friends and associates call on us. The Association is ready, willing and able to meet your requests.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

THE WOMEN HAVE THE LAST WORD

Mrs. Henry J. Hersey, Water Resources Committee, Inter-League Council of the Delaware River Basin, League of Women Voters.

October 19, 1960

"THE WOMEN HAVE THE LAST WORD"

by Mrs. Henry J. Hersey, Water Resources
Committee, Inter-League Council of the
Delaware River Basin, League of Women Voters

As we approach the end of this conference I shall not try your patience by a lengthy speech.

Speaking for the Inter-League Council of the League of Women Voters of the Delaware River Basin, I wish to express appreciation for this opportunity to communicate to you what the League of Women Voters is now prepared to do in the area of water resources and what the Inter-League Council is presently engaged in trying to accomplish for the future.

The Inter-League Council of the Delaware River Basin was organized in Philadelphia in 1958, and represents the total League membership of the four Basin states, Delaware, New Jersey, New York and Pennsylvania, and has as its general purpose to study and take action on water resources to promote long-range planning and development of the Delaware River Basin and its Service Area. (The Executive group of the Council is in attendance at this conference and I should like you to meet:

Mrs. Gustave R. Keene, Huntington, New York, Chairman of the Inter-League Council of the Delaware. Mrs. Keene is also a member of the New York League State Board. Mrs. Charles Kellers, Co-Chairman, Upper Montclair, New Jersey; member of the New Jersey State Board and past president of the League of Women Voters of New Jersey. Mrs. George M. Dusinberre, Secretary, State College, Pennsylvania, is a member of the State Board of Pennsylvania and was the first Chairman of the Inter-League Council in 1958. Mrs. Alan Mather, Treasurer, Wilmington, Delaware;

a member of the Delaware State Board. Mrs. J.C. Merrill, Trenton, New Jersey; member of the New Jersey State Board and past president of the League of Women Voters of New Jersey. Mrs. Merrill has been an active contributing member of the Executive Council for the past three years. Mrs. Merrill, however, was unable to attend this meeting; also Mrs. F.L. MacArtor, Editor of the Inter-League Council Newsletter, Wilmington, Delaware, could not be with us. Mrs. John K. deVries, President of the League of Women Voters of New Jersey. Mrs. C. Handloff, President of the League of Women Voters of Delaware.) The League is grateful for the quality of leadership which this group provides.

The general purpose of the League of Women Voters is to promote active participation in government. It is non-partisan and has a total membership made up of over 1,000 local Leagues in all fifty states and the District of Columbia. As the League of Women Voters is primarily concerned with government, out pattern of organization is similar to the traditional U.S. governmental levels: local, state and national. The Inter-League Council of the Delaware is perhaps a recognition of the need for experimentation with a new governmental structure, able to implement solutions to specific area problems which spill over state boundaries, such as water resources development. We like to think of ourselves as a citizens group rather than as a women's organization. I suppose this might be due to our past history. The League, an out-growth of the suffragette movement which gained support by such brave actions as that of the wild western state of Wyoming which dared to permit women to vote. During this dangerous period, about September 6, 1870, as the Wyoming women flocked to the polls to cast

their ballot, a Wyoming lawmaker raised his shaky glass to propose a toast--"To the lovely ladies," he said, "Once our superiors, now our equals." (We are perfectly happy to maintain this status.)

Conservation and Water Resources have been a National League program item for the past four years. Intensive study on the part of the total membership resulted in general agreement on these positions at the last National League convention: Support of national policies and procedures which promote comprehensive long-range planning for conservation and development of water resources. Among these policies are: "(1) Better coordination and elimination of conflicts in basic policy at the federal level; (2) machinery appropriate to <u>each region</u> which provides coordinated planning and administration; (3) cost sharing by government and private interests in relation to benefits received and ability to pay."

League members, therefore, are taking into consideration whether or not the proposed plan for the Delaware will contribute to the over-all water resources development and economic well-being of the <u>nation</u> as well as of the <u>region</u>.

Fortunately, recent basic data has been provided to help us answer this question, both by the Delaware River Basin Survey Coordinating Committee and by the United States Senate Select Committee on National Water Resources. We know at present that the Delaware Basin and Service Area, with its 1% land area and 13% population, employs 14% of the labor force of the United States and provides 17% of the national income. (Chart #1) A report made by Dr. Luna Leopold, Chief Hydraulic Engineer, U.S. Geological Survey, shows the nation's water demand on the

basis of East and West requirements. It was prepared for the U.S. Senate Select Committee. The explanatory note below this chart states, "At present we use about 270 billion gallons per day. Demands will increase until by 1980 we will be using 600 billion gallons per day. The increase in the 31 eastern states, which includes the Delaware River Basin states, will be 200 percent but only 50 percent in the western states. This regional difference is significant because use in the western states is predominantly irrigation; whereas, in the eastern states it is predominantly industrial. The greatest increase, therefore, will be in non-consumptive use.

These charts (Chart #II and #III) were offered as part of a report, "The Impact of New Techniques on Integrated Multi-purpose Water Development," by Dr. Edward A. Ackerman and his committee of outstanding water resources experts. The report, again, was prepared at the request of the Senate Select Committee. The explanatory note to this first chart: "It is likely that more than half of the population of the United States will be concentrated at the end of the century in two very densely settled areas--the industrial belt of the northeast and the midwest, and in California." Probably 60% of the total population will be in these two areas, which, together, comprise only 18% of the country's land area, Alaska and Hawaii excepted. The report prepared for this same committee by the Department of Commerce, "Population Projections and Economic Assumptions", supports this same possible condition.

We are concerned also with whether or not the proposed plan is a truly comprehensive one: If all phases of multiple use have been

considered on the basis of adequate information and with due consideration of alternate proposals. Does it provide a flexible plan for the future with provision for the development and/or exchange of needed basic data, while at the same time providing for all the immediate needs of the region? We also want to know whether or not there have been effective land use plans combined with water control and development and a wise, balanced consideration given to accepted conservation principles. In the Delaware Valley every water need except that of reclamation is included in planning.

Better coordination between federal agencies as well as federal-state-and-local interests in policy and/or operation has been of primary League concern during the past four years. The Leagues of the Delaware River Basin have observed with interest those agencies and levels of government which have been effectively planning together at the ten meetings of the Delaware River Basin Survey Coordinating Committee. We have been concerned with inconsistencies in water policy and how the plan might help to eliminate them without sacrificing the benefits derived from specialization. We look for a plan which creates an organizational framework to weigh competing demands for water use as our primary interest is government. The Syracuse report has been studied carefully by League members as it suggested to us proposals for possible governmental implementation of the physical plan. A mechanism to provide coordinated administration is one of our fundamental requirements. The Inter-League Council is presently asking membership for further direction as to which powers immediately or eventually it would like this single administrative agency to have relative to such

functions as water allocation, water quality standards, land acquisition, design, construction, and operation of water control structures, collection and correlation of data.

Should the agency be empowered to implement its plan if other agencies fail to carry out their functions?

Are we to decide on the composition of the agency--who should appoint the members and what kind of representation should it embody? Also, what the role of the general public should be in conjunction with the plans of the proposed agency and if a quasi-public agency is required?

The problem of financing is likewise important to us. We examine proposals from the standpoint of equitable and adequate provisions for cost-sharing. We favor arrangements which are conducive to a policy of having the several levels of government and/or private interests contribute in reasonable relation to the amount of benefit received from the development. In addition to considering ability to pay and fair sharing of costs, we must determine under what condition the federal government should provide assistance--when the project is in the national interest; when incentive payments are needed to stimulate action; designation of the goals a project is to attain also affects the cost of construction and the basis for payment. For example, on the question of flood control a choise might be made as between flood control structures and flood plain zoning.

There are also intangible and perhaps non-assignable benefits to be considered. A part of recreational development might come within this category--that of social benefit. It might be impossible to attach a price tag to this benefit directly, yet we realize it is worth paying

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for in a plan for a densely populated area as it provides one of the ingredients needed for a stable society.

There is every indication of impending decrease in the number of working hours, and, therefore, increase in the amount of leisure time available to the average person during the coming years. Resources of the Future estimates place the 1980 per capita gross national product at one and one-half times that of 1959, and that of 2000 at 2.4 times the 1959 level. Finally, as the League of Women Voters is an action, as well as an educational group, we concern ourselves with some practical political considerations such as, how much political understanding and congressional support can the groups responsible for the introduction of this legislation acquire and will it have favorable consideration by the Administration and Congressional leadership? Members of the Inter-League Council of the Delaware hope to arrive at some specific conclusions about the considerations we have just described to you by January 1961. After this, its total present membership of 27,694 will be provided with necessary information and direction so that they can effectively take part in the public education and action required in their respective Basin-state communities.

Our fear is that the impetus which the Delaware River Basin studies have achieved so far as a result of persistent drive during the past three years might be lost due to unnecessary delay. The advantages to be gained by the very physical plan itself might be imperiled by late timing. In the past the League has studied many good water resources proposals prepared by commissions and committees, only to have them shelved and ignored--not actively used to implement needed water legislation. We hope such delay and apathy will not jeopardize the great effort that has been made in preparing the Delaware River Basin plans. The past year

the League saw the 86th Congress awake from a long period of national water resource legislative somnolence to appoint the United States Senate Select Committee and introduce the Water Resources Act of 1960. Both of these procedures the League of Women Voters, as a national organization, enthusiastically supported. It will continue to do everything possible to awaken the 87th Congress to its responsibilities as far as National Water Resources problems are concerned. League members of the Inter-League Council of the Delaware River Basin will continue to earnestly prepare themselves for the realization of these specific goals falling within the area of League agreement which I have outlined for you this morning.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

CONFERENCE SUMMARY

Francis A. Pitkin, Chairman, Interstate
Commission on the Delaware River Basin

October 19, 1960

CONFERENCE SUMMARY

by Francis A. Pitkin, Chairman
Interstate Commission on the Delaware River Basin

All of the reports made during this two and a half days of the Incodel Annual Conference have been very interesting and informative. Certainly, if we were going to try to summarize the Conference in one word, that word would be progress. There has been significant and encouraging progress in many different fields, each of concern to all of us who are interested in the Delaware River Basin and its water resources.

I am not going to attempt to recapitulate the contents of these reports. But I would like to remind you of the large number of subjects and the diversity of those subjects that have been covered during these few days.

You will recall that we opened the Conference with Incodel's Annual Report which, this year, was presented by Bob Everest. The Annual Report pointed out that Incodel was following with interest the work of the Army Engineers, not only in trying to be helpful to them, but also in reviewing the 24 Appendices as well as the preliminary drafts of the final report on the comprehensive plan for the Delaware River Basin. The Incodel Annual Report also made note of Incodel's stewardship in the field of water pollution control. You will recall that seven different activities were enumerated, each of importance in connection with our continuing effort to keep abreast of the water pollution control necessities in the Basin. Some of those activities are research projects concerned with the development of techniques for instrumentation. Some are concerned with the collection of technical data. Others are concerned with the policing aspect; keeping track of water quality and providing information, as necessary, to assist the four state administrative agencies in the exercise of their duties in the enforcement

of the interstate agreement on standards for the abatement of water pollution. I think the report of Incodel's stewardship was significant and I think it indicates excellent progress in a great many different fields.

You will recall Lester Klashman's fine report on the studies of water quality in the tidal Delaware River estuary. Certainly, that report reminds us of our debt of gratitude to the U. S. Public Health Service for the assistance it has given us in this important field.

The Monday afternoon report on the proposed compact was a little disappointing. Actually, however, if that program item had been scheduled for this morning instead of for Monday afternoon, it might have been a very different presentation. I am told by Chairman Robin that during these two days the compact drafters have had opportunities to meet constructively, and significant progress has been made as the result. There is now complete anticipation of the availability of a compact draft for consideration in the 1961 sessions of the Legislatures. So, here again, we see evidence of progress in this important field.

It is hardly necessary to remind you of Colonel Setliffe's excellent presentation. It was an encouraging report on the proposed physical plan for the water resources of the Delaware River Basin. It was a report on a plan on which the general observation of every one who has reviewed it, in its development and in its current stage of presentation, has been one of general agreement that here is a practical plan, an attainable plan, a plan that will solve many of the basic problems of the Basin. Assuredly, the Engineers plan will provide a framework and an objective toward which we can all work in the future. We are all going to have the opportunity to review it in its final form and we anticipate the development of general

support for the attainment of the objectives set forth in that plan.

You will recall yesterday afternoon's sessions, when we heard from the several watershed associations of the Basin. Each of these presentations reported on some one aspect of the comprehensive plan on which the individual Watershed Association is engaged. Flood plain studies, problems of pollution, hydrologic studies, implementation of Public Law 566, and liaison in watershed work were all discussed.

These presentations constitute more evidence of progress in very important fields. We are gratified by the gradually increasing number of watershed agencies being organized throughout the Basin as a whole.

We have already heard this morning many favorable comments on the talk given by Harvey Banks last evening at the annual banquet. I think it was an excellent presentation. It was a presentation which gives us perspective in our approach to this half-billion dollar package which Colonel Setliffe and his associates have developed. We have been able to develop a feeling that while this is a lot of money, it is not out of scale with the needs of the Basin or with the ability of the people of the Basin.

It is hardly necessary to summarize the Water Resources Association or the League of Women Voters presentations of this morning's conference session since both are still ringing in our ears.

I think you will agree with me, in reviewing the scope of this Conference, that we can feel encouraged by the very obvious evidence of progress on a great many fronts; progress which we are certain will continue and will lead ultimately to the solution of the many problems with which we are all concerned.

I want to say that we of Incodel are happy that the Delaware River Basin Advisory Committee has joined us as co-sponsors of this Conference

again this year. It has certainly been a great pleasure to have all of you in attendance. We hope you feel, as we do, that this Conference has been productive and beneficial.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

REGISTRATION LIST

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Incodel Annual Meeting
Pocono Manor, Pennsylvania
October 17-19, 1960

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